



THE EFFECT OF *SCIENCE, ENVIRONMENT, TECHNOLOGY, AND SOCIETY* (SETS) APPROACH ASSISTED BY VISUAL MEDIA ON CRITICAL THINKING ABILITY AND STUDENTS' SCIENTIFIC ATTITUDES IN THE MATERIAL OF LIVING CREATOR CLASSIFICATION

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Abstract

This study aims to determine the effect of the Science, Environment, Technology, and Society (SETS) approach assisted by visual media on critical thinking abilities and scientific attitudes of students on biology subjects on the classification of living things. The research method used a quasi-experimental research sample of 2 classes determined by random sampling. Class VIII as many as 32 students were taught with the approach of Science, Environment, Technology, and Society (SETS) assisted by visual media and class VII2 as many as 32 students were taught with conventional learning. The research instrument tests the form of critical thinking Cornell X which is based on Ennis and was independently developed by researchers and scientific attitude observation sheets. The data analysis technique used partial hypothesis testing at a significant level $\alpha = 0.05$. The results showed 1) There was a significant influence of the approach of Science, Environment, Technology, and Society (SETS) assisted by visual media on students' critical thinking skills ($t_{count} = 2.37$; $t_{table} (0.05.62) = 1.66$). 2) There is a significant influence of the Science, Environment, Technology, and Society (SETS) approach assisted by visual media on scientific attitudes ($t_{count} = 3.88$; $t_{table} (0.05.62) = 1.66$). The results showed that the level of thinking ability using the SETS approach assisted by visual media ($(X)^- = 82.38$) was higher than conventional learning ($(X) = 49.00$). The results of the study also showed better scientific attitudes in the classroom the SETS approach assisted by visual media ($(X)^- = 74.63$) is better than conventional learning ($(X)^- = 43.02$). Thus, learning science with the SETS approach must continue to be developed because implementing SETS learning can improve students' critical thinking skills and scientific attitudes.

Keywords: guided inquiry, dynamic fluid, learning outcomes

Introduction

The Organization for Economic Cooperation and Development (OECD) informed that the results of the Program for International Student Assessment (PISA) in 2012 ranked Indonesia 64th out of 65 participating countries. Indonesia obtained an average score of 382 with an average OECD science score of 501 (OECD, 2013). While the 2015 survey results, Indonesia ranked 69 out of 76 countries (OECD, 2016). PISA results illustrate that education in Indonesia is very alarming. The ability of Indonesian students is in low order thinking while the XXI century requires mastery of high-level thinking, critical thinking, mastering information technology, being able to collaborate, and communicative (Setiawati, 2015)

Based on observations, during the learning process there are still students who are lazy in following the lessons, there are those who talk to other friends and when given the opportunity to ask questions, no students ask questions, even when there is discussion, not all students participate actively in his group. Students tend to be passive in learning and have not actively built their own knowledge. Therefore, it is necessary to have a comprehensive learning process in order to create the expected results.

According to Ennis in Fisher (2008) critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do. Critical thinking is to think well and reflect on or study about other people's thought processes. Implicitly, critical thinking evaluates the implicit thinking of what they hear, read and examine their own thought processes when writing, solving problems, making decisions or developing a project (Fisher, 2008).

Ennis groups student activities into the top five as follows:

- 1) Provide Basic Explanations; focusing questions, analyzing arguments, asking and answering clarifying questions and challenging questions.
- 2) Building basic skills; consider whether the source can be trusted or not,

observe and consider the results of observations.

- 3) Summing up; deduce and consider deduction, induce and consider induction, make and review the values of the results of consideration.
- 4) Make an explanation; define further terms.
- 5) Strategy and tactics; decide on an action, interact with other people.

One of the values in developing character education is curiosity and creativity. In learning, curiosity is one aspect of scientific attitude. Scientific attitude is an establishment (tendency) towards a particular stimulus which is always oriented to science and scientific methods (Astika, 2013).

The grouping of scientific attitudes according to Herlen was developed by Anwar (2009) as follows: 1) a curious attitude; 2) critical attitude; 3) open attitude; 4) objective attitude; 5) respect; 6) courage to maintain; 7) forward reaching attitude. So the classification of scientific attitudes as outlined above, shows that scientific attitudes in schools are quite varied. The scientific attitude of students in the learning process will lead to high interactions between teachers and students and students and students themselves. This will result in a conducive classroom atmosphere, where each student can involve his abilities as much as possible.

