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THE EFFECT OF THE GUIDED INQUIRY MODEL ON THE REASONING ABILITIES OF ELEMENTARY SCHOOL STUDENTS

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Abstract

This study aims to determine the effect of the guided inquiry learning model on students' reasoning ability in science subjects in class V SD Muhammadiyah 5 Porong. Using a quantitative approach, this type of research is a pre-experimental one-group pretest-posttest. The population in this study were all fifth-grade students of SD Muhammadiyah 5 Porong, with a total of 22 students. The sample in this study is to use saturated samples because the number of students is less than 30, with a total of 22 students. Primary data is in students' pretest and posttest reasoning ability test results and secondary data is in photo documentation. Data collection is done by giving reasoning ability tests to students. The collected data were analyzed using hypothesis testing using the paired t-test formula. The results of hypothesis testing using paired t-tests stated that the results of the significance value of 0.066, which means > 0.05, so that Ha is accepted, and H0 is rejected. There is an effect of using the guided inquiry learning model on the reasoning ability of elementary school students in learning science.

Keywords Guided Inquiri, Science Learning; SD Muhammadiyah 5 Porong, Reasoning Ability

INTRODUCTION

Science literacy is one of the 21st-century skills needed in the era of Industrial 4.0. The importance of scientific literacy is believed to be the right step in preparing for various global competitions that are currently starting to enter Indonesia (Safrizal, 2021). Therefore, learning is not only oriented toward conceptual abilities but must focus on the application of concepts. One of the literacies that need to be improved as a provision for students in solving real-world problems is science literacy.

Science literacy is a skill that must be possessed in designing scientific activities and applying the concepts possessed in real life. Science literacy requires not only knowledge of scientific concepts and theories but also knowledge of procedures and applications related to scientific inquiry. Therefore, scientifically literate people master the main conceptions and ideas that underlie scientific and technological thinking, how knowledge is obtained, and the extent to which knowledge is justified by facts or theoretical explanations (OECD, 2019)

In science learning, science literacy plays a very important role because it prepares students who are competent, professional, and able to compete internationally. To create and improve science literacy in learning, teachers must create a learning environment that connects activeness to students (Irsan, 2021). Learning methods only through textbooks and lectures, teacher-directed learning only makes students become passive listeners and creates boredom among students. This boredom ultimately causes students to lack the ability to think and science literacy knowledge.

Science literacy indicators, according to TIMSS, are (a) Knowing in this area when assessing learners' knowledge of facts, contexts, processes, concepts, and tools. Correct and accurate comprehensive knowledge provides the foundation on which learners successfully engage in more complex cognitive activities important in scientific endeavors. (b) Applying requires learners to participate in the application of knowledge of scientific information, relationships, processes, concepts, tools & methods in contexts that are common in science learning. (3) Reasoning requires learners to use reasoning to analyze data and other information, draw conclusions, and improve their understanding of new situations. Scientific thinking also includes developing hypotheses and designing scientific models and studies (Mullis et al., 2021).

According to the results of surveys conducted by PISA from 2000 to 2018, Indonesia is one of the countries with low levels of science literacy. In 2015, the PISA scores of Indonesian students were still below the OECD average. The average science score in science literacy across OECD

countries is 493, while Indonesia's score is only 403. In research conducted by TIMSS, science literacy in Indonesia is also still lagging behind when compared to other countries. In 2015, which focused on Mathematics and Science followed by 4th-grade students from 47 countries, showed that Indonesia's science literacy was ranked 44 out of 47 countries (Jones et al., 2015). The results of the TIMSS study suggest that the quality of Indonesia's science literacy is still not optimal and must be improved. The ability of students in science literacy must be developed early since students are still in elementary school. This is so that at a higher level of education, students are able to have good skills and be able to improve their science literacy. Increasing science literacy must be applied in learning with the hope that students learn to know themselves and their environment and apply knowledge to solve problems aimed at meeting daily needs through the discovery process (Nopiyanti, 2017).

