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SETS Learning Efficacy to Improve Students Science Literacy Skills

Hayu Ristina✉, Suharto Linuwih, Murbangun Nuswowati

Universitas Negeri Semarang, Indonesia

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Abstract

Science learning aims to help students to be able to master the knowledge of scientific order. Science learning will be more meaningful for students, if students have good literacy skills. Someone has scientific literacy skills that can both understand and communicate science, and applying science knowledge in solving problems, and can make decisions based on scientific considerations. The results of international research show that the literacy rate of Indonesian students is in the low category. This study aims to determine the effectiveness of SETS learning to improve students' scientific literacy skills. The design of this study used quasi experimental with non-equivalent control group design. In general, the results of the study show that the effectiveness of SETS learning can be seen based on student learning outcomes in the experimental class showing better than control class students and increasing scientific literacy skills in each of the relatively high categories. Science literacy skills in the interaction of science, technology, and society experienced the highest increase in ability compared to other scientific literacy categories.

✉ Alamat korespondensi:
Kampus Pascasarjana Jl Kelud Utara III, Semarang 50237
E-mail: hayu.ristina@yahoo.com

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INTRODUCTION

Improving the quality of education is a government effort to obtain quality human resources, because in the current global era students are required to be able to develop the ability to compete at an international level. Science literacy has been recognized as a benchmark for the quality of education internationally (Ardianto & Rubini, 2016). Science literacy is one of the domains in the PISA study (Programme for International Student Assessment) that focuses on the ability to think scientifically using knowledge and science processes to understand natural phenomena, so as to be able to make decisions in solving scientific problems encountered (Arief, 2015). Chiapetta et al. (1991) stated that scientific literacy consists of four categories: science as a body of knowledge, science as a way of thinking, science as a way of investigating, and the interaction of science, technology, and society

Science literacy is important to be mastered by students regarding how they view environment, health, economics, and the problems of modern society that are more dependent on technology and the development of science (Rusilowati et al., 2016). Science literacy skills are used to prepare students to plunge into the community environment, as well as solve problems faced scientifically and can be accounted for (Rohkmah et al., 2017). Science literacy makes people wiser in responding and making decisions regarding issues that have not been proven truthful.

Based on the PISA survey, Indonesia ranks the bottom 10. In 2012 Indonesia was ranked 64th out of 65 OECD member countries, up to 64th out of 72 OECD member countries in 2015 (OECD, 2016). Based on the results of discussions with science teachers from five different junior high schools in Demak Regency, it was shown that eleven of the twelve science teachers still did not understand science literacy and the teacher had not yet identified the mastery of students' scientific literacy skills.

The results of a preliminary research study by Ardianto & Rubini (2016) at one of the junior high schools in Bandung revealed that science learning had not been integrated, was still a teacher center, orientation towards the mastery of material, and 55% of students stated that science learning was rarely given related problems with everyday life. This opinion is reinforced by the results of research conducted by Sari et al. (2017) states that science learning focuses on knowledge and has not involved students in applying concepts in real life, so students' ability to explain the implications of applying science knowledge to society is still low. This condition is one of the causes of low scientific literacy skills in students.

The low level of scientific literacy shows that most students cannot use science to provide explanations or draw conclusions based on investigations, do reasoning and make interpretations of the results of scientific investigations. In addition, students have not been able to choose and use facts and evidence to explain phenomena, analyze and apply concepts to solve a problem, and integrate science-based knowledge in making explanations about several aspects of real life situations (Nisa et al., 2015).

One of effort to improve scientific literacy skills is that teachers need to consider the learning model that will be used in accordance with the conditions and potential of students, which the learning process can focus on providing direct experience and application of science. Learning that focuses on providing direct experience and application of science is contained in SETS learning. SETS learning provides an opportunity for students to learn the nature of science and its implementation in everyday life in the form of the use of science for the benefit of society, including in the form of practical technology and products that do not damage or harm the environment and society itself (Binadja, 1999). SETS learning is believed to produce meaningful knowledge for students and gain an in-depth understanding of their knowledge.

This study aims to determine the effectiveness of SETS learning to increase scientific literacy skills based on science categories science as a body of knowledge, science as a way of thinking, science as a way of investigating, and the interaction of science, technology, and society. Theoretically the study of this study contributes conceptually to the advancement of the world of education, especially regarding efforts to improve students' literacy skills.