Biology learning in the 2013 curriculum is expected to be delivered holistically through integrated science in accordance with integrating aspects of the technological environment, and society into Biology so that it will be meaningful for students because it is close to their daily lives. SETS learning model is a learning model that invites students to investigate, analyze, and apply concepts, and processes in real situations (Fatchan et al, 2014).

The SETS summary sequence carries the message that to use science (S-first) to form technology (T) in meeting the needs of the community (S-second) requires thinking about the various implications for the environment (E) physically and mentally. SETS will guide students to think

globally / overall and act to solve environmental problems, both the local environment and environmental relations with everything related to society and participate in solving international problems according to their capacity (Khasanah, 2013).

Operationally the National Science Teacher Association arranges the stages of science learning using the SETS approach as follows:

- 1) Initiation stage = At this stage the teacher gives an actual issue / problem that is developing in the surrounding community.
- 2) Exploration stage = Students through their own actions and reactions trying to understand or learn the problem given.
- 3) Solution stage = Students analyze and discuss ways of solving problems
- 4) Application stage = Students are given the opportunity to use the concepts that have been obtained.
- 5) Concept strengthening phase = The teacher gives feedback / reinforcement to the concepts obtained by students. Thus the SETS approach can help students in knowing science, the technology it uses and the development of science and technology can affect the environment and society.

Weaknesses of SETS include the difficulty of students in linking elements in SETS consisting of science, environment, technology and society. Therefore we need a technique to overcome these weaknesses. According to Widiyanti (2017) The use of the SETS learning model in learning can be integrated with a virtual lab. Virtual labs are made to describe reactions that might not be seen in real situations. Virtual lab is defined as an interactive multimedia object. According to Hermansyah, et al (2015) Interactive multimedia objects consist of various heterogeneous formats including text, hypertext, sound, images, animation, video and graphics. So that in this study using the help of visual media to facilitate students understanding the material and linking science, environment, and society through technology. This is supported by the statement Melani (2012) Through the media,

abstract things can be concrete, and complex things can be simplified, the use of media can also enhance learning outcomes with regard to students' level of thinking.

Research Method

This type of research is a quasi-experimental study. Quasi experiment is research that uses a whole group of subjects in experiments that are naturally formed in the classroom and do not control all the variables that exist. Nonequivalent control group design, meaning that there is a control group, in each group given a preliminary test and a final test with different treatments. This research was conducted at SMP Negeri 5 Lima Puluh, Batu Bara Regency, North Sumatra. The population in this study were all grade VII students of SMP Negeri 5 Lima Puluh. Sampling by random sampling to get Class VII-1 as an experimental class amounting to 32 students and the control class as a control class totaling 32 students. The instrument used in this study was the critical thinking ability test instrument refers to the form of the cornell critical thinking test series (the cornell class-reasoning test, form X) developed by Ennis et al and the student's scientific attitude observation sheet. According to Arikunto (2006) using the observation method is the most effective way to format or blank the observation as an instrument. The observation sheet uses the scientific attitude dimension developed by Anwar (2009).

Result and Discussion

This research was conducted during 5 meetings. At the first meeting a pretest was conducted to determine the students' critical thinking skills, then the learning implementation was carried out 3 times each meeting in the SETS class assisted by visual and conventional media. During the learning process, an assessment of students' scientific attitudes is carried out and after learning is completed, at the 5th meeting a posttest is conducted to find out the increase in students' critical thinking skills.

a. Critical Thinking Ability

Based on the results of research that has been done, the data obtained pretest and posttest scores of students' critical thinking skills in the SETS class assisted by visual and conventional media as a whole in Table 1.

Tabel 1 Data Pre-Test dan Post-Test Kelas Konvensional dan Kelas SETS

Hasil	Pre-test		Post-test	
	Konvensional	SETS	Konvensional	SETS
\bar{X}	35,5	35,63	49	82,4
SD	6,72	8,28	15,02	13,1
Varians	45	69	226	172
Range	36	32	56	52
Median	35,5	35,38	49,25	82,4

Based on the results of the analysis of the average acquisition of pretest scores of critical thinking skills in the experimental class and the control class found that the results were not significantly different. Table 1 shows the experimental class and the control class respectively obtained an average value of 35.6 and 35.5. Acquisition of grades in the experimental class and the control class before learning shows that students already have preliminary knowledge relating to the concepts to be learned.

