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ANALISIS KEMAMPUAN BERPIKIR KRITIS SISWA TERHADAP PEMBELAJARAN HYPOTHETICO-DEDUCTIVE REASONING DALAM LEARNING CYCLE 7E

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Abstract

This study aims to determine the effect of the Hypothetico-Deductive Reasoning method in Learning Cycle 7E on students' critical thinking skills. The design of this study is quasi-experimental with nonequivalent control group design and implemented at SMPN 1 Baureno with a population of all class VII. The sample used was 2 classes, namely class VII A as an experimental class and class VII B as a control class. The critical thinking ability test consist of 7 essay questions. It can be concluded that students' critical thinking skills are in good criteria with an average percentage of 72.61%.

Keywords: *Critical Thinking, Hypothetico-deductive Reasoning, Learning Cycle 7E*

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INTRODUCTION

Science learning is a learning process that examines natural knowledge. The meaningful learning process of science is expected to develop the quality of education in Indonesia. Learning in science must prioritize the meaningful learning process. The concept of meaningful learning in the science learning process will be able to answer the problems encountered by students (Sulistyowati, 2014).

The context of natural science learning is not much different from the concept of learning in other subjects where only the pressure must be in accordance with the nature of science, learning science must occur in the process of science, produce science products by conducting experiments or experiments and formed scientific attitudes. Science learning cannot by memorizing or passively listening to the teacher explain the concept, but students themselves who have to do learning through experimentation, observation and active experimentation will eventually form creativity and awareness to maintain and improve natural phenomena that occur to further form scientific attitudes which in turn will be active in maintaining good and sustainable stability (Sulthon, 2016). Conventional learning is identical with lecture, question and answer, and assignment methods, so that it can cause students to be passive in learning (Nur, Moh., & Hasnawati, 2016).

The situation that occurs in learning activities is not as expected. There is a tendency for teachers to see science learning only as a combination of products and neglect other aspects of science as a process. Learning science in schools is still attached to the paradigm of information search, science should emphasize more on process skills, so students encounter facts, theories, form concepts, and scientific attitudes that can have a positive impact on educational excellence. Teachers often teach science only by relying on books (Suciati & Setiawan, 2014).

Indicators of critical thinking skills have not yet been developed as competencies in students. As a result, students barely have time to provide solutions to the problems obtained. This can be used as an indicator that the critical analysis power of students is still low. This is proven by research that states that students who take part in learning by using direct learning are still partially empowered in memorization and memory. This causes the information obtained by students is very easy to forget (Adnyana, 2012).

Critical thinking does not mean people who stand firm with the wrong arguments or assumptions, but people who think critically can also provide a way out of the problems and arguments presented have a rational basis, cautious and precise (Amir, 2015). Through the ability to think critically, students can think evaluatively in measuring the problem-solving actions taken (Trisnowati & Firdaus, 2017). Efforts in training students' critical thinking skills need to use supportive learning models. One model that supports in training students' critical thinking skills is Learning Cycle 7E.

7E Learning Cycle Model is a learning model that is centered on student activities and is based on constructivism. The constructivism approach is a learning perspective that teaches students to construct or form knowledge with schemata that students have. Students learn to construct knowledge based on their exploration experience, through discussion, observation, experimentation, and problem solving. Learning Learning Cycle 7E students are directed to be active, confront themselves, reflect on the findings obtained, interpret their findings against the initial schemata that have been owned, and predict findings in new contexts (Huda, 2013).

Learning Cycle 7E has 7 phases, namely: (1) elicit (determining students 'initial knowledge), (2) engaging (attracting and attracting students' attention), (3) exploring, (4) explaining (explaining), (5) elaborate (apply), (6) evaluate, (7) extend (Indrawati et al., 2015). Learning by applying the 7E Learning Cycle model requires students to pursue material significantly by working and thinking so that the knowledge obtained is the result of construction of experiences experienced by students (Sumiyati, Yeni, Atep Sujana, 2014). In addition to the model, also required learning methods that support in helping students to practice students' critical thinking skills.

Hypothetico-Deductive Reasoning method is very influential on students' critical thinking skills. This is evidenced by research that states that students who follow learning using the Hypothetico-Deductive Reasoning learning cycle model provide wider space for students to think and argue. The ability to argue is closely related to the ability to think critically.

