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The Effect of Problem Based Learning Models and Interest to Learn Physics on Students Critical Thinking Skills of Class XI Students at SMA Negeri 1 Selayar

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ABSTRACT: This research is a true-experiment research using a 2x2 factorial design which aims to find the influence of the problem-based learning model and interest in learning physics on students' critical thinking skills. Sampling in this study used a simple random sampling technique to obtain a sample of 60 students in the experimental class and 60 students in the control class. This research was carried out by providing treatment in the form of a problem-based learning model on static fluid and dynamic fluid material. Data on interest in learning physics was collected using a questionnaire, while data on critical thinking skills used tests. Research data was analyzed using the Two Way Anova statistical test. The results of the first study showed that There are differences in critical thinking skills between students who are taught using the problem-based learning model and students who are taught using the discovery learning model. Second, it states that there is no interaction between the learning model and interest in learning physics on critical thinking skills. Third, stating that for high interest in learning, there are differences in critical thinking skills between students who are taught using the problem-based learning model and students who are taught using the discovery learning model. Then the results of the fourth research show that for low interest in learning, there are differences in critical thinking skills between students who are taught using the problem-based learning model and students who are taught using the discovery learning model.

KEYWORDS: Problem Based Learning Model, Discovery Learning Model, Interest in Learning Physics, Critical Thinking Skills

I. INTRODUCTION

Cognitive ability is an intellectual-based potential that occurs in the central nervous system of a person's thinking. Cognitive abilities can be called a person's basic ability to think which is related to intelligence and can also be used to explore with the help of the five senses. One of the cognitive abilities included is the ability to think critically. It can be said that critical thinking skills are part of cognitive abilities, only they are more focused on how students develop their thinking to be more critical and responsive to things that are happening around them.

Students really need to have critical thinking skills, because these skills can be used to prepare them for dealing with everyday problems. Critical thinking is a fundamental skill and can be used in all aspects. Critical thinking skills are the ability to think reflectively and assess skills, so that students can decide the right type of information and the type of action that should be taken in an effort to solve problems.

Based on this statement, it can be seen that the critical thinking skills possessed by students will influence their lives after completing formal education, this is because they can analyze various issues and problems of everyday life. Thus, critical thinking skills are important for every student to have as a modality for problem solving. This is in accordance with the demands of the 2013 curriculum which requires an educational process that provides opportunities for students to be able to develop all their potential. Potential related to aspects of attitude (affective), knowledge (cognitive), and skills (psychomotor). Where by empowering all potential, students are expected to become competent humans in life.

One of the sciences that students should be able to optimize their cognitive abilities in the learning process, especially in critical thinking skills in solving given problems, is Physics. Physics is a branch of science that studies natural phenomena and natural events, both visible and abstract. Physics subjects are a forum for students to develop critical thinking skills in solving problems they face, both in learning activities at school and problems faced in everyday life. However, based on the results of observations made at SMA Negeri 1 Selayar, several conclusions were obtained that student-centred learning activities have not been implemented well, students' learning activity is still lacking, only a few students are active in learning, students still have difficulty finding and determining the right reference or concept as a step in solving a problem, the test questions usually given by

teachers are not in the category of high-level thinking questions, then students rarely ask questions to the teacher and only accept what the teacher says so that learning tends to be one-way, so This can be one of the factors causing some students to be less interested in learning physics.

Students' interest in participating in physics learning is one aspect of interest in learning physics. Interest is defined as a feeling of preferring or tending to be interested in something based on one's own wishes without anyone asking or forcing it. Interest in learning has several important roles, such as increasing concentration or attention, bringing joy or feelings of pleasure, strengthening students' ability to remember, giving birth to positive and constructive learning attitudes. The role of interest in learning activities is one of the supporting factors in whether or not the learning objectives to be achieved are successful, one of which is supporting the success of students so they can think critically.

Seeing this, it is necessary to implement an appropriate learning model to support students' critical thinking skills through interest in learning physics. The learning model plays an important role in the learning process and makes learning activities easier, helps the learning process become interesting and not boring because it is not only centered on the teacher but the important role is that students have the opportunity to provide explanations and exchange opinions from an uninteresting atmosphere to an interesting one. A model that can be independently applied to learning activities is by fostering curiosity and developing real thinking processes and not just relying on the teacher's explanation. The steps in the learning process at SMA Negeri 1 Selayar, especially in physics, include: a) checking attendance, b) explaining the learning objectives at the meeting, c) then the teacher divides the students into several groups and explains the introductory material, d) students are then asked to enrich the material provided by the teacher by reading various reference sources, e) then the teacher gives questions to students, if possible students will do it in class, but if not possible it will be made into an assignment to be done at home, f) After the assignment has been completed by the students, the teacher provides an assessment and explanation regarding the questions that many of them answered incorrectly. Referring to the steps used by teachers in learning, they tend to be in accordance with the discovery learning model.

