Jurnal Inovasi Pembelajaran Fisika
(INPAFI)
Available online http://jurnal.unimed.ac.id/2012/index.php/inpafi
e-issn 2549-8258, p-issn 2337-4624

THE APPLICATION OF INQUIRY TRAINING LEARNING MODEL WITH MULTIREPRESENTATION APPROACH TOWARD LEARNING OUTCOMES AND CRITICAL THINKING SKILL IN SENIOR HIGH SCHOOL

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Diterima: September 2019. Disetujui: Oktober 2019 Dipublikasikan: November 2019

ABSTRACT

This research have purpose knowing whether the learning outcomes and critical thinking skills of students using the inquiry training learning model are better than conventional learning in material work and energy in the class X SMAN 1 Perbaungan.This type of research is a quasi-experimental design with two group pre-test-post-test. The population in this research were all students of class X second semester SMAN 1 Perbaungan which consisted of 4 classes totaling 144 people. The research sample was taken two classes, namely class X-A2 (as experimental class) and class X-A3 (as control class) each of the 36 students was determined by simple random sampling technique. The instruments used are objective tests, namely cognitive questions form of multiple choice learning outcomes 15 questions and 5 questions of critical thinking skills in the form of descriptions. Based on the results of the reseach obtained the average value of pretest experimental class learning outcomes is 31,27 and the average value control class is 30,16 while the average value of critical thinking skills pretest experimental class is 17,44 with the average value control class is 16,89. Through testing the hypothesis test results are obtained that the initial ability of the two classes is equivalent. Then given different treatment, the experimental class with inquiry training learning model with multirepresentation approach and control class with conventional learning. Posttest data obtained is average value experimental class learning outcomes 78 and average control class 65 while the average value of critical thinking skills experimental class is 77,33 and control class 67,47. These results illustrate that inquiry learning training with multirepresentation approach is better than conventional learning in work and energy matter in class X SMAN 1 Perbaungan A.Y 2018/2019.

Keyword: *Inquiry training, multi representation approach, learning outcomes, critical thinking skill*

INTRODUCTION

Education is one form of the realization of dynamic culture and full of development. Therefore, changes or developments in education are things that are supposed to happen in line with changes in the culture of life. Changes in the meaning of improving education at all levels need to be continuously carried out in anticipation of future interests. The concept of education feels increasingly important when one has to enter life in the community and the world of work, because the person concerned must be able to apply what is learned at school to deal with problems faced in daily life at that time and in the future (Trianto, 2011).

One of the subjects taught in schools, especially secondary schools is physics. Physics is a subject that has a long record of success in creating new knowledge that is applied to a wide range of human experiences on a broad

scale and encourages the development of technology (Marpaung&Simanjuntak, 2018).

Based on the historical global view, physics has provided instantaneous more generic methods to help humans analyze and solve complex life problems. However, physics as a school subject still gets a bad reputation, which is difficult to learn and is not in demand by most students. Therefore, physicists or teachers, even those who are interested in physics in general, have very large problems in their efforts to present physics learning more meaningfully and make the young generation fascinated and interested in learning it (Euler, 2004).

The ability to think helps students solve the problems of daily life. Especially with critical thinking, students can decide what steps are right to solve the problem by thinking about the impact that resulted from that step. If the resulting impact is not good, the students critically find out what is the cause and other alternative solutions. In addition, critical thinking can help someone understand how he sees himself, how he views the world and how he relates to others, helps understand his own behavior, and values himself (Lambertus, 2009).

Critical thinking is a reasonable reflective way of thinking or that is based on logic that focuses on determining what must be trusted and done (Ennis, 1996).

The standard of student success in learning is seen from the ability to absorb the teaching material taught to achieve high achievement, both individually and in groups delivered by teachers in the class. A teaching and learning process about a material is said to be successful if it has achieved basic competencies. The teacher needs to hold a test after finishing presenting one subject (Bahridan Aswan, 2006).

