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Learning Effectiveness of Guided Science to Improve Student Learning Outcomes

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ABSTRAK

Rendahnya hasil belajar Ilmu Pengetahuan Alam peserta didik merupakan permasalahan utama dalam penelitian ini. Hal tersebut disebabkan oleh sistem pembelajaran IPA yang kurang efektif dalam penerapannya sehingga peserta didik menjadi kurang berminat untuk belajar IPA. Penelitian ini bertujuan untuk mengetahui keefektifan penggunaan pembelajaran penemuan IPA terbimbing dalam meningkatkan hasil belajar siswa kelas V SD. Metode yang digunakan dalam penelitian ini yaitu *pre-experimental* jenis *one group pretest posttest design*. Teknik pengambilan sampel menggunakan *nonprobability sampling* model yaitu *purposive sampling*. Analisis data yang digunakan adalah uji efektifitas menggunakan uji paired sampel t-tes berbantuan SPSS 21 dengan membandingkan nilai sig (2-tailed) dengan nilai alpha 5%. Jumlah sampel yang digunakan sebanyak 28 orang peserta didik. Instrument penelitian berupa tes pilihan ganda dan angket. Hasil penelitian menunjukkan bahwa rata-rata nilai pretest sebesar 59,29 dan nilai *posttest* sebesar 0,082, dan signifikansi pada pretest sebesar 0,126, signifikansi untuk posttest sebesar 0,082, dan signifikansi pembelajaran penemuan IPA terbimbing sebesar 0,200 masing-masing nilai signifikansinya yaitu 0,000 < 0,05 yang artinya terdapat perbedaan signifikan, sedangkan nilai t nya yaitu sebesar 12,515 yang berarti bahwa nilai pretest lebih kecil daripada posttest sebesar 12,515 sehingga dapat dinyatakan bahwa pembelajaran penemuan IPA terbimbing efektif dalam meningkatkan hasil belajar peserta didik. Dengan demikian maka dapat disimpulkan bahwa terdapat pengaruh positif dan signifikan pembelajaan penemuan IPA terbimbing terhadap hasil belajar peserta didik siswa kelas V SD.

ABSTRACT

The low learning outcomes of students in Natural Science is the main problem in this study. It is due to the ineffective science learning system in its application so that students are less interested in learning science. This study aimed to determine the effectiveness of using guided science discovery learning in improving learning outcomes of fifth grade elementary school students. The method used in this research is pre-experimental one group pretest-posttest design. The sampling technique used nonprobability sampling model, namely purposive sampling. The data analysis used was the effectiveness test using the paired sample t-test assisted by SPSS 21 through comparing the sig (2-tailed) value with an alpha value of 5%. The number of samples used was 28 students. The research instrument was a multiple-choice test and a questionnaire. The results showed that the mean pretest value was 59.29 and the posttest value was 0.082; the pretest significance was 0.126, the significance for the posttest was 0,082; the significance of guided science discovery learning was 0,200, each of which has a significance value of 0,000 <0, 05. It means that there is a significant difference, while the t value is 12,515. It means that the pretest score is smaller than the posttest, which is 12,515, so it can be stated that guided science discovery learning is effective in improving student learning outcomes. Thus, it can be concluded that there is a positive and significant effect of guided science discovery on learning outcomes of fifth grade elementary school students.

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1. Introduction

Natural Science (IPA) is one of the subjects taught at the elementary school level. Natural Science is a branch of science that can be a forum for students to study themselves, plants, animals, the environment, and things related to human interactions with nature in everyday life. Natural Science is a science that deals with systematic natural and material phenomena where knowledge is organized into a system. Science is not independent, interrelated with one another, which is a whole, regularly arranged, generally accepted collection of observations and experiments (Sulthon, 2016; Yupriyanti, 2015). The essence of science is 1) as a process of human efforts to understand various natural phenomena which can be interpreted that a certain way is needed such as analytical, careful, complete and connects one natural phenomenon with another natural phenomenon so that the whole forms a new perspective on the object observed, 2) as a product of human efforts to understand various natural phenomena, which means that the products are in the form of principles, theories, laws, concepts and facts, all of these are intended to explain various natural phenomena, and 3) as a capable factor of changing human attitudes and views of the universe, from a mythological point of view to a scientific point of view (Sophuan, 2018; Surahman et al., 2013).

