JURNAL EDUSCIENCE (JES)
p-ISSN : 2303 - 355X | e-ISSN : 2685 - 2217
PUBLISHED BY : LPPM of UNIVERSITAS LABUHANBATU

Mini Solar Panel Props with Guided Inquiry Model to Improve Science Literacy

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ARTICLE INFO

Keywords:
Science Literacy
Guided Inquiry
Props

ABSTRACT

Purpose – This research aims to find out: (1) the effectiveness of using mini solar panel props with guided inquiry models to improve students' science literacy, (2) whether there is a difference in the average score of significant improvement in students' science literacy before and after the implementation of mini solar panel props with guided inquiry models, (3) how much the effect size of using mini solar panel props with guided inquiry models to improve students' science literacy.

Methodology – This is a pre-experimental study that used a one-group pretest-posttest design. The study population included all students in class VIII of a junior high school in Yogyakarta. The purposive sampling technique was used to select the sample, which included 31 students from class VIII B. The instrument used was a science literacy test, while data analysis was conducted using descriptive and inferential statistics.

Findings – The results of the analysis concluded that 1) mini solar panel props with guided inquiry models effectively improve students' science literacy by 0.55 in the medium category, 2) there is a difference in the average score of significant improvement in students' science literacy before and after the implementation of mini solar panel props with guided inquiry models, 3) the implementation of mini solar panel props with guided inquiry models provides an effect size of 2.19 with a huge category on improving science literacy.

Contribution - These findings are expected to improve science education by integrating mini solar panel props with guided inquiry models, making science learning more interesting, practical, and relevant to real-world applications.

Received 07 February 2025; Received in revised form 18 February 2025; Accepted 12 August 2025
Jurnal Eduscience (JES) Volume 12, No. 4 (2025)
Available online 30 August 2025

INTRODUCTION

21st-century education requires individuals to master certain skills, so education is expected to prepare students to develop various skills. A series of processes is needed to optimize one's potential. Specific skills that individuals naturally possess in certain areas are trained through repeated practice, continuous problem solving, and deep understanding (Cahyaningsih et al., 2025). The World Economic Forum has identified scientific literacy as one of the skills required in the 21st century (Rahmi et al., 2023).

Science literacy is not merely a collection of knowledge, but also includes an understanding of the characteristics of science, its impact on the social, physical, and cultural environment, and a readiness to actively engage in scientific activities. Science literacy also includes a range of scientific skills that enable people to formulate questions, acquire new information, understand natural phenomena, and draw conclusions based on verifiable data (Amran et al., 2020; Yusuf et al., 2022). This ability includes identifying problems, explaining phenomena, and drawing conclusions based on scientific evidence (Kelp et al., 2023; Kintan Limiansih et al., 2024). PISA 2018, science literacy includes explaining scientific phenomena, evaluating investigations, and interpreting data. This ability involves applying scientific knowledge and values in daily life and is influenced by experience, culture, and prior knowledge to build a more profound understanding (Haruna et al., 2024a; Irwandi, 2020).

Indonesian students' science literacy scores in the 2022 PISA survey were 383 points, which is still below the international average of 500 set by the OECD (OECD, 2023). These results show that students struggle to apply scientific ideas and procedures to real-world scenarios and have not yet fully grasped them (Sutrisna, 2021). In addition, the results of the literature review show that students have low levels of scientific literacy. As a result, they face difficulties in solving very difficult problems and applying their knowledge in everyday life (Aida Sufinasa & Saenab, 2023). One factor contributing to low science literacy among students is the role of teachers in the learning process. As influential figures, teachers who rarely involve students in science literacy exercises cause students to become less accustomed to dealing with problems related to science literacy. Additionally, a lack of understanding of basic scientific concepts, limited initiative to ask questions, conventional science education methods, difficulties in reading and interpreting tables or graphs, and low awareness of the importance of reading and writing literacy contribute to this issue(Yusmar & Fadilah, 2023).