Student learning difficulties will greatly affect the student's learning outcomes, both because of internal and external factors that are faced by students. Therefore students must be able to deal with the difficulties of the factors that influence these difficulties so that they do not affect student learning outcomes. The monotonous learning process is also one of the learning problems that we often encounter in several schools where the teaching carried out by the teacher runs in one orientation, which is only prioritizing mastery of mathematical equations without presenting the problems that exist in everyday life. Students can be said to only master mathematical discussions without knowing the theories in physics material, so students do not appreciate and animate the discussion being taught.

Based on the results of observations made by researchers at SMA 1 Perbaungan, namely by distributing questionnaires to 36 students obtained 50% (18 people) students think physics is a difficult and less interesting lesson, 33,3% (12 people) students think ordinary physics lessons, and only 16,67% (6 people) students think physics lessons are easy and fun. The questionnaire data also shows that before physics material is taught in the class that students have done is 16,67% (6 people) say study first at home, 52,7% (19 people) states sometimes study first at home, and 30,55% (11 people) don't open a physics book at all. The data shows most students do not like physics lessons and consider physics lessons difficult and boring. This causes their learning outcomes to be low, which is as much as 60% of students have an average score below KKM and students also confess that what makes them do not understand about physics is that teachers rarely confront them with real problems that occur in their lives related to the physical material being taught but only confront students with problems, as well as situations in classesthat are less supportive. Most highlighted are verbal representations and formulas.

In addition, the researchers also noticed that in the classroom students' critical thinking skills were relatively low. This can be seen during the learning process taking place at the presentation stage of the results of the group

discussion, namely the questions raised by students are only limited to knowledge questions that even the answer is a theory of the material being studied, not the question of analyzing what the presenter group presents. In addition, there are still many students who do not use the right method or strategy in working on the problem description, and are not careful in the calculation, so that the final answers of many students are incorrect. The researcher also conducted interviews with teachers in the field of physics study that the teacher uses conventional learning which is usually done and centered on the teacher and still uses the dominant method of lecture and assignment of assignments. Teachers also very rarely train in students' critical thinking skills. If learning like conventional is always done and too long it will be very boring and result in students becoming passive.

In connection with the problems that occur in school physics lessons, one of the ways that can be used to overcome the problem of student learning outcomes and can help students learn physics so that later really mastering physical material and technology and interested in developing it in the future, is a multi-representation approach that can clarify the concept learning material with the help of verbal, mathematical, graphical and pictorial representations;so that teachers can increasingly help students understand physics materials more easily and prevent abstractions in the concept of physics itself (Wadrid, et al, 2010).

Multi representation can also train students' critical thinking skills. Marpaung and Simanjuntak (2018) said that multi-representation based physics learning can train critical thinking skills because physics is a science that presents natural phenomena in the form of images, mathematical equations, has a relationship between physical variables. To access the characteristics needed in accordance with the physics.Representations, in this perspective, play a crucial role for expressing and internalising higher mental functions. They are cognitive tools invented by the scientific culture to carry out, and communicate, scientific reasoning (Treagust, et al, 2017). Physics learning requires students to master various representations (experiments, graphs, conceptual, formulas, images, diagrams) (Mahardika, 2013). This is relevant to the research conducted by Haratua and Sirait (2016) showing that students use more than one representation such as motion diagrams, style diagrams when solving problems, obtaining higher scores than students who do not. This means that some representations can be effective in increasing students' understanding of the concepts of physics.

According to Sanjaya (2009) the inquiry learning model is a series of learning activities that emphasize critical thinking processes and analysis to search and find their own answers to a questionable problem. This process of thinking is done about question and answer between teachers and students. The essence of inquiry learning is to give students learning to deal with the problems they face when dealing with the real world. In inquiry learning the teacher must plan the situation in such a way that students work like a researcher using procedures to recognize problems, answer questions, investigate and prepare frameworks, hypotheses and explanations that are compatible with experience in the real world.

Based on the description above, one of the inquiry model learning that can be used is the inquiry training learning model. This is also supported by Hutagalung (2013) stating that critical thinking will be more successful if applied with learning training model learning. Then the solution offered is learning using the Inquiry training model with a multi-representation approach.