METHOD

The research method used is a quantitative method with the type of experimental research. The study was conducted in March 2019 at SMPN 1 Baureno. The population of the study was VII grade students of SMPN 1 Baureno in the 2018/2019 school year. The research design uses Quasi Experimental Design Nonequivalent Control Group Design. The sample selection technique used is the Purposive Sampling technique. The sample of the study was students

of class VII A and VII B of SMPN 1 Baureno. Class VII A students are treated using the Hypothetico-Deductive Reasoning method in Learning Cycle 7E and class VII B without treatment. The independent variables in the research conducted are the Hypothetico-Deductive Reasoning method and the Learning Cycle 7E model that will be applied to the experimental group. The type of independent variable data in the study conducted is nominal. The dependent variable in question is the critical thinking ability of students. Variable data types are dependent on the research conducted, namely the interval.

The instruments used in the study consisted of two kinds, namely the instrument of learning implementation and the instrument of data collection. The learning implementation instrument consists of a syllabus, lesson plan (RPP), and student worksheet (LKS). The data collection instruments consisted of tests of critical thinking skills.

Tests are given to students in research conducted to determine students' critical thinking skills before and after learning by using the Hypothetico-Deductive Reasoning method in Learning Cycle 7E. The tests in the research carried out included pre-test and post-test in the form of description questions. Analysis of students' critical thinking skills tests can be done using formula 1.

$$\%\ Critical\ thinking\ skills = \frac{Skor\ yang\ diperoleh}{Skor\ maksimal}\ x\ 100\% \quad (2)$$

(Permana, 2016).

As for the percentage criteria for students' critical thinking skills explained in table 1.

Table 1. Criteria for the percentage of critical thinking skills

Interpretation (%)	Criteria
$80 \leq X \leq 100$	Very good
$60 \leq X < 80$	Good
$40 \leq X < 60$	Quite good
$20 \leq X < 40$	Not good
$0 \leq X < 20$	Very not good

(Modified by (Trisnowati & Firdaus, 2017)).

RESULTS AND DISCUSSIONS

The results of students' pretest and posttest scores can be analyzed on each indicator of critical thinking (giving simple explanations, building basic skills, concluding, giving further explanations, and arranging strategies and techniques) the experimental class and the control class.

The results of the acquisition of critical thinking skills from the pretest values of the experimental and control classes can be seen in Table 2.

Table 2. Percentage of pretest critical thinking ability categories

Category	Experiment		Control	
	Frequency	Persentation(%)	Frequency	Persentation(%)
Very good	0	0.00	0	0.00
Good	5	16.67	3	10.00
Quite good	21	70.00	23	76.67
Not good	4	13.33	4	13.33
Very not good	0	0.00	0	0.00

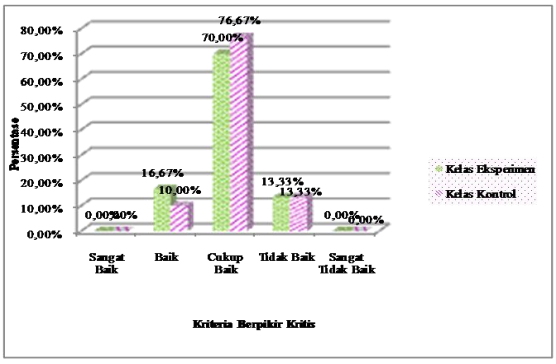

Figure 1. Graph of percentage of pretest critical thinking ability categories of experimental and control classes.

The percentage of critical thinking from the pretest values of the experimental and control classes can be seen in Figure 1.

Based on Table 2 and Figure 1 can be known the percentage of pretest in the experimental class and the control class. The results of the percentage of criteria obtained in the experimental class with a very good criterion of 0.00%, good 16.67%, 70.00% good enough, not good 13.33%, and very

not good 0.00%. Whereas in the control class with very good criteria 0.00%, good 10.00%, good enough. 76.67%, good 13.33%, and not very good 0.00%. Furthermore, the results of the acquisition of critical thinking skills from the experimental class's posttest value and the control class can be seen in Table 3 and the results of the critical thinking percentage of the posttest value of the experimental class and the control class are processed into graphical form in Figure 2.

Table 3. Percentage of Posttest Critical Thinking Ability Categories

Category	Experiment		Control	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Very good	8	26.67	0	0.00
Good	22	73.33	18	60.00
Quite good	0	0.00	12	40.00
Not good	0	0.00	0	0.00
Very not good	0	0.00	0	0.00

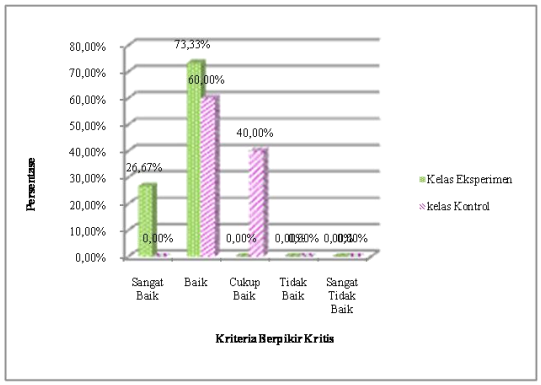

Figure 2. Graph of percentage of posttest critical thinking ability categories of experimental and control classes

Based on Table 3 and Figure 2 it can be seen the percentage of posttest in the experimental class and the control class. The results of the percentage of criteria obtained in the experimental class with very good criteria 26.67%, 73.33% good, 00.00% good enough, not 00.00% good, and not very good 0.00%. Whereas in the control class with very good criteria 0.00%, good 60.00%, good enough 40.00%, good 00.00%, and very not good 0.00%.