Based on the results of pre-research conducted at SD Muhammadiyah 5 Porong with observation techniques and giving written tests to determine scientific literacy skills. By using the reference indicators according to TIMM, which include knowing, applying, and reasoning. Science literacy skills in the aspect of knowing the average results of pre-research is 14% in the aspect of applying 12% and reasoning 10%. In determining the category according to TIMSS, which consists of low, medium, and high categories, from the results of pre-research data, it was found that science literacy ability was classified as a low category with a result of 36%. This can be seen from the low quality of classroom learning, especially science learning. In science learning, teachers often require students to learn science concepts and principles by memorization.

The results of the above calculations show that the reasoning ability of students is still low. Students are still lacking in reasoning skills both in learning and in daily activities. Reasoning indicators are important for understanding concepts and solving problems. However, the reality in the field of science lessons is still difficult for students to understand because there is some teaching material that is abstract, while elementary school children tend to understand something that is real more easily (Stavinibelia, 2022). Factors causing the low reasoning of students in elementary schools are motivation, educator attitudes, environment, learning media, large elementary school posture, quality of educational facilities, and infrastructure. Indonesia has a very large number of elementary schools. In addition to the large number of elementary schools, there are also a large number of students. In other words, this is referred to as a large primary school posture (Dharma et al., 2022). Thus, researchers take reasoning ability as a special reference to improve the literacy skills of

students.

The low position of science literacy of students who are the object of research by PISA and TIMSS needs to be used as a reference by the government in improving the learning system in Indonesia, especially science learning (Suparya et al., 2022). A teacher must be able to choose a learning model that is in accordance with learning activities or the needs of students so that it will affect the science literacy skills of students. Creating a comfortable learning atmosphere and providing pleasure for students is the teacher's job so that learning is created effectively and efficiently. Science literacy can overcome people's ignorance of the true role of science (Hidayati & Julianto, 2018).

In the learning process, teachers can sort out creative, varied, and interesting learning models in order to create a conducive learning atmosphere. Namely, teachers can apply innovative learning models, namely guided inquiry learning models (Putri et al., 2018). The inquiry-based learning model is a learning model that involves students' critical thinking in asking questions, seeking information, and conducting research systematically, allowing students to make their own observations with full confidence (Erna Muliastrini et al., 2019). According to Sanjaya (Nida Hidayati, 2019), the guided inquiry learning model is an inquiry-based learning model where the teacher provides detailed guidance or direction to students. Most of the planning is made by the teacher, and students do not formulate problems or problems. Meanwhile, according to Dewi (Dewi Muliani & Citra Wibawa, 2019), the guided inquiry learning model is a guided research learning model that emphasizes the concept discovery process as a teacher-led guide for students to develop a scientific attitude. The use of learning models can improve student skills in terms of knowledge, attitudes, and skills (Aribawati et al., 2018).

The steps of the guided inquiry learning model, according to Sanjaya (Budiartini et al., 2013), are (a) Orientation; the orientation stage is a step to foster a responsive learning atmosphere. At this stage, students are ready to complete learning, (b) formulate problems; problem formulation is a step involving students in a problem that involves puzzles. The problem presented is a problem that challenges learners to think, (c) formulate a hypothesis, which is a temporary answer to the problem under study. For an intermediate response, the validity of the hypothesis must be verified, (d) data collection; data collection is the process of collecting data needed to test the hypothesis that has been proposed, (e) hypothesis testing; hypothesis testing is the process of determining answers that are considered acceptable based on data or information collected from data collection, (f) drawing

conclusions; drawing conclusions is the result of hypothesis testing as a process of describing the results.

The advantages and disadvantages of the guided inquiry learning model, according to Roestiyah (Jundu et al., 2020), are; (a) the Formation and development of concepts in students, (b) help to use memory in new learning situations, (c) encourage students to work hard and think, objectivity, honesty, and openness, (d) encourage students to formulate their hypotheses. While the shortcomings of the guided inquiry learning model, according to Suyadi (Anggraini, 2022) that the weaknesses of research used as a learning strategy, (a) the activities and success of students are difficult to control, (b) this strategy is difficult to design because it conflicts with the learning habits of students, (c) sometimes its application takes a long time. Therefore, it is often difficult for teachers to integrate it in the time given, (d) As long as the conditions for successful learning are determined by the technical mastery of students, inquiry-based learning is difficult for every teacher to implement.

