IMPLEMENTATION OF GUIDED INQUIRY MODEL TO IMPROVE STUDENTS SCIENCE LITERACY ON EARTH AND THEIR SATELLITES MATERIAL

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Abstract: This study aims to describe the results of implementing the guided inquiry model to scientific literacy in the Earth and Satellite material. The type of research used is descriptive through the design pretest-posttest with one group. The subjects in this study were 36 students in class VII-A at Junior High School 1 Wonoayu Sidoarjo, even semester of the 2022/2023 academic year. Data collection techniques using observation, tests, and questionnaires. The research instruments included learning implementation observation sheets, scientific literacy tests, and student response questionnaire sheets. The test results were analyzed using paired t-test and counting effect size. The results showed that implementing learning using the guided inquiry model on the Earth and Satellite material obtained very well-implemented criteria with mode 4. The student's scientific literacy skills had increased, as evidenced by the paired t-test results of 0.000 and the calculation effect size of 1.823. Students' scientific literacy level after most learning is at level 4. The most significant increase in scientific literacy competence is in the indicator of explaining phenomena scientifically at 27.08, then the indicator of interpreting data and evidence scientifically at 23.15, and the indicator of designing and evaluating scientific investigations at 6.29. The learning process using the guided inquiry model on Earth and its satellite material was also very well received by students, with 66.67% of statements in mode 4. Based on the description above, implementing the guided inquiry model can increase students' scientific literacy in the Earth and Satellite material.

Keywords: *Guided Inquiry, Science Literacy, Earth and Their Satellites*

INTRODUCTION

The era of globalization in the 21st century makes education very important because it seeks to give students the ability to learn and grow, utilize technology and media, and be able to apply these talents to survive [1]. Learners are expected to have three 21st-century skills: skills for self-sufficiency and employment, learning and innovation skills, and abilities to utilize media information [2]. These skills are generally called the 3Rs of reading, writing, and arithmetic. Reading and writing, often called literacy, is defined as the ability to understand concepts through words and media in the context of reading and writing in modern education [3]. The 3Rs are functional literacy, numeracy, and ICT skills taught in schools.

One way to face the challenges of the 21st century is to require human resources who are scientifically literate or who can apply their knowledge to answer problems that arise in everyday life [4]. Students must be able to apply the scientific ideas they learn to produce new knowledge or information that can be applied and used in everyday life [5]. In the end, scientific literacy is essential to help the nation's next generation adapt to the times [6].

Organization for Economic Cooperation and Development (OECD) defines scientific literacy as a person's skill to interact with conflicting topics related to science and scientific concepts, which includes the ability to collect and assess scientific research and understand scientific facts and evidence [7]. According to the OECD report based on test results, the average score of the Program for International Student Assessment (PISA) 2018 was 371 for reading, 379 for math, and 396 for science. Reading and mathematics scores were 487 and 489, respectively, far below the average of the 79 participating countries in PISA [7]. The results above show that literacy skills, especially in science, need to be improved and increased so that they can compete at the international level. Preliminary findings from observations made at Junior High School 1 Wonoayu indicate that 60% of students have not mastered the scientific literacy competency component, so it needs further development.

The curriculum used today is the independent curriculum. Based on the Ministry of Education and Culture No. 56/2022 decision, the total number of study hours remains the same. Still, the time allocated for extracurricular projects and learning activities has been absorbed to raise the profile of Pancasila students. The structure of implementing the driving school program, according to the Ministry of Education and Culture number 371/2021, contains changes at one of the Junior High School equivalent education levels regarding the number of teaching hours. One of these changes affected the subject of Natural Sciences, which was originally reduced from 5 lesson hours to 4 lesson hours. Furthermore, each lesson hour only gets 40 minutes.

According to the findings of interviews with science teachers at Junior High School 1

Wonoayu, adjustments to class hours have a significant effect. Teachers can only provide material in the form of PowerPoint, which only contains material from books to be explained in front of the class, provides questions as additional assignments, and cannot carry out learning supported by experimental or observation activities due to limited study hours. The preliminary observations at Junior High School 1 Wonoayu showed that 50% of students still lacked interest in learning the Earth and Satellite material, and 80% agreed to learn using an experiment/observation-based model.