Based on the results of the analysis of the posttest scores, the scores obtained by the experimental class and the control class have increased. However, there are differences in the average value of critical thinking skills in the two class groups. The experimental class that uses the SETS learning model has an average score of 82.38, while the control class has an average score of 49. Based on these values it can be concluded that the average critical thinking ability of the experimental class is higher than the average increase in class control. Students' critical thinking skills in the experimental class and the control class before and after learning can also be seen based on hypothesis testing. Hypothesis testing in this study uses the t test in Table 2.

Table 2 t-test critical thinking skills

Pre-Test					
Kelas	N	S ²	t _{hit}	t _{tab}	Keterangan
SETS	32	68,5	0,7	1,6	Ho rejected Ha accepted
Konvensional	32	45,16			
Post-Test					
Kelas	N	S ²	t _{hit}	t _{tab}	Keterangan
SETS	32	172,24	2,4	1,6	Ho rejected
Konvensional	32	225,48			Ha accepted

Based on Table 2 on the t test pretest data it can be concluded that the initial abilities of students in the classification of living things between the experimental and control classes are the same.

Based on Table 2, the t-test posttest data obtained that the critical thinking ability of students who learn through the SETS approach assisted by visual media is better than the critical thinking abilities of students who learn with conventional learning.

The difference in the development of critical thinking skills experienced by students after the learning process is due to the SETS stages filled with activities of thinking, arguing, and discussing. In addition, Zulfiani (2003) said that to develop students' critical thinking skills can be done through a learning cycle which includes three stages, namely exploration, introduction, and application stage. These three stages are in the SETS stage. The ability of this student is inseparable from the active role of students in finding information to be applied in solving problems (Maimunah, 2016). Following are the stages in learning with the approach of Science, Environmental, Technology and Society (SETS) assisted by visual media.

Stages of invitation or giving issues or actual problems that are developing in the surrounding community that can be understood by students and can stimulate students to overcome them. This activity students can find out various types of problems that occur in the real world related to the material so that this spurs students to think broadly. This is in accordance with what was said by Hanaswati (2000) that the way of thinking of students can be improved by giving problems that require students to use the processes of problem retention. At

this stage students can provide basic explanations based on what students know about the problems given by the teacher and their relation to the subject matter.

The stages of exploration, students through their own actions and reactions try to understand or learn the problem given. Students can identify problems and think about what needs to be done to solve the given problem. According to Maimunah (2016) the problem-solving ability at each stage of the SETS encourages and motivates students to give / answer questions that will be a further interaction in learning.

The stages of finding problem solving solutions. students with their group friends discuss and analyze ways of solving problems based on literature then linking it to seeing directly the surrounding environment and students asking the community in the school environment. At this stage students use their understanding ability to deduce based on observations so that students will get solutions to problem solving. Maryani (2017) The stage of the SETS model trains five main lessons such as observing, asking questions, gathering information, associating and communicating as mandated in the 2013 Curriculum.

In the application phase, students use the solutions they have obtained and present them to the class. While other students provide responses and questions related to the problem presented. According to Pratiwi (2012) intelligence in expressing ideas or ideas can make students have good skills. This statement can be supported by the opinion of Astuti and Yuliyanto (2015), which states that critical thinking skills can improve students' abilities in linking learning material with daily life.

Then the stabilization of the concepts given by the teacher, the teacher reinforces the concepts obtained by students in knowing science, using technology and the development of science and technology that can affect the environment and society. in accordance with the statement of Sutarno (2007), the weaknesses of SETS include students having difficulty in linking elements in SETS consisting of science, environment, technology and society. Therefore we need a technique to overcome

these weaknesses. According to Widiyanti (2017) The use of the SETS learning model in learning can be integrated with a virtual lab. Virtual labs are made to describe reactions that might not be seen in real situations. Virtual lab is defined as an interactive multimedia object. According to Hermansyah, et al (2015) Interactive multimedia objects consist of various heterogeneous formats including text, hypertext, sound, images, animation, video and graphics. So that in this study using the help of visual media to facilitate students understanding the material and linking science, environment, and society through technology. This is supported by the statement Melani (2012) Through the media, abstract things can be concrete, and complex things can be simplified, the use of media can also enhance learning outcomes with regard to students' level of thinking.

