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Integration of Dalihan Natolu's Local Wisdom in the SETS Learning Model to Improve Student's Problem-Solving Ability

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ABSTRACT

This study integrates the Science, Environment, Technology, and Society (SETS) learning model with the cultural framework of Dalihan Natolu (DNT), aimed at fostering active, effective, and creative learning. The objective was to examine the impact of this integrated DNT-SETS approach on students' problem-solving skills, particularly in the context of environmental pollution. A quasi-experimental design was employed, involving 60 students from SMA GKPS Pematang Raya, divided into an experimental group (30 students) and a control group (30 students). The learning materials included lesson plans, student worksheets, learning model guides, and six essay questions related to environmental pollution designed to assess problem-solving skills. Data were analyzed using the Kolmogorov-Smirnov test for normality and Levene's test for variance homogeneity, both at a 5% significance level. A t-test was conducted to determine the effectiveness of the DNT-SETS model. The t-test results showed a significance value of 0.000, indicating a statistically significant difference between the experimental and control groups. The experimental group, which used the DNT-SETS model, demonstrated a 59% improvement in problem-solving skills, compared to a 38% gain in the control group. This suggests the DNT-SETS model effectively enhanced students' abilities to address environmental issues. The integration of the DNT-SETS model enabled students to approach environmental problems holistically, linking scientific concepts with real-world challenges. This model encourages students to gather evidence and develop effective solutions based on their understanding. The DNT-SETS model significantly improves problem-solving skills in environmental education, offering a practical and culturally relevant teaching strategy.

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1. INTRODUCTION

Globalization, meaning the interconnectedness of the entire world, has influenced education. Global education aims to cultivate a sense of global citizenship in students by fostering connections between cultures, people, and the environment we all share (Aisyah et al., 2019). Global education is

an attempt to instill a view of the world in students by focusing on the interrelationships between cultures, humanity and the conditions of the planet earth. The current condition of education emphasizes students' ability to solve problems, but there is something unique in global education, namely the focus on substance originating from worldly matters which are increasingly characterized by pluralism, interdependence and change. Global education strives to equip students with the knowledge, skills, and values they need to thrive in a world facing challenges like dwindling natural resources and increasing cultural diversity, cultural pluralism and increasing interdependence. To prepare for and face the world in the 21st century, the learning process must be able to facilitate the process of developing students' potential (Gathong & Chamrat, 2019).

The concept of 21st-century education has been adapted by the Ministry of Education and Culture of the Republic of Indonesia to develop a new curriculum 1). Creative and innovative (creative and innovative), 2) Critical thinking (the nature of critical thinking), 3) Integration of science, 4) Easy to get information (easy to get knowledge) , 5) Have a communicative and collaborative spirit (communicative and collaborative spirit), 6) Appreciate differences of opinion (respect differences of opinion), and 7) lifelong education (long life education) for SD, SMP, SMA, and SMK (Miller & Maellaro, 2016). The goal of teaching science isn't just memorizing facts from textbooks. Instead, it's about igniting students' curiosity about the amazing world around them. Scientists at the University of California agree that by exploring science, students can actively discover scientific concepts general rules, and even form their own ideas (hypotheses) – just like they do when studying other subjects (Kusmianty et al., 2020).

The success of 21st-century education in formal environments depends on the support of all educational aspects, particularly effective teaching methods that help students develop the skills to understand and address real-life problems. One pressing challenge is environmental degradation, as highlighted in the World Water Development Report (WWDR), which notes that approximately 2 million tons of waste enter water bodies daily, while liquid waste production reaches 1,500 cubic meters, contaminating global water supplies. Another serious issue involves hazardous and toxic (B3) waste, generated by businesses or industrial activities, which poses significant risks to ecosystems and human health due to its harmful nature, high concentration, or sheer volume (Maimunah, 2016). These environmental problems are not confined to specific regions but are prevalent across many countries, including Indonesia, where pollution remains a persistent challenge.