In the learning process, teachers rarely provide opportunities for students to understand the phenomena around them, which can then be connected to the concepts learned. In the learning process, teachers focus more on teaching materials and textbooks so that students are less enthusiastic about the learning process. (Marisya & Sukma, 2020) By using the guided inquiry model in the science learning process with a combination of science literacy activities, students' learning ability towards science learning has increased. When teachers provide learning to students in the classroom by applying a guided inquiry model in which science literacy activities such as investigation are applied, students can understand theories or concepts in elementary school science learning, and students can find new concepts independently.

The results of previous research conducted by Ranti Nur et al. (Fa'idah et al., 2019) with the research title "The Effect of Guided Inquiry Learning Model on Science Literacy of Grade V Elementary Students" results of the study state that the guided inquiry model can improve students' science literacy and has a significant difference with the direct learning model. The initial ability of students does not affect the improvement of science literacy, both among low-level and high-level students. The guided inquiry learning model and initial skills of learners have no interaction with the science literacy of fifth-grade students of Tanjung Rejo 2 Elementary School in Malang. Research conducted by Ni Ketut et al. (Ni Nyoman L.H, 2022) with the title Effect of Inquiry Model on Science Literacy and Science Learning Outcomes of Grade V Students of SDN 4 Sangsit. The results of the

study said that there was a significant difference in science literacy between students who used the research model and students who used conventional learning, with an F value of 36.03 and p <; 0.05. The average obtained in the science literacy of students who follow the inquiry model is higher than the science literacy of students who follow conventional learning. Research conducted by Erna Muliastrini (Muliastrini, 2019) with the research title "The Effect of Environment-Based Guided Inquiry Learning Model on Science Literacy Ability and Science Learning Achievement of Grade V Elementary Students." The results showed that there were differences in creative thinking skills and science learning achievement between participants who learned with guided inquiry learning models and students who learned with conventional learning models. Research conducted by Ummu Aiman et al. (Aiman et al. 2019) with the title "The Effect of Guided Inquiry Learning Assisted by Student Worksheets on Mastery of Science Literacy in Elementary School Students." The results showed that there was a difference in increasing the mastery of science literacy of students taught with the guided inquiry model with students taught by conventional methods for fifth-grade students at Darul Hijrah Madani Elementary School in Kupang City. This is evidenced by the results of hypothesis testing showing a significance value of 0.000, which means <0.05, then Ho is rejected, and H1 is accepted.

This research is expected to provide benefits as (a) an effort to improve science literacy skills in reasoning and (b) taking policies related to the importance of using models in learning to improve the reasoning abilities of students. This study aims to (a) explain whether there is an effect of the guided inquiry learning model on elementary school reasoning ability and (b) how significant the effect of the guided inquiry learning model is on elementary school reasoning ability.

METHOD

This research is quantitative research. Quantitative research methods, according to (Sugiyono, 2017), are research based on the philosophy of positivism, which emphasizes objective phenomena and studies them quantitatively. The type of research used is research with a pre-experimental design. A research design using one group pretest-posttest, which is a research design that has a pretest before treatment and a posttest after treatment. This study aims to determine the effect of the guided inquiry learning model on elementary school reasoning ability.

One group pretest-posttest design formula:

O1 X O2

Description:

1. O1: before treatment
2. X: treatment or treatment
3. O2: after treatment

According to (Sugiyono, 2,017), Population is a generalization area consisting of several objects with certain characteristics and characteristics that are determined in research and then draw conclusions.s The population in this study were all fifth-grade students of SD Muhammadiyah 5 Porong, with a total of 22 students. The sample in this study is to use saturated samples because the number of students is less than 30, namely, with a total of 22 students. The sampling technique used in this study was a saturated sample. Saturated sampling is a sampling technique that uses all members of the population. The reason for using the saturated sampling technique is that the population used is relatively small, with a total of 22 students.

