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THE USE OF SCIENCE ENVIRONMENT TECHNOLOGY AND SOCIETY (SETS) LEARNING MODEL FOR ENHANCING THE CRITICAL THINKING SKILLS AND SCIENTIFIC ATTITUDES

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Maimunah

Department of Informatica Engineering, Faculty of Technique, Mathematics, and Natural Science
Universitas Indraprasta PGRI
Email:queenahakim@gmail.com

Abstract

This research purposed to determine the improvement of student's scientific attitudes and critical thinking skills on the colloidal concept with implementation the learning model science environment technology and society (SETS). The method for this study is quasi-experimental with research design "Pretest-Posttest Nonequivalent Control Group Design". Class XI student at one of SMAN in Majalengka District is the sample in this research with 62 students. The written test and the observation sheets used for collecting the data. The results showed that SETS learning for colloidal concept can enhance the student's scientific attitude was 72,7 % (good category) and student's critical thinking skills with N-Gain of 42% (moderate category). Increasing student's critical thinking skills class experiment is also significantly differ from the control class. So, the students' scientific attitudes and critical thinking skills can improved by implementation the learning chemistry with SETS learning model

Keywords: Colloidal Systems, Critical Thinking Skills, Science Environment Technology and Society (SETS), Scientific Attitude

INTRODUCTION

The basis for the development of science and technology in the future is the Mastery of natural science (IPA). IPA is concerned with how to find out about natural phenomena systematically, so IPA is not only a collection of knowledge in the form of facts, concepts or principles but also a process of discovery (Anwar, 2010). Science education help students in learning about themselves and the environment, as well as the prospects for further development and application in daily life. This is like the opinion of Liliasari (2005), who said that the basic idea of a competency-based curriculum is to improve the mastery of the sciences learned in school to be applied in everyday life. Exactly, science education can have direct implications in everyday life.

Science lessons are less related to social and technological issues that exist in the environment and society, especially with regard to technological developments and the presence of technological products in the environment and society, as well as their consequences. Science teaching in schools is solely oriented to the demands of the curriculum that has been poured in textbooks. On the other hand, the advancement of science and technology is growing too, so that it can be the impact to the environment and society. This condition requires the teachers prefer to the active learning than the passive learning. In addition, students in the process of learning in the classroom are encouraged to develop their thinking skills. The fact students in the process of learning in the classroom, are directed to the ability of information memorizing. According Suyanti (2010) students are forced to remember and accumulatethe information without being required to understand information and apply that information in everyday life.

The quality learners can be produced by chemistry as a part of science which it important role in improving the quality of education. The ability to think critically, creatively, and have a positive attitude toward science, society and responsive in response to issues in society is the quality of the learners which resulted from the impact of the development of science and technology smartly and critical. In order to the teachers need to design the learning that can facilitate the student to produce the learners who are able to develop critical thinking skills and scientific attitudes.

BSNP (2007) said that the critical thinking ability of students is the ability of high-level thinking is important for the students because the ability to think

critically can helping the students in facing the problems which can be happen in the future not only in classroom learning. a person will be easy to process the information it finds and used it to solve the problem by the ability to think critically. So, in the learning science students at the secondary school level is not only a cognitive aspect, but also affective aspect is a very important part in planning, delivering, and evaluating a lesson. This is same with opinion Carin and Sund (1997) that science education should producethe attitude and scientific values.

In the relevant research from Rahayuni (2016) about the correlation of critical thinking skills and scienctific Literacy on integrated science learning with problem based learning and science technology society, that the science the science ttechnology society is better than problem based learning to improve the student's critical thinking skills.

Taking note of the above problems, an alternative learning model that the model of learning SETS can be used to overcome the problems. the teachers can connect the concepts of science which they have delivered in the classroom with the problems that occur in society, the student's daily life environment. SETS learning model is expected to make the students see things in an integrated, ie by paying attention the elements contained in the SETS of science, environment, technology and society.

