

Research article

The Effect of the Discovery Learning Model on the Critical Thinking Abilities of Geography Students

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Abstract.

The discovery learning model, a mainstay in the Indonesian 2013 curriculum, can help hone students' critical thinking skills. The purpose of this study was to determine the effect of the discovery learning model on critical thinking skills in terms of students' perceptions of geography subjects. Critical thinking ability, the dependent variable, was measured by a test of critical thinking skills. The moderator variable, namely students' perceptions of geography subjects, was measured by a subjective questionnaire. The study took place over three meetings and ended with a post-test and questionnaire. The hypothesis was tested using independent sample t-tests and ANOVA using SPSS and a significance level of 0.05. The results showed that there was a significant difference between the scores of the experimental group and the control group. The average critical thinking skills value of students who used the discovery learning model was higher than that of the other students.

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1. Introduction

Critical thinking ability is a skill that is needed by students as one of the skills in the 21st century. This ability requires a systematic and independent way of thinking, which way of thinking will produce an interpretation, analysis, or conclusion on a matter or problem [1]. The ability to think critically is owned by a person to decide whether a person is right or wrong about existing phenomena or problems and various efforts to fix them [2]. Critical thinking contains a number of abilities including, 1) analyzing and evaluating arguments and evidence, 2) compiling clarifications, 3) making valuable judgments, 4) compiling explanations based on relevant and irrelevant data, and 5) identifying and evaluating assumptions [3]. Training critical thinking skills can be done in various ways and through various cognitive processes. This critical thinking ability consists of several students' cognitive processes, namely in analyzing systematically and specifically the problems encountered, distinguishing these problems carefully and thoroughly, as well

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as identifying and reviewing information in order to plan problem solving strategies [4] [24].

Critical thinking skills can be improved through various learning activities on subjects at school. One of the learning activities that can be used is the field of geography. Geography is an integrative field of science that studies the symptoms that occur on earth (in the physical and human dimensions) using spatial perspective [5]. Furthermore, the study of geography subjects is directed at the point of view of human existence and activities which are influenced by the dynamics of the physical nature. Some of the problems related to the spatial perspective and human activities can become one of the topics of discussion in learning by involving critical thinking by students in class. This is also because having the ability to think critically is a must in this era of globalization, especially for students who will compete and survive in a society full of problems so that expertise is needed [1]. To support such learning objectives, geography learning needs to be accompanied by a supportive learning model.

The learning model that can support students to explore critical thinking skills in accordance with the 2013 curriculum is the model discovery learning [2] [6]. This model is a way to convey ideas or ideas through discovery [2] [21]. The use of the approach discovery can involve students in independent learning activities, critical thinking, and understanding [2] [21]. In practice, the model discovery learning has several advantages, namely, 1) increasing student experience in learning, 2) providing opportunities for students to be closer to sources of knowledge other than books, 3) exploring student creativity, 4) being able to increase students' self-confidence, and 5) increase cooperation between students [6] [13].

A number of studies on the effect of models discovery learning on students' critical thinking skills have been carried out, for example research conducted by [6,2,7] The results show that the model discovery learning has an effect on students' critical thinking skills in terms of learning motivation [6] model .The discovery learning has a significant effect on critical thinking skills seen from the scores of the experimental class's critical thinking skills with using the learning model discovery learning is higher than the control class using conventional methods [2]. The Model is discovery learning very influential in improving critical thinking skills and student learning outcomes [7]. Not only students but also there is a significant influence model learning discovery learning to air capability students' critical thinking [2]. A number of studies on model discovery learning use critical thinking skills as the dependent variable. The implementation of teaching and learning activities using the model discovery learning needs to pay attention to the incoming information to students in class. To assess the success and magnitude of the

influence of the model discovery learning in the classroom, one of them can be done by looking at and considering students' perceptions. Perception is relative, selective, has an order, can be influenced by the expectations and readiness of the recipient [8]. Therefore, to distinguish from previous research, researchers in conducting this study involved students' perceptions of the subject as a moderating variable to measure the effect of learning models discovery learning on students' critical thinking skills in the classroom.

Based on the description above, the purpose of the study is to find out whether the model discovery learning has an effect on critical thinking skills or not, and also to find out whether the model discovery learning has an effect on critical thinking skills when viewed from students' perceptions of geography subjects.