According to the observation results, students' science literacy still needs to be improved because they have trouble understanding scientific concepts, particularly when it comes to applying what they have learned to real-world situations, and they don't actively participate in class. Instead, they are more likely to be passive and merely absorb information from the teacher without doing much research. Furthermore, the lack of creative learning resources exacerbates the use of repetitive teaching strategies that do not promote critical thinking and problem-solving abilities. Teachers face a unique difficulty in educating children to succeed in the twenty-first century when they have low science literacy.

Mastery and understanding of science and technology are crucial in supporting educational success in the digital era. Science literacy plays a strategic role in science education because it aims to develop students who are excellent, capable, and able to compete globally. Therefore, teachers must ensure that students are engaged in science education in an environment that encourages them to participate actively (Gultom & Alwi, 2024; Irsan, 2021). Learning activities are geared toward direct student involvement so that they can develop their competence in observing, analyzing, and understanding natural phenomena around them. In addition, this direct involvement helps students analyze and understand natural phenomena more deeply, and realize that science learning is theoretical and applicable in everyday life and real problem solving (Adi, 2021; Trianto, 2014; Wilujeng, 2018). Therefore, in order to increase students' science literacy, instructional solutions that are both engaging and intriguing must be used.

In overcoming low science literacy and supporting the science learning process, namely, using teaching aids (Delima et al., 2023). Students can learn science in-depth by using science teaching aids, which enable them to comprehend not only natural knowledge concepts but also how, why, and what they are discovered through experimental activities. (N. AL Islami et al., 2020). Teaching aids in science education are very beneficial because they help teachers explain concepts through tangible objects. In addition, teaching aids can attract attention, increase interest in learning, encourage activity, develop psychomotor skills, and stimulate students' problem-solving creativity (Prima et al., 2020; Retnaningsih, 2023).

The context of science learning that can be taught using teaching aids is renewable energy, specifically through mini solar panels. Renewable energy is a sub-material in 8th-grade science that focuses on understanding energy sources, types of energy, and changes that occur around us. Through props, students will understand how renewable energy can be utilized for everyday life by looking directly at the fundamental concepts on props designed using solar panels in producing electrical energy (Irawati et al., 2021). Supporting the science learning process requires taking into account the use of learning models in addition to learning material.

Students' science literacy is enhanced when guided inquiry models are incorporated into tiny solar panel teaching aids because this method encourages students to actively investigate and develop conceptual understanding via hands-on experience (Latukau, 2022). Learning with this approach is highly integrated into the scientific process, with logical and critical thinking. The guided inquiry approach is a good option to use in the learning process because of its features that promote active student participation (Agustina et al., 2020). Similar findings were also made by Mayub et al (2024), who discovered that using learning materials powered by solar cells has a beneficial effect on students' science literacy development. In addition, Uliyandari & Lubis (2020) also revealed that applying the inquiry learning model supported by props media increased learning motivation, improving student learning outcomes.

However, most previous studies have discussed using teaching aids and inquiry-based learning models separately, without testing the integration of both in a comprehensive learning design. Furthermore, there aren't many studies that explicitly look at how incorporating teaching tools (such miniature solar panels), renewable energy resources, and guided inquiry-based learning approaches might help students become more science literate. Science literacy is not only influenced by learning models or media separately, but by the alignment between content, learning strategies, and the tools used. Therefore, a study is needed to test the effectiveness of integrating renewable energy content using mini solar panel teaching aids and guided inquiry learning models in science education at the junior high school level to enhance students' science literacy more optimally. This study aims to determine: (1) the effectiveness of using mini solar panel props with guided inquiry models to improve students' science literacy, (2) whether there is a difference in the average score of significant improvement in students' science literacy before and after the implementation of mini solar panel props with guided inquiry models, (3) how much the effect size of using mini solar panel props with guided inquiry models to improve students' science literacy. Based on the above description, a study was conducted entitled "Mini Solar Panel Props with Guided Inquiry Model to Improve Science Literacy."

