



## Science Technology Society (STS) Learning Through The Utilization of Potato Skin Waste on Students' Science Literacy

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### Abstract

Soil damage due to excessive use of chemical fertilizers on potato vegetable crops is a real problem that must be solved. Through science learning with the Science Technology Society (STS) approach through the use of potato skins as organic fertilizer, it has helped reduce the use of chemical fertilizers. This study aims to foster scientific literacy in the area of awareness and concern for the environment. The research was conducted in class VII MTs Ma'arif Kejajar Wonosobo. This type of quantitative research with a true experimental approach pre-test-post-test control design. For data collection techniques with a questionnaire to see the attitude of awareness and concern for the environment. Data analysis was performed by *t* test. The results of the study showed that the  $t\text{-test} = 2.6 > t\text{ table} = 1.7$ . Science learning with the STS approach has a significant effect on scientific literacy in the area of awareness and concern for the environment.

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## 1. Introduction

The nature of science learning is a product, process, and scientific attitude [1]. Science learning must start from the facts that occur in everyday life, so that it is closer to the lives of students, and does not seem theoretical and mere calculations. The learning process is according to its characteristics, namely inquiry (discovery) [2]. Good science learning should link science concepts with everyday life, so students can get the opportunity to generate ideas, build curiosity about everything that happens in the surrounding environment, and raise students' awareness that science is very important to learn. Students can build their knowledge through perception and direct experience with their environment. In addition, students can better make sense of their world when they get the opportunity to interact directly with the surrounding environment which actively makes them have more knowledge.

Wonosobo region condition cold temperatures and high altitudes allows for agricultural areas with vegetable crops. The number of vegetable crops and the lack of plants that function to protect the soil are one of the causes of frequent landslides.

This demands the concern of the residents of the community around the mountainous area to be more concerned so that landslides can be prevented. One way to cultivate a sense of caring for the environment is through education. Integrating learning with the environment is one way to foster a sense of concern for the environment. Awareness and concern for environmental problems is one category of scientific literacy competence in the attitude area. Aspects of scientific literacy in the attitude area include how to respond to scientific issues on a personal, national, and global scale. This area includes an interest in science, appreciating/valuing scientific approaches, and awareness and concern for the environment [3]. However, science learning is currently not much directed towards realizing an attitude of awareness and concern for the environment.

The development of the world economy has consequences for the environment, one of which is the destruction of agricultural land caused by the excessive use of chemical fertilizers. Around 69 percent of land in Indonesia is categorized as severely damaged caused by excessive use of fertilizers and pesticides [4]. In addition, the use of technology by farmers is also still low due to the lack of knowledge [5]. Therefore, knowledge about the environment must continue to be part of education. But unfortunately, various studies have shown that students' knowledge of environmental concepts is still very minimal and requires broader knowledge. One of the things that can motivate students to have scientific literacy competence in understanding and caring for the environment is by showing real examples of how to solve problems that occur in society. Namely, providing solutions to soil problems in Indonesia, of which 69% have been badly damaged due to excessive use of pesticide fertilizers.

Learning by linking problems that occur in the community also aims to introduce students to the facts and phenomena that occur in a society that can be directly linked to the science materials studied by students at school [6][7]. Students will also feel that learning by providing direct solutions to community problems will provide knowledge and competence in making wise decisions. In addition, educational units through their students have the opportunity to introduce technology to the community to solve existing problems. In this study, Social Technology Science (STS) learning was used, with the aim that science concepts can be applied through skills that are beneficial for students and the community. The STS approach is based on the development of science and technology. The STS approach in the view of the social sciences and humanities provides an understanding of the relationship between science, technology, and society as well as developing students' scientific literacy. Therefore, in people's lives, especially in the world of education, the approach of science and technology has a mutually influencing relationship.

Awareness and concern for environmental problems is something that must exist in a person to try to prevent environmental damage and maintain and preserve the surrounding environment [8][9]. In addition, this attitude also has the aim of realizing a balance between humans and the environment and realizing the wise use of natural resources. The formation of a conscious and caring attitude towards the environment is an effort to form humans who have a positive attitude towards the environment, raise awareness and increase awareness about nature and encourage the protection and restoration of nature [10]. Learning science with the Science Technology Society (STS) approach is carried out on the material of temperature and its effects. Students are directed to conduct experiments by utilizing potato peel waste which is widely available in the environment around the student's residence into organic fertilizer to reduce the use of pesticides. STS learning by linking the issues that exist around these students is expected to be able to contribute to solving the problems of most of the land in the Wonosobo area which has been damaged due to vegetable cultivation with excessive use of pesticides. Thus, students can understand the concept thoroughly so that their knowledge is broader and more meaningful.