In Indonesia, environmental pollution is a long-standing issue, with biological activists frequently raising concerns about unsustainable human activities. Common problems include the improper disposal of household waste, illegal logging, and deforestation, all of which contribute to ecosystem damage and threaten biodiversity (Maimunah, 2017). Addressing these challenges requires education systems to equip students with the critical thinking and problem-solving skills necessary to engage with complex environmental issues and encourage responsible behavior for sustainable living.

In the Raya sub-district of Simalungun Regency, significant environmental issues demand urgent attention, particularly the problem of littering, which clogs drainage systems with waste. During heavy rainfall, these blockages lead to flooding, with water carrying trash onto roads. As the floodwaters recede, transportation is disrupted by scattered garbage, and roads are left damaged with potholes. Another serious issue is the indiscriminate cutting of trees, which has caused landslides on several hillsides along the roads (Miller & Maellaro, 2016). A notable local habit contributing to environmental pollution is the careless disposal of saliva when chewing.

These environmental challenges present an opportunity to shift educational practices from conceptual learning to contextual learning, allowing students to engage directly with real-world problems. Such an approach fosters deeper understanding and meaningful learning experiences by connecting classroom knowledge with environmental issues in students' surroundings (Nurkhasanah et al., 2019). Encouraging contextual learning can enhance students' awareness, equipping them with the skills and knowledge needed to actively contribute to sustainable solutions.

Currently, many students struggle with problem-solving skills, as they often find it difficult to comprehend the problems presented by their teachers. This challenge arises from several factors, including a reliance on theoretical learning without sufficient practical or contextual experience—specifically, the opportunity to engage in real-world problem-solving within their communities (Partayasa et al., 2020). In the aforementioned areas, students could benefit from direct exposure to local environmental issues, allowing them to apply their knowledge in meaningful ways. Even starting with small, community-based projects would be valuable in helping students develop stronger problem-solving abilities and fostering a deeper connection between academic learning and real-world applications.

Learning that is simple but provides a great learning experience for students is by starting from "what appears and happens in the environment" in other words learning from the "environment" and then *teaching* it through *"science"* because biology has unique characteristics. namely on the object of the problem and has a scientific method in studying, obtaining results to provide solutions. Efforts to gain knowledge and learning experience will certainly be better if supported by *"technology"*. Technology is not only used as a means to support learning but can be used as an alternative in solving these problems. Solutions to these problems can be applied in their lives and can be disseminated to the community around *the "society"*. The ideas that have been described are an illustration of learning the SETS concept (Rosdiana & Surya, 2022).

The SETS (Science, Environment, Technology, and Society) learning model is proposed as a response to the challenges of our globalized world. This model emphasizes the interconnectedness of these four areas, ensuring that students don't just learn science in isolation but understand its relationship to the environment, technology, and society as a whole (Sylviana, Kusuma, & Widiyanto, 2019). The main objective of SETS learning is to facilitate students in achieving scientific literacy so they can make decisions about science, technology, and the environment that affect people's lives (Sujiono et al., 2017). Here is a paraphrase of the sentence: SETS learning gets students out into the real world to participate in science and technology activities that connect to their community.(Nurkhasanah et al., 2019). In it, to identify problems, actively seek information, and find answers to problems in the surrounding environment (Ulfah et al., 2020). On the other hand, SETS also invites students to look at the problems around them in a more complex manner and act as a determinant of solutions. The SETS learning model breaks down the learning process into five stages, building upon the existing Science, Technology, and Society (STS) approach. These stages are: Initiation, Concept Formation/Development, Concept Application, Concept Consolidation, and Evaluation**.** The first stage (initiation) is carried out by giving problems which can be a stimulus for students to explore and check answers through giving problems. The second stage (concept formation) aims to increase students' scientific literacy so that they can provide answers or solutions to environmental problems faced by society (Zahra et al., 2019). This third stage can be applied with several methods, such as demonstration methods, laboratory experiments, role-playing, and group discussions.