In line with the previous description, it can be seen that physics learning at SMA Negeri 1 Selayar has accustomed students to acquiring concepts through discovery activities by collecting various information from various reference sources, but through these information gathering activities students have not carried out measurement activities on the variables in material directly or in practicum so that the concept obtained by students only seems to be someone else's view. Therefore, in physics learning that takes place in the classroom, it is necessary to use a learning model that can provide students with real experience in order to obtain concepts that can be carried out through experimental activities. Thus, the appropriate learning model for physics learning is the problem-based learning model.

The problem-based learning model is one of the learning models that strives to be able to develop critical thinking skills. This learning model will create students who can think openly to new ideas, are able to analyze problems well, have the ability to think systematically, and can do it independently. In problem-based learning the teacher will present a problem to be studied and then students will respond to what happens in the problem. So that students will be more required to actively participate so that the learning process is more student centered, which is one of the goals in the 2013 curriculum.

Based on the description above, research was conducted with the title "The Influence of the Problem-Based Learning Model and Interest in Learning Physics on Students' Critical Thinking Skills".

II. METHOD

A. Types of research

The type of research used was True Experiment (real experiment) using a 2 x 2 factorial design. The research carried out involved two classes, namely one class as a control class and another as an experimental class. The experimental class was given treatment, namely applying a problem-based learning model, while the control class was still taught using discovery learning.

B. Research design

The research design used in this research is factorial design research. In this design, there are two class groups that are research subjects, one class group that is given treatment (experimental class) using a problem-based learning model and one class group as a control class that uses a discovery learning model. Based on this research design, the research design used is factorial, depicted as in Table 1

Table 1. 2x2 Factorial Design

Interest in Learning (B)	Learning Model (A)	
	Problem Based Learning (A1)	Discovery Learning (A2)
High (B1)	$Y[A_1B_1]$	$Y[A_2B_1]$
Low (B2)	$Y[A_1B_2]$	$Y[A_2B_2]$
$\sum$	$Y[A_1B_1] + Y[A_1B_2]$	$Y[A_2B_1] + Y[A_2B_2]$

C. Population and sample

The population in this study were all students in class XI MIPA SMA Negeri 1 Selayar consisting of 5 classes with a total of 151 students. The sample in this study was determined using a simple random sampling technique (simple random sampling). In this simple random sampling technique, students are actually randomly selected, but considering that this could disrupt the learning process at the school, a class random sampling is only carried out. Class randomization is carried out by drawing lots for the classes that will be used as research samples. From the class summary, XI MIPA 1 and XI MIPA 4 were obtained as experimental classes, namely 60 people, so that there were 16 students. This means that there are 16 students who are in the high physics learning interest group and 16 students are in the low physics learning interest group $60 \times 27\%$

D. Instrument

There are two research instruments used in this research, namely a questionnaire about interest in learning physics and a test of students' critical thinking skills. Determining interest in studying physics in this research took the form of a self-assessment-based questionnaire according to what the students felt. The test for students' critical thinking skills used in this research is a multiple choice test using indicators of critical thinking skills, namely: interpretation, analysis, inference, evaluation and explanation.

E. Preparation phase

Before carrying out physics learning through a problem-based learning model and interest in learning critical thinking skills as intended in this research, several preparations are first carried out, such as conducting observations at the research location and determining the class that will be used as the research object. Then analyze the curriculum to see competency standards and basic competencies so that the subject matter that will be taught is visible. Then create learning tools based on basic competencies that are adapted to the material being taught. The learning tools prepared are RPP, LKPD, and teaching materials. The next preparation is to prepare research instruments in the form of a physics learning interest questionnaire and a test instrument for students' critical thinking skills based on several indicators

F. Implementation Stage

Before the RPP, teaching materials and LKPD are applied in learning, an expert validity test is first carried out. Likewise, for instruments, before they are used, expert validation tests, empirical validity tests, reliability tests, difficulty level tests and different power tests are carried out on the instruments used.

The empirical test was carried out on classes that were not included in the research sample, namely 31 students in class XI MIPA 5. Then, validity and reliability, difficulty and differentiation tests are carried out based on the data that has been obtained.

This research was carried out by providing an interest in learning physics questionnaire sheet that had been prepared and validated before being given treatment to the four classes that had been selected as research samples. Providing this questionnaire sheet is used as a prerequisite in determining the sample size for each class which will be divided into two groups, namely students with high interest in learning physics and students with low interest in learning physics.

The sample obtained in the research was 27% of the total group population. Because each class consists of high interest in learning physics and low interest in learning physics, a sample of each group, namely students, was obtained, so that four groups of students were obtained $27\% \times 60 = 164 \times 16 = 64$

After being given a questionnaire sheet regarding students' interest in studying physics directly, the learning process was then carried out by applying the problem-based learning model in classes XI MIPA 1 and XI MIPA 4, while the discovery learning model was carried out in classes XI MIPA 2 and XI MIPA 3.