The Earth and Satellite material is one of the materials whose learning process requires a lot of mastery of broad science concepts and the implementation of solving problems encountered in nature. Due to the lack of experimental or observational assignments, students struggle to understand concepts, making them less adept at articulating explanations, identifying conflicts or problems, properly organizing or interpreting data, and drawing conclusions. This situation underlies the importance of increasing scientific literacy skills in students with observation activities in the Earth and Satellite material chapter.

Minister of Education and Culture Indonesia number 958/P/2020 concerning Earth and Satellite material including the core material of the Earth and Solar System with learning outcomes, namely "Students elaborate their understanding of the relative position of Earth-Moon-Sun in the solar system." It requires a strong understanding of natural science to support competence in elaborating with the C4 cognitive level on Earth and satellite material. As a real example of the goal of integrated science, namely developing the ability to identify, formulate and solve problems, this material emphasizes the importance of conducting various in-depth studies to collect correct and reliable data [8]. It is also in accordance with the scientific literacy competencies contained in the OECD, where an individual is expected to have the ability to be able to interact with various topics or issues related to science and scientific ideas [7].

Following national education standards in the National Education System Law number 20 of 2003, teachers must plan strategies for using appropriate and exciting learning models and approaches to achieve maximum achievement and learning objectives. So that children can engage with peers and educational resources and feel comfortable and interested in learning. Even though the amount of time is reduced, learning still occurs.

The guided inquiry model is an appropriate solution for learning science material. Researchers have applied the concept of guided inquiry in a number of ways to scientific literacy. The guided inquiry learning model includes science content, context, and students' scientific processes and uses experimental research methods.

Based on this background, researchers conducted research on the implementation of the guided inquiry model to increase scientific literacy on the Earth and its satellites. This study aims to describe the implementation of learning by implementing the guided inquiry model to scientific literacy and students' responses to the Earth and Satellite material.

RESEARCH METHODS

This research includes a descriptive and pretest-posttest with one group design. The research will be seen whether or not there is an increase in students' scientific literacy in the Earth and Satellite material using the guided inquiry model. This research was applied to class VII-A in the even semester of the 2022/2023 school year at Junior High School 1 Wonoayu, Sidoarjo with 36 students. The sample is obtained by purposive sampling technique.

It is collecting data with observation techniques, tests, and questionnaires. The research instrument implemented learning observation sheets, scientific literacy test sheets (pretest and posttest), and student response questionnaire sheets. The technique for analyzing data on the results of learning implementation is in the form of ordinal data using a Likert scale which is included in the score category 1-4. Data analysis is used by knowing the mode or value that often appears from each aspect item, obtaining the mode of each phase/aspect, and then the mode of the whole mode. Students' scientific literacy test is in the form of results pretest and posttest, then the normality test, paired t-test, and counting were carried out effect size.

The normality test helps know whether the data obtained is usually distributed or not, using the Shapiro-Wilk normality test through the SPSS program, where data is declared normally distributed if the significance value is more than 0.05 and not normally distributed if the significance value is less than or equal to 0.05. Paired t-test serves to determine the difference in results pretest and posttest using SPSS where the average value of the scientific literacy test results has increased or not, judging by the significance value of more than 0.05, there is no difference, and if the significance value is less than 0.05, there is a significant difference between the results pretest and posttest. Calculation effect size serves to determine the magnitude of the effect of the guided inquiry model on the results of scientific literacy.

$$ES = \frac{\bar{x}\,posttest - \bar{x}\,pretest}{standard\ deviation\ of\ the\ population}$$

Table 1. Interpret of Effect Size

Interval	Category
$0 \leq ES \leq 0.20$	Small
$0.20 \leq ES \leq 0.50$	Medium
$0.5 \leq ES \leq 1.00$	Large
$ES > 1.00$	Very Large

Data based on student response questionnaires are presented in a graph because they are in the form of ordinal data, namely the Likert scale, which is included in four categories, namely strongly agree (4), agree (3), little bit agree (2), and disagree (1) and data analysis which is used by knowing the mode or value that often appears from each item of the statement, then the mode is obtained from the overall mode.

RESULT AND DISCUSSION

The implementation of learning is seen from the preliminary phase, the core activity phase, the closing phase, aspects of teaching and learning activities, time management, and aspects of the classroom atmosphere. The introduction at the first meeting and learning activities related to Earth and Satellite information were carried out. Students use student worksheets to record the results of their observations of the motion of the Earth in the solar system during this lesson. They then presented their findings for other students to see. The instructor then goes through the material again and reinforces it.