The third stage of the SETS model, concept application, is the core of its syntax, as it enables students to apply scientific concepts to develop solutions for the problems under discussion (Lubis, Sahyar, & Derlina, 2021). The fourth stage, concept strengthening, focuses on enhancing students' problem-solving abilities by exposing them to a variety of problem situations. In the final stage, evaluation, students engage in assessments or reflections, reinforcing their decision-making processes and refining their approaches to problem-solving (Asrial, Syahrial, Maison, Kurniawan, & Nugroho, 2021).

Previous research on the SETS learning model has not sufficiently incorporated local wisdom as a tool for student exploration during the learning process. The integration of cultural values makes learning more accessible, as it aligns with the systems and traditions familiar to students in their communities. Science education can be enriched by embedding cultural elements, as classroom interactions often reflect broader cultural dynamics. Using these cultural frameworks during the learning process helps shape meaningful student activities and deepens understanding. In this context,

the researcher aims to explore the integration of *Dalihan Natolu*—a local wisdom tradition from the Pematang Raya GKPS High School environment—within the SETS model. This combination offers a promising approach for equipping students with the problem-solving skills needed to address real-world environmental challenges (Wati et al., 2021).

Dalihan Natolu is the basis of life for the Batak people, which regulates their relationship and behavior towards every layer of Toba Batak society wherever they are. *Dalihan Natolu* literally means a three-kiln or a stove made of three stones arranged symmetrically to support the cauldron when installing (Hadi et al., 2022). *Dalihan Natolu* is essentially divided into 3, namely: *somba marhula-hula* (Bone), elek Marboru (Boru), and manat *mardongan tubu* (Semarga) which of course have structured and permanent rights and obligations. *Somba marhula-hula* is the first term which means that we must respect our hula-hula who are brothers from the wife's side (brothers of a woman). The second term is elek marboru which means gentleness in attitude towards women who are our sisters. And the third term is manat mardongan tubu which means that we must get along with our relatives who live in the same clan as us (Hadisaputra et al., 2023).

Based on these three main elements, the Batak people in the *Dalihan Natolu cultural system* are required to behave together or care for relatives on every occasion and this behavior is perceived as a high value and is a noble and noble deed (Munthe, 2018). The ideal society according to the Batak tribe is a society in which *holong* (affection) is found in the nature of social interaction. *Holong* is made the source of all life. Because of this, there is a term in the Simalungn Batak and Toba Batak: *holong do mula ni adat* (initial affection from custom), or *holong do mamboan domu* , *domu mamboan parsaulian* meaning "affection brings intimacy, familiarity brings common good" (Susanti & Rahmidani, 2021). As for advantages of integrating natolu reasoning in the SETS (DNT SETS) learning model , including: The division of groups in the DNT SETS learning model is made with patterns of social interaction and system kinship. Communication in Dalihan Na Tolu Social Interaction Pattern is multi-way (optimal interaction between teachers and students, between students and students). Components of the Social System in the Learning Model, namely: syntax, social systems, reaction principles, support systems and teaching and accompanying impacts (Khairani & Febrinal, 2020). The social system is the interaction that occurs between learning actors (Ozer et al., 2021). As a conductor, the teacher's role is to organize and encourage each student so that they remain engaged in learning activities. As a moderator, the teacher leads class discussions, and arranges mechanisms so that group discussions run well, and achieve optimal results (Maimunah, 2022).

The principle embodied in the pattern of social system interaction is working together to solve problems between students and students, teachers and students, and groups; freedom of expression; cooperation of students, and teacher-students, between groups lasts a long time during learning. Therefore, sociocultural interaction is intended to produce problem-solving skills that are mutually agreed upon (Chowdhury, 2016). This can be seen in the following scheme:

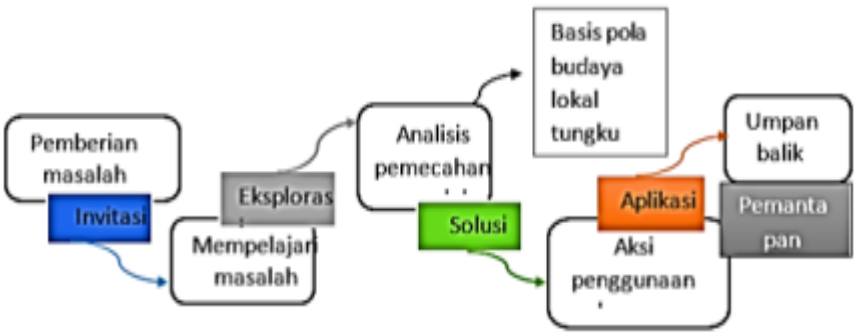

Figure 1. Schematic of the stages of the SETS learning model based on Local culture Dalihan Na Tolu (Tungku Nan Tiga)