Learning is carried out face to face for minutes for physics subjects in 1 meeting. The learning materials used were static fluid and dynamic fluid material for 12 meetings 2×40

G. Final Stage

In principle, this stage is carried out during the research, the activity carried out is giving a posttest, namely in the form of multiple choice questions that have been validated and tried out and then given to the students who are the samples in the research. This test aims to measure students' critical thinking skills. Next, carry out an analysis of the data obtained, then draw conclusions based on the results of data analysis by comparing the research results of the experimental class and the control class. Lastly, make a research report.

H. Data analysis technique

The data analysis technique in this research is divided into two parts, namely data analysis related to the instruments that will be used in the research and analysis of data obtained during the research.

III. RESULTS AND DISCUSSION

The collected data is examined to answer the hypothesis by carrying out prerequisite tests. The prerequisite tests in this research consist of a normality test and a homogeneity test. Normality test results in Table 2 and Table 3

Table 2. Normality Test of Critical Thinking Skills Score Data for Experiment Class and Control Class

Class	Sample Size	L count	L table	Information
Experiment	60	0.099	0.114	Normal
Control	60	0.109	0.114	Normal

The normality test was carried out using the Liliefors test. The testing criteria are based on the largest calculated Liliefors value with a significance level of 95% or α = 0.05%. Based on Table 3.11 for α = 0.05 with a sample size of 60 students in the experimental class, it is obtained that L count = 0.099 and L table = 0.114, which means the data is normally distributed. In the control class with a sample size of 60 students, L count = 0.109 and L table = 0.114, which means the data is normally distributed. Thus, it can be concluded that the critical thinking skills score data for class XI MIPA students at SMAN 1 Selayar who use the problem-based learning model in the experimental class and the discovery learning model in the control class are normally distributed.

Table 3. Data Normality Test for Interest in Learning Physics for Experiment Class and Control Class

Class	Sample Size	L count	L table	Information
Experiment	60	0.097	0.114	Normal
Control	60	0.092	0.114	Normal

Based on Table 3 for α = 0.05 with a sample size of 60 students in the experimental class, the calculated L = 0.097 and L table = 0.114, which means the data is normally distributed. In the control class with a sample size of 60 students, L count = 0.092 and L table = 0.114, which means the data is normally distributed. Thus, it can be concluded that the physics learning interest score data for class The next prerequisite is the homogeneity test which is presented in Table 4

Table 4. Data Homogeneity Test

Class	Sample Size	Variance	*f*count	*f*table	Information
Experiment	60	9.68	1.49	1.54	Homogeneous
Control	60	14.39			

From the calculation results, it is obtained or 1.49 < 1.54 for a significance level of 5%. Than it can be concluded that the data on students' critical thinking skills scores for classes taught using the problem-based learning model and discovery learning model is homogeneous.

After fulfilling the prerequisite tests, the hypothesis was tested using two-way ANOVA.Hypothesis testing using two-way ANOVA can be carried out to test the differences in the influence and interaction of the independent and moderator variables on the dependent variable. Explanation of hypothesis test results in Table 5

Table 5. Two Way ANOVA Test Results

Motivation	Statistics	Learning Model (A)		
		Problem Based Learning (A1)	Discovery Learning (A2)	∑B
High (B1)	n	16	16	32
	∑X	360	275	635
	∑X^2	8294	5165	13459
	Ẋ	22.50	17,19	36.69
Low (B2)	n	16	16	32
	∑X	351	220	571
	∑X^2	7809	3282	11091
	Ẋ	21.94	13.75	35.69

∑K	nt	32	32	64
	∑Xt	711	495	1206
	∑Xt^2	16103	8438	24550
	Ẋt	22,23	15.47	18.83

Overall, there are differences in the critical thinking skills of students who are taught using the problem-based learning model and those taught using the discovery learning model.

Based on Table 5, it shows F count= 471.80 and F table = 3.15 (F calculated > F table) so it is rejected. This means that there are differences between skills H_0 critical thinking of students who are taught using the problem-based learning model and those taught using the discovery learning model. Based on the analysis of the descriptive and inferential data that has been processed, it appears that statistically, the problem-based learning model provides differences in critical thinking skills when compared to the discovery learning model. The difference is also clearly visible through the average critical thinking score in the class taught using the problem-based learning model, which gives a higher score compared to the control class taught using the discovery learning model.

There is no interaction between learning model and Interest in studying physics on students' critical thinking skills.