The results of students' pretest and posttest scores can be analyzed on each indicator of critical thinking (giving simple explanations, building basic skills, concluding, giving further explanations, and arranging strategies and techniques) the experimental class and the control class. The percentage of pretest based on indicators of critical thinking ability of the experimental and control class can be seen in Table 4 and the percentage of completeness of the Pretest Indicator of the Pretest Class of the Experiment Class and the Control Class can be seen in Figure 3.

Table 4. Pretest percentage of critical thinking skills in the critical thinking indicators of the experimental and control classes

Indicators of Critical Thinking	Experiment		Control	
	Pretest (%)	Criteria	***Pretest*** (%)	Criteria
Provide a simple explanation	46.94	Quite good	39.17	Quite good
Build basic skills	50.83	Quite good	52.50	Quite good
Conclude	46.67	Quite good	54.17	Quite good
Provide further explanation	50.42	Quite good	48.75	Quite good
Manage strategies and techniques	47.08	Quite good	51.67	Quite good

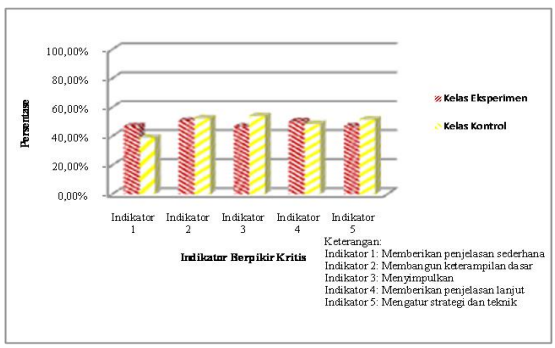

Figure 3. Graph of percentage of completeness of the pretest indicators of experimental and control classes

Based on Table 4 and Figure 3 it can be seen that the pretest value of the experimental class and the control class on each indicator is quite good. On the indicator gives a simple explanation, the percentage of experimental class is 46.94% and the control class is 39.17%. In the indicator of

building basic skills, the percentage of the experimental class was 50.83% and the control class was 52.50%. On the indicators concluded, the percentage of the experimental class was 46.67% and the control class was 54.17%. On the indicator provides further explanation, the percentage of the experimental class was 50.42% and the control class was 48.75%. In the indicators governing strategy and technique, the percentage of the experimental class was 47.08% and the control class was 51.67%.

The percentage of posttest based on indicators of critical thinking ability of the experimental and control class can be seen in Table 5 and the graph of the percentage of mastery posttest indicators of the experimental class and the control class can be seen in Figure 4.

Table 5. The posttest percentage of critical thinking skills in the critical thinking indicators of the experimental class and the control class

Indicators of Critical Thinking	Experiment		Control	
	Posttest (%)	**Criteria**	**Posttest** (%)	**Criteria**
Provide a simple explanation	78.89	Good	58.06	Quite good
Build basic skills	75.00	Good	69.17	Good
Conclude	72.08	Good	65.83	Good
Provide further explanation	67.92	Good	57.50	Quite good
Manage strategies and techniques	69.17	Good	62.50	Good

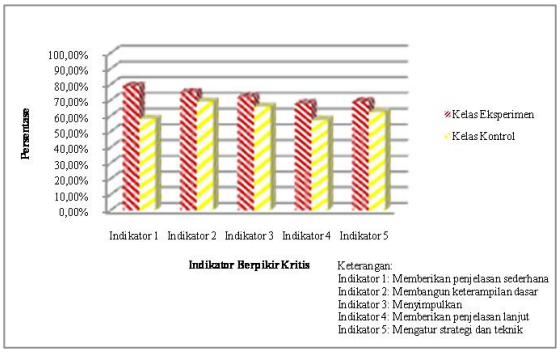

Figure 4. Graph of percentage of mastery posttest indicators of the experimental class and the control class