With the interaction between groups of students, it can make students more open and able to understand one another. This learning model can improve students' problem-solving skills. For this reason, the components of the social system learning model contained in the natolu excuse were chosen in this study which was integrated with the SETS learning model.

2. METHODS

2.1 Design Study

Study This manifold experiment pseudo (*quasy experiment*) with design pre test-post group control test. The quasi-experimental research design was carried out under conditions that did not allow researchers to fully control the research subject (Calado, Scharfenberg, & Bogner, 2015). Implementation study involving two class, that is class control And class experiment.

Table 1. Design Study

Class	*Pre-Test*	Treatment	*Post-Test*
Experiment	a	X	B
Control	c	-	D

Information:

a : Provision of pre-test for the experimental class
b : Giving pre-test For class control
X : Learning with the SETS model integrated with Dalihan Natolu
c : Giving post-test For class experiment
d : Giving post-test For class control

A detailed overview of the study's design is presented in Table 1. Before implementing the learning model, both the experimental and control classes were given pre-tests to assess students' initial competencies in problem-solving. The experimental class received treatment through the SETS (Science, Environment, Technology, and Society) learning model integrated with *Dalihan Natolu*, while the control class followed a conventional learning approach without any special interventions. At the conclusion of the study, both classes completed post-tests to evaluate learning outcomes and measure the effectiveness of the applied methods (Pimvichai et al., 2019).

2.2 Subject Study

The study involved students from Class X IPA at SMA Negeri 1 Pematang Raya as the subjects. The selection of participants was determined using purposive sampling, ensuring that the average class performance was equivalent. The sample included Class X IPA 3, which served as the control group, and Class X IPA 4, which acted as the experimental group, with 30 students in each class.

Table 2. Subject Study

Class	Gender		Total
	Woman	Man	
Experiment	20	10	30
Control	21	9	30

2.3 Instrument and Collection Data

This study gathered numerical data (quantitative data) to assess students' problem-solving abilities. This data was collected through pre-tests and post-tests. Furthermore, the research instrument used form guide learning model , and test questions in the form of essays with a total of 6 questions. The test questions are in the form of problem-solving with the topic of discussion of environmental pollution problems adapted to indicator problem-solving skills (Sujiono et al., 2017).

Table 3. Results validity Instrument Ability to solve the problem

Items Question	r Count	Classification
1	0.360	Valid
2	0.508	Valid
3	0.834	Valid
4	0.584	Valid
5	0.724	Valid
6	0.497	Valid

The researchers checked if the problem-solving assessment tool was accurate by using a correlation analysis. Questions were considered valid if the correlation coefficient (r) between the questions and the overall assessment was higher than a set benchmark (r table = 0.349). All the questions had a correlation coefficient greater than 0.349, indicating that they were all valid for measuring problem-solving abilities.

The researchers also ensured the assessment tool provided consistent results by using Cronbach's Alpha, a common reliability test. A score greater than 0.6 on this test indicates a reliable instrument. Based on their analysis (Table 5), the problem-solving ability test itself scored a high 0.629, demonstrating its reliability.

2.4 Analysis Data

To investigate our hypothesis, we employed an independent samples t-test. This test helps us determine if there's a statistically significant difference in the results between two separate groups. Before applying the t-test, we ensured our data met specific assumptions. One such assumption is normality, which refers to the data following a bell-shaped distribution. To verify this, we used the Kolmogorov-Smirnov test with a 95% confidence level (meaning a 5% significance level).