METHODS

This type of research is quantitative research in the form of quasi experimental using non-equivalent control group design. The research was carried out in class VII of the State Junior High School 2 in the District of Demak in the academic year 2018/2019. The sampling technique is done by cluster random sampling which is taken as many as two classes from ten classes. One class as an experimental group which amounted to 28 students, and one class as a control group totaling 29 students. The instrument used is a written test in the form of a description question based on scientific literacy in the heat material and its displacement.

The initial step of this research is to do the pretest in the experimental class and the control class. The aim is to determine students' scientific literacy skills at the beginning of both classes. The next step, conducting learning by applying SETS learning to the experimental class and applying conventional learning to the control class. Then, posttest was conducted to determine students' literacy skills after being given treatment. Data from the research results obtained in the form of pretest and posttest values. Furthermore, it was analyzed using the t test and gain test to determine the effectiveness of SETS learning on students' literacy skills.

RESULTS AND DISCUSSION

The results of the study based on tests of students' scientific literacy abilities based on each category are presented in the form of a diagram in Figure 1.

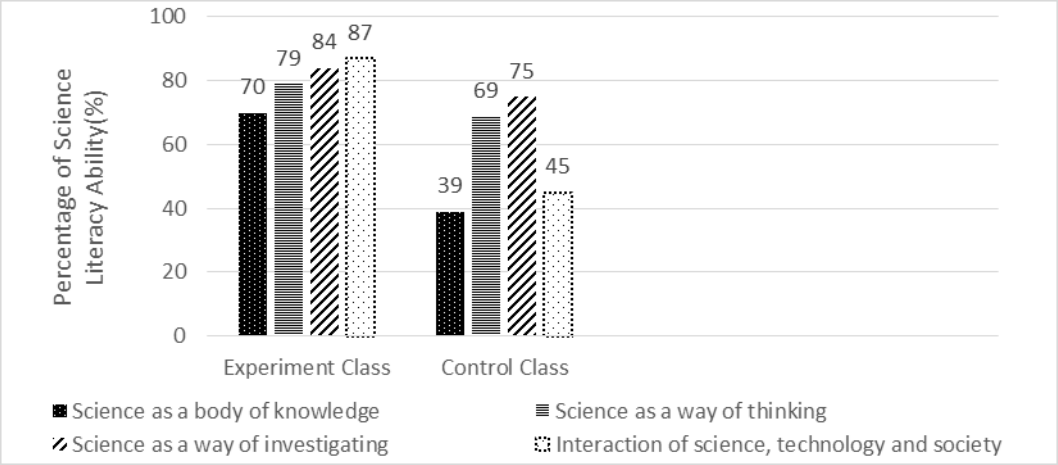

Figure 1. Percentage of Science Literacy Ability

T-test was used to determine the differences in the average scientific literacy abilities of students between the experimental class and the control class. Data used for T-test is the posttest value of the experimental class and the control class in the heat material and its displacement. Results of t-test analysis based on each category of scientific literacy are presented in Table 1.

Table 1. T-Test Results by Category of Science Literacy

Categories of Science Literacy	T table	T count	Information
Science as a body of knowledge	1,673	6,087	
Science as a way of thinking	1,673	1,826	Tcount >
Science as a way of investigating	1,673	1,754	Ttable
Interaction of science, technology, and society	1,673	8,812	

Based on the data in Table 1 shows a significant difference in scientific literacy skills of students in each category between the experimental class and the control class after being given treatment. The existence of differences in scientific literacy skills that are significant between the experimental class and the control class can be caused because SETS learning can foster students' high curiosity towards the material. Students 'attention can be focused on the learning process because of the students' interest in the issues, events and phenomena that are around them. The statement is in accordance with McCare (2011) study that the use of issues as a stimulus can stimulate students to be more active in learning.

If students feel the topic of learning is in accordance with what they have or have experienced everyday, then they will feel more interested, enthusiastic, and give a positive response. The results of research by Tiyanto et al. (2013) & Fuada et al. (2014) show that learning that raises phenomena/ problems around students can make the atmosphere pleasant and lessons more easily accepted by them. This makes students not feel bored during learning and students are able to play an active role in learning activities. So, SETS learning can improve students' literacy skills. In accordance with the results of the research by Wijayanti et al. (2013) & Salila et al. (2015) show that SETS learning can improve students' science process skills and student learning outcomes.

Meanwhile, the gain test is used to determine the increase in students' literacy skills. Increased scientific literacy based on the results of the pretest and posttest data from the experimental class and the control class can be seen in Table 2.

Table 2. Improved Science Literacy Experiments and Control Class

Class	Average Pretest	Average Posttest	N-gain	Category
Experiment	16,50	80,00	0,76	High
Control	17,79	54,14	0,44	Medium

Based on the data presented in Table 2 shows that the increase in scientific literacy skills of the experimental class students is higher than the control class. If viewed from each scientific literacy category, the experimental class shows a higher increase in results than the control class is presented in Table 3.

