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SCIENCE, ENVIRONMENT, TECHNOLOGY AND SOCIETY MODELS (SETS) ON ENVIRONMENTAL LITERACY IN ELEMENTARY SCIENCE LEARNING

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ABSTRACT

This research aims to determine the application of the Science, Environment, Technology, and Society (SETS) learning model on environmental literacy in Natural Sciences (IPA) education at the elementary school level. This study uses a Quasi Experimental Design with a Non-equivalent control group design. The research sample consists of all students from class VA (37 students) and class VB (38 students) at one elementary school, using saturated sampling technique. Data collection techniques include multiple-choice tests and questionnaires. To analyze the quality of the instruments, validity test, reliability test, difficulty level, and discriminating power were used. Data analysis was conducted through normality test, homogeneity test, and hypothesis testing using paired sample t-test and independent sample t-test, with the aid of SPSS for Windows and Microsoft Excel. The results of the paired sample t-test showed a significance value of 0.000 < 0.05, and the independent sample t-test showed a value of 0.010 < 0.05. Therefore, it can be concluded that there is a significant effect of the application of the SETS learning model on environmental literacy. This research provides practical implications for teachers in choosing effective and contextual learning models. Additionally, these findings can serve as a basis for developing a science curriculum that is adaptive to environmental issues and technological advancements.

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1. INTRODUCTION

Technology exists as a tool that makes activities easier for humans. Technology products are very familiar with everyday life. With technology products, we no longer have to draw water from wells, and we don't need to take a long time to light a fire to cook. Access to information is very easy to reach because of the presence of gadgets and the internet, making it easier for us to interact and communicate. Technology products are very influential in various aspects such as the economy, education, agriculture, entertainment, and others. However, if it is not managed wisely, it will have negative impacts. Therefore, according to (Poedjiadi, 2019) those using technology must have sufficient knowledge and a strong mentality so that technological products can be used effectively and efficiently and prevent misuse of technology which results in harm to the environment and society. Human indifference in using technology and technological products in

everyday life can have fatal consequences for the environment and can cause natural disasters due to human actions. Therefore, it is important to strive for this through education aimed at building public awareness of the importance of preserving the environment (Syofyan et al., 2020)

The challenge of facing rapid technological developments is that it is important for every individual to have literacy skills. Literacy was initially only defined as the ability to read and write, but as time goes by and the development of the era the definition of literacy becomes broader and deeper. According to Abidin et al., (2017) literacy is a complex process for building knowledge. The scope of literacy also does not lie in language learning alone but the literacy domain includes mathematics, science, technology, culture, the environment, and others. The urgency of environmental literacy must be realized by every individual because according to (Nugraha et al., 2021) humans are the main subjects who benefit from nature. Humans have been gifted with reason by Allah SWT and are trusted to be caliphs (leaders) on earth as recorded in the Al-Quran, Surah Al-Baqarah verse 30 :

وَاِذْ قَالَ رَبُّكَ لِلْمَلٰۤىِٕكَةِ اِنِّيْ جَاعِلٌ فِى الْاَرْضِ خَلِيْفَةً ۗقَالُوْٓا اَتَجْعَلُ فِيْهَا مَنْ يُّفْسِدُ فِيْهَا وَيَسْفِكُ الدِّمَاۤءَۚ وَنَحْنُ نُسَبِّحُ بِحَمْدِكَ وَنُقَدِّسُ لَكَ ۗقَالَ اِنِّيْٓ اَعْلَمُ مَا لَا تَعْلَمُوْنَ

and (remember) when your Lord said to the angels, "I will make a caliph on earth." They said, "Are You going to place someone there who will cause corruption and shed blood, while we praise You and sanctify Your name?" He said, "Truly I know what you do not know."