3. FINDINGS AND DISCUSSION

3.1 Results

This study examined whether integrating the SETS learning model with Dalihan Natolu, a local wisdom tradition, improves students' problem-solving skills. Researchers compared an experimental group that learned using this model with a control group that did not. Both groups took pre-tests and post-tests to measure any changes in problem-solving abilities. Table 4 shows the results, with the difference between pre-test and post-test scores for each group. These results will reveal if the SETS model with Dalihan Natolu led to a meaningful improvement in problem-solving skills for the experimental group.

Table 4. Pre-test and post-test results for experimental class and control class

Class	*Pre-Test* Average	Average *Post-Test* Gain Score
Experiment	63	85.2 59 %
Control	62,4	77.4 38 %

Looking at Table 4, we see a clear improvement in problem-solving skills for the students who participated in the SETS learning model with Dalihan Natolu (experimental group). Their average score increased from 63 on the pre-test to 85.2 on the post-test, reflecting a significant gain of 59%. In contrast, the control group showed a more modest improvement. Their average score went from 62.4 on the pre-test to 77.4 on the post-test, representing a 38% increase. The fact that both groups started with similar scores (no significant difference in pre-tests) strengthens the argument that the SETS model with Dalihan Natolu made a **positive impact.** The experimental group's significantly higher improvement suggests that this learning approach effectively enhances students' problem-solving abilities.

Table 5. Data Normality Test Results Ability to solve problems

Group	Kolmogorv Smirnov Statistics D
Experimental group	.097 36 .201
control groups	.068 36 .201

Before analyzing the main results, we checked to make sure the data met some important assumptions. One assumption is that the data should be normally distributed. To test this, we looked at the gain scores in both groups. The normality tests showed a value of 0.201 in both classes, with a significance level greater than 0.05. This indicates that the problem-solving abilities in both groups are normally distributed.

Table 6. Data Homogeneity Test Results Ability to solve problems

Levene Statistics	df1	df2	Sig.
0.198	1	69 0.655	

To ensure reliable results, we checked if the data met certain assumptions. We used the Levene test, a common homogeneity test, to see if the problem-solving abilities in both groups had similar variations (p-value = 0.05). Thankfully, the test resulted in a value of 0.655, indicating that the data has homogeneous variance.With this confirmation (shown in Tables 5 and 6), we proceeded to test the main hypothesis: whether the SETS learning model with Dalihan Natolu wisdom impacts students' problem-solving abilities. Since the data has equal variances, we used an independent samples t-test for this analysis (Table 7).

Table 7. Independent Sample T-Test Results

Class	*N Mean Std. Deviation*	*T Df Sig. (2-tailed)*
Control	36 37.77 18.792	
Experiment	36 58.85 13.606	6.870 69 0.000

The analysis of the learning gains (Table 7) revealed a very statistically significant effect (Sig. (2 tailed) = 0.000). This means we can reject the null hypothesis (H0) and accept the alternative hypothesis (H1). In other words, integrating the SETS learning model with Dalihan Natolu wisdom has a significant impact on students' problem-solving abilities.

3.2 Discussion

Based on research, the SETS learning model integrated with local wisdom, Dalihan Natolu, has a significant effect on problem problem-solving abilities of student. Integrating this model with the local wisdom of Dalihan Natolu makes the learning process more interesting, fun and meaningful (Çınar & Çepni, 2021). Learning with the SETS model, the focus of learning is how students can carry out investigations, how they can acquire, relate and develop their knowledge about science, technology and society to solve every minimum environmental problem in everyday life. Therefore in learning with the SETS model, science is associated with elements of technology (technology), environment (environment) and society (Society) Figure 2.