The variables in this study are independent variables (free) and dependent variables (bound). According to (Sugiyono, 2017), independent variables are variables that affect or cause changes in the dependent variable, while the dependent variable is the variable that is affected or caused by the independent variable. In this study, the independent variable (X) is the guided inquiry model, while the dependent variable (Y) is elementary school reasoning ability.

Data collection techniques in this study were observation, documentation, and tests. Observation in this study was carried out to collect data that supported the research. Observations were made with homeroom teachers, giving tests to students to determine the ability of science literacy in indicators. Documentation is carried out during observation and tests, taking photos that aim to data obtained in the form of facts of learning process events so that they can be used as evidence. The test referred to in this study is a test to determine the reasoning abilities of students. The tests used are the initial test (pretest) and the final test (posttest). Before giving pretest and posttest items to students, they have gone through validity and reliability tests with a total of 21 students. Thirty valid items totaled 20, and invalid ones totaled ten items with the results of the calculation of SPSS alpha, 687. The scoring technique is done by giving a value of 10 for the correct question and a value of 0 for the wrong question.

The data collection steps were carried out as follows: (a). Preliminary test (pretest) The initial test was conducted before treatment. Pretest was conducted to determine the ability of students before the introduction of guided inquiry-based learning models. (b) The final test (posttest) is given after the application of the treatment or guided inquiry learning model. The posttest was conducted to assess the skills of students after applying the guided inquiry-based learning model.

Data analysis techniques Before conducting hypothesis testing, first conducted prerequisite tests, namely the normality test and homogeneity test, with the help of SPSS version 26. Hypothesis testing using paired t-test. Research data was obtained through written test results of fifth-grade students and observation results. The data source of this research is all fifth-grade students of SD Muhammadiyah 5 Porong.

Based on the problems that have been stated above, the hypothesis of this study is (Ha) there is an effect of the guided inquiry learning model on reasoning ability, (H0) there is no effect of the guided inquiry learning model on reasoning ability.

FINDINGS AND DISCUSSION

Findings

This research is a type of experimental research using the one-group pretest-posttest model. This study was conducted to determine the effect of the guided inquiry learning model on the reasoning of elementary school students. The research was conducted at SD Muhammadiyah 5 Porong with a sample of all 5th-grade students totaling 22 students. Data collection was carried out twice, and the first pretest was given before treatment and posttest after treatment.

In the research process, the researcher first delivered the material and coordinated it according to the steps in the lesson plan. The teacher will convey to students during learning using the guided inquiry model, which contains the steps of the learning model. The teacher tells students about the purpose of learning. Learners are expected to follow the directions of the teacher. In the learning process using the guided inquiry model, there are six phases that will be carried out by students.

First, the problem orientation phase contains conveying the material, learning objectives, and activities that will be carried out later. The orientation phase is given at the beginning of learning to students. When students are given an overview of the material changes in the form of objects, the teacher invites students to think about solving problems. Second, in the problem formulation phase,

after students are given a problem, they are then required to think about solving the problem and finding the answer based on the orientation of the problem that has been conveyed. In this stage, the teacher can invite students to do question-and-answer activities that have been packaged in such a way that the teacher only answers questions from students with two answers "yes" or "no." So if learners ask questions that cannot be answered with "yes" or "no," then learners must ask other questions. Learners are required to find their own answers or facts to solve the problem. Third, in the phase of presenting hypotheses at this stage, learners make a hypothesis or temporary answer to the problem that has been presented. Learners must make relevant hypotheses based on the formulation of the problem. Presentation of hypotheses is required that can be proven by conducting simple experiments or investigations. Fourth, in the data collection phase, at this stage, learners carry out activities to collect information needed to test the hypothesis they have made. Learners can prepare materials to test hypotheses and can also find information about various books that are available. Here learners can find answers to their hypotheses by conducting simple experiments.