Science learning aims to equip students with the ability to develop knowledge and understanding of science concepts that are useful and applicable in everyday life. It also aims to develop curiosity, positive attitudes and awareness of the interplay between science, environment, technology. and society, and to develop process skills for investigating the environment, solving problems and making decisions (Asta et al., 2015; Khaerudin & Junaedi, 2007). Meanwhile (Hazmiwati, 2018; Sulistyorini & Suparton, 2007) explained that the science subject has the aim of giving students an understanding about natural surroundings, improving students' skills in gaining knowledge in the form of scientific process / method skills, so that students have a scientific attitude in knowing the natural surroundings and solving problems at hand. According to the science learning objectives described by the experts above, it can be seen that science is an important subject for elementary school students to understand. It is because science learning is a science related to nature that can be directly related to the natural sustainability and human life itself. Therefore, understanding the concept of science learning must be implanted properly so that it can improve the quality of science knowledge in elementary students and the preservation of the natural surroundings.

Improving the quality of science learning in elementary schools must be linked to the environmental conditions, society, and technological developments in order to meet human needs in solving identifiable problems. The science application must be carried out wisely so that it does not have a negative impact on the environment and humans themselves. Therefore, science subjects must be well desirable and understood by elementary students through implementing an interesting and fun learning system. The learning process in educational units is held interactively, inspiring, fun, challenging, and motivating students to participate actively, providing sufficient space for initiative, creativity and independence according to the talents, interests and physical and psychological development of students (Bayu & Wahyuni, 2019). In science learning at schools, efforts are made, so that students have the competence to work / study scientifically. Competency Standards and Basic Competencies for Natural Science subjects in SD / MI as outlined in content standards are the minimum standards that must be achieved nationally by students. The achievement of SK and KD in elementary schools is based on empowering students to build their abilities, work scientifically, and their own knowledge which is facilitated by the teacher. The success of the implementation of learning is influenced by the ability of teachers to understand the characteristics of their students (Jonkenedi, 2017; Juniantari, I, G, A & Kusmariyatni, 2019).

Teachers are educators who play a role in improving the quality of student learning in schools. Teachers take a big part in shaping the character, mindset, and creativity of students. However, nowadays most of the teachers are less able to develop the creativity of students due to the tendency of the teachers to prioritize aspects of verbalism. Verbalism is an educational principle that emphasizes memorization rather than understanding and using formulation or substancing, so that it cannot hone the students' talents and quality in learning. The science teaching system must be able to raise children's awareness that science is not a series of facts, concepts, and theories that are ready to be presented and memorized as a series of information, but as a vehicle for students to learn about themselves, the environment, and the prospect of further development in applying it in their daily lives. Science education is directed to "find out" and "do" so that it can help students gaining a deeper understanding of the natural surroundings (Paolini, 2015). Science education emphasizes providing direct experience to develop student competencies so that students are able to explore and understand the natural surroundings scientifically. Science learning taught is learning that does not pay attention to the pleasant atmosphere for students,

rigid lesson conditions and does not pay attention to student characteristics, so that it affects student learning outcomes (Hadinata et al., 2017; Kristinawati et al., 2017).

Based on the results of interviews and observations conducted at SD Negeri 28 Cakranegara, problems were found including: 1) the pattern of delivering science material in the conventional learning process, namely only the transfer of knowledge so that students only listen to the material presented by the teacher; 2) teachers are more dominant than students (teacher centered) so that sometimes they make students feel bored; 3) lack of student motivation and impact on low student learning outcomes; 4) the average student learning outcomes are low; 5) students are less enthusiastic in following lessons and there are even some students who are absent from science lesson hours. The learning outcomes (daily tests) obtained by students can be seen in Table 1. as follows.

Table 1. Acquisition of Science Value on the Final School Examination

Class	Average of Science Score	
Grade V of Elementary School 28 Cakranegara	2017/2018	2018/2019
	67,80	70,00

Source: *teacher of grade V Elementary School 28 Cakranegara*

Based on Table 1 above, it can be seen that the average science lesson scores obtained by students on the School Final Examination are still low from the previous semester to the next semester. To overcome the problem of low student scores in science learning, the implementation of learning strategies which is more effective and attractive, as well as a more interactive teaching system by teachers is believed to play an important role in improving and changing these conditions. The success of implementing science education is largely determined by the learning process handled by the teacher. One important factor to achieve educational goals is the learning process that focuses on students optimally.