1.1. Critical Thinking Ability Critical

Thinking ability is a reflective and reasoned thinking ability that is focused on what is believed or done. Critical thinking skills include basic clarification skills, basic decision-making, conclusions, providing further explanations, estimation and integration, as well as additional abilities [9]. Critical thinking is self-regulation in deciding something that results in interpretation, analysis, evaluation, and inference, as well as exposure using evidence, concepts, methodologies, criteria, or contextual considerations that form the basis for making decisions [9]. Critical thinking ability which is the dependent variable in this study is the test score that reflects the students' ability to think according to the indicators. Indicators of critical thinking skills are, 1) filtering information and providing simple explanations, 2) identifying problems, 3) compiling problem solving, 4) drawing conclusions, and 5) developing ideas and reasons for the conclusions drawn [4] [9]. To measure the ability to think critically, one of them can be done by holding a test. One form of test is a description test that uses items that have reliability, so that it can be used to measure critical thinking skills in a valid and reliable manner [4] [20]. The success and failure of learning activities in improving critical thinking skills are usually influenced by internal and external factors of each student. There are five factors that affect critical thinking skills, namely physical condition, motivation, anxiety, intellectual development, and interaction [10] [19].

1.2. Students' Perception of Geography Subjects

Perception can be interpreted as a different point of view for each individual. According to the Big Indonesian Dictionary (KBBI) perception is a direct response (acceptance) of something. Perception is a process that involves the entry of messages or information into the human brain [8]. Perception in a broad sense is a view or understanding of how someone views or interprets something [11] [22] [23]. Perception is subjective, while the factors that influence students' perceptions include, 1) innate, namely the most basic sensory abilities and develop at a very early age, 2) critical periods or student experiences, 3) psychological and cultural factors, which are meant here are needs, beliefs, emotions, and expectations [8]. In addition, perception also has indicators. The indicators of perception are 1) absorption, 2) understanding or understanding, and 3) assessment or evaluation [9] [11] [20]. Students' perceptions of geography in this study have a function as a moderator variable. Students' perceptions of geography subjects here are defined as positive and negative views of geography subjects measured using a questionnaire instrument with questions referring to indicators filled out subjectively by students.

1.2.1. Models Discovery Learning

Model discovery learning is learning that emphasizes active student learning in finding the concept itself [12]. In the implementation of learning with this model, students are encouraged to identify what they want to know and then proceed with finding their own information, organizing or forming (constructively) what they know and understand in a final form [17] [18] [21]. The discovery learning model is a learning model that tries to lay the foundation and develop a scientific way of thinking, students are placed as learning subjects [21]. The Model discovery learning is an independent variable in research, can be defined as a student-centered teaching style and aims to build knowledge through several stages of systematic learning activities in the form of six activity steps. The steps of learning activities with the model discovery learning include, 1) stimulation (providing stimulation), 2) problem statements (problem identification), 3) data collection (data collection), 4) data processing (data processing), 5) verification (proof), and 6) generalization (drawing conclusions) [14].

The Model discovery learning has several advantages including, 1) students are active in learning activities, because they think and use their abilities to find final results, 2) students understand the learning material properly, because they experience the

process of finding them themselves. Something obtained this way takes longer to remember, 3) discovering it yourself can lead to a sense of satisfaction. This inner satisfaction can encourage students to make more discoveries so that their learning interest increases, 4) students who gain knowledge by the discovery method will be better able to transfer their knowledge to various contexts [15]. Furthermore, this model can also make learning more realistic and meaningful because it is motivated by direct student interaction and involves students directly in learning [1] [16].

2. Method

2.1. Research Design This research

Is a quantitative study that uses a quasi-experimental design with a post-test only control group design. The design used has the aim of knowing the influence of the learning model used on critical thinking skills in terms of student perceptions. The following is an illustration of the implementation of the posttest only control group design. For more details, the research design is presented in the following table.

TABLE 1: Research Design.

Class	Treatment	Post-test
Experiment	X	O
Control	-	O

Description:

X : Treatment using model discovery learning

- : No treatment/using conventional model

O : Post-test / critical thinking ability test

2.2. Research

Subjects in the study this time using class XI IPS students at SMA Negeri 3 Malang for the academic year 2020/2021 population, while the research sample used was class XI H4 and XI I4 at SMA Negeri 3 Malang. The selection of the type of group on the research subject as the experimental class and the control class was carried out using the lottery technique. The results of the selection showed that the subjects selected were class XI H4 as the experimental class with 35 students with 16 male students and 19 female students and class XI I4 as the control class with 36 students with 13 male students and 23 female students. The treatment in the experimental class is by using

the independent variable in the form of a model discovery learning, while in the control class the independent variable used is a conventional learning model, namely lectures and discussions.