However, humans also have desires that can lead them to misuse technology and exploit nature, resulting in damage to the earth. Humans tend to utilize and abuse the environment for their livelihood but do not take preventive measures against its destruction. Therefore, humans who have been bestowed with reason and intelligence must be able to reflect attitudes and behaviors that are loving towards the environment (Nugroho, 2022). Environmental literacy does not automatically decline as a natural attitude in every human being, but this ability must be planted and built within their soul. According to (Usman, 2019), all humans are born in a state of weakness and slow maturity, yet humans are entrusted by Allah SWT as khilafah (leaders) on earth, which means humans have a very great responsibility with all their limitations and capabilities. That ability is merely a potential that must be explored, realized, and concretized through the process of behavioral change that we call education. (Anggraeni et al., 2021) state that education is an important part of character building that understands and is aware of the importance of preserving the environment. Environmental literacy according to (Kurniati et al., 2022) is an individual's ability to understand the environment both in terms of knowledge and attitude that can provide solutions to environmental issues. According to (Fettahlıoğlu et al., 2016), environmental literacy is an individual's ability to transform knowledge into tangible attitudes toward their environment as an effort to prevent environmental problems. The indicators of environmental literacy according to McBeth & Volk 2010 are (1) knowledge (ecological knowledge), (2) cognitive ability (identification of environmental issues, analysis of environmental issues), (3) planning for environmental problem solving, (4) attitudes (verbal commitment, and environmental sensitivity), (5) behaviors (actual commitment).

Environmental literacy is the awareness of each individual in understanding cognitively how the environment is sustainable with life, through these cognitive abilities must produce environmental literacy attitudes in their daily lives by being aware of the impact that humans have

on their environment. The life of each individual accompanied by a sense of responsibility will result in a sustainable life between the environment and humans, meaning that each individual is expected to be able to take strategic steps in overcoming environmental problems and protecting the earth's ecosystem (Caesarina et al., 2017). The strategy that can be used in learning to answer the phenomenon of technological development, construct environmental literacy skills in schools is by using the Science, Environment, Technology and Society (SETS) learning model or in Indonesian known as STM (Social Science Technology) or mutual themes (science, environment). (technology, and society) the terms Science, Environment, Technology, and Society were first put forward by John Ziman in his book entitled "Teaching and Learning about Science and Society" then initially developed in America and Europe and were structured longitudinally in 1985 and in 1993 this model began adapted in Indonesia with the aim of forming individuals who have scientific and technological literacy and are concerned about the problems of society and the environment.

The SETS model develops cognitive, affective and psychomotor abilities which are fully formed within the individual as a student with the hope that they will be applied in everyday life (Poedjiadi, 2019). The Science, Environment, Technology and Society learning model using a contextual approach hopes that student learning achievements will have meaning and will be used in everyday life and learning that is not easily forgotten. This creates more fun and challenging student learning motivation. Apart from that, according to (Poedjiadi, 2019) the SETS learning model with a contextual approach can make it easier for students to construct knowledge. The goals of the SETS learning model according to Yager (Hunaepi et al., 2014) include providing opportunities for students to compare and contrast science and technology and appreciate how science and technology contribute to new knowledge and influences. The objectives according to (Surata & Arjaya, 2018) are to provide opportunities for students to investigate various real global issues, develop students' abilities and self-confidence to express opinions and make decisions based on correct information and take action with full responsibility.

Some of the advantages of the SETS model in (Poedjiadi, 2019) Science, Technology, Society as an approach can increase student enthusiasm at low ability levels, the STM model also has a superior accompaniment effect besides developing cognitive aspects, through developing intellectual abilities this model develops emotional abilities and spiritual. According to experimental research (Winandika, 2020), learning with a SETS vision influences student participation in learning, including asking questions, expressing opinions, respecting friends' opinions, and working together in groups. The advantages of the SETS learning model according to Yeni et al (I Made Sudarmawan, Ida Bagus Gede Surya Abadi, 2020) are that the SETS learning model emphasizes the process or ways in which students are able to acquire concepts in certain fields of science, students can obtain dimensions of knowledge, Students are faced with real situations, develop an attitude of tolerance and gratitude and realize the greatness of God Almighty, and foster creativity. Through experimental research (Irfandi, Nurul Azmy Rustan, 2022) STM can raise students' curiosity, obtain as much information as possible honestly and objectively, cooperatively, enthusiastically and actively, diligently and responsibly, as well as social attitudes.