## 2. Method

This type of research is quantitative research with a true experimental approach, with an experimental design post test only control design [11], [12]. This research was conducted at MTs Ma'arif Kejajar. The research population was class VII students in 2020/ 2021, totaling 102 students. The research sample was taken by random sampling, two classes were taken with class A as the experimental class and class B as the control class. The experimental class carried out STS learning using potato peel waste, and the control class was not given any treatment, the learning was carried out as before, namely the lecture model. Scientific literacy data collection was focused on the attitude area, namely awareness, and concern for environmental problems using a questionnaire. In the context of learning, scientific attitudes can be measured according to the material studied by students.

The form of the questions can be developed in the form of questionnaires and questions that require students to express responses, both in the domain of knowledge (agree or disagree), affective (happy or displeased), and psychomotor (tendency to act) [3]. The questionnaire used is a closed questionnaire using a Likert scale. The validity of the questionnaire instrument was tested with validity and reliability. Only valid questions were used in the study. The questionnaire on the attitude of awareness and concern for the environment consists of 18 questions, namely 10 positive questions and 8 negative questions. On positive questions, if students answer Always (S) get a score of 3, answers Sometimes (K) get a score of 2, and answers Never (TP) get a score of 1. While in negative questions if students answer Always (S) gets a score of 1, answered Sometimes (K) got a score of 2, and answered Never (TP) got a score of 3. Before the research, an initial ability similarity test was conducted for both classes using the previous score and tested with a two-party *t-test*. To see the effect of learning science with the Science Technology Society approach on students' scientific literacy, technical data analysis was carried out using quantitative analysis with a one-sided *t-test* by first conducting prerequisite tests, namely normality and homogeneity. After the prerequisite test is met, parametric statistics are used, namely the *t-test*.

$$t_{\text{hitung}} = \frac{x_1 - x_2}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}} \quad (1)$$

## 3. Result and Discussion

This research was carried out from October 21<sup>th</sup> to November 2020, at MTs Ma'arif Kejajar, Wonosobo in class VII odd semester of the 2020/ 2021 academic year. This research begins with observation activities as an effort for researchers to know the school environment. MTs Maarif Kejajar was founded from the concern of NU community leaders in Kejajar District about education issues, especially for elementary/ MI graduates who are very low in continuing their education to the SMP/MTs level. This is due to economic factors and low awareness of parents and guardians of students. At the time, children who graduated from SD/ MI who continued their education were still relatively low, and even then we were still limited to the upper middle-class economy and also among Civil Servants.

Meanwhile, for those whose economic level is middle to lower, children who graduate from SD/MI tend to choose to work rather than continue their education. At that time, there were only 3 (three) schools in Kejajar District, namely: SMP N Kejajar, MTs. Ma'arif Tieng and SMP Muhammadiyah 06 Tieng, and even then with a relatively small number of students. Children who

graduated from SD/MI prefer to continue their studies in other sub-districts such as MTsN Kalibeyer which was quite a lot at that time.

The Wonosobo area is an area with cold temperatures, so it is very suitable for vegetable crops. Vegetable crops are the first and main source of income for the Wonosobo community, especially those living around the mountains. To maximize the yield of vegetable crops, many people use pesticides and chemical fertilizers, so that in the long term the soil is damaged. In addition, the lack of large-rooted plants that can withstand the danger of landslides because the land has been planted with vegetables, many landslides occur. In the science learning model, researchers observe the processing of potato farmland, which is mostly done by using chemical fertilizers and pesticides in excess, and then reconstructed using potato peel waste processing technology into organic fertilizers that are safer than chemical fertilizers. This is not only done to restore soil but also aims to foster scientific literacy in the area of awareness and concern for the environment. The data from the research on the questionnaire on the attitude of awareness and concern for the environment consists of 18 questions shown in

Tabel 1.

Tabel 1. Data	Class	$\Sigma$	$\bar{x}$	Min	Maks	S	S <sup>2</sup>	Result
	Eksperimen	609,5	40,6	36	45	1,72	2,96	
	Class	$\Sigma$	$\bar{x}$	Min	Maks	S	S <sup>2</sup>	
Eksperimen	609,5	40,6	36	45	1,72	2,96		
Control	567,5	37,8	34	42	1,72	2,96		