According Joyce, et al, (2011) the inquiry training learning model is designed to bring students directly into the scientific process through exercises that can condense the scientific process into a short period of time. The aim is to help students develop discipline and develop the intellectual skills needed to ask questions and find answers based on their curiosity.

The main learning outcomes of inquiry training are processes that involve activities of

observation, collecting and processing data, identifying and controlling variables, making and testing hypotheses, formulating explanations, and drawing conclusions. This is consistent with the achievement of indicators in critical thinking skills (Hutagalung, 2013).

Critical thinking is a must in problem solving, decision making, as an approach, analyzing assumptions and scientific discoveries. Critical thinking is applied by students to learn to solve problems systematically in facing challenges, solving problems in an innovative way, and designing fundamental solutions. The process of critical thinking can only arise if there is openness of mind, humility, and patience. This momentum helps a person fully understand an event. Critical thinking still maintains openness of mind as long as he is looking for reasons, proofs and truths of logic (Sanjaya, 2009).

Combining the inquiry training learning model by using multiple representations will be able to improve students' understanding and critical thinking skills about physics so that learning will also increase.

Research on the inquiry learning training model with a multi-representation approach has been carried out by Habibah (2018) in her research showing that there is an influence from the application of the inquiry learning training model with a multi-representation approach significantly to improve student learning outcomes.

RESEARCH METHOD

The research conducted at year X of SMA Negeri 1 Perbaungan on march until april in second semester of research Academic year 2014/2015. The population in this research is all students at year X of SMA N 1 Perbaungan and consist of eight classes. The sample of this research used a simple random sampling technique with two group pretest-posttest designs. The research sample consisted of two classes, namely, one class as an experimental class with inquiry training learning model with a multi-representation approach and one other class as control class with conventional learning. The type of research used in this research was quasi-experimental. The method used in this researc is an experimental method with the designTwo group pre-test-post-test design in Table 1.

Table 1. Research Tables (Two group pre-test-post-test design) (Arikunto, 2006).

Class	Initial test	Treatment	Final Test
Experiment	T_1	X	T_2
Control	T_1	Y	T_2

Description:

T_1 :Initial test (Pre-Test) in the experimental and the control class

T_2 :Final Test (Post-Test) in the experimental and the control class

X :Treatment in experimental class with inquiry training model with Multi representation approach

Y :Treatment in the control class with conventional learning

The instruments used are objective tests, namely cognitive questions form of multiple choice learning outcomes 15 questions and 5 questions of critical thinking skills in the form of descriptions. The application treatment of inquiry training learning model was analyzed using a different test, namely the t-test. These results illustrate that inquiry learning training with multi representation approach is better than conventional learning in work and energy matter in class X SMAN 1 Perbaungan A.Y 2018/2019

RESULT AND DISCUSSION

a. Result

The initial stage of the both classes of research was given the initial ability test (pretest) of learning outcomes and critical thinking skill which aims to determine the initial ability of students in both classes together or not and obtain the average value

pretest of learning outcomes experimental class 31,27 and control class 30,16. While average value pretest critical thinking skill experimental class 17,44 and control class 16,89. The results of the pretest experimental class and control class were tested using normality test, homogeneity test, and two-tail t test, the results showed that the pretest value of experimental class and control class were normally distributed, homogeneous and the initial ability of both classes were the same. The final ability test (posttest) was conducted after the two classes were given different treatment, the experimental class was given treatment by applying the inquiry training learning model and the control class using conventional learning. The average posttest learning outcomes value of the experimental class 78 with standard deviation of 9,55 and average control class posttest score 65 with standard deviation 11,01. And average posttest critical thinking skill of the experimental class 77,33 with standard deviation of 3,85 and control class 67,47 with standard deviation 4,02.The results posttest learning outcomes and critical thinking skill of the experimental class and the control class after being given treatment can be seen in Figure 1 and Figure 2.