At the second meeting, the activities carried out were students observing the Moon as an Earth Satellite with the help of student worksheets. Students presented it, and other friends responded to the observations' results. After that, the teacher reviews and reinforces the learning, then continues doing the posttest.

In Figure 2, the results of the implementation of learning at the first and second meetings, the mode assessment for each phase/aspect did not change. In the preliminary phase, it has mode 4, with very good parameters. The core activity phase has mode 4, with very good parameters. The closing phase has mode 4, with very good parameters. Regarding time management, teaching, and learning activities have mode 3, with good parameters. In the aspect of class atmosphere, it has mode 4, with very good parameters.
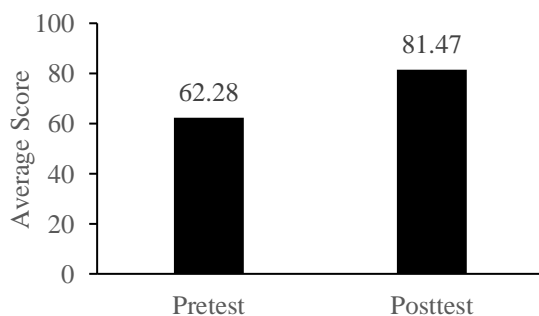

Figure 1. Average Score Pretest and Posttest

Value results pretest What is stated is that most students have low scores, where the average score in the result pretest obtained is 62.28. Results posttest shows a significant increase, where the mean score results posttest obtained is 81.47. The data is then tested for normality Shapiro-Wilk through the SPSS program as a determinant of the data obtained is normally distributed. The results get a significance value greater than 0.05, which means the data has a normal distribution.

Table 2. Result of Normality Test Saphiro-Wilk

	Statistic	df	Sig.
Pretest	0.962	36	0.250
Posttest	0.976	36	0.597

Table 3. Result of Paired t Test

	Mean	t	df	Sig.
Pretest-Posttest	-19.194	-10.939	36	0.000

Based on Table 3, the paired t-test has been carried outshow a significance level of 0.000<0.05. It gives the meaning of a significant difference between values pretest and posttest scientific literacy of students. The results effect size also supports this through a calculation of 1.823>1.00, which means that the effectiveness of the implementation of the guided inquiry learning model to the results of scientific literacy skills is very large.

Based on Figure 3, competence increases relatively high in each indicator of scientific literacy. Of the three indicators of scientific literacy competence, explaining phenomena scientifically is the indicator with the highest improvement. The indicator interprets data and evidence scientifically has an increase which is included in the moderate category. In contrast, the indicators of designing and evaluating scientific investigations have increased, including in the low category.

Figure 4 shows the various levels of scientific literacy of students. Judging from the results pretest, three students are at level 1, 20 are at level 2, 10 are at level 3, and three are at level 4. Compared to the result posttest, one student is at level 2, 10 students are at level 3, 12 students are at level 4, eight are at level 5, and five are at level 6.

Based on Figure 5, the overall results of the response statement have a very agreeable mode (score 4) with very good parameters. Evidenced by responses related to learning motivation, guided inquiry stages, model suitability, methods, and

abilities in the strongly agreed mode (score 4), while reactions related to scientific literacy competencies are in the approved mode (score 3).
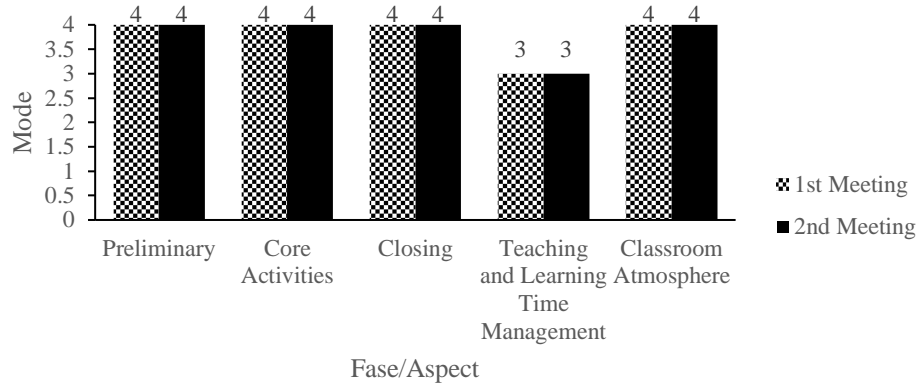