The data in Table 3 shows the magnitude of the increase in scientific literacy skills in the experimental class the aspect of science as a way of thinking, science as a way of investigating, and the interaction of science, technology, and society is high, and in the aspect of science as a body of knowledge experiences a moderate increase. Meanwhile, the control class in the aspect of science as a body of knowledge and interaction of science, technology, and society experienced a relatively low increase, and in the other categories namely science as a way of thinking and science as a way of investigating experienced a relatively moderate increase.

The ability of scientific literacy in the aspect of science as a body of knowledge has experienced a moderate increase. However, when compared with the other categories, this category experienced the lowest increase. These results are consistent with the research of Rohman et al. (2017) shows that scientific

literacy skills of students in the aspect of science as a body of knowledge get the smallest percentage because of the conceptual errors that students receive. Unlike the case with the results of research by Mardhiyyah et al. (2016) stated that the ability of scientific literacy in the aspect of science as a body of knowledge is the highest category of scientific literacy compared to other aspects of scientific literacy.

Table 3. Price of N-Gain for Each Category of Science Literacy

No.	Category of Science Literacy	Price of N-Gain		Information
		Experiment	Control	
1.	Science as a body of knowledge	0,65	0,28	N-gain experiment class > control class
2.	Science as a way of thinking	0,76	0,66	
3.	Science as a way of investigating	0,80	0,67	
4.	Interaction of science, technology, and society	0,84	0,29	

This shows that students' ability to understand concepts, laws, and principles in science subjects is not optimal and students tend to use alternative conceptions. One of the factors behind the emergence of alternative conceptions in students is the understanding of concepts that are less profound (Lestari & Linuwih, 2014). The low ability of students in understanding concepts, indicates the existence of learning difficulties experienced by students. Learning difficulties students will need to be diagnosed later through various approaches.

Another factor that causes the science literacy ability in this category has the lowest percentage, namely students tend to be lazy in reading discourse questions and students are not accustomed to completing tests or problems based on scientific literacy. The statement is in accordance with Permanasari's research results (2016) that the constraints of students in learning science are one of them because of the low ability to read and interpret reading. According to Afifah et al. (2016) results, the ability to analyze discourse is able to direct students to interpret information in discourse and avoid misconceptions.

Whereas, scientific literacy skills in the categories interaction of science, technology, and society experienced the highest increase in students' abilities compared to other scientific literacy categories. This result is in accordance with Rohman et al. (2017) research which states that students' scientific literacy skills are highest in the categories interaction of science, technology, and society. It is different from the results of Mardhiyyah's research that scientific literacy in the interaction of science, technology, and society is the lowest category compared to other scientific literacy categories.

This happens because SETS learning is able to train students to use science skills and provide direct experience in their lives. Direct experience during the learning process can build students' understanding well. The results of the Inzanah et al. (2014) study state that good learning material is presented using phenomena that are close to the world of students, so students can understand and apply that knowledge in answering problems or questions they encounter in life.

SETS learning examines a problem, phenomenon, event / event not only from the aspect of scientific knowledge. SETS examines various aspects, namely aspects of science, technology, society and environment. SETS teaches students to look at everything from various aspects such as the benefits offered and the impact they have, to finding alternative solutions. Experimental class students are trained to be skilled in the application of science and technology in everyday life. When students are faced with a problem, namely "how to keep

the temperature around the house cool without damaging the environment?". Students are able to identify the impact of using AC or fan technology on the environment, and they are able to find alternative solutions so that the temperature around the house still feels cool without damaging the environment and is more economical for the community.

The high level of scientific literacy in this category indicates that SETS learning can train students' sensitivity to the environment and provide insights in the fields interaction of science, technology, and society. The importance of mastering this category according to Ibrahim & Aspar (2011) is that without a good knowledge of science, we cannot apply all the technological sophistication that exists, but we only play a role as weak technology users. According to Widodo et al. (2017) the application of scientific knowledge to be able to solve a problem, then one must be able to keep up with technological developments. It is important for students to master science and technology that is beneficial to society and does not damage the environment, because all of them are interrelated.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that SETS learning is effective towards increasing students' scientific literacy skills in each category, namely science as a body of knowledge, science as a way of thinking, science as a way of investigating, and the interaction of science, technology, and society . The effectiveness of SETS learning is shown based on the results of differences in students' scientific literacy skills and the increase in scientific literacy skills that are classified as high.

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