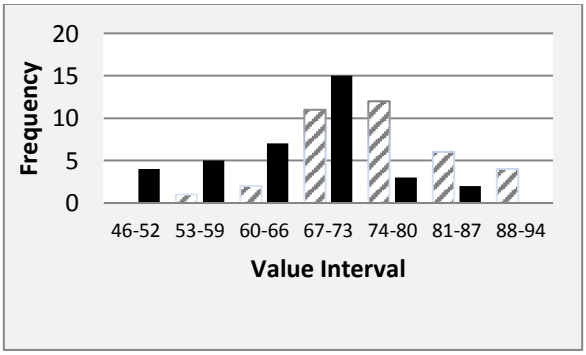

Figure 1. Bar Chart Posttest Data Learningout-comes Experimental and control class

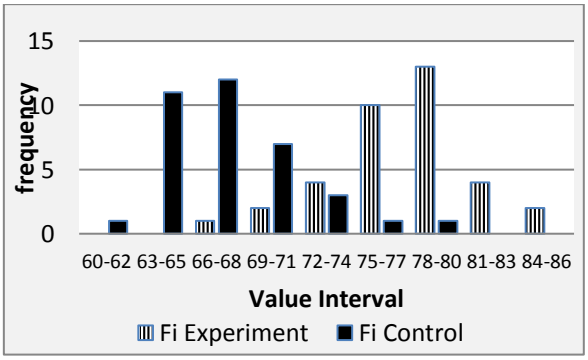

Figure 2. Bar Chart Posttest Data Critical Thinking Experimental and control class

The diagram above shows that the posttest value of the learning outcomes and critical thinking skills of the experimental class is higher than the posttest value in the control class. Based on the Normality test using the Liliefors test for both samples, it was found that the posttest value was normally distributed. Testing homogeneity of data posttest in experimental classes and control classes conducted by the equality test of variance to determine whether the sample group derived from a homogeneous population.

Hypothesis test results for posttest learningoutcomes and critical thinking skills use the t test at a significant level α=0,05 obtained for learning outcomes tcount>ttable (5,33> 1,998). The results of hypothesis testing of posttest learning outcomes can be shown in Table 1.2, for critical thinking skill tcount>ttable(10,6 > 1,998). The results of hypothesis testing of posttest learning outcomes and critical thinking skill can be shown in Table 2 and Table 3.

Table 3. Hypothesis Test Average Value Postest Learning Outcomes

Class	Average	t_{count}	t_{table}(α= 0,05)	Conclusion
Experiment	78	5,33	1,998	Reject H_o, H_a Accept
Control	65			

Tabel 4. Hypothesis Test Average Value Postest Critical Thinking Skill

Class	Average	t_{count}	t_{table}(α =0,05)	Conclusion
Experiment	77,33	10,6	1,998	Reject H_0, Ha Accept
Control	67,47			

Based on Table above can look that tcount>ttable with α=0,05so H_o rejected dand H_a accept. This shows that the average value of learning outcomes and critical thinking skills of students in the experimental class is significantly greater than the value of the

average critical thinking skills of the control class.

b. Discussion

The initial data analysis was obtained from the results which showed that the experimental and the control class were normally distributed and had homogeneous variations and had the same initial ability as the control class. Based on the results of the study showed that there were significant differences between students using the Inquiry Training learning model with a multi-representation approach and conventional learning on the material Work and Energy Class X Semester II in SMAN 1 Perbaungan A.Y 2018/2019.

The increase in student learning outcomes of the experimental class was higher than the control class, where in the experimental class the treatment was given the application of the inquiry training model with a multi-representation approach while the control class used conventional learning, this meant that learning in the experimental class was better than conventional learning. This is relevant to the research conducted by Haratua and Sirait (2016) whose research results show that students who use more than one representation when solving problems can score higher than students who do not. This shows that some representations can be effective in increasing students' understanding of physics concepts and problem solving skills.