According to (Poedjiadi, 2019) this Community Science Technology Model can be used in various subjects but teachers must be able to choose the right theme because not all studies can use the STM model. Technology as a product of science, and also the universe is a resource that

will be utilized by humans which is processed through technology in theory is very suitable for elementary science learning using the SETS model. Through science learning, it is hoped that it will become a forum for students to learn about themselves and the natural world around them, as well as prospects for further development in applying it in everyday life. Some of the objectives of elementary school science learning according to (Ramadhani, 2019) are developing curiosity and a positive attitude towards science, technology and society, developing process skills for investigating the natural environment, solving problems and making decisions, developing knowledge and understanding of concepts. science that will be useful and can be applied in everyday life, develop awareness about the role and importance of science in everyday life, transfer knowledge, skills and understanding to other areas of teaching, participate in maintaining, safeguarding and preserving the natural environment. Appreciating the various forms of God's creation in this universe to be studied, gaining knowledge, concepts and science skills as a basis for continuing education to a higher level. Natural Science (hereinafter referred to as IPA) is a science that offers ways to answer questions about the very diverse phenomena on earth and the universe. Science also provides knowledge about how we live according to these natural things (Ramadhani, 2019). In essence, science is not only about knowledge of the universe but it contains scientific products, scientific processes, scientific attitudes and scientific applications. The SETS model is theoretically believed to have an influence on the cognitive, affective and psychomotor domains. Supported by (Irfandi, Nurul Azmy Rustan, 2022) who states that the SETS model has an effect on students' scientific attitudes.

2. METHOD

This study employs a quantitative approach with an experimental method. A quantitative approach was chosen because the research aims to measure the effect of a treatment on results that can be observed objectively and measured precisely. According to Sugiyono (2022), experimental quantitative research involves treatment, aiming to identify the influence of a specific treatment on other variables under controlled conditions. Therefore, this approach is relevant to examine the effect of a learning model on students' abilities. The research design used is a quasi-experimental design, which includes a control group but does not fully control external variables that may affect the implementation of the experiment (Abraham & Supriyati, 2022). Specifically, the design applied is the nonequivalent control group design, which involves conducting pre-tests and post-tests, although the experimental and control groups are not selected randomly. The sampling technique used is saturated sampling, where the entire population is taken as the sample. The research sample consists of elementary school students from classes VA and VB at SDN Cemerlang in Sukabumi City. The instruments used in this research consist of two types. The first is a multiple-choice test constructed using the Guttman scale, where the highest score is 1 (for correct answers) and the lowest score is 0 (for incorrect answers). The second is a questionnaire developed using a Likert scale with 7 items. The highest score on the questionnaire is 4 and the lowest is 1.

The data analysis techniques used include descriptive statistics, which describe the collected data without drawing conclusions, and inferential statistics, which are used to make conclusions based on the analyzed data (Sugiyono, 2022). The prerequisite tests include the normality test, which determines whether the data is normally distributed. If the significance value

is greater than 0.05, H_o is accepted and H_1 is rejected, indicating that the data is normally distributed. The homogeneity test determines whether the data comes from the same group. If the significance value is greater than 0.05, H_o is accepted and H_1 is rejected, indicating that the data is homogeneous (Lukman, 2017). Once the data is confirmed to be normal and homogeneous, the next step is to conduct an independent sample t-test on the pre-test data to determine if there is a mean difference between the control and experimental classes. Then, a paired sample t-test is performed on the post-test data for both the control and experimental classes to assess whether there is a significant mean difference after the treatment. Additionally, an independent sample t-test is applied to the post-test data to evaluate the difference in means between the control and experimental groups. The criteria for the independent sample t-test are: H_o is accepted and H_1 is rejected if the significance value is greater than 0.05, indicating no significant difference in means. For the paired sample t-test, H_o is rejected and H_1 is accepted if the significance value is less than 0.05, indicating a significant mean difference after treatment (Lukman, 2017). All data processing is assisted by SPSS software and Microsoft Excel.

3. RESULTS AND DISCUSSION

This research was carried out in 3 meetings in the control and experimental classes. The first meeting was conducting a pre-test, the second and third meetings were conducting learning activities (treatment) in the experimental class using the SETS learning model, while in the control class using the teacher center learning (TCL) learning model, at the third meeting while carrying out post tests in the control and experimental classes.

After conducting normality and homogeneity tests, it can be found that the sig values of the control class and the experimental class are respectively 0.185 and 0.268 where both are greater than 0.05, then the two pre-test data are distributed normally and it is known that the sig value based on the average is 0.870 > 0.05, then it can be concluded that the data comes from a homogeneous group. According to (Widhiarso & Belakang, 2024), if it is known that the data is distributed normally and homogeneously (assuming the prerequisite test of the analysis is met), then the hypothesis test can be continued with parametric statistics (Nilda, 2020). Pre test data were tested using an independent sample t test for the average control class and experimental class.

