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Application of Teaching Material Science of SETS-Oriented to Increase the Ability of Science Literacy Junior High School Students

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abstract

Teaching materials are one part of learning tools that can help the teaching and learning process of both teachers and students. This study aims to determine the application of SETS-based science teaching materials to increase the scientific literacy skills of junior high school students. This study uses two classes as an experimental class. Treatment in the experimental class by giving SETS teaching materials with scientific literacy aspects and control classes using teaching materials used in daily teaching and learning activities. The learning process takes place at SMP N 01 Taman. The class is chosen as the control and experimental class with purposive sampling obtained from the mid-semester test scores. At the same time, the pretest-posttest method was used to determine whether the students' scientific literacy skills were good or not. The results of this study indicate that the application of SETS-based science materials with literacy aspects can significantly improve literacy skills. This can be seen from the calculation of N-Gain. Implementation of SETS-based science teaching materials can improve scientific literacy.

1. Introduction

Education is a conscious and planned effort to realize a learning atmosphere and learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and country (Ichsan, 2021). Education is important in terms of the output to be achieved which has been stated in Law Number 20 of 2003 concerning the National Education System, the learning in schools should not forget the expected output. One that shapes students how they can be skilled, intelligent, useful in society, nation and country through science learning. In science learning, the life of modern society cannot be separated from the 'culture' of science and technology. Annisa (2017) said that people's daily lives are significantly influenced by science, one of which is shown by the rapid increase in the number of scientific and technological products that are closely related to the daily lives of the people. In connection with the condition of this society, the Office of the National Education Commission, or abbreviated ONEC, said that in an era of tight international economic competition, producers (graduate users) need qualified scientific staff, namely people who have understanding and good knowledge about

science to meet the demands of the times (Syahri, 2017). Therefore, learning science and technology is very important for everyone in the world.

The ability to use science and technology is known as scientific literacy. Scientific literacy is one of the fields of PISA study. In the PISA context, scientific literacy is the capacity to use scientific knowledge and abilities, identify questions and draw conclusions based on available evidence and data in order to understand and help researchers make decisions about natural world and human interaction with nature (Kristyowati & Purwanto, 2019). Science literacy is a very important thing to be mastered by every individual because it is also closely related to how one can understand the environment and other problems faced by modern society which is very dependent on the development of science and technology, including social problems. Until 2017 the aim of education was not well achieved were students in Indonesia had low scientific literacy. This can be seen from the low results of the TIMSS survey (Trends in International Mathematics and Science Study) and PISA (The Program for International Student Assessment) which ranked Indonesia in the bottom 10. TIMSS is an international study on mathematics achievement and science at junior high school students coordinated by the IEA (The International Association for Evaluation of Educational Achievement). Based on the results of a survey from TIMSS in 2015 it was reported that science learning achievement of eigh grade students in Indonesia was ranked 45th out of 48 TIMSS participating countries (Susanti & Syam, 2017; Rusilowati, 2018).

The low number has many causes which state that the low level of scientific literacy in Indonesia, that the low literacy skills of Indonesian students include the curriculum and education system, the choice of teaching methods and models by teachers, facilities and learning facilities, learning resources, teaching materials, and so on. One that often intersects with teaching and learning is about teaching materials used in the learning process (Fuadi et al., 2020).

One of the teaching materials is the module. Module is an organization of learning material that takes into account the function of education (Wijaya & Muhfahroyin, 2021). A good module fulfills three components of feasibility according to the Badan Standar Nasional Pendidikan (BSNP), namely the components of content feasibility, language feasibility, and presentation feasibility (Ridho Pradita & Lubis, 2018). For the time being the module used by teachers in science learning still uses modules without any insertions in it. In the 2013 curriculum, the modules used by teachers are also able to organize students to be able to think critically and be directed to become scientific (Hariri & Mulyani, 2016; Rawung et al., 2021). One module that can represent it is a module based on Science, Environment, Technology and Society (SETS).