METHODOLOGY

Research Design

This is a quantitative study. This study employed a pre-experimental design with a single group pre-test and post-test design. This research involves only one experimental group and focuses on treatment without a comparison or control group. This design was chosen because this study aims to assess learning using Mini Solar Panel Props with the Guided Inquiry Model. The application in the experimental class begins with giving a pre-test. It continues with giving treatment with the use of mini solar panel props with the guided inquiry model, followed by a post-test. The purpose of this assessment is to ascertain how much pupils' science literacy has increased. Table 1 displays the research design.

Table 1. One Group Pretest-Posttest Design

Pre-test	Treatment	Post-test
O_1	X	O_2

Source: (Sugiyono, 2012)

Description

O_1 : Pre-test value (before treatment)

O_2 : Post-test value (after treatment)

The study was conducted in the odd semester of the academic year 2024/2025 in three main stages: preparation, implementation, and final. Activities in the preparation stage included observation, preparing teaching materials, making teaching aids media, and developing research instruments. The implementation stage includes giving a pre-test at the initial meeting, followed by the treatment application to the experimental class, and closed with implementing the post-test at the last meeting. Meanwhile, the final stage focuses on data analysis to evaluate the improvement of students' science literacy after being treated.

Sample and Population

Population is the whole subject of research (Arikunto, 2007). Population of this study included all students in grade VIII of junior high schools in Yogyakarta in the academic year 2024/2025. Purposive sampling, which is a strategy for choosing samples based on certain criteria or considerations, was used to choose the sample (Sugiyono, 2012). The sample selection was carried out with specific considerations, namely, having the same characteristics. The sample used was one class, class VIII B, which acted as an experimental class with 31 students. This class was chosen purposefully because it represents characteristics relevant to the research objectives: the level of academic ability is almost the same, the learning experience is comparable to the topic under study, and the availability of time for learning implementation.

Instruments and Data Collection

This study used a science literacy test that focused on renewable energy. The test consisted of a pre-test and a post-test to assess students' science literacy levels. The questions were in the form of multiple-choice questions consisting of 15 items, with four answer choices based on three indicators of science competency. The question instrument used in this study is the result of adaptation from several previous studies by Luthfianingrum (2024) and Fidiarti (2024) by selecting questions by the needs of the material taught, namely renewable energy and the questions have been tested for validity with a validity test the material taught, namely renewable energy and the questions have been tested for validity validity and reliability using Item Response Theory (IRT) with the help of the following using Item Response Theory (IRT) with the help of the quest program. Indicators of Science literacy are presented in Table 2.

Table 2. Science literacy indicators

Science Literacy Indicator	Sub-Indicators of Science Literacy Competency Aspects	Number of Questions
Competency Aspect	Explaining Scientific Phenomena	6
	Evaluating and Designing Research	3
	Interpreting Scientific Data and Evidence	6
	Number of Questions	15

Data Analysis

Pre-test and post-test results were analyzed in this study, and students' science literacy scores were described using descriptive and inferential statistics. The score increase was analyzed using the N-Gain test with the following formula:

$$N\text{-}Gain = \frac{post\text{−}test\ score - Pre\text{−}test\ score}{Maximum\ score\text{−}Pretest\ score} \text{ .... (1)}$$

The N-Gain results are then classified according to the criteria in Table 3.

Table 3. N-Gain Score Criteria

Value Interval	Criteria
N-gain > 1,0	High
0,3 ≤ N-gain < 0,7	Medium
N-gain < 0,3	Low

Source: (Lestari et al., 2021)

This study's inferential comprises effect size computation, hypothesis testing, and a normalcy test. Before utilizing statistics to test the hypothesis, it is crucial to ascertain whether the data is regularly distributed, which is what the normality test seeks to ascertain. The Paired Samples t-Test is used to test the hypothesis. The Sig. (2-tailed) is used to make decisions in this test. If Sig is less than 0.05, H0 is rejected and H1 is approved; if Sig is greater than 0.05, H_0 is accepted and H_1 is rejected. In addition, effect size analysis is used to measure how much influence the application of mini solar panel props with a guided inquiry model has on improving science literacy. Mathematical calculation of effect size analysis using Cohen's equation as follows:

$$d = \frac{(M_2 - M_1)}{\sqrt{\frac{SD_1{}^2 + SD_2{}^2}{2}}} \quad \text{.........................} \ (2)$$

Description:
D = Cohen's effect size
M_1 = Mean pre-test score
M_2 = Mean post-test score
SD_1 = Pre-test standard deviation
SD_2 = Post-test standard deviation

The effect size results are then classified according to the following criteria in Table 4.