Table 1. Independent Sample T-Test Pre-Test

Independent Samples Test						
		Levene's Test for Equality of Variances		**t-test for Equality of Means**		
		F	**Sig.**	**t**	**df**	**Sig.(2-tld)**
Pretest result	Equal variances assumed	.027	.870	-.479	60	.634
	Equal variances not assumed			-.479	59.886	.634

According to (Isnawan et al., 2020) in quasi-experimental research, determining the control and experimental classes must be chosen randomly even though the two samples have the same

abilities and characteristics. Based on table 7, it is known that the sig (2-tailed) value is 0.634 > 0.05, so it can be concluded that the average value of the control class and experimental class does not have a significant difference, which means that these two classes have the same character. So, these two groups meet the requirements for conducting quasi-experimental research. The following are graphs and data on the frequency distribution of the average values of the control class and experimental class.

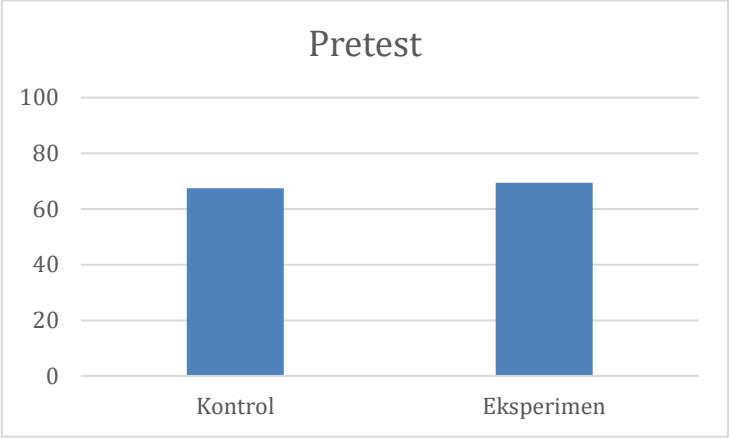

Figure 1. Graph of the Average Pretest for the Control Class and Experimental Class

Initial data on environmental literacy ability (before treatment) in students were 11 people in the control class in the poor category, 5 people in the adequate category, 6 in the good category, and 9 in the very good category. In the experimental class, 11 people were categorized as poor, 3 people were categorized as adequate, 8 people were categorized as good, and 9 were categorized as very good. It is known that the sig values of the control class and the experimental class are 0.649 and 0.129 respectively, both of which are greater than 0.05, so it can be concluded that the data is normally distributed. Based on table 11, it is known that the sig value is based on an average value of 0.789 > 0.05, so it can be concluded that the data comes from a homogeneous group.

Table 2. Paired Sample Test Posttest Control Class

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2-tld)
					Lower	Upper			
Pair 1	Pretest – Posttest	-5.968	11.638	2.090	-10.236	-1.699	-2.855	30	.008

Table 3. Paired Sample T-Test Posttest Experimental Class

Paired Samples Test									
		Paired Differences					T	Df	Sig. (2-tld)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Posttest	-12.516	11.581	2.080	-16.764	-8.268	-6.017	30	.000