Figure 1. Data Collection Phase

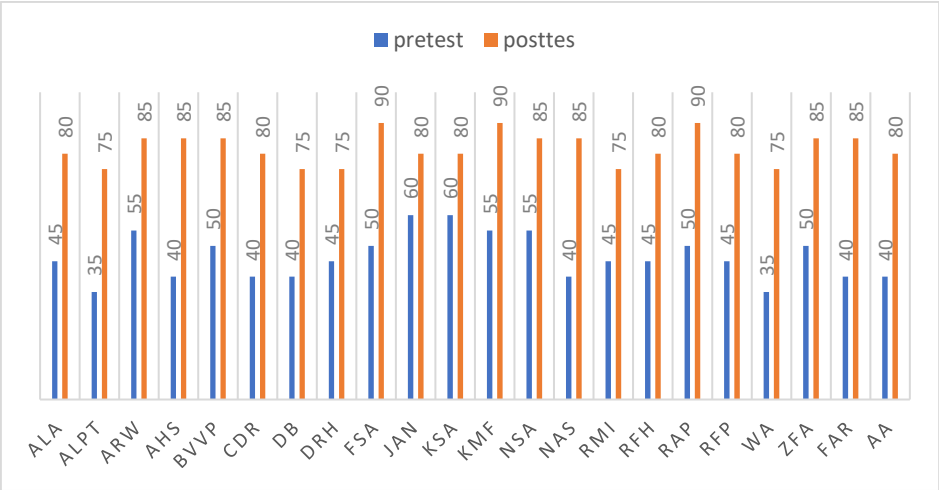
Fifth, testing hypotheses is the stage where learners' rational skills are trained and where hypotheses made are tested through simple experiments. At this stage, learners are taught to conduct their own experiments so that they can test their hypotheses against data and facts. In experimental activities, learners can find answers to their hypotheses

Figure 2. Hypothesis Testing Phase

Sixth, the phase of making conclusions in this step requires students to describe the findings that have been obtained from simple experiments or from other information so that students can reach accurate conclusions and get real knowledge.

Based on statistical tests with homogeneity tests, it is proven that there is a difference between reasoning skills using guided inquiry learning models and conventional learning models. The difference shows that there is an influence during the learning process using the guided inquiry model on the reasoning of fifth-grade students of SD Muhammadiyah 5 Porong.

Figure 3. Pretest Posttes Reasoning Ability Results



Based on the graph above, it shows that there is an increase in reasoning ability after the application of the guided inquiry learning model. All students' posttest results have increased. The lowest pretest score was two students, ALPT and WA, with a score of 35. The highest pretest score was two students, JAN and KSA, with a score of 60, while the low posttest score was a score of 75. The highest was three students, FSA, KMF, and RAP, with a score of 90.

Table 1. Normality Test Results Kolmogorov Sminov

Statistic	Differences	Significant	Crit.
.143	22	.200	Normal

The normality test in this study used the help of SPSS version 26. A distribution is said to be normal if the significance level is> 0.05. Otherwise, if the significance level is <0.05, then a distribution is said to be unable to continue. Based on the results of the normality test using Kolmogorov-Sminov, the significance value is 0.200, which means above 0.05. Thus, the variable can be said to be normally distributed at 0.200> 0.05.

Table 2. Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Learning outcomes	Based on Mean	3.678	1	42	.062
	Based on Median	2.301	1	42	.137
	Based on the Median and with adjusted df	2.301	1	38.503	.137
	Based on trimmed mean	3.554	1	42	.066

Based on the data in Table 2, the homogeneity test was carried out using the help of SPSS version 26 using the Levene test. Obtained with the results of the significance value based on mean 0.066. In accordance with the basis for decision-making, if the significance value of the mean results obtained data> 0.05, it can be concluded that the data is homogeneous. Hypothesis testing was then conducted using paired t-test.

Table 3. Paired Sample t-test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	pretest - postest	-35.45455	6.88495	1.46788	-38.50716	-32.40193	-24.154	21	.000

In this study, the paired t-test was used to determine whether there were differences in the pretest group (before being given a guided inquiry learning model and posttest (after being given a guided inquiry learning model). The paired t-test can be done through SPSS. The paired t-test hypothesis using the SPSS program is as follows:

H0: accepted if lower is negative upper is positive, and (2-tailed) > α

Ha: accepted if the lower is negative upper is negative, and (2-tailed) < α

Research hypothesis:

Ha: There is an effect of the guided inquiry learning model on the reasoning ability of elementary school students

H0: There is no effect of the guided inquiry learning model on the reasoning ability of elementary school students.

