APPLICATION OF INQUIRY LEARNING MODEL TO IMPROVE STUDENTS' CRITICAL THINKING SKILLS ON EFFORT AND ENERGY MATERIALS IN STATE SENIOR HIGH SCHOOL OF JOGOROTO

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Abstract

The purpose of this study is to describe how learning carried out, how students enhance critical thinking and how students respond to effort and energy material used Inquiry learning models for questions. The type of research used is quantitative with Quasi-Experimental Design and Non-eq research Design. The subjects of this research were students of class X in the second semester of the 2019/2020 school year, State Senior High School of Jogoroto. The instrument used when conducting research are essay test questions, workability sheets, and student questionnaire responses. The results showed that the implementation of pre-study learning exams, basic activities, graduation and time management done very well and an average score of 3.67 to help students think critically about aspects of knowledge analyzed by improving and the results obtained through t-test in pairs. The analysis showed that students' critical thinking skills improved in class X MIPA 3 with a value of <g> of 0.75 with a high category. Based on the results of the paired t-test analysis, it found that there was a significant increase in the experimental group class. Student responses to the inquiry learning method reached 80% in the good category. The results of the data that can conclude are that the application of the learning process using the Inquiry model has the benefit of the ability to increase the students of Class X MIPA 3 of State Senior High School of Jogoroto with effort and energy materials.

Keywords: inquiry learning model, critical thinking skills, effort and energy.

Abstrak

Tujuan dari penelitian ini adalah untuk mendeskripsikan keterlaksanaan pembelajaran, meningkatkan berpikir kritis peserta didik, dan respon peserta didik terhadap model pembelajaran inquiry pada materi usaha dan energi. Jenis Penelitian yang digunakan dalam penelitian adalah kuantitatif dengan *Quasi Experimental Design* dan desain penelitian *Nonequivalent Control Group Pretest and Posttest Design*. Subjek penelitian ini adalah peserta didik kelas X semester genap tahun pelajaran 2019/2020 SMA Negeri Jogoroto. Instrumen yang digunakan pada saat melakukan penelitian adalah dengan menggunakan soal test essay, lembar keterlaksanaan, dan angket respon peserta didik. Hasil penelitian menunjukkan bahwa pelaksanaan ujian belajar pra-studi, kegiatan dasar, kelulusan dan manajemen waktu dilakukan dengan sangat baik dan rata-rata 3,67, membantu peserta didik untuk berpikir kritis tentang aspek pengetahuan dan hasil tersebut didapatkan melalui uji-t berpasangan. Hasil analisis menunjukkan bahwa keterampilan berpikir kritis peserta didik meningkat di kelas X MIPA 3 dengan nilai <g> sebesar 0,75 dengan kategori tinggi. Berdasarkan hasil dari analisis uji-t berpasangan, ditemukan bahwa terjadi peningkatan secara signifikan pada kelas kelompok eksperimen. respon peserta didik pada metode pembelajaran *inquiry* mencapai 80% dengan kategori baik. Hasil data yang dapat disimpulkan peneliti adalah penerapan proses pembelajaran dengan menggunakan model *Inquiry* memiliki manfaat yaitu dapat meningkatkan kemampuan berpikir kritis peserta didik SMA Negeri Jogoroto Kelas X MIPA 3 pada materi usaha dan energi.

Kata kunci : model pembelajaran *inquiry*, keterampilan berpikir kritis, dan usaha dan energi.

INTRODUCTION

According to Usman (in Umami and Jatmiko, 2013) Physics is a branch of science that underlies every technological development and can create a harmonious life with the surroundings nature. Physics can help students have skills in critical thinking. Analytical thinking skills of students developed using various natural phenomena as a form of physics implementation (Supardi, 2012).

The learning process takes place gradually and followed by relatively positive changes in student behaviour (Fajar dan Supardi, 2013). According to Alonso (in Bao, 2019), the goals of physics education in the 21st century are to foster reasoning skills and deepen deep conceptual understanding. Meanwhile, according to Suharto (2015), the purposes of physics education are to make it possible to enable students to develop the ability to argue in analytical thinking using physics to explain natural events and to solve problems qualitatively and quantitatively. To achieve these goals, students' critical thinking skills very necessary and require training. In critical thinking, the thinking used is conscious thought using intellectual thinking wisely, independently, clearly and rationally (Ahmatika, 2016).

Effort and energy lesson is one of the materials studied in physics. According to Singh and Schunn (in Mustofa, 2016) energy is a basic abstract concept of physics. The concept of effort and energy is a basic concept for understanding the phenomenon of motion in everyday life (Abell & DeBoer, 2011). Therefore, to help students understand the phenomena related to energy and effort, critical thinking skills needed.