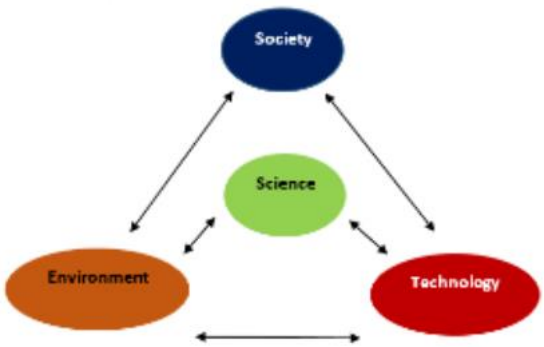

Figure 2. Relationship of elements in the SETS model with a focus on Science (Yuniastuti, 2019)

In this regard, Figure 2. above gives the meaning that in learning with the SETS model, science, environment, technology and society have dependencies. Science is closely related to the environment, and technology provides needs for society. Therefore the SETS learning model can sharpen students' brains to analyze every condition that occurs. According to Yuniastuti (2019) SETS has characteristics in learning, namely; (1) The learning used is learning about science; (2) Directing students to utilize science material in the form of technology; (3) Ask students to be able to explain the relationship between the four elements (science, environment, technology and society); (4) Students are invited to be able to develop their ideas about the impacts that occur (positive, negative) when science is applied in the form of technology, both the impact on the environment and society; (5) Students discuss with group mates or with the teacher in order to gain basic knowledge about SETS. The purpose of this SETS lesson is to enable students to understand science better encourage them to improve their problem-solving abilities, and make boring topics more interesting and fun. SETS also aims to build students' understanding of the SETS concept and integrate their life experiences into the world of artificial technology. SETS relationships should enable students to recognize their environmental and technological conditions, care about their contribution to society and predict possible damage (Yıldırım & Sevi, 2016). Models and forms of SETS learning that can be carried out according to Binadja (in Pimvichai & Buaraphan, 2019) are as follows; (1) The SETS learning model trains students' abilities to be able to show their elements of technology and science, (2) The teacher utilizes science and technology by linking it to environmental impacts. (3) Using students' cognitive abilities (terminology) to be able to analyze the influence of science and technology on society.

The SETS summary sequence conveys the message that in order to use science (Science) to form technology (Technology) in meeting the needs of society (Society) it is necessary to think about its various implications for the environment (Environment) (Permatasari, Ramdani, & Syukur, 2019). The opinions of the experts above reflect that the learning objectives of the SETS model are to develop problem-solving abilities that are more concerned with the environment in living systems. Understanding the concept of science and technology in meeting the needs of society is a form of concern for the environment. The most important thing is to see the impact on the environment, a comfortable, clean environment will make the journey of human life perfect

In this study, students were directed to identify and solve environmental problems contextually, especially in environmental pollution material using the SETS learning model integrated with Dalihan Natolu local wisdom. Dalihan natolu is integrated into the SETS learning model to act as a supporting tool for student exploration in group discussions The SETS learning model emphasizes solving real-world environmental problems. According to Maimunah (2017), it's crucial for students to grasp complex environmental issues and apply scientific knowledge to address them within society. Research by Fatchan et al. (2014) and Nurkhasanah et al. (2019) highlights that SETS encourages students to actively identify problems, seek information, and draw conclusions to solve them. SETS also pushes

students to consider solutions with a global perspective, keeping the societal context in mind (Riwu et al., 2018).

The SETS learning model fosters problem-solving skills throughout its different stages. Research by Minarti et al. (2012) suggests that SETS helps students develop critical thinking and reasoning abilities when tackling problems. This approach provides students with hands-on experiences in real-world community settings, particularly those involving science and technology. SETS emphasizes the interconnectedness of science, technology, society, and the environment, making it a well-suited concept for such exploration pollution problems in the surrounding environment, so that they can lead to interactions Furthermore. Students' ability to formulate problems through Biology questions indirectly increases the ability to analyze problems in the surrounding environment. Besides that, Maimunah (2016) also explained that the ability to solve problems in SETS learning, is built starting from the presentation of environmental problems that must be resolved.

In the second stage, concept formation is carried out through lecture methods, discussions and ask questions. The method itself gets students thinking critically by asking questions and having conversations rooted in the topic material that has been submitted (Retno & Marlina, 2018a). Next, mastery of the concept of environmental pollution material can be a provision students before entering the concept application stage. Concept formation can also help students in solving a problem. This is in accordance with the opinion, that to discuss internal environmental problems learning activities, students also need a comprehensive understanding of the concept.