Based on table 3 shows that the significance value is 0.00, meaning that the significance value

is <0.05. in the sense that there is an influence on the reasoning ability of students after the application of the guided inquiry learning model at SD Muhammadiyah 5 Porong. It can be concluded that if the significance level> 0.05, then Ha is accepted, and H0 is rejected.

Based on the descriptive data of the research results, the results of students' reasoning ability using the inquiry learning model proved to be better when compared to using conventional learning. The learning process using the inquiry learning model provides opportunities for students to find information or knowledge independently. Simple experimental activities can also provide opportunities for students to solve problems through experimental or investigative activities so that the results obtained by students are obtained in real terms.

Discussion

Based on the hypothesis test analysis with the n-gain formula above, it can be stated that there is a significant difference in reasoning ability in science subjects between students who take part in learning with conventional models. The results of research conducted by (Fa'idah et al., 2019) also stated that the guided inquiry learning model could improve students' reasoning abilities skills. Judging from the results of the calculation of research data, the group of students who took part in learning with the guided inquiry learning model had higher reasoning skills compared to the conventional learning group. The difference in the science reasoning ability of students who are taught using the guided inquiry model and students who take lessons with conventional models is due to the syntax in the learning process. In contrast to conventional learning, teachers tend to deliver material to students. Therefore, in the implementation of conventional learning models, the role of the teacher as a stimulus provider is a very important factor. The results of research conducted by (Muliastrini, 2019) also stated that in the learning process, if the teacher uses the guided learning model, students will experience an increase in their learning outcomes.

The use of inquiry models is better and more effective in improving students' science literacy skills in the learning process. This model provides sufficient space for students to construct knowledge, develop their abilities, and develop their scientific abilities (Erna Muliastrini et al., 2019). The guided inquiry learning model is an innovative learning model for teachers and students in learning science. The reason is that this learning design motivates students to be active in learning by utilizing a contextual approach. In addition, science learning is directed at finding out for themselves the answers to questions or problems so that it can help students to gain a deeper understanding of the surrounding nature (Jundu et al., 2020). The guided inquiry learning model is

able to invite students to build their own knowledge, and they tend to improve their memory because students directly do and experience it themselves (Suryantari et al., 2019).

There are several obstacles in the application of the guided inquiry learning model. Namely, students are not accustomed to and do not understand learning through the application of the guided inquiry learning model. Therefore, a process that instills habits and understanding is needed. Students are still not used to studying the problems around them because they think that learning at school is enough. From the results of research conducted by (Aiman et al., 2019), it is stated that the application of the guided inquiry learning model in classroom learning is proven in this study that the use of the guided inquiry learning model in learning is better than the conventional learning model in understanding science concepts. The guided inquiry learning model involves more students independently discovering scientific concepts through discovery. The teacher only acts as a facilitator of the learning process. From the discussion of the research results, it can be concluded that in learning, students who use the guided inquiry model get higher results compared to students who use conventional learning models.

CONCLUSION

Based on the results of research and discussion, it is concluded that there are differences in reasoning skills using the inquiry model and conventional learning models in fifth-grade students of SD Muhammadiyah 5 Porong in science subjects. It can be seen from the value that the ability the reasoning of students taught using the guided inquiry learning model is better than students who use conventional learning models. This is shown in the results of hypothesis testing using the paired t-test by getting the results of a significance value of 0.066, which means> 0.05, so that Ha is accepted H0 is rejected. It can be stated that there is an effect of using the guided inquiry learning model on the reasoning ability of elementary school students in learning science.

Suggestions for future researchers who will conduct the same study can develop the research objectives to be studied and focus on what will be studied. Researchers must also understand what will be the focus of the study to be studied by reading more journal articles related to what will be studied. For future researchers, it is advisable to use a larger number of respondents so that the research results are even better.

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