Table 4. Effect Size Classification

Value Interval	Criteria
0 < d < 0,2	Small
0,2 < d ≤ 0,5	Medium
0,5 < d ≤ 0,8	Large
d > 0,8	Very Large

Source: (Widyastuti & Airlanda, 2021)

FINDINGS

Descriptive Statistical Analysis

The results of descriptive statistical analysis provide an overview of the characteristics of science literacy after teaching using mini solar panel teaching aids with a guided inquiry model. The descriptive analysis results are presented in Table 5.

Table 5. Results of Descriptive Analysis of Science Literacy

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test	31	2	10	6.38	2.201
Post-test	31	7	14	10.93	1.931

Table 5 shows that the total number of samples was 31 students. The students' science literacy pre-test results in the research sample obtained an average score of 6.38 with a standard deviation of 2.201. This indicates that most students had not mastered science literacy optimally before the treatment. Meanwhile, the post-test results after the treatment were obtained with an average score of 10.93 and a standard deviation of 1.931. The increase in the average score, accompanied by a decrease in the standard deviation, indicates that there was an overall improvement in ability and a more even distribution of results among the students. Thus, integrating teaching aids and guided inquiry learning models has proven effective in comprehensively improving students' science literacy. To clarify the comparison between pre-test and post-test science literacy scores, Figure 1 below shows the difference in average scores obtained by students before and after treatment.

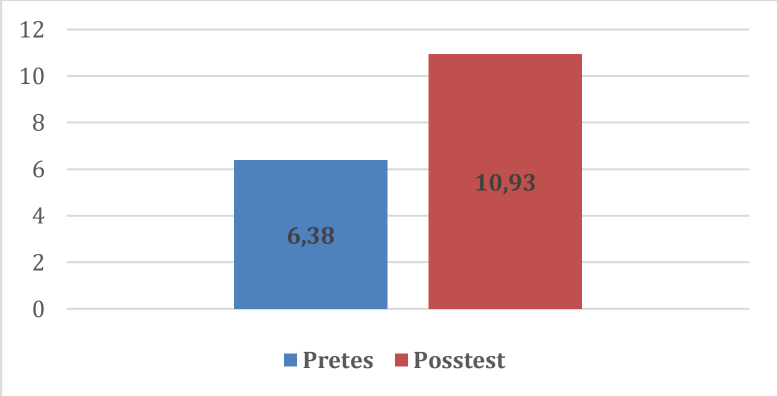

Figure 1. Comparison graph of pretest and posttest scores

The N-Gain score, which was determined using formula (1), was used in an analysis to gauge how much students' science literacy had improved following treatment. An overview of the treatment's efficacy in raising the score from the pre-test to the post-test is given by this N-Gain value. Table 6 displays the findings of the N-Gain analysis according to the science literacy of the pupils.

Table 6. Results of N-Gain Analysis of Students' Science Literacy Ability Data

Class	N	Minimum	Maximum	N-Gain	Description
Class Experiment	31	0,29	0,91	0,55	Medium

Table 6 shows that the average N-Gain in science literacy among students was 0.55, which falls into the medium category. This means that the students' science literacy scores increase after treatment. Despite not falling into the high category, the average N-Gain of 0.55 can be regarded as highly significant, especially compared to the results of conventional science learning, which, according to previous research, tends to produce slightly lower improvements. In addition, this achievement also shows that the integration of renewable energy media can strengthen the literacy aspects of students through the direction of the independent curriculum, which emphasizes experiential learning and real problem solving. To ensure the measurability and coverage of science literacy, the question indicators were compiled referring to the three main competency aspects in science literacy. Details of indicators with the number of questions and N-Gain for each indicator are presented in Table 7 below.