Learning by using the SETS approach assisted by visual media has several advantages. According to Fatchan (2014) the strengths of the SETS learning model are (1) Can improve inquiry skills, solving skills, and process skills, emphasizing good learning methods that include cognitive, affective and psychomotor domains, emphasizing science in cohesiveness and between fields of study. (2) If viewed in terms of learning, emphasizing student success, it can be combined with various learning strategies, making teachers aware that they do not always function as sources of information. (3) If it is evaluated from the aspect of evaluation there is a relationship between the objectives, process and learning outcomes, the difference between the skills, maturity and background of students and the function of the program are also evaluated.

b. Scientific attitude

Data on students' scientific attitudes were obtained from Observation Sheet 25 statement items, which contained indicators of scientific attitudes. After completing the scientific attitude observation sheet, the average scientific attitude data obtained in the experimental group and the control group as a whole in Table 3.

Tabel 3 Deskriptif Data Sikap Ilmiah

Hasil	Konvensional	SETS
Rata – rata (\bar{X})	41,5	74,6
Standar deviasi (SD)	9,4	7,5
Variansi (S^2)	88,55	56,8
Minimum	31	60
Maksimum	74	89
Median (M)	41,38	74,5

Based on Table 3 shows the average score of scientific attitudes of SETS class students assisted by visual media by 74.6 (good category) while the average score of conventional classes is 41.5 (medium category). This shows that the average scientific attitude in the SETS class assisted by visual media is higher when compared to the conventional class. This happens because the attitudes found in humans are influenced by several factors, namely desires, knowledge, habits, social interactions that occur within groups or outside the group can influence or form new attitudes.

Tabel 4 Uji-t Sikap Ilmiah

Kelas	N	t_{hit}	t_{tab}	Ket.
SETS	32	3,8	1,66	Ho rejected
Konvensional	32			Ha accepted

Table 4 hypothesis testing shows there is an influence of the use of Science, Environment, Technology, and Society (SETS) assisted by visual media on students' scientific attitudes on the classification of living things in class VII SMP N 5 Fifty academic year 2018/2019.

Learning using the approach of Science, Environment, Technology, and Society (SETS) assisted by visual media in this study students are grouped into small groups to facilitate students in learning, so students can discuss problem solving solutions with their groups. This is in accordance with the statement of Widiyanti (2017) In order for learning to take place more effectively and achieve learning objectives, then in applying the SETS approach it is better to use small groups that are heterogeneous consisting of 3 to 4 people each group. Too many group

members can make the learning process ineffective, because it can reduce the activity and sense of responsibility of each group member.

Learning that uses groups in experimental activities will require collaboration between students in the group. So students will always interact with their peers and this is what fosters and trains a scientific attitude, one of which is an attitude of respect and an attitude of courage to defend. This is in line with research Melani (2012) Experiment to train cooperation between students. Students must put aside egoism. So that respect will grow in learning in conducting experiments. The experimental activity will train the honesty of students in making observations and get results according to what was found at the time of observation. So that when applied in the classroom and the real world students will be able to defend their opinions because the opinions of students are obtained through observations. Existing facts can be refuted and replaced with new facts because the truth in experiments is relative Melani (2012).

The Science, Environment, Technology, and Society (SETS) approach assisted by visual media can improve students' scientific attitudes. This is in accordance with research Maimunah (2016) through the SETS approach students are able to grow their scientific attitude compared to using conventional learning. Resni, et al (2013) the use of the SETS approach can increase student interest and curiosity.

Conclusion

Based on the results of the analysis and discussion carried out in the previous chapter, several conclusions can be drawn as follows:

1. There is a significant influence on the use of the Science, Environment, Technology, and Society (SETS) approach assisted by visual media on the ability to think critically on the classification of living things in Class VII students of SMP N 5 Fifty academic year 2018/2019. The ability to think critically SETS approach assisted by visual

media is better (82.37) than conventional approaches (49).

2. There is a significant influence on the use of the Science, Environment, Technology, and Society (SETS) approach assisted by visual media on scientific attitudes on the material classification of living things in Class VII students of SMP N 5 Fifty academic year 2018/2019. The scientific attitude of the SETS approach assisted by visual media is better (74.63) than the conventional approach (43.02).

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