Interaction effects with sources of variance and project-based learning models Motivation to learn physics produces F count = 1.99 and F table = 3.15 (F count < F table). accepted. It means,H_0there is no interaction between the problem-based learning model and Interest in studying physics on students' critical thinking skills. The interaction pattern can be seen in Figure 1

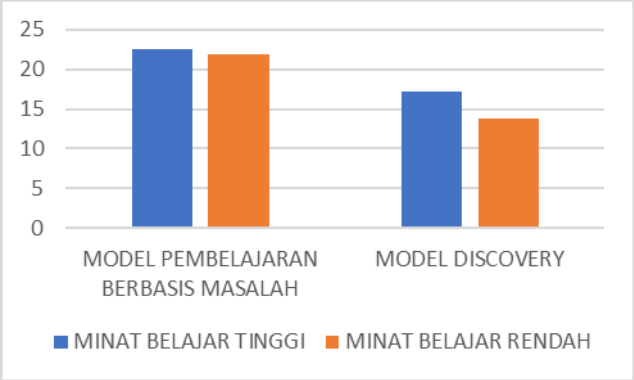

Figure 1. Interaction Patterns of Problem-Based Learning Models and Interest in Learning Physics on Critical Thinking Skills

The second hypothesis was accepted, which means there is no significant interaction between the learning model and learning interest on students' critical thinking skills. The absence of interaction between the application of learning models and interest in learning is caused by many factors that influence the learning process. Syah (2006) states that the success of the learning process is influenced by internal and external factors. Internal factors that exist within individuals include attention, interest, talent, motivation, readiness, and fatigue. External factors include family factors, school factors, and community factors. All internal and external factors in learning are interrelated and influence one another, so that the learning process is not only influenced by the learning model and interest in learning but there are many influencing factors.H_0

Judging from the high interest in studying physics, there are differences Skills critical thinking of students who are taught using the problem-based learning model and those taught using the discovery learning model.

Based on Table 5, it shows F count = 43.81 and F table = 3.15 (F calculated > F table). rejected. This means that based on learning interest on high learning interest, H_0 there are differences Skills critical thinking of students who are taught using the problem-based learning model and those taught using the discovery learning model. This states that the influence of interest in learning on the critical thinking skills of students in this research has a significant effect. This means that the higher a student's interest in learning, the higher their critical thinking skills, and vice versa. So if students' interest in learning decreases, students' critical thinking skills will also decrease.

Judging from the low interest in studying physics, there are differences Skills critical thinking of students who are taught using the problem-based learning model and those taught using the discovery learning model

Based on Table 5, it shows F count= 3.85 and F table = 3.15 (F calculated > F table). rejected. This means that based on learning interest on low learning interest, H_0there are differences Skills critical thinking of students who are taught using the

problem-based learning model and those taught using the discovery learning model. Based on the data from the third and fourth hypotheses, it shows that the use of a problem-based learning model in the physics learning process needs to pay attention to the high or low level of students' interest in learning. According to researchers' observations, the difference in learning interest between the experimental class and the control class in static fluid and dynamic fluid material is caused by the learning interest of students in the class when taking part in the lesson. In the experimental class, namely the class taught using a problem-based learning model, students seemed more interested in learning.

This is in line with Rahayu's (2020) opinion that the Problem Based Learning model can increase students' interest in learning. Teacher play an important role in increasing students' interest in learning and creating a conducive classroom environment for students. Apart from that, students' progress needs to be observed so that problems can be detected early. Therefore, teacher support and continuous discussion involving teachers and students are very necessary. For example, teachers can help by providing access to information and supporting learning with instructions to make tasks more manageable. It is said that teachers must break down tasks in order to train students in formulating strategies to solve problems, and gradually release responsibility to students.

The problem-based learning model has helped students improve their critical thinking skills. The 5 syntaxes in the project-based learning model according to experts include problem orientation, organizing for learning, guiding investigations, presenting and developing work results, evaluating and analyzing the problemsolving process. This is in accordance with Ennis' opinion that someone with critical thinking skills is able to act systematically and orderly with parts of the whole problem. Existing systematic thinking will be increasingly formed with the application of the 5 syntaxes in the problem-based learning model.

Based on the results of the research and discussions that have been carried out, it can be seen that the problem-based learning model provides an increase in critical thinking skills for students who have high or low interest in learning compared to the discovery learning model. This means that students' critical thinking skills can be said to have improved regarding the material that has been delivered with the right learning model.

IV. CONCLUSION

Based on research it can be concluded that the firstThere are differences in critical thinking skills between students who are taught using the problem-based learning model and students who are taught using the discovery learning model. Second, there is no interaction effect between the problem-based learning model and students' learning interest on critical thinking skills. Third, for students who have a high interest in learning, there are differences in critical thinking skills between students who are taught using the problem-based learning model and students who are taught using the discovery learning model. Then fourthly, for students who have low interest in learning, there are differences in critical thinking skills between students who are taught using the problem-based learning model and the discovery learning model.

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