Table 7. N-Gain Analysis of Each Indicator of Science Literacy Ability Aspects of Learner Competence

No	Indicator	Number of Questions	N-Gain	Category
1	Explaining Scientific Phenomena	6	0,55	Medium
2	Evaluating and Designing Research	3	0,56	Medium
3	Interpreting Scientific Data and Evidence	6	0,36	Medium

Based on Table 7, there is an increase in science literacy in each indicator. The most significant increase was observed in the indicator for evaluating and designing scientific investigations (N-Gain 0.56), indicating that students are better trained in designing and evaluating experiments. Meanwhile, the smallest increase was observed in the indicator for interpreting scientific data and evidence (N-Gain 0.36), suggesting that students' ability to analyze data still needs improvement.

Inferential Statistical Analysis

Normality Test

The normality test was carried out using the Shapiro-Wilk test with a significance level> 0.05 for normally distributed data using the SPSS 22.0 for Windows program. The results of the normality test analysis are presented in Table 8 below.

Table 8. Shapiro-Wilk Pre-test Post-test Normality Test Analysis Results with SPSS 22.0

	Shapiro-Wilk		
	Statistic	df	Sig.
Pre-test	.946	31	.121
Posttest	.950	31	.155

Based on Table 8, the significance values of the pre-test and post-test are greater than 0.05, so it can be concluded that the data is normally distributed.

Hypothesis Test

The hypothesis test used is the Paired Samples t-Test. This data analysis was calculated with the help of SPSS version 22.0 for Windows. Hypothesis testing criteria using the Paired Samples t-Test are based on a comparison between the Sig. (2-tailed) value with the significance value $\alpha = 0.05$. If the value of Sig. (2-tailed) <0.05 then H_0 is rejected and H_1 is accepted. Conversely, if the value of Sig. (2-tailed) > 0.05 then H_0 is accepted and H_1 is rejected. The results of hypothesis testing with Paired Samples t-Test through the SPSS 22.0 application are presented in Table 9.

Table 9. Analysis Results of Paired Samples t-Test Hypothesis Test with SPSS 22.0

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretes Postets	-4.548	1.546	.27762	-5.11536	-3.98141	-16.384	30	.000

Table 9 shows the Sig. (2-tailed) value <0.05 or 0.00 <0.05. This means that H_0 is rejected and H_1 is accepted, so it can be concluded that there is a significant difference in the average score of students' science literacy before and after using mini solar panel props with guided inquiry models.

Effect Size

Effect Size aims to determine the effect size of mini solar panel props with guided inquiry models in the learning process. Cohen's effect size test, which is based on calculations using equation (2), is mentioned in the effect size analysis results. The following are the findings of the analysis:

Table 10. Effect Size Results

Class	N	Effect Size	Description
Class Experiment	31	2.19	Very Large

Table 10 shows the effect size of 2.19 with a vast category. This is by Cohen's categorization, which states that d> 0.8 is included in the vast category, so that learning mini solar panel props with guided inquiry models significantly affects students' science literacy. In addition, there was an increase in the science literacy scores of students in the moderate category. This finding shows the relevance of using mini solar panel props with guided inquiry models in science learning, which requires an in-depth understanding of concepts for students, so that it can train students' science literacy.

DISCUSSION

A pre-test was given prior to the start of the study, and a post-test was given following the conclusion of the course, at one of Yogyakarta's junior high schools. This study aimed to assess the effectiveness of using mini solar panel props with guided inquiry models to improve students' science literacy. This study also aims to identify whether there is a significant difference in the average score of students' science literacy before and after the application of these teaching aids, as well as to determine the effect size of the use of these teaching aids on improving science literacy. The sample used in this study was class VIII B, which consisted of 31 students. The aspects of science literacy competence measured include three indicators: explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence.