The SETS model dedicates a stage to applying learned concepts. In this stage, students work in groups to discuss environmental issues they've observed in their own communities. By sharing these problems, each group broadens the exploration and tackles various environmental challenges using a scientific approach. This discussion method uses the principle of natolu excuse made with patterns of social interaction and system kinship. Communication in Dalihan Na Tolu Social Interaction Pattern is multi-way (optimal interaction between teachers and students, between students and students). The teacher acts as a facilitator, conductor and moderator. As a facilitator, the teacher's role is to provide and prepare learning resources for students, motivate students to learn, and provide guidance to students so they can learn and construct their knowledge optimally. As a conductor, the teacher's role is to organize and encourage each student so that they remain engaged in learning activities. As a moderator, the teacher leads the course of class discussions, arranges mechanisms so that group discussions run well, and achieve optimal results.

Several studies have discussed the influence and contribution of the SETS learning model on student learning outcomes. Research conducted by Kusmianty, et al (2018b) with the title Effectiveness of the SETS learning model practicum method on global warming material in improving critical thinking skills, in science learning at SMP Negeri 1 Moga in class VII D. The results obtained in this study were an increase significantly in the SETS learning practicum method compared to the control class using the FGD method. The average results of the pretest and posttest in the experimental class in critical thinking skills increased by 41.94%, while those in the experimental class increased by 12.06%. From this study, it was stated that here are a couple of paraphrases for the sentence "that there was an effect of applying the learning model on students' critical thinking learning outcomes" on global warming material. In a study conducted by Umar et al (2018) with the title Developing Geothermal Signal Modules Based on SETS Model to improve learning outcomes for physics students in class XI at SMAN 7 Sijunjung. From the results it is known that the physics module based on the SETS method is very useful, with 92% percentage.

Besides that, it also meets the effective criteria of 0.76. Furthermore, in the research conducted by Sylviana et al. (2019) with the title "Profile of students' critical thinking abilities with the implementation of the PRObing-Promting-based SETS learning model". The results showed that students' critical thinking skills after the implementation of the probing-prompting-based SETS learning model increased, namely by 10.4%. Meanwhile, according to Poedjadi (in Retno & Marlina, 2018b) the advantages of the SETS learning model, when used in the teaching and learning process, include: Train

students to improve inquiry skills, problem solving and process skills students develop a well-rounded set of skills, including thinking skills (cognitive), attitudes and values (affective), and practical abilities (psychomotor), make learning fun, can be learned by students because it is interesting real and applicable, helping students to know and understand science and technology as well as the negative impacts that can be caused in everyday life and can increase learning activities, as well as according to Rosdiana et al (2020) Using the SETS (Science, Environment, Technology and Society) learning model .which is enriched with the local culture of pretext can improve and Enhance students' thinking skills and emotional intelligence, in this case the ability to think critically and care for the environment.

4. CONCLUSION

The findings of this research demonstrate that the SETS (Science, Environment, Technology, and Society) learning model, when integrated with the local wisdom of *Dalihan Natolu*, significantly enhances students' problem-solving abilities. The t-test results, with a significance value of 0.000 ($p < 0.05$), confirm that the integration of the SETS model with *Dalihan Natolu* improves learning outcomes, leading to the rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_1). The experimental group showed a gain score of 59%, outperforming the control group, which achieved a 38% gain. This approach encourages students to view problems holistically and connects scientific concepts with real-world environmental challenges. Through the inclusion of *Dalihan Natolu*, students also develop problem-solving strategies rooted in local cultural practices.

However, the study has some limitations. Students initially struggled to fully understand the principles and application of *Dalihan Natolu* within the learning process, indicating that more structured guidance is needed. Future implementations should provide clearer instructions on both the stages of the SETS model and the cultural principles underlying *Dalihan Natolu* to ensure effective learning. Future research could explore how this model performs across different cultural contexts or investigate the long-term impact on students' ability to apply problem-solving skills beyond the classroom. Additionally, examining how emerging technologies can be integrated into the SETS model may further enhance its effectiveness.

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