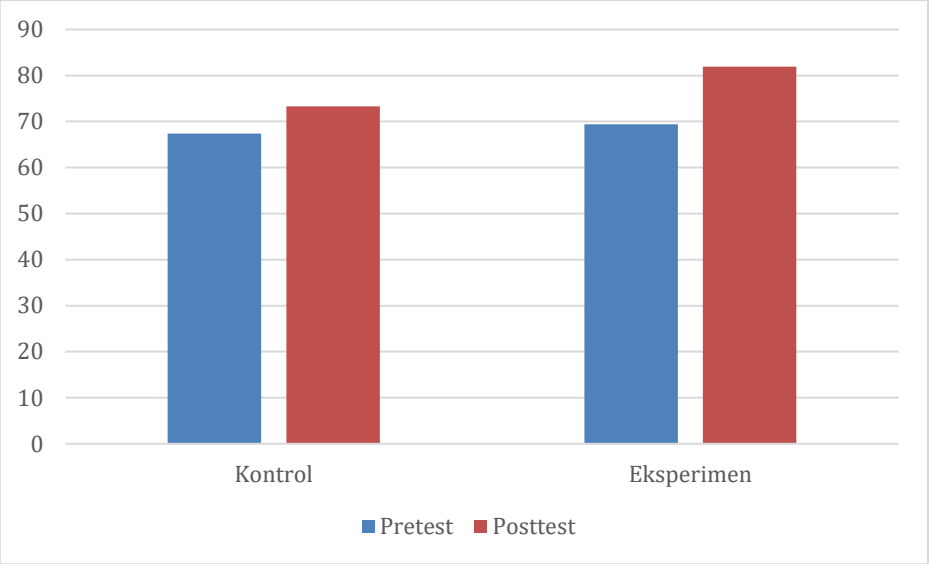

Figure 2. Graph of the Average Value of the Control and Experimental Classes

Table 4. Independent Sample T-Test Posttest

Independent Samples Test						
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Hasil Posttest	Equal variances assumed	.073	.789	-2.667	60	.010
	Equal variances not assumed			-2.667	59.927	.010

Based on tables 3 and 4, the paired sample t test shows that the sig (2-tailed) values in the control and experimental classes respectively show values of 0.008 and 0.000, both of which are smaller than 0.05. So it can be concluded that there are differences in learning outcomes after treatment with learning models, both the SETS model and the TCL model. However, based on table 13 there is a difference between the averages in the control class and the experimental class

of 9, in Figure 2 it can be seen that the average value for the experimental class is greater than the control class. The results of the independent sample t test in table 15 show a value of 0.010 < 0.05, so it can be concluded that there is a significant influence of the application of the science, environment, technology and society learning model on environmental literacy based on the average posttest value in the control class and experimental class. . Consolidating the discussion above, it is known that the science, environment, technology and society learning model has a superior influence, supported by Kim et al (Surata & Arjaya, 2018) which is able to improve students' understanding (cognitive) and attitudes (affective) in everyday life.

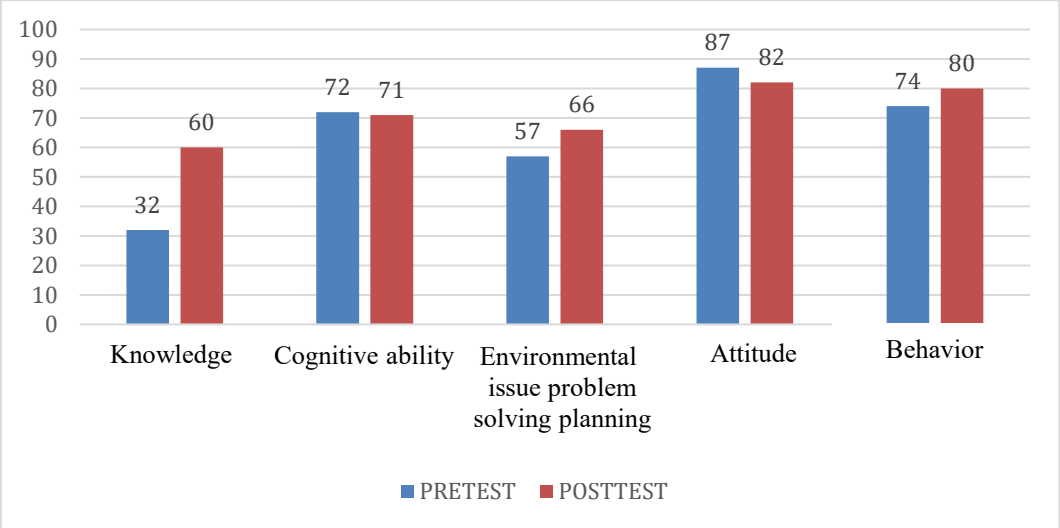

Figure 3. Average Graph of the Literacy Ability of the Control Class Environment

Based on Figure 3, the literacy ability of the control class environment showed results successively, namely 32, 72, 57, 87, and 74. After being given posttest results treatment in the control classes in succession, namely 60, 71, 66, 82, and 80.