The colloid chemicals have the concrete characteristics with the concrete examples too. The fact there are still students who have the difficulty in understanding colloid concept although the colloid concept is a simple concept and not so difficult to learned by students. This is because the number of examples on colloid topics and concepts just in form of memory for students, it is not studied meaningfully; and the applied learning still emphasizes on the delivery of information by the teachers;the students are taught only to memorize concepts, principles, laws and formulas and the students' understanding is not as a result of experience but the transfer of knowledge from teacher to student. For that cause, one of the alternative learning model is SETS learning model. It is the innovation for learning model of colloidal concept.

The improvement of critical thinking ability and student's scientific attitude by applying science environment technology and society (SETS) learning model on colloidal concept is the purpose of this research.

The benefits for the education from this research, such as for teachers, the results of this study can provide

information and insight about science and technology environment (SETS) model of learning that can be used as an alternative learning to teach in the classroom, especially to improve students' scientific attitude and critical thinking skills. For schools, as an input to improve the quality of learning in schools that lead to more scientific attitudes and critical thinking. For other researchers, can be the reference in the same research theme on different subjects.

METHOD

Quasi experimental methods with nonequivalent control group design is the method in this research. Quasi experiments is the study that use whole groups of subjects in experiments that are naturally formed in the class and do not control all the variables. Nonequivalent control group design, meaning there is a control group, in each group were given the preliminary and final tests with different treatments (Sugiyono, 2009).

Table 1. Research Design

Group	Pre-test	Treat-ment	Pos-test
E	O_1	X_1	O_2
K	O_1	X_2	O_2

Information:
O_1 = Pretest
O_2 = Posttest
X_1 = Learning using SETS learning model
X_2 = Learning using conventional learning model

The research subjects in this study consisted experimental class as many as 31 students and control class as many as 31 students. This research was conducted on 13-29 August 2013 in one of SMAN in Majalengka District. The instrument used in this study is the critical thinking test instrument of 8 essay test questions and students' scientific attitude observation sheet.

RESULT AND DISCUSSION

This research was conducted for 5 meetings in classroom. In the first meeting, conducted the pretest to know the critical thinking skills of students, then conducted the implementation of learning as much as 3 times each meeting in the experimental class and control. During the learning process, an assessment of students 'scientific attitudes and after learning is completed, at the 5^{th} meeting, the posttest was conducted to determine the improvement of students' critical thinking skills.

Based on the results of research that has been done, obtained the data score pretest, posttest, and N-Gain capacity improvement of critical thinking of students in experimental class (E) and control class (K) as a whole.

Table 2.The *Pretest, Posttest*, and N-Gain of The Student's Critical Thinking Skill

Data		Number of Student	Minimum Score	Maximum Score	Average	Deviation Standard
E	*Pretest*	31	29,17	45,83	38,98	4,10
	Posttest	31	45,83	87,50	64,52	10,08
	%N-Gain		42		Moderate	Category
C	*Pretest*	31	33,33	45,83	39,93	4,66
	Posttest	31	45,83	70,83	56,59	7,47
	%N-Gain		28		Low	Category

The experimental class and control classes each obtained an average of 38.98 and 39.92 values. Based on the results of the average analysis of pretest score of critical thinking skills in the experimental class and control class found results that did not differ significantly. Obtaining grades in the experimental class as well as the control class before the lesson indicates that the student has the initial knowledge related to the concept to be studied.

The experimental class using the SETS learning model has an average score of 64.52, while the control class has an average score of 56.59. Based on the results of the analysis of the posttest score, the value obtained by the experimental class and control class has increased. However, there are differences in averages scores in both classes. It can be concluded that the average of the increasing in experiment class is higher than the average of the increasing in the control class.

The students' critical thinking skills in the experimental and control classes before and after the learning can also be seen based on the hypothesis test. Hypothesis test in this research used nonparametric test (Mann-Whitney), this is because pretest data and posttest data in experimental class and control class are not normally distributed. The normality test using Kolmogorov-Smirnov test using SPSS for Windows standard version 16.00.