Based on the results of pre-research on 23-25 July and 23 October 2019 conducted at State Senior High School of Jogoroto, it shows that physics is a subject that still considered difficult for students and the total percentage of students' critical thinking skills based on the given questions is 35.69 %. Meanwhile, the results of an interview with one of the physics teachers stated that the learning method used by providing the material means using the lecture method, namely by delivering information orally in the classroom. From the results of the research conducted for the first time, it shows that the skills of students in solving a problem and thinking critically are still in the low category.

Byun, et al., 2010; Reddy & Panacharoensawad, 2017 (in Alharti, 2020) have found that one of the factors that can hinder the skills of students to solving problems is the inability of students to fully understand the problems they face. It caused by the lack of basic knowledge of students about the concepts of physics, thus hindering their understanding of the physics problems at hand.

Research conducted by Yip in 1997 (in Ghaemi, 2017) states that students do not become passive recipients of the information provided and ask for modifications in the pedagogical and academic environment involved in improving thinking skills and limiting creativity. Yoder & Cook (in Lee & Mary Ewell, 2016) explains in their research that there are several new learning methods, that widely applied in the world of education, both in lectures, high schools, and laboratories. This learning method is like Active Physics, where the implementation involves a lot of students in generating questions and experimenting to find answers for themselves. The activeness of students in finding answers is very influential in increasing critical thinking, one of the solutions that can be done to students to improve their critical thinking skills is by applying inquiry learning (Jayanti, 2018).

The inquiry is a learning model that can motivate students to participate in the learning process enthusiastically. The teachers encourage students to gain experience and learners try experimental processes so that students can find out the principles (Shoimin, 2014). In this learning model, there are also fact-finding, organization, and structure of ideas, so that students can learn to do research and organize gradually (Wahyudi and Supardi, 2013) in other words, the inquiry learning model can be interpreted as several activities and skills focused on searching something that is a priority (Puspita and Jatmiko, 2013). In science, inquiry-based learning has done a lot to improve the literacy and skills development of students, so that students gain confidence in scientific abilities (Brickman, 2009). According to the National Education Department of Indonesia (in Primadani and Arief, 2012) physics learning should be conducted in inquiry to foster the ability to think, work, be scientific as well as able to communicate it as important aspects of life skills.

Based on the background of the problem, the research title can be compiled as follows: "Application of Inquiry Learning Model to Improve Students' Critical Thinking Skills on Effort and Energy Materials in State Senior High School of Jogoroto"

RESEARCH METHODS

Quasi-Experimental Design is the type used in research. This research includes the experimental class and the control class. The design of this research is the *Nonequivalent Control Group Pretest and Postest Design.* Giving pre-test (O1) questions were done before processing to see students' initial skills. The inquiry learning model (x) given to the experimental group which functions to train students to think critically. In the control class using learning used by teachers at school (-).

Table 1. Research Design

Class	Class Category	Pretest	Treatment	Posttest
X MIPA 1	Control	O_1	-	O_2
X MIPA 3	Experiment	O_1	X	O_2

In collecting research data is to use three types of instruments, namely questions that will be given to students to see to what extent critical thinking, using observation sheets to apply the *Inquiry* learning model and apply the *Inquiry* learning model to generate student responses. The test questions include elements with indicators for critical thinking according to Ennis (2011), which has the goal of developing critical thinking skills in students in terms of effort and energy materials both before (before the test) and after applying pre-test learning (after the test). Analyze data from the results before the test and after the test used to determine the ability of students to think critically using the *N-Gain test* and the *T-test* in combination with the pre-test, which is a test of normality and is a test of homogeneity (Sugiyono, 2015). Implementation of observation sheets to see whether learning is going well or not, which assessed using evaluation criteria (Ridwan, 2012). Response questionnaires to determine students' responses to learning models for analytical inquiry using a Likert scale (Ridwan, 2012).

RESULTS AND DISCUSSIONS
1. Results of Students' Critical Thinking Skills.

Students' critical thinking skills related to effort and energy materials measured by five test questions with indicators of critical thinking. The following table compares the mean scores of pre and post-tests in the control class and the experimental class.

Table 2. Comparison of Pretest and Posttest Average Scores

Point	Class	
	X MIPA 1	X MIPA 3
Pre-test	21,75	22,21
Post-test	74,87	80,30

From this table, there is a significant difference between the pre-test and post-test scores, this shows an increase in the ability of students to think critically. In the experimental class, group learning also applied, which according to Johnson (in Ghaemi, 2017) explained that collaborative groups learn at a higher level of thinking and remember information longer than those who work individually. When students engaged in collaborative discussions, their thinking skills will improve. Meanwhile, science and technology lessons taught within the boundaries of textbooks did not result in a significant increase in the critical thinking level of students (Duran, 2016).

For further analysis, the researchers also performed paired t-tests to find differences in the results before and after the test, which showed improvements in critical thinking skills. The table of normality test results presented in Table 3.