Figure 2. Result of Learning Implementation in 1st Meeting and 2nd Meeting
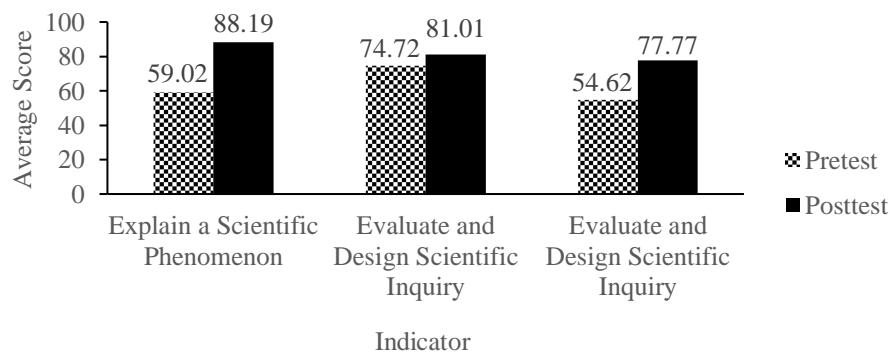

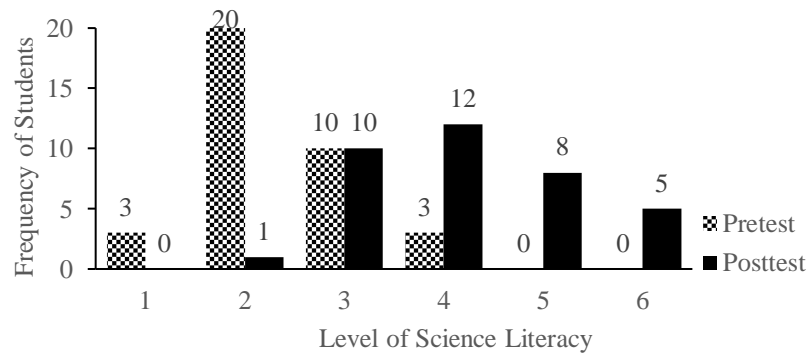Figure 3. Average score based on Indicator of Science Literacy Aspect Competence

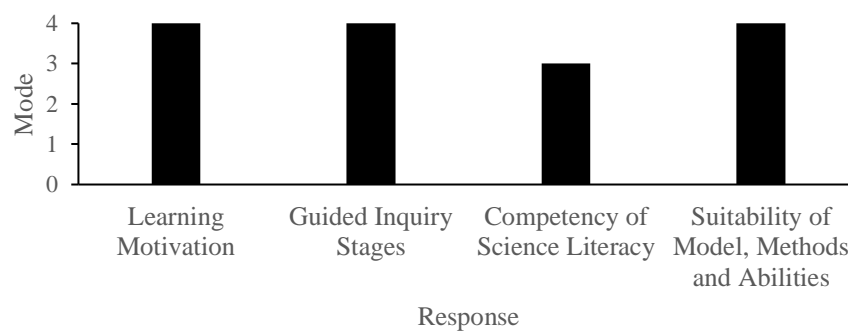Figure 4. Level of Students' Science Literacy

Figure 5. Students' Response to Teaching and Learning

Learning using the guided inquiry model that has been carried out consists of three types of activities, namely introduction, core activities, and closing. Learning activities on Earth and Satellite material are implemented using a guided inquiry model, which is included in the core activities. Implementing the inquiry model will make students disciplined and have the intellectual skills needed to raise problems and find their own answers through curiosity [9].

Based on the observations of the first meeting and the second meeting regarding the implementation of learning, it can be seen that the learning activities were carried out in two meetings. At the first meeting, the student activity was to make observations about the movement of the Earth in the Solar System. Implementation with low parameters lies in the activities "The teacher guides students to ask questions" and time management "Teaching and learning activities according to the time allocation in the teaching module." It is because students are not used to asking observation questions independently first and immediately adhere to other friends. Before that, the teacher rarely gives practice questions regarding observation questions, so the teacher must be given keywords to help answer them. It is also supported by other research, which states that students' initial thought processes toward a problem so that they can raise observational questions must be balanced by providing keywords or stimuli to facilitate the learning process [10].