2.3. Research

The research instrument used to measure critical thinking skills as the dependent variable is in the form of test questions with a composition HOTS (descriptions Higher Order Thinking Skill Of 10 items of) according to the material. The test questions were given to the two research groups (control and experiment) as a post-test that had to be done after the learning activities with the materials used were over. The instrument used to obtain data from students' perceptions of geography subjects was in the form of a questionnaire with a composition of 30 statement items accompanied by the use of a Likert scale interval 1-5 as answer options. The research instrument was first tested on a number of respondents to test the level of validity and reliability of each item of the instrument.

The measurement of the validity of the instrument items for the critical thinking ability variable, namely the post-test questions of 10 items with an r table of 0.361 indicates that 90% of the instrument items have a value > 0.361 so that it can be said to be valid. The questionnaire instrument that measures students' perception of the subject of geography is 30 items with an r table of 0.355 showing the results of 87% of the instrument items having a value of > 0.355 so it can be said to be valid.

Furthermore, the reliability test on both instruments shows that the instrument is reliable. The test on the instrument post-test has a Cronbach's Alpha value > 0.60 , namely 0.628, which means the instrument is reliable. The value of Cronbach's Alpha on the questionnaire instrument also shows a value of > 0.60 , namely 0.747, which means the instrument is reliable. A number of instruments that have invalid or unreliable values are caused by students or respondents not understanding the questions or students from answering questions without considering the answers correctly. Some of these obstacles can be overcome by removing invalid instrument items or replacing them with other questions.

2.4. Data Analysis Data

Processing in this study using descriptive statistical methods and inferential statistics. Descriptive statistics in this study are used to describe the data in the form of tables

and graphs obtained from the average value. While inferential statistics are used to test the hypothesis that is safe in the study. Before testing the research hypothesis, it first passes the prerequisite test which contains the normality test with the Kolmogorov-Smirnov Test and the homogeneity test of the data using the F test by looking at the p value of Fisher F. The normality test of the data carried out is the data from the answers to the test questions (post-test) and the questionnaire instrument.

The results of the normality test on the answer data post-test with Kolmogorov-Smirnov showed a Sig value of 0.093. This figure is in the value > 0.050 which means the data is normally distributed. The same test was also carried out on the questionnaire instrument, which consisted of 30 questions with 59 respondents. The normality test data from the questionnaire answers showed Sig 0.200. This figure is also in the value > 0.050 which means the data is normally distributed. So, testing the normality of the data on both instruments shows the results of the data being normally distributed.

The next step is to test the homogeneity of the data. The homogeneity test on the answer data post-test showed a Sig value of 0.079. The value is > 0.050 then it can be said that the data is homogeneous. Homogeneous data can be defined as the data taken or used come from the same population. The homogeneity test on the data from the questionnaire answers shows a Sig value of 0.160. The number 0.160 is > 0.050 , it means that the questionnaire instrument data is also homogeneous.

3. Result and Discussion

3.1. The Effect of the Discovery Learning Model on Critical Thinking Ability

Before testing the research hypothesis, the following data is presented from the results post-test of the control class and the experimental class to measure the critical thinking ability variable.

TABLE 2: Data on the results of the post-test of critical thinking skills for both classes of.

Descriptive Statistics							
	N	Min	Max	Sum	Mean	Std. Dev	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Control	582.6	16,18	.2900	1.7399	13.4	18.8	36
Experiment	612.4	17,49	.2340	1.3843	15.2	20.0	35
Valid N (listwise)	35						

Based on table 4.1 above, it can be seen that the results of measuring critical thinking skills for the two classes using a test instrument (post-test questions) show that the average value between the control class and the experimental class is different. The experimental class that carried out learning activities using the model discovery learning had a higher average score of 87.48 compared to the control class that carried out learning activities using conventional methods in the form of lectures and question and answer discussions, which was 80.91.

Hypothesis testing was carried out with two types of methods, namely the independent sample t-test and the ANOVA test. The study uses moderator variables so that there are two research hypotheses to be tested. The first hypothesis testing was carried out with the help of IBM SPSS Statistics 25 with the following results.

TABLE 3: Hypothesis testing with independent sample t-test.