From the Tabel 1 it can be seen that the average value of students' awareness and concern for the environment in the experimental class is 40.6 with the highest score being 45 and the lowest being 36. Meanwhile, the average value of students' awareness and concern for the environment in the control class is 37.8 with the highest score 42 and lowest 34. To test the hypothesis in this study, the correlated sample t-test was used. This test is used to determine whether there is an influence of the Society Technology Science (STS) learning model through potato peel waste on students' scientific literacy. Testing is carried out after the end of learning or after being given treatment. In this study, the researcher used the right-hand hypothesis test. The right side test is used if the null hypothesis ( $H_0$ ) reads smaller than ( $\leq$ ) and the alternative hypothesis ( $H_a$ ) reads bigger ( $>$ ). Based on the results of calculations for the questionnaire, the  $t_{count}$  value is 2.63, and the  $t_{table}$  with a significant level of 5% and  $dk = (15+15)-2 = 28$ , the  $t_{table}$  is 1.761. From these results  $t_{count} > t_{table}$  ( $2.63 > 1.761$ ), then  $H_0$  is rejected and  $H_a$  is accepted. So it can be concluded that there is an effect of learning science with the Science Technology Society (STS) approach using potato peel waste on students' scientific literacy in the area of awareness and concern for the environment.

A good learning process in schools must of course have a target of teaching materials that must be achieved by every educator. The teaching materials that are summarized in the curriculum must also be adjusted to the time available in the school year; but usually the material available is more than the time available. Thus, teachers are required to have a learning effectiveness strategy. Because an effective learning process indicates the success of teaching. The results of this study indicate that using the Science Technology Society (STS) approach can grow scientific literacy in the area of environmental awareness and care. This is to research conducted by [13] that an attitude of caring for the environment can be grown by habituation, teaching, conditioning, and example. When students are faced with natural disaster conditions such as soil damage and landslides and analyze the causes, in situations like this students are aware that vegetable crops on mountain slopes do not have good roots in holding water, causing landslides. Although the temperature is very supportive in growing vegetables.

Students' awareness and concern for soil damage encourage students to use the concepts of science and technology to provide solutions to overcome this land damage. Understanding the scientific concept of potato peel content which is very good for the soil is the capital in processing potato skin waste into organic fertilizer to reduce the use of chemical fertilizers. The technology used is the potato waste processing technique, namely the skin to be used as fertilizer. In the first experiment, the potato vegetable waste used was thinly peeled potato skins, the potato skins used were potato skins that had been washed with cold water, then put into a container with hot water added in it, then given decomposing bacteria and covered with a meeting. Then let it sit for about 1 week. This activity shown at Figure 1.



**Figure 1.** First Experiment with Thin Peeled Potato Skin

In the second experiment, the potato vegetable waste used was potato skin which was peeled by scraping it off, then put in a container with hot water, and let sit for 1 night. Second experiment shown at Figure 2.



**Figure 2.** Second Experiment with Peeled Potato Skins

Learning science with this community science technology approach has a very good impact on the formation of scientific literacy in the attitude area. Habituation carried out in the learning process will shape the mindset of students, and build awareness and concern for protecting the environment. In general, after the experimental class was taught using the Science Technology Society (STS) approach, there were several advantages to using this method in the learning process, including 1) The Science Technology Society (STS) approach made science learning more meaningful because it was

directly related to problems that arise in everyday life; 2) The Science Technology Society (STS) approach can improve students to apply concepts, process skills, creativity, and an attitude of appreciating technology products and being responsible for problems that arise in the environment; 3) The Science Technology Society (STS) approach provides broader knowledge about the relationship between science and other subjects; 4) The creation of a work or application of the material can foster self-confidence in students that they can play a role or benefit society as well as for science and technology.

Learning science with the Science Technology Society (STS) approach using potato peel waste has a significant influence on scientific literacy in the area of awareness and concern for the environment. The time used in this study was 3 meetings. In its implementation, the Science Technology Society (STS) method is used to create fun, and real learning [16] [17]. This learning is considered capable of stimulating students to improve the quality of their learning outcomes. The implementation of experiments in learning with the STS approach through the use of potato peel waste is carried out by the students themselves in their environment. In conducting experiments students are given worksheets so that experiments can be carried out systematically. After students submit reports on experimental results, the teacher provides feedback on reports made by students. Then continued discussion, so that it can deepen students' understanding of the concepts being studied. Thus learning with the STS approach by linking problems around students is effectively used in science learning.

## 4. Conclusion

Learning science with the Science Technology Society (STS) approach through the utilization of potato peel waste has a significant effect on scientific literacy in the area of awareness and concern for the environment. The attitude of caring for nature and preventing its damage is effectively carried out through learning in schools. So it is necessary to do a lot of learning in this way. Teachers need to direct and accompany students to conduct field visits, so they can see firsthand the problems that exist. Learning that directly relates to problems around students makes learning more real, so that problems that must be solved by students are familiar because they are around students. Thus learning will be more useful and more meaningful.

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