SETS-based modules are one of various modules that can be inserted in scientific literacy (Nisa et al., 2021; Hardianti et al., 2020; Ulfah et al., 2020). the content or content of the module is very influential on how students think. The making of a module based on SETS aims to improve student learning outcomes in the field of science and shape students' concern for the environment, social, technology that is developing and being worked on at this time and can be used in the future. SETS insightful module is one of the modules that can be inserted in aspects of scientific literacy such as: 1) Mention the use of science and technology for the community, 2) Describe natural phenomena related to science, environment, technology and society, 3) Summing up or describing the phenomena of science, environment, technology and society (Rusilowati, 2018).

2. Method

This research is quantitative research using experimental methods. The population in this study was class VIII SMP Negeri 01 Taman Academic Year 2017/2018, which consisted of eight classes, namely class VIII A to VIII H. The research sample was part of the population used as

the research subject as a "representative. of population members, namely class VIII B, and VIII C. The class was selected as the control class and the experimental class by purposive sampling.

The technique of determining members of the data population by purposive sampling has criteria, namely the value of the pretest class that will be given treatment, and the class used as control has a normal value. The next criterion is that the average value obtained from the pretest is not far apart (Dewantoro, 2019). Moreover, the last criterion is that the number between classes is not far apart. The pretest value used as a benchmark for purposive sampling is a cognitive question that contains literacy questions with the same material and the same number of questions. The design of this study is the pretest-posttest design control group. Pretest-Posttest was used as a measure of research sampling. The research design is shown in Table 1 (Fu, 2017).

Table 1. Pretest-posttest control group research design

Sample	Initial condition	Treatment	Final condition
Experiment Class	O_1	X_1	O_2
Control Class	O_3	X_2	O_4

Information

O_1 and O_3 : pre test experimental class and control class

O_2 and O_4 : post test experimental class and control class

X_1 : treatment with SETS insightful teaching materials

X_2 : treatment with teaching materials commonly used by teachers

Information collection techniques used in this study are observation, questionnaires, and tests. The test used in the form of a gap test and pretest and posttest. Passenger tests are used to determine the level of readability of teaching materials while pretest and posttest are used to determine the results of students' scientific literacy.

The information processing techniques were carried out were the feasibility study of teaching materials, readability of teaching materials, comparative hypothesis testing of two uncorrelated samples, and N-gain test. Feasibility test of teaching materials to determine the feasibility of teaching materials based on aspects of content, presentation, language, graphics, and local wisdom. Readability test to determine the level of readability of teaching materials and whether or not the teaching material is easy to understand by the reader. Comparative hypothesis testing of two samples is uncorrelated to determine the influence of SETS-based science teaching materials and N-gain test to determine the improvement of students' concept understanding. The processed data can then be categorized as Table 2 (Hardjo et al., 2020), Table 3, and Table 4.

Table 2. Criteria for evaluation of validity levels

No	Value (%)	Category
1	$85.00 \leq P \leq 100.00$	Very feasible
2	$70.00 \leq P < 85.00$	Eligible
3	$50.00 \leq P < 70.00$	Less Than Feasible
4	$01.00 \leq P < 50.00$	Not Feasible

Readability test to determine the level of readability of teaching materials and whether or not the teaching material is easy to understand by the reader. There are several criteria for teaching materials that can be understood easily or not (Oktiani, 2017).

Table 3. Bormuth criteria assessment of level of readability of teaching materials

No	Value (%)	Category
1	$P < 37$	Teaching materials are difficult to understand
2	$37 \leq P \leq 57$	Teaching materials have met the legibility requirements
3	$P > 57$	Learning materials are easy to understand

The gain criteria table assesses the overall level of understanding of scientific literacy (Hardjo et al., 2020; Sugiono, 2017).

Table 4. Criteria for normalized gain <*g*>

No	Value ⟨*g*⟩	Category
1	g ≤ 0,30	Low
2	0,30 < g ≤ 0,70	Medium
3	1,00 < g > 0,70	Height

3. Result and Discussion

The results of this study are the characteristics, feasibility, and legibility of teaching materials based on sound material scientific literacy. The research conducted was an experimental study with two classes being a trial class with one class as an experimental class and one class as a control class. The initial stage analysis of this study is an analysis of the feasibility of teaching materials and readability of teaching materials. The final stage analysis consists of a comparative hypothesis analysis analysis of two uncorrelated samples.