Independent Samples Test		Levene's Test for Equality of Variances							t-test for Equality of Means	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Interval of the Difference	Confidence of the Difference
								Lower		Upper
Score	Equal variances assumed	0.079	-3,52	-1.31	69	0.001			3,178	-0.5681
	Equal variances not assumed	3738	-2.06	-3.53	66	0.001	-1.3138	0.3726	-2.0577	-0.57

First Hypothesis

Hi = There is an effect of model discovery learning on critical thinking ability of high school students

H0 = There is no effect of model discovery learning on critical thinking ability of high school students

This first hypothesis was tested by involving the data from the answers for post-test the control class and the experimental class using the independent sample t-test. The result shows the value of Sig (2-tailed) on Levene's Test is 0.001. If the value of Sig (2-tailed) <0.05 then H0 is rejected and Hi is accepted. So the results of the study state that there is an influence between the discovery learning model on critical thinking skills.

3.2. The Effect of Discovery Learning Model on Critical Thinking Ability Viewed from Students' Perceptions of Geography Subjects The

Data obtained to test the hypothesis of this second study were the results of the answers to the questionnaires filled out by both classes. Students as respondents fill out a questionnaire subjectively. The following table shows the frequency distribution of questionnaire answers by students.

Second Hypothesis

Hi = There is an influence between the model discovery learning on critical thinking skills in terms of students' perceptions of high school students' geography subjects

H0 = There is no effect between models discovery learning on critical thinking skills in terms of students' perceptions of high school students' geography subjects

The following table presents the frequency distribution of the results of the questionnaire answers by students in both classes regarding perceptions of the geography subject.

TABLE 4: Frequency distribution of student perception questionnaires on geography subjects.

Classification	Range of	Qualifications	Frequency	Percentage (%)
1	102 - 135	Good/Positive	37	62.71
2	36 - 101	Enough	22	37.29
3	0 - 35	Less/Negative	0	0

Table 4.3 above presents the data obtained from students of both classes. A total of 27 questions in the questionnaire were answered by students subjectively and honestly. The results show that most students have a positive perception of the subject of geography, which is 62.71% and the remaining 37.29% of students have a sufficient or neutral perception of the subject of geography.

The second hypothesis was tested using the ANOVA test (analysis of variance), namely the two way ANOVA by looking at the results of the between-group test. The following table shows the results of the ANOVA test on the second hypothesis.

The results show that the Sig value in the between groups test is 0.020. The Sig value is <0.05 then H0 is rejected and Hi is accepted. So, the results of the study indicate that there is an influence between the model discovery learning on critical thinking skills in terms of students' perceptions of the geography subject of high school students.

TABLE 5: Hypothesis testing using ANOVA (analysis of variance).

ANOVA					
	Value				
	Sum of Squares	df	Mean Square	F	Sig.
Groups Between	16,508 5,754 .020	1			16,508
Within Groups	163 541	57	2,869		
Total	180,049	58			

3.3. Discussion

The results of the research that have been analyzed prove the influence of the model on the research variables. The results of testing the first hypothesis in this study indicate that the model discovery learning has an effect on students' critical thinking skills. This is also supported by the difference in the average post-test results between the control class and the experimental class. Student learning in the experimental class using the model discovery learning has a higher critical thinking ability test score. In the implementation of learning with this model discovery learning, students are encouraged to identify what they want to know and then proceed with finding their own information, organizing or forming (constructively) what they know and understand in a final form [15] [17] [18]. Therefore, in an effort to improve students' critical thinking in this study, it is proven that it can be obtained using the discovery learning model.

This research was conducted online (on the network) in full due to the pandemic conditions that limited student learning activities in the classroom. This study involved two classes using two different learning models. It can be seen from the results of the study that the average value of students' critical thinking skills in the control class that did not use the model, discovery learning, namely class I4 was lower than students in the experimental class who used the model, namely class H4. These results are in line with research findings [2] regarding the learning model with discovery learning which shows that there is a significant influence on the critical thinking ability score of the experimental class conducted using the learning model which is higher than the control class using conventional methods. The difference in the average value was obtained from the provision of a post-test which was carried out at the same time, namely at the end of the learning activity meeting. The instrument used contains indicators of critical thinking skills in each item. The material used is Basic Competence 3.7 on Natural Disaster Mitigation in Indonesia.