In accordance with the multi-representation function, which is to provide representations that contain complementary information or help complete the process of student learning outcomes, limit the possibility of misinterpretation of others, and encourage students to build understanding of concepts that are more mandatory. With this multi-representation implementation, learning from students in the experimental class is very helpful for students because students have different intelligence according to their intelligence so students in the experimental class are helped in understanding physics concepts.

The highest correlation between the four representations by the experimental class students is graphfic representation, which is 94%, while for the other representations is mathematical 78%, pictorial 77%, and verbal 75%, table 71%.

Surakhmad, (Koentjaraningrat, 1986) states that the advantages of using graphics in explaining the relationship of various concepts are: (1) graphs in presenting data clearly, densely, concisely and simply rather than delivering written descriptions; (2) graphs can highlight the distinctive characteristics of the data more clearly than through written descriptions.

The Inquiry Training model can influence student learning outcomes in learning where this model provides an opportunity for each student to be actively involved in the teaching and learning process and aims to train students' ability to research, explain phenomena and solve scientific problems and build their own knowledge through exercises that done in learning.

The implementation of the inquiry training model gives a difference to student learning outcomes on cognitive aspects because it has 5 learning phases which make students' knowledge better and increase, this is also in accordance with Lumban Gaol and Makmur (2014). As long as the research takes place in the first meeting to the second meeting, it is found that in the first phase, namely formulating the problem, the researcher gives a problem to the students so that students can respond to the questions given by the researcher individually students experience cognitive conflict that will motivate students to solve the problem, in the first meeting students still looked confused and less active in giving responses, there were still many who were silent, but at the next meeting students had begun to give responses, so many students

began arguing or giving questions with learning stimulus.

The second and third phase are formulating hypotheses, designing experiments and conducting experiments, where students form hypotheses or provide temporary answers to problems given in student worksheets (LKPD), then design practicums according to work procedures in LKPD and do lab work. At the first meeting students were confused to comment on the problem given by the researcher, because they never got a physics problem in previous learning until the researcher explained repeatedly about the problem presented until they understood what was meant by the problem, but after being seen at the second meeting the conducive until students understand more about the problems presented and practicum activities go well. Students are actively involved in giving hypotheses of the problems given with different arguments, but again after giving appreciation the researchers direct students to find answers to their curiosity.

The fourth phase, which is conducting experiments to obtain the information needed, process, formulate an explanation. Students are asked to use numbers in stating observations, performing calculations, choosing the right instruments, identifying quantities that must be measured, designing investigations and paying attention to experimental errors.

The fifth phase is to draw conclusions, in the first meeting many students ask and are confused about how to make conclusions and students cannot yet to connect the discovery of concepts obtained when practicing with the concepts in book, so that when making conclusions it is not in accordance with the problem given, so the researcher again explains to students so that the conclusions obtained must be in accordance with the problems given by the researcher and able to connect the concepts that exist in the book or other references, then at the second meeting and then students will increasingly understand the conclusions obtained as expected.

In conducting research, researchers have followed the procedures that have been made in the planning stage but during the use of this model there are still obstacles to implementing each phase. One of the class conditions that was not conducive to the implementation of phase III was organizing students to design experiments, some students who sat quietly or did not participate in carrying out lab work in their group in phase IV, making use of time inefficient. Especially when students develop practicum results using only limited references from the textbook.

Never the less these obstacles can be minimized in order to get better learning outcomes with the same learning model. Collaboration between researchers and teachers in school subjects is to join so that during the study the teacher can see firsthand the atmosphere and teaching and learning activities. In addition, this is also useful for researchers so researchers can exchange ideas or share information with subject teachers.

Critical thinking skills in this research were obtained from the results of posttest tests on business material and energy assessed from the cognitive aspects given at the end of learning. The research data can be seen in the experimental class taught using the inquiry training learning model with a multi-representation approach. The average value of pretest for critical thinking skills is 17,44 and the posttest average score is 77,33 while in control class the average score of critical thinking skills pretests is 16,89 and the posttest average value is 67,47.The results of this research are almost the same as the Damanik (2013) study that the inquiry training learning model can improve critical thinking skills.