Before conducting research, feasibility testing is conducted. In addition to the modules being tested, pretest and posttest were also tested. Teaching materials in the form of modules are tested for the feasibility of readability to other school students who have been given similar material in natural science subjects. The trial of the feasibility of readability, feasibility of content, presentation, language, and graphics were tested and analyzed by experts. The expert who tested the feasibility aspects of the SETS-based science teaching module was a science teacher. Testing of instructional materials aims to find out whether or not the teaching materials will be used as instruments. The results of the feasibility test of SETS-based teaching materials are presented in Table 5.

Table 5. Recapitulation of learning material feasibility test results

No	Aspect	Percentage (%)	Criteria
1	Contents	88	Very Decent
2	Presentation	90	Very Decent
3	Language	80	Worthy
4	Graphic	80	Worthy
	Average	84,5	Worthy

Table 5. shows the results of the feasibility test of SETS-based science teaching materials that obtain eligible criteria that can improve scientific literacy skills. The percentage in the aspect of content has a high value. Content aspects include material listed on teaching materials and illustrations that can be easily understood by students. This means that SETS-based science teaching materials meet the eligibility requirements for printed teaching materials according to BSNP standards so that they can be used in learning. SETS-based textbooks can be used as one of the teaching materials in learning activities. In the aspect of feasibility the presentation gets a very high percentage (Muzanni & Zinnurain, 2018). Presentation on proportional teaching materials and arrangement of images and writing that are appropriate and do not make the eyes become tired to read the influencing factors.

Other things besides the proportional arrangement of images and writing aspects of scientific literacy can also increase interest from those who see and use SETS-based science teaching materials. The aspects of scientific literacy that appear in SETS-based science teaching materials are the body of knowledge (a body of knowledge), science as a way to investigate, science as a way of thinking and the interaction between science, technology, and society (interaction of

science, technology, and society). The scientific literacy aspects of teaching materials based on scientific literacy sound material are on the material, let's try, let's practice, and I know.

After learning and using teaching materials in the form of SETS-based science modules, the ability of students in the form of scientific literacy can be known to increase from questions that have aspects of scientific literacy. These aspects are (1) mentioning the usefulness of science and technology for the community, (2) describing natural phenomena related to science, environment, technology and society and (3) concluding or describing the phenomena of science, environment, technology and society (Habibah, 2017).

In addition to aspects like teaching materials or not teaching materials must also be read. Read what is meant is that it can be understood, can be understood, and can be applied if there is a problem related to the material in the teaching material that has been learned. The results of the readability of the teaching material can be seen from the problem that has been analyzed. The results of the readability test analysis of SETS-based science teaching materials with the scientific approach are presented in Table 6.

Table 6. Readability test results for science learning materials based on SETS

No	Respondent	Percentage (%)	Criteria
1	UCK-1	87	Easy to understanding
2	UCK-2	87	Easy to understanding
3	UCK-3	93	Easy to understanding
4	UCK-4	87	Easy to understanding
5	UCK-5	87	Easy to understanding
6	UCK-6	87	Easy to understanding
7	UCK-7	93	Easy to understanding
8	UCK-8	80	Easy to understanding
9	UCK-9	73	Easy to understanding
10	UCK-10	73	Easy to understanding
	Averange	84,7	Easy to understanding

Based on Table 6 The average percentage of readability of teaching materials was 84.7% and the criteria were easily understood. This is because teaching materials use simple language so that it is easily understood by readers. In addition to the language used, students can easily understand because the images and illustrations used can be digested by students. In the readability test results some students get a score that can still be said to be high (73%) and some get very high scores (93%).

The SETS-based science teaching materials use the letters Arial and Berlin Sans FB with sizes 9-16. This is so that the teaching material does not look boring. Teaching material pages that are too high in content can make it difficult for students to focus attention. The contents of the teaching material are also equipped with pictures and illustrations to make it more varied and do not look full of writing.

From the results of the development of the teaching materials for SETS-based science module, which has been used in the learning process, it is tested whether the SETS-based science teaching material in which there are aspects of scientific literacy can improve scientific science literacy skills or not. Results from students' literacy aspects in the experimental class and control class are shown in figure 1.