In addition, the school is a driving school where the lesson hours for science are only four, divided into two meetings so that each meeting only consists of two lesson hours, and each lesson hour has 40 minutes. The 80 minutes for conducting observation-based teaching and learning activities is minimal because it can only be done in class to save time and the process from the beginning of group division to the end of the presentation of the results of observations with the guided inquiry model with the condition that there are a large number of class VII students and are not used to doing these activities. Students are taught by the teacher for classroom conditioning to remain conducive and active during learning. Other researchers also initiated that when carrying out experimental activities, students tend to be more active because they act like scientists, thus gaining experience and new knowledge, which results in forgetting the time and circumstances when learning takes place [11].

In the second meeting, the student's activities were to make observations about the Moon as an Earth Satellite. Implementation with low parameters lies in the management of "Teaching and learning activities time in accordance with the time allocation in the teaching modules." It happens because students still need guidance from the teacher to condition the class to remain conducive and active when learning occurs. This fact is similar to previous researchers' opinion that when carrying out experimental activities, students tend to be more active because they act like scientists, so they gain experience and new knowledge, which results in forgetting the time and circumstances when learning takes place. Accompanied by giving time limits and teacher contributions to remind students to be more disciplined and respect time [11].

The results of the implementation of learning using the guided inquiry model on the Earth and Satellite material obtained very good results; in other words, the guided inquiry model for students was implemented very well to provide support for research results, namely test results or scientific literacy tests. In line with other researchers' opinions, treatment effectiveness is fulfilled when all aspects are carried out well, and using media or teaching materials is optimal [12].

The learning process on Earth and its Satellite material, which provides direct experience to students to actively explore and understand existing natural events and facts, can develop cognitive abilities, including developing scientific literacy skills. It is assisted by the use of observation-based student worksheets with details of activities identifying problems according to illustrations with groups, asking observational questions from group discussions, planning investigations by determining procedures and preparing material tools according to distribution, collecting data, and carrying out investigations independently, orderly and cooperation, analyzing data according to the results of observations in groups, formulating conclusions according to the effects of comments and group discussions, and communicating the results in front of the class to train the confidence of each group member. According to previous researchers, learning using the guided inquiry model for students has a role in improving their scientific literacy skills [13]. Supported by other researchers who state that the guided inquiry learning model can develop cognitive (knowledge), affective (attitude), and psychomotor (skills) aspects in a balanced way so that learning activities become more meaningful [14].

Scientific literacy competency indicators used in pretest and posttest, namely explaining phenomena scientifically, designing and evaluating scientific investigations, and interpreting data and evidence scientifically [7]. In the indicators that explain phenomena scientifically, there is a relatively high increase in value pretest 59.02, while the value posttest 88.19 has a difference of 27.08. The increase in these indicators shows that after implementing the guided inquiry model, students can explain phenomena scientifically through planning investigations, collecting data, and carrying out investigations [15].

In the indicators of designing and evaluating scientific investigations, there is an increase, but it is pretty low; that is, from the value pretest 74.72 being the value posttest 81.01, there is a difference of 6.29. The increase was relatively low because, in the previous science lesson, scientific literacy questions were used by teachers to design and evaluate scientific investigations, such as making hypotheses, identifying tools and materials for an experiment, and identifying appropriate experimental procedures, so that students are used to answering questions like this. Efforts to train students' scientific literacy skills require more contextual learning so that students can implement various new concepts and knowledge in their lives and are more interested and want to explore information according to the concepts studied [16].

In the indicator of scientifically interpreting data and evidence, there is a relatively high increase in value pretest 54.62; the value posttest 77.77, there is a difference of 23.15. One of the influences is the need for students' ability to interpret data because students are only used to completing the contents of tables that educators have given. As a result, expertise in interpreting table or graphic results is limited [17]. This matter is commensurate with the opinion of previous researchers who argued that every student is called scientifically literate when he is able to elaborate on various scientific concepts obtained so that solid new understanding and knowledge can be built and applied in life [5].

The level of scientific literacy of students increases, as evidenced when the pretest namely between levels 1 to level 4, with the majority being level 2, meaning that students have sufficient scientific knowledge to provide explanations or draw conclusions based on simple investigations. They can make direct reasoning and make general interpretations of the results of scientific investigations or solve problems from technological aspects when the posttest is level 2 to level 6, with the majority being level 4, meaning that students can work with situations and issues that may involve explicit phenomena that require them to make conclusions about the role of scientific or technological knowledge. It shows increased students' understanding and knowledge of learning after implementing learning using the guided inquiry model on the Earth and Satellite material. Learners' abilities can be developed through teaching attitudes using the guided inquiry paradigm, enabling them to become autonomous problem solvers and foster skepticism about things and events in this world [18]. In line with what other researchers have done, the guided inquiry learning model impacts students' literacy attitudes in science [19].