Table 3. normality test results

Class	X^2 table	X^2 counting		Information
		Pre-test	Post-test	
X MIPA 1		6,9	2,8	Normally distributed
X MIPA 3	11,1	7,1	4,2	Normally distributed

Table 3 shows that the results of the normality value before and after testing the X2 table are <table X2 with a significance level of 0.05, so the resulting data shows that the population sample uses a normally distributed research. To determine whether the sample produces homogeneous data, it done in two classes by performing a homogeneity test. Table 4 shows the homogeneity test values of the two groups where Ho is a homogeneous sample and H1 is a heterogeneous sample with a significance level of 0.05.

Table 4. Homogeneity Test Score

Class	X^2 table	X^2 count		Information
		Pre-test	Post-test	
X MIPA 1				
	5,99	2,88	0,44	Homogen
X MIPA 3				

The table defines that the results of X^2 count $<X^2$ table so that it can be seen that the results of the hypothesis obtained are Ho then accept the conclusions drawn in two classes in this type of research used is homogeneous research. Paired t-test was then carried out to find out how different it was when students applied inquiry learning, before and after learning. The results of the paired t-test are presented in Table 5.

Table 5. Paired t-test results

Class	t table	t count	Hypothesis
X MIPA 1	1,69	36,2	H_0 rejected
X MIPA 3		40,1	H_1 diterima

Table 5 shows the t-count $\geq$ t-table with a significance level of 0.05. We can therefore interpret that Ho rejected and H1 accepted, indicating that there is a difference between the pre and post-test results in the study. Table 5 shows that the after-test scores greater than the pre-test scores. So, the conclusion is that the inquiry learning process has a positive effect on students who can improve their critical thinking skills about effort and energy materials. The normality test then carried out with N-Gain to analyze the extent to which the students' ability to think has increased critically. Table 6 below is the N-gain result

Tabel 6. N-gain Recapitulation Results

Class	Category	Amount of Students	n-gain score	Presentase
X MIPA 1	Low	0	-	-
	Medium	18	0,63	54,54 %
	High	15	0,72	45,46 %
X MIPA 3	Low	0	-	-
	Medium	4	0,68	12,12 %
	High	31	0,76	87,88 %

The table above shows that the n-gain value in the control class is smaller than in the experimental one with n-gain. More than 50% of students in the experimental group in the highest category in terms of improving critical thinking skills. Therefore it can be said that the application of an effective learning model to questions effectively improves critical thinking skills. It is relevant to the research of Deti Ahmatika (2016) which argues that students' critical thinking skills increased after using a survey model. The difference in student n-gain occurs because the level of cognitive skills of each person is different, even though the material prepared by the same

teacher and lesson, but the learning outcomes of each student different. (Arrends, 2012).

2. Observation Results of Learning Implementation

Observations that include all student activities during the learning process. The purpose of this observation is to determine the extent to which students have learned or not. Observations made by two observers, namely physics students from the State University of Surabaya. The table shows that as long as the learning process goes well it can be seen from all aspects, including learning activities starting from the opening, the process during learning and closing learning activities. The average results of learning management presented in Table 7.

Table 7. Recapitulation of Learning Implementation

No	Activity Aspects	Class	
		X MIPA 1	X MIPA 3
1	Opening	3,75	4
2	*Syntax* Phase 1	3,75	3,75
3	*Syntax* Phase 2	3,55	3,33
4	*Syntax* Phase 3	3.5	3,35
5	*Syntax* Phase 4	4	3,50
6	*Syntax* Phase 5	3,35	3,75
7	*Syntax* Phase 6	4	3,75
8	Closing	3,75	4
Categories		Excellent	Excellent
Percentage		92,65%	91,96%

The implementation of the learning process in these two classes can run smoothly and well. The Zoom application is one of the learning media used during learning both in the experimental group and the control group. In the table above, the opening, syntax phase 6 and closing process have the highest score, while the lowest score is in Phase 2 syntax, which is solving problems in which students are invited to discuss, but class conditions are less favourable.

3. Results of Student Response Questionnaire

The questionnaire used to determine the responses of students using the *inquiry* learning model. The student response questionnaire used in this study included 10 items that assessed by each student in the experimental class. The statement contains information about the learning process that learners passing by and learners can answer "yes" or "no". An inquiry learning model that applied to the learning process is to get 80% results and these

results are very effective in learning physics. This also supported by research (Susilowati, 2018) which shows that students are very enthusiastic about learning by using the *inquiry* method, even though at first students have difficulty in identifying problems. According to Ridwan (2010), the higher the percentage of student responses received, the more positive the students' responses in learning.

CONCLUSION

Based on the data from the research results, the conclusion is that the inquiry learning model process can run effectively and that learning can improve the critical thinking skills of students in class X MIPA 3 of State Senior High School of Jogoroto and at the good category. It can be seen from the *n-gain* value of students who have increased in the high category experiment class. Besides, based on observations on the implementation of learning, also in the excellent category, which based on the results of students' responses to a questionnaire about the use of the *inquiry* learning model method for exams, the enthusiasm of students when using the exams learning model is very high made by the researcher..

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