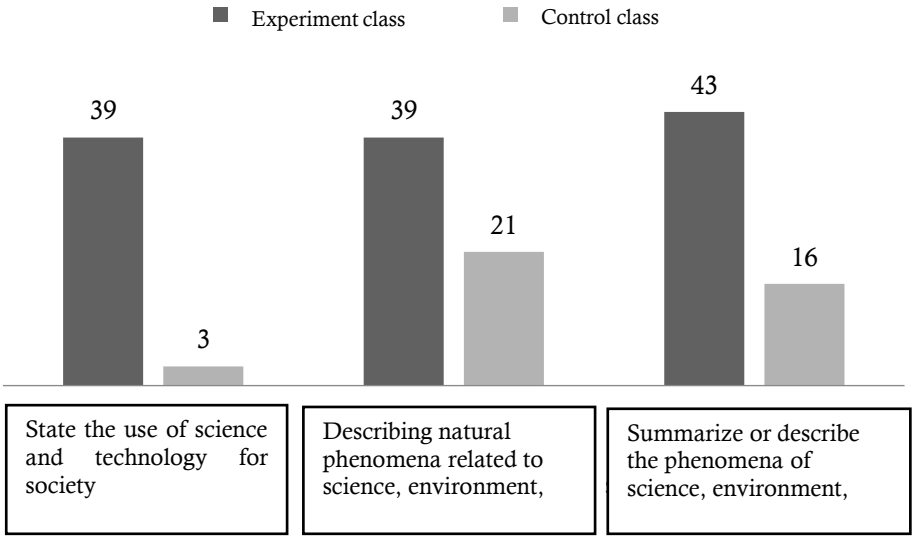

Figure 1. Increased aspects of scientific literacy between the experimental class and the control class

Based on Figure 1, there is a difference in the improvement of students' scientific literacy aspects between the experimental class and the control class. In the experimental class using SETS-based science teaching materials, there was a significant increase while the control class had an increase in scientific literacy skills but not as significant as the class that used SETS-based science teaching materials.

In addition to increasing scientific literacy by percentage, improvements in aspects of scientific literacy are presented in the graph of n-gain improvement. The n-gain chart is presented on Figure 2.

Table 7. Enhancement N-gain <g> scientific literacy

No	Class	Mean of pretest	Mean of posttest	N-gain	Criteria enhancement
1	Experiment	42,05	80,76	0,70	High
2	Control	44,95	62,95	0,32	Low

The increase in N-gain in aspects of scientific literacy in the experimental class and control class was obtained from the pretest and posttest scores. Based on the N-gain graph, the experimental literacy aspects of the experimental class and the control class of each aspect have different N-gain criteria. In the aspect of mentioning the usefulness of science and technology for the community N-gain obtained by the experimental class is 0.7 with high criteria, whereas in the control class only shows the N-gain 0.07 with low criteria. The next aspect is to describe natural phenomena related to science, environment, technology and society. The experimental class has an N-gain of 0.6 with a medium criterion, while the control class has an N-gain of 0.24 with a low criterion. In the control class for aspects of describing natural phenomena related to science, environment, technology and society is low, even when the teaching and learning process of teachers or teaching materials does not mention about describing or how natural phenomena related to science, environment, technology and society occur. The aspect of concluding or describing the phenomena of science, environment, technology and society in the experimental class gets an N-gain of 0.7 with a high criterion, whereas in the control class gets an N-gain of 0.22 with a low criterion.