Table 3.The Result of Different Test of Pretest and Posttest Average

Score	Pretest	Posttest
P-value/Sig	0,398	0,001
Conclusion	Not significantly differed	Significantly differed

We can see that students' critical thinking skills before learning in the experimental class and control classes are relatively the same or not significantly different based on Table 3, in the significance test of the pretest obtained significance (α) of 0.398.00.05, then h_0 accepted. Thus it can be

concluded that the students' initial ability on the colloidal concept between the experimental and control classes is subjects in different groups needs to exist, so that if the different results are obtained by the group, it is not due to the unequal groups, but because of the treatment.

We can see that there is a significant difference between the critical thinking ability of students learning using SETS learning model with students learning using conventional learning model based on Table 3, obtained the significance (α) of posttest data is 0,001 <0,050, so h_0 is rejected. Critical thinking ability of the learners through SETS learning model is better than the critical thinking ability of students who learn with conventional learning model.

Based on the results of the normalized gain (N-Gain) calculation in Table 2, the students' critical thinking ability with the control class showed that the average of N-Gain was 42% and the control class was 28%. From the scores, it is known that the N-Gain experimental class is in the medium category, while the N-Gain control class is in the low category. The difference in the development of critical thinking skills experienced by students after the learning process is due to the SETS stage is full of thinking, arguing, and discussing activities. In addition, Zulfiani (2003) said that to develop students' critical thinking skills can be conducted through the learning cycle which includes three stages of exploration, introduction, and application stage. These three stages are in the SETS stage. The ability of this student is not independent of the active role of students in finding information to be applied in solving the problem.

the same. This is like the research from Russefendi (1998), that the equivalence of

Hanaswati (2000) described that students' thinking can be improved by giving problems that require students to use problem-solving processes. In the learning process with SETS learning model, students are required to be able to solve problems or issues that develop in society. This problem solving capability is developed at each stage of the SETS, which is through the emergence of problem issues at the introduction stage, based on the problems presented and then the students are encouraged and motivated to give/answer questions. The questions given by students are then made into further interaction. After that the students perform the investigation tasks in the research group, then presented the results of the study.

In the learning process, the students' scientific attitude data were collected by the students' observation sheet. The observation sheet consists of 20 items of statements, which contain several indicators of scientific attitude. The average data of scientific attitudes on the experimental group and the control group as a whole were obtained.

Table 4. The Sheet Observation Result of Student Scientific Attitudes on Experiment Class and Control

Experimental Class	Control Class
72,7	60,7
Good	Enough

The average score of scientific attitude of experiment class students was 72.7 (good category), while the average score of control class was 60.7 (enough category) based on Table 4. This shows that students in the experimental class and control class have a good scientific attitude. However, the average scientific attitude in the experimental class is higher when compared with the control class. The condition is possible because the human attitude in responding to something is not always the same. According Gerungan (1988) this occure because the attitudes of the human being are influenced by several factors: desire, knowledge, habit, social interaction that occurs in groups or outside the group can influence or form a new attitude.

The differences in scientific attitude scores in the experimental class with the control class are also possible because during the learning, the students are equally focused on the learning model that is being conducted, the students follow the learning process with scientific method from the beginning to the end well. The differences in scientific attitude scores in the experimental class and control classes are due to the differences in frequency and treatment provided. Similar to Fuady (2007) opinion in Hulu (2009) which stated that the process and the frequency of enjoyable learning can increase the high learning motivation for students so that it can provide the quality learning outcomes. For the experimental class is given a learning treatment with SETS learning model in which there are discussion, demonstration, and practicum activities, and control class with conventional learning model in which there is also practicum activities. This practicum activity can be able to train students to do scientific work, such as observation, identification, and explaining problem solving. This is in line with the statement of Amin (1994) that to acquire knowledge not only by reading, but also through the investigation of phenomena

and the phenomenon of life directly. An investigation conducted in a systematic way through scientific methods will produce a scientific attitude. Depdiknas (2002) supported Amin's (1994) statement that learning science can help students to understand nature and its symptoms related to research and investigation so that it can produce the students' scientific attitude.

CONCLUSION

SETS learning model can improve students' critical thinking ability. Statistically shows that there is a significant difference between the average of students' critical thinking ability in experimental class and control class. Overall, the average score of students' scientific attitude with SETS learning model is 72.7% (good category).

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