Learning activities with the model discovery learning carried out in the experimental class have several steps or stages. As described in the literature review, the steps

of the model discovery learning consist of, 1) stimulation (providing stimulation), 2) problem statements (problem identification), 3) data collection (data collection), 4) data processing (data processing), 5) verification (proof), and 6) generalization (drawing conclusions) [15]. These steps have been carried out in every meeting or every learning activity carried out in this study, both synchronously and asynchronously. The research was conducted in 3 (three) meetings where each study fulfilled 2 (two) stages of the model discovery learning. A number of stages described above are carried out online either through face-to-face synchronous or asynchronous so that the implementation of each model syntax discovery learning adapts to students' abilities.

The successful implementation of each stage of the model is discovery learning done by forming students in the experimental class into 6 (six) discussion groups. Discussions by students are carried out in stages which are arranged at each meeting online or online where the output of the discussion is in the form of scientific articles based on the chosen topic. The Model discovery learning or can be referred to as the discovery learning model, is a model that gives students the freedom and independence to find learning resources. The teacher or researcher here functions as a facilitator and director of the ongoing learning activities. At the syntax or stages of data collection and data processing, students can search for sources of discussion and material through various media and platforms that students have. As for the proof/stage verification, students are directed and given a comprehensive understanding of the concepts, materials, and topics they have discussed, namely the Mitigation of Natural Disasters in Indonesia.

Based on several findings in previous studies that discussed the effect of the discovery learning model this model has a significant effect on critical thinking skills. Research findings by [6] [7] [2] show the results that the model discovery learning supports and has an influence on students' critical thinking skills. However, there has been no research that has found any effect when viewed from the perspective of students' perceptions of the subject. Therefore, this research is one of the latest findings that the model discovery learning affects students' critical thinking skills in terms of students' perceptions of the subjects in this study, namely the field of geography.

As it is known that the perception of a student's perspective and in practice the students have a view that is different. This can be particularly associated with the learning model of discovery learning for learning activity in this model centered on the student (student centered). Discovery learning is a model learning that emphasizes the message-centered learning process of students and active learning experiences that will guide students to find and express their ideas related to the topics studied [15] [21]. Therefore, the involvement of students' perceptions of the subject of geography

is an important thing when assessing the effect of the model discovery learning in the classroom.

The results of testing the second hypothesis in this study indicate that there is a significant effect on the class that uses the model discovery learning compared to the class that uses the conventional model in terms of each student's perception of the subject of geography. Students' perceptions of geography subjects were measured using a questionnaire. Perception values are classified into good/positive, moderate/enough, and less/negative categories. Each student has his own perception of the subject of geography, so hypothesis testing is done by involving the post-test scores of critical thinking skills and questionnaire scores. Students who have low grades do not necessarily have a negative perception of geography subjects, and vice versa. However, the results of hypothesis testing indicate that the model has an effect on critical thinking skills in terms of students' perceptions of geography. Therefore, research on the two classes that have different perception results in each student proves that this model discovery learning has an effect on students' critical thinking skills.

The implementation of research using the learning model in the classroom certainly has several weaknesses and obstacles. Seeing the condition of learning activities in 2021, which are carried out online or online, technical problems when research occurs more when carrying out activities according to the syntax or stages of the model discovery learning. Student participation that cannot be said to be maximal makes meeting schedules and task collection hampered. However, these obstacles can be overcome with the help of asynchronous learning that can be accessed by students anytime and anywhere according to their respective times and abilities.

4. Conclusion

Based on the description of the data from the research and discussion above, it can be concluded that the model discovery learning has an effect on students' critical thinking skills. This model discovery learning also affects students' critical thinking skills in terms of students' perceptions of geography subjects.

This research, which was conducted online or online at SMAN 3 Malang, showed the high results of the critical thinking ability test in the experimental class using the model discovery learning compared to the control class. This is also accompanied by the results of the perception questionnaire scores of each student, most of which show positive scores on the subject of geography. Therefore, it can be interpreted that the use of appropriate learning models and in accordance with learning materials is able to

support learning activities that are in accordance with learning objectives and can also improve students' thinking skills.

Some of the recommendations that researchers can give so that research and learning activities become better and more optimal include:

1. Further researchers can use research findings to be used when learning activities in research are carried out face-to-face.
2. Further researchers should adjust the implementation of learning models through lesson plans and other learning instruments to the class conditions that will be used, and pay attention to the procurement of online or offline systems used in schools because they affect the implementation of learning activities and student participation.
3. Further researchers can use research findings to be applied to other fields of science so that research results are more diverse.

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