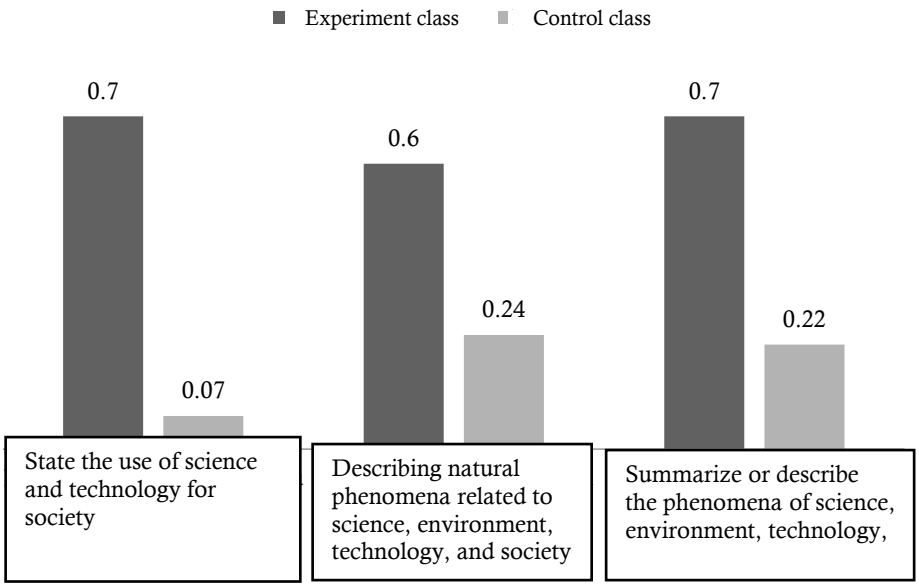

Figure 2. N-gain differences in aspects of scientific literacy in the experimental class and control class

Based on the results that have been obtained, the results of the development of teaching materials, namely the results of the Feasibility Test for Teaching Materials, got 82.73 with a feasible category. The content aspect includes the material listed in the teaching materials and illustrations that students can easily understand from these results. That is, SETS-based science teaching materials meet the eligibility requirements for printed teaching materials according to BSNP standards to be used in learning. This follows the results of Zinnurain & Muzanni's research, which states that SETS-based textbooks can be used as teaching materials in learning activities (Muzanni & Zinnurain, 2018). In the aspect of presentation feasibility, it gets a very high percentage. The presentation of proportional teaching materials and the arrangement of images and writing are appropriate and do not make the eyes tired to read the influencing factors (Kartini, 2018).

After developing teaching materials, learning is carried out using teaching materials that have been created. Before doing the teaching and after measuring the ability to scientific literacy skills. Graph 1. The results of the highest increase from the experimental class are in summarizing or describing the phenomena of science, environment, technology, and society. The high result of this aspect in the practical course is because students already know the wonders that exist around students. This is supported by Dwisetiarezi's research, describing the phenomenon of science, environment, technology, and society. Getting new knowledge can increase direct learning (Dwisetiarezi & Fitria, 2021). While the lowest score obtained is found in two aspects: Mention the use of science and technology for society and parts of Describing natural phenomena related to science, environment, technology, and culture.

After knowing high scores on specific aspects of the experimental class, then from these results, the results of the increase in n-gain are increased with the high category. The rise of n-gain or increasing scientific literacy some factors influence it. The first factor that influences is the application of SETS-oriented teaching materials. The use of insightful teaching materials is one of the most influential factors. This factor is also supported by Hardianti's research (Hardianti et al., 2021) that the teaching materials developed can improve scientific literacy. Apart from

Hardiyamti's research, Farda also researches by applying SETS integrated science teaching materials. The result of Farda's research is that the teaching materials used can support better learning (Farda & Rinjani, 2018).

Another factor in increasing students' scientific literacy skills is that the teacher as a guide in using SETS-oriented teaching materials is also very influential. In addition to the aspect of the teacher as a supervisor or director, the use of the teacher module can also combine SETS-oriented teaching materials with learning models. This is supported by Yantoro's research, where the teacher is very influential on what innovations the teacher must make in learning which significantly influences learning outcomes (Yantoro et al., 2021; Sabaniah et al., 2021).

In addition to the success factor, several factors influence the teaching and learning process that is not optimal using SETS-oriented teaching materials. The first factor is the limited time during the research process, which causes students to be less than optimal in learning the concepts contained in the teaching materials that have been given. The second factor is that the material taught is limited, so the teacher does not yet know the students' overall ability. There is still an opportunity for this research to be developed with a long period and more diverse materials from the factors that influence the research that has not been maximized.

4. Conclusion

Research that has been done shows that SETS-based science teaching materials can improve students' scientific literacy skills and can be implemented in learning. The increase in N-gain in scientific literacy in the experimental and control classes obtained from the pretest and post-test scores can be seen from the increase in N-gain in scientific literacy. Based on the increase in the average N-gain of the pretest and post-test, it was found that the experimental class got a score of 0.7 with high criteria and the control class with a score of 0.32 with low criteria.

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