The increase in scientific literacy after implementing the guided inquiry model for two meetings is supported by several factors. Supporting factors are observation activities at each meeting that involve students independently and in groups, the collaboration between students, and the suitability between the material and learning models in class with the scientific literacy questions given to students, as well as a good relationship between attitudes or behavior between teachers and students. In line with previous scientists' opinions, learning involves three stages: the information gathering stage, the information transformation stage, and the mastery learning stage. In mastery learning, it takes more than one meeting to ensure students understand the material being studied [20]. As has been done by previous researchers with two meetings using the guided inquiry learning model, it can also improve students' literacy skills on different materials but in the context of science [19]. The same thing was also done by other researchers using experimental research methods, which impacted scientific literacy [11]. The teacher-student relationship is also the strongest predictor of scientific literacy and moderates the effect of guided inquiry on scientific literacy [21].

The mode of 4 on the parameter strongly agrees with responses related to learning motivation, guided inquiry stages, model suitability, methods, and abilities. Meanwhile, statements with a mode of 3 on the agreed parameter refer to responses related to scientific literacy competence. In the responses related to learning motivation, four words with parameters strongly agree and two others with parameters that agree. The level of liveliness and lack of confusion is the point of discussion. It can happen when learning occurs, such as during question and answer discussions, only a few students are active, and others feel less confident. It is in line with the statement put forward by previous scientists that learning is a social process where individuals learn through interaction/response with other people and through language [22].

In the responses related to the guided inquiry stage, five statements with parameters strongly agree and two others with parameters that agree. The process of asking questions, collecting data, and carrying out investigations became the discussion points. In their daily lives, students are not used to making observations in a structured way, so in the inquiry stage, they still need teacher guidance and providing stimulation and reprimands so that learning activities remain following learning objectives and achievements. In line with other researchers, the teacher-student relationship is also the most potent predictor in disciplining learning to follow learning objectives and achievements [21].

In the responses related to scientific literacy competence, one statement with the parameters strongly agree, and the other two with the parameters agree. The ability to explain phenomena scientifically is a point of discussion.

Activities on indicators explain scientific phenomena carried out by students, namely remembering and implementing appropriate scientific knowledge and making and justifying the right predictions, where this has been given through practice questions to stimulate students' memory and understanding [15].

In the responses related to the suitability of models, methods, and abilities, there are two statements with strongly agreed parameters. Learning with the applied model is easy to understand in scientific literacy, balanced with observation, discussion, question and answer, and presentation activities to make students more enthusiastic. It shows that the combination of learning models and methods that have been implemented can improve scientific literacy skills. The higher the positive response regarding learning, the higher the students' learning achievement. Conversely, the higher the negative response regarding learning, the lower the learning achievement of students [23].

Activities that can increase cooperation and influence in this learning include identifying problems according to illustrations/phenomena, making observation questions for each group, determining observation procedures together, carrying out investigations by dividing performance according to procedures, and answering data analysis questions in group discussions. , and write down each discussion result on the student worksheets evenly. The relationship between positive responses and the results of scientific literacy, which has increased towards the Earth and Satellite material, shows that students have a good view of learning science, so through this view, students will act positively according to this view. In this case, the use of student worksheets can be a solution to support limited time, space, and sensory power [24].

CONCLUSION

Based on the results and discussion, the conclusion is that the implementation of learning by implementing the guided inquiry model to the Earth and Satellite material is found to be very well implemented, as evidenced by the learning implementation mode having a value of 4, meaning that it is following the teaching module. The results of the paired t-test of 0.000 indicate that there is a significant difference between the results of the scores pretest and posttest. The calculation results from an effect size of 1.823, meaning implementing guided inquiry to students greatly affects scientific literacy. The students' scientific literacy level after most learning was at level 4. The student's responses to implementing the guided inquiry model to the Earth and Satellite material were very good, as evidenced by 66.67% of statements in the strongly agree mode on implementing the guided inquiry model to increase scientific literacy.

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