This research uses learning media in the form of mini solar panel props designed to teach students the working concepts of solar panels and the application of renewable energy, especially solar energy, in everyday life. In this project, students will test the mini solar panel and see how energy conversion occurs from solar energy, which is converted into electrical energy through solar panels, to produce electrical energy on a small scale. This device has several main components, namely solar panels that capture sunlight and convert it into electrical energy, as well as a mini dynamo, fan blades, and LED lights to support the device's operation. (Figure 2). In addition, this research is complemented by guided inquiry-based learning. The activity contains six stages that emphasize the process of discovering concepts and relationships between concepts through experiments with props that have been designed (S. Islami et al., 2022).

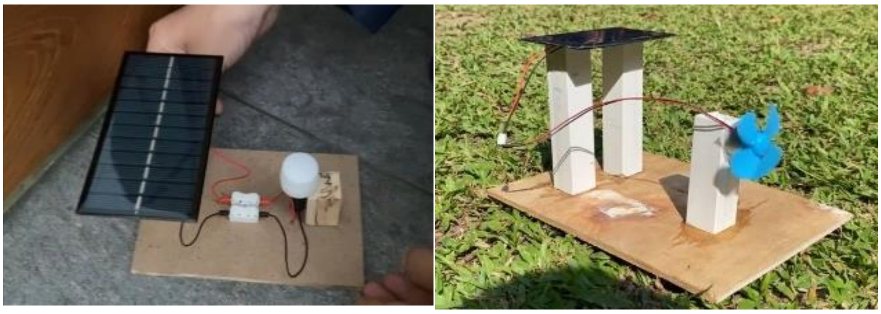

Figure 2. Mini Solar Panel Trainer

Based on descriptive statistical analysis, there was a difference in the average scores of the experimental class between the initial and final tests in science literacy skills. The test results showed that students experienced a significant improvement in science literacy by using mini solar panels and guided discovery-based science learning models in junior high school. Findings in the field show that students appeared enthusiastic and active when using mini solar panels. They experimented by directing the panels toward various light sources, recording the changes in light produced, and discussing why light intensity affects the energy output. Students also exchanged opinions and demonstrated high curiosity when connecting renewable energy to daily life. Direct student involvement in using this teaching aid is key to strengthening conceptual understanding and enhancing meaningful science literacy.

The average N-Gain score for science literacy skills was in the medium category, indicating that students already had good science literacy skills. According to Abadi et al (2020), teaching aids are media that can support the smooth learning process. Teaching aids serve as components that clarify learning materials, making them more realistic and objective (Hariani et al., 2024). Findings Warmadewi (2022) also support this, as inquiry-based learning has been proven effective in improving students' science literacy skills. This is because the learning stages are in line with students' cognitive development, especially in the formal operational stage, where they are already capable of abstract or symbolic thinking and solving problems through experimental activities. The discovery-oriented learning model (guided inquiry) teaches students to think creatively, process information, communicate, and draw conclusions independently through an active learning process (Aprizanti, 2023; Dagnew & Mekonnen, 2020).

The use of mini solar panel props significantly impacts learning, especially on renewable energy material. This teaching aid helps transform abstract concepts into more concrete and understandable ones, making it easier for students to grasp the concepts in science lessons (Hariani et al., 2024). Some previous studies have shown the positive impact obtained by students after learning renewable energy material using solar cell-based props. One relevant study was conducted by Delima et al (2023), which examined the development of renewable energy-based science teaching aids. he study's findings indicated that the solar cell-based power bank prototype was deemed appropriate and effective for implementation in renewable energy science learning. A related study was carried out by Verawati et al. (2022), In relation to the development of teaching aids for energy materials, a solar cell-based learning medium integrated with Arduino has been developed. This shows that these tools can serve as additional aids for teachers in improving students' understanding of energy. By actively involving students in experiments, this learning medium allows students to explore energy concepts independently, strengthen their scientific understanding, and increase their interest in learning (Fadhilah et al., 2025).