The highest correlation between the four representations by the experimental class students is verbal representation, which is 86%, while for the other representations is pictorial and mathematical 84%, graph 84%, pictorial 83%, and mathematic 50%.

The experimental class's critical thinking skills are higher than the control class, this difference occurs because in the learning process in the experimental class using the Inquiry Training model there are 5 phases

namely (1) problem presentation, (2) verification data collection, (3) experimental data collection, (4) organization of data and formulation of conclusions; and (5) analysis of inquiry processes. The five phases really help improve students' critical thinking skills.

In the phase of presenting the problem, students are given fishing questions so students are interested and focused on the learning process. Students respond according to students' initial understanding. From this phase, students are trained to think critically on indicators analyzing arguments because students submit their opinions spontaneously and after that try to select which arguments are correct.

The second phase is collecting data verification, in this phase the researcher guides students to look for theoretical answers to the questions given. In this phase researchers have difficulty growing students' interest in reading. Before the learning process researchers require students to bring any book with material work and energy. However, at the first meeting there were only a few students who brought the book so that this phase was not going well. At the next meeting the researcher provided reading material but most students did not read the reading material. At the third meeting it seemed to be going well because students started reading both through books and the internet. From this phase it is expected to stimulate critical thinking skills to analyze assumptions because students try to find the right answers or assumptions about the problems given. In this phase the researcher saw a lack of interest in reading students and considered this as a habit of students in the learning process.

The third phase is the collection of experimental data. In this phase researchers have difficulty controlling some students who are less active in participating in the discussion. The researcher tried to solve the problem by approaching the less active students.

The fourth phase is the organization of data and making conclusions, in this phase the researcher directs students to draw conclusions from activities in previous phases. Conclusions are made based on the material that has been read and the experiments conducted. From this phase it is expected to be able to train critical thinking skills students make induction and consider the induction of students directed to conclude what has been obtained in the phase of collection of experimental data and conducted in the verification data collection phase.

The fifth phase is the analysis of the inquiry process, in this phase the researcher directs the errors that may occur in the data organization process and the collection of experimental data.

When the above learning takes place, students focus on working on the LKPD given. The LKPD given is done in groups, in each group there are students who are less active but there are also those who always try to complete the LKPD provided. This shows students' interest in different forms of learning. Even though with a different activity, researchers keep guiding the cooperation of each group member in turns to grow group member interactions. So students who are initially passive start participating. Students are very active in working on the LKPD, repeating demonstrations or experiments, and asking researchers. This activity describes the learning process that is purely focused on students. This makes students more quickly understand the material taught and this student's understanding is more in-depth.

The application of this learning model, the researchers had difficulty making students accustomed to reading books and adjusting questions in the LKPD because students were working on LKPD that needed a long time. While researchers consider the Inquiry Training learning model to be very good for training students 'critical thinking skills, this is also supported by the results of the application

of conventional learning models in the control class lacking in training students' critical thinking skills. This is because students depend on the explanation given by the researcher. Students are only familiar with practice questions with the same pattern. When faced with the question of critical thinking skills, students tend to be confused to understand the meaning of the problem

CONCLUSION AND SUGGESTION

Based on result research, we know, 1) The student learning outcomes of experimental class students who applied the inquiry training learning model with a multi-representation approach, the average value of the pretest was 31,27 and the average posttest value was 78. Student learning outcomes in the control class that apply conventional learning, the average score of the pretest was 30,16 and the average posttest value was 65. 2) Critical thinking skills in the experimental class that apply the inquiry training learning model with a multi-representation approach, the average pretest value is 17,44 and the posttest score is 77,33. Critical thinking skills of students in the control class who apply conventional learning, the average score of the pretest was 16.89 and the post-test average value was 67.47. 3) Learning Outcomes in the Experiment class are better than the control class seen in the posttest average value. Critical Thinking Skills Students in the Experiment class are better than the control class seen in the posttest average value.

Students who are prospective teachers or teachers who apply the inquiry training learning model, should pay attention to time efficiency for each phase, especially the division of groups to conduct experiments in the phase of collecting data.

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