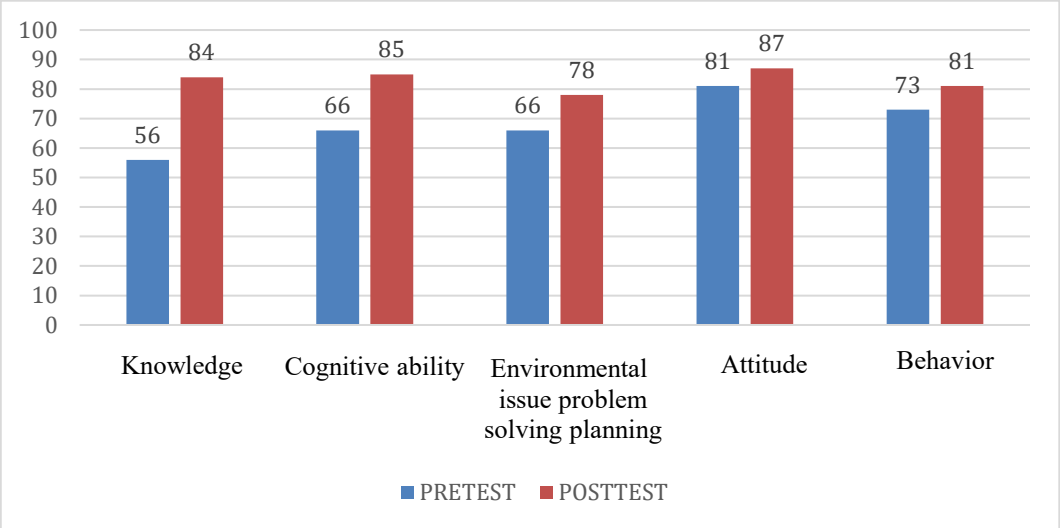

Figure 4. Average Graph of Environmental Literacy Ability of Experimental Classes

Based on Figure 4, the environmental literacy skills of the experimental class are 56, 66, 66, 81, and 73 respectively. After being given treatment, the posttest results in the experimental

class were 84, 85, 78, 87, and 81. Based on Figures 3 and 4, it shows that there is a difference in the average value in each indicator where in the experimental class the overall results are increased. Learning activities with the science, environment, technology, and society model support interactive learning activities both between teachers and students as well as students and students in line with the statement from (Winandika, 2020) that learning with the SETS vision affects student participation in learning including asking questions, expressing opinions, respecting the opinions of friends, and working together in groups. Science learning using science, environment, technology and society models has also been proven and tested for effectiveness through research conducted by (Belvana, 2024) which concluded that the SETS learning model has an effective influence in improving students' ability to apply concepts.

In addition, it can be seen that the expected learning outcomes in the experimental class show higher results than the control class in line with (Suarni et al., 2021) who say that the STM model has an effect on student learning outcomes. Students in the experimental class show an active participation attitude in expressing opinions (stage 1), in stage 2 students play a role in the formation of concepts which are carried out in groups so that at this stage students directly get interactive learning between students and other students. So it can be seen that in stage 3 students show more optimal ability to fill out the LKPD with satisfactory answers. Based on the image 4, it can be seen that the increase in students' cognitive abilities in the experimental class is rising, which is in line with the statement from (Poedjiadi, 2019) that the SETS learning model can improve students' cognitive abilities. Therefore, this research can serve as a reference for teachers in determining contextual-based learning models that are expected to foster students with abilities and behaviors that are concerned about the environment. Based on the image 4, it can be seen that the increase in cognitive abilities of students in the experimental class has risen, which is in line with the statement from (Poedjiadi, 2019) that the SETS learning model can improve students' cognitive abilities. Therefore, this research can serve as a reference for teachers in determining a contextual-based learning model that is expected to build students with abilities and behaviors that are concerned about the environment.

4. CONCLUSION

Based on the research that has been conducted, it can be concluded that the use of the SETS Learning Model has an influence on Environmental Literacy in Science Learning at the elementary school level. This is evident from the average results of students' abilities in the pretest and posttest across five indicators: knowledge, cognitive ability, environmental issue-solving planning, attitude, and behavior. The results of the independent sample ttest on the posttest showed a significance value of $0.010 < 0.05$, indicating a significant difference in the average scores between the control class and the experimental class. Overall, it can be concluded that the SETS Learning Model has a significant effect on students' environmental literacy in elementary school science learning. The results of the students' abilities using the SETS model showed improvement, whereas in the control class it was not very significant. The results of this study reinforce the relevance of the SETS learning model as an approach capable of integrating the elements of science, environment, technology, and society in the learning process, thus not only focusing on cognitive aspects but also on the affective and social aspects of students. This also supports the statement from that the vision of SETS involves interaction, participation, and student engagement in

discussions and group work. This research can provide recommendations for teachers in determining the learning model in science subjects or other relevant subjects. The use of this learning model not only facilitates students in understanding concepts contextually but also fosters awareness of environmental issues from an early age. The results of this research can be a strategy in building a generation that is more environmentally conscious, thinks critically about the environment, and has active participation in society.

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