The indicator of evaluating and designing scientific investigations has the greatest increase in achievement in the medium category, based on the results of the N-Gain analysis of science literacy indicators. The increase is because the props allow students to be directly involved in conducting experiments on converting solar energy into electrical energy. By utilizing these props, students learn the theory and experience firsthand the learning process involving observation, measurement, and data analysis. According to OECD (2023), learners have demonstrated the ability to identify questions that can be answered through scientific inquiry and evaluate the right questions to answer in the LKPD. They can also interpret the meaning of scientific evidence, design and carry out investigations, and understand the implications in everyday life. In addition, learners can interpret data appropriately to answer the questions posed (Chi et al., 2019).

The indicator of explaining phenomena scientifically is a competency that requires students to be able to explain knowledge precisely with reasons, be able to predict and formulate hypotheses, and know the benefits of knowledge in everyday life. This indicator is in the medium category. This increase occurs because the use of props provides an understanding of the concept of the material and changes something abstract to be more concrete or tangible, allowing students to explain what they get from the experiment into questions on the LKPD. According to Halina et al (2020), the increase in the indicator of explaining scientific phenomena shows that students have understood the concept of material that has been learned and can apply it in everyday life. When learners can describe a scientific phenomenon, they can apply scientific knowledge, draw conclusions, and apply relevant theories, ideas, information, and facts in everyday life (Hardianti et al., 2020).

The indicator of interpreting data and scientific evidence has the lowest N-Gain. This may be because there is not enough time to practice data interpretation or because students are not yet accustomed to reading observation results critically. Similar results can be found in studies conducted by Yusuf et al (2022), who mentioned that data interpretation requires a more intensive learning approach. Although this indicator is slightly lower than the other two indicators, this learning has a pretty good impact because it is still in the medium category, so the use of props such as mini solar panels can provide concrete evidence that can help students in the data interpretation process. With direct experiments that produce measurable data, students can learn to connect the results of experiments with the scientific concepts they learn, improve their ability to interpret data and scientific evidence, and this still needs to be trained again for students.

To support the descriptive analysis results, inferential analysis was also conducted, including normality tests and hypothesis testing. The significance value (Sig.) in the pre-test and post-test data was in the normal category, based on the normality test using the Shapiro-Wilk method. The results of the paired sample t-test show a significance value of 0.000 (< 0.05), indicating a significant difference between the average science literacy scores of students before and after participating in learning with mini solar panel teaching aids using a guided inquiry model. In addition, the results of the effect size analysis show that science literacy is in the vast category. Thus, it can be concluded that the use of mini solar panel props with a guided inquiry approach significantly improves the science literacy of junior high school students. Data shows that the use of mini solar panels and guided inquiry learning models in teaching renewable energy is relevant and effective in improving students' science literacy. This is because these methods help them solve scientific problems, understand how scientific ideas relate to everyday phenomena, and develop critical thinking and decision-making skills to deal with real-world problems. (Agustina et al., 2020; Haruna et al., 2024b; Vo & Simmie, 2025).

This study is expected to improve science learning quality by using mini solar panel props with a guided inquiry model that makes learning more contextual through real experiments on the concept of energy conversionAlthough this study produced significant findings, the generalization of the results is still limited due to a number of constraints, such as the limited sample size, the absence of a control group, and the relatively short treatment period. Therefore, future research should use experimental designs with control groups, larger samples, and explore the integration of teaching aids in project-based learning to assess their impact on other dimensions of science literacy, such as creative thinking and critical thinking.

CONCLUSION

Based on the results of data analysis, it can be concluded that the improvement of students' science literacy using mini solar panel props with guided inquiry models of 0.55 is in the medium category. There is a difference in the average score of significant improvement in students' science literacy before and after learning with mini solar panel props with guided inquiry models, and the implementation of solar panel mini props with guided inquiry models provides an effect size of 2.19 in a vast category. This indicates that the mini solar panel props with the guided inquiry model can improve students' science literacy.

Learning should focus on strengthening low indicators, such as interpreting data and scientific evidence, through more intensive data analysis exercises and using concrete examples. It is recommended to explore other relevant teaching aids and apply this model to different science materials to test its effectiveness more broadly. Teacher training is also important to facilitate the inquiry process optimally, especially in helping students understand data analysis and interpretation.

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