Based on Table 5 and Figure 4 it can be seen that the posttest value of the experimental class and the control class there is a change in the value of the five indicators. In the indicator providing a simple explanation, the percentage of experimental class reached 78.89% included in the criteria well and the control class reached 58.06% included in the criteria quite well. The acquisition of the posttest value of the experimental and control classes is a significant difference. This shows that the ability of the experimental class students in providing simple explanations is more appropriate in providing explanations than in the control class, because in the context of the questions the students are working on are related to experiments that have been carried out by experimental class students. Therefore, the students' answers to the questions given have different quality answers in each class. The hallmark of the Learning Cycle 7E learning model is that it provides opportunities for students to use learning styles to discover and apply (Suwito, 2014 in (Partini, Budijanto, & Syamsul, 2017)). This is in accordance with Bruner's learning theory which states that in learning students interact with the environment, explore, ask and experiment, so students will easily remember a concept if the concept is acquired by students themselves through the learning process of discovery that is by inquiry and finding (Herpratiwi, 2016).

In the indicator of building basic skills, the percentage of experimental class reached 75.00% included in the criteria of good and the control class reached 69.17% included in the criteria of good. This shows that the indicators building the basic skills between the experimental and control classes have the same criteria but the scores obtained by the experimental class are still high. On the indicator of building basic skills, the experimental class can analyze images of observations appropriately because the context of the questions students do is in accordance with the experiments that have been carried out. This is appropriate for the Explore activities where students explore knowledge through experiments, observations, and discussions (Sumiyati, Sujana , & Djuanda, 2016). Learning Cycle 7E learning model shows the involvement of students' critical thinking skills in several phases that can be directly seen in the learning phase of Learning Cycle 7E (Hardinita & Muchlis, 2015).

In the indicators concluded, the percentage of the experimental class reached 72.08% included in the criteria of good and the control class reached 65.83% included in the criteria of good. This shows that the indicators concluded between the experimental class and the control class have the same criteria but still high values obtained by the

experimental class. In concluding indicators, the experimental class can read the table of observations and analyze the problem precisely because the context of the questions that students do in accordance with experiments that have been conducted. Learning Cycle Learning Model 7E has the advantage of being able to practice finding concepts through experiments (Manurung, 2018). Therefore, the students' answers to the questions given have different quality answers in each class.

In the indicators providing further explanation, the percentage of experimental and control classes is quite good. While at the posttest the value of the experimental class reached 67.92% included in the criteria well and the control class reached 57.50% included in the criteria quite well. The acquisition of the posttest value of the experimental class and the control class there is a significant difference. The acquisition of the value between the experimental class and the control class there is a significant difference. On the indicator provides further explanation, the experimental class can analyze news about a problem appropriately because the context of the problem the student is working on relates to experiments that have been conducted. Learning Cycle Learning model 7E has the advantage of one of them being the flexibility for students to find alternative problem solving to explain the concepts learned (Manurung, 2018). Therefore, the students' answers to the questions given have different quality answers in each class.

While the indicators governing strategies and techniques, the percentage of the experimental class reached 69.17% included in the criteria both and the control class reached 62.61% included in the criteria both. This shows that the indicators governing strategies and techniques between the experimental class and the control class have the same criteria but the values obtained by the experimental class are still high. In indicators governing strategies and techniques, the experimental class can analyze images in the form of problems and then create strategies precisely because the context of the question students is working on relates to experiments that have been conducted. This is in accordance with the Elaborate activity where the teacher guides students to solve problems according to the concepts obtained by giving assignments (Sumiyati, Sujana, & Djuanda, 2016). Through problem solving students will be able to think critically, because critical thinking is a scientific process used to solve problems (Patmah, Purwoko, & Muntari, 2017). Therefore, the students' answers to the questions given have different quality answers in each class.

Based on the students' posttest results, from the five critical thinking indicators the highest percentage of posttest obtained is the indicator giving a simple explanation in the experimental class with a percentage of 78.89%. Indicators provide simple explanations directing students to formulate or identify criteria for considering and handling inaccurate answers (Susanto, 2013). So that the indicators provide simple explanations make it easier for students to answer questions and obtain the highest percentage of results than other critical thinking indicators. The ability to think critically can hone the mind to analyze and determine the correct choice of answers (Nuryanti, 2018).

CONCLUSION AND SUGGESTIONS

Conclusion

The level of critical thinking skills of students in learning Hypothetico-Deductive Reasoning in Learning Cycle 7E experimental class the average score of pre-test is 48.39% with quite good criteria and the average posttest score is 72.61% with good criteria. Whereas in the control class the average pretest score was 49.25% with quite good criteria and the average posttest score was 62.61% with good criteria.

Suggestions

Students 'critical thinking skills must be trained in learning activities to support student success to be more optimal and further research needs to be done to train students' critical thinking skills by using other learning methods and models that are in accordance with the Hypothetico-Deductive Reasoning method and the Learnig Cycle 7E model.

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