For this reason, there is a need for renewal and improvement in the science learning process in elementary schools that prioritizes the achievement of learning outcomes in the form of processes and products. One of the alternative solutions to this problem is to apply the guided science discovery learning model, which is a learning model that focuses on the assessment of processes and products that are discovery and inquiry oriented. In discovery-oriented learning, students must actively seek, discover, organize and form their own knowledge. *GDL moel is an elaboration of the model of Discovery Learning (DL)* (Harianti, 2018; Herlily et al., 2018). If this inductive learning approach is carried out correctly and continuously, it is hoped that new discoveries will emerge and be beneficial to mankind and for the development of science itself. Principally, the learning approach model of discovery (discovery) and inquiry (inquiry) emphasizes that students have freedom in learning. This is of course very demanding for students to be active in learning. Students should be motivated to start the discovery process. Meanwhile, the teacher can position himself as the creator of problem situations, responders to the inquiry process shown by students, and expand the student inquiry process by developing the types of information students get.

The guided discovery learning method was first introduced by Plato in a dialogue between Socrates and a child. So, it is also known as the Socratic method involving the interaction between students and teachers, where students seek the desired conclusion through a sequence of questions arranged by the teacher. According to (Hanafiah & Suhana, 2010) Guided discovery learning model is a series of learning activities that maximally involves all the students' abilities to seek, research, and investigate systematically, critically, and logically so that knowledge, attitudes, insights and skills are a form of change in themselves. Guided discovery is learning that trains and guides students to learn, gain knowledge, and build the concepts they find for themselves (Pardede et al., 2016).

The application of guided science discovery learning must go through several steps in order to obtain maximum results. The steps that must be passed consist of several phases, namely 1) the orientation phase, 2) the problem formulation phase, 3) formulating hypotheses, 4) collecting data, 5) planning problem solving, 6) carrying out experiments, 7) testing hypotheses, 8) formulating conclusions. For more details, the steps that are followed in the application of the guided science discovery learning method can be seen in Table 2 as follows.

Table 2. Steps of Guided Science Discovery Learning Method

The phases	Teacher Activities	Student Activities
Orientation	The teacher conveys the objectives of learning science, conditioning students to be ready to carry out the learning process.	Students prepare themselves to get science learning materials.
Formulating Problems	The teacher brings students a problem that contains puzzles to be solved by students.	Students solve puzzle problems given by the teacher.
Formulating Hypotheses	The teacher guides students in making predictions of answers to problems and preparing problem explanations.	Students make predictions of answers to problems and prepare explanations of problems.
Planning Troubleshooting	The teacher guides students to plan problem solving, helps prepare the tools and materials used and develop work procedures.	Students seek information, data, facts needed to answer problems or hypotheses.
Carry out Experiments	As long as students work, the teacher guides and facilitates.	Students test the correctness of the temporary answer.
Collecting data	Helping students find the information needed to test the hypothesis proposed by students.	Students collect information by making observations according to the science material being taught.
Hypothesis Testing	The teacher helps students determine the answers that are considered acceptable according to the data or information obtained based on data collection.	Students answer problems according to the data or information obtained based on data collection.
Formulating Conclusions	Helping students write or discover the principles obtained based on the results of hypothesis testing.	Students draw the conclusions they have.

The guided discovery learning method has advantages and disadvantages in its application. The advantages of the guided discovery learning method include 1) students can actively participate in the learning presented, 2) instill and foster an inquiry attitude, 3) support students' problem-solving abilities, 4) provide a vehicle for interaction between students, as well as students and teachers, 5) learning material can reach a high level of ability and is longer remembered because students are involved in the process of finding it. While the shortcomings of this method are 1) it takes longer time on certain materials, 2) not all students can take lessons with this method, 3) not all relevant topics are conveyed by this method. The shortcomings of this method can be overcome by selecting learning materials that are easier to teach and analyzing students who will be given subject matter with this method.

The importance of a learning method in improving learning outcomes needs to be realized. Moreover, the use of guided science discovery learning methods is expected to be effective in improving elementary student learning outcomes. The success of guided science discovery learning is proven to improve student learning outcomes. This is confirmed by (Mirasi et al., 2013) which states that the average learning outcomes using the guided discovery method are higher than the average learning outcomes using other methods.

This research is supported by relevant previous studies such as: (1) research conducted by (Khaidir, 2013), The results showed that students taught using the guided discovery method with a cooperative setting are higher than those taught by conventional methods. (2) research conducted by (Sobarna et al., 2014), obtained the results that the learning of students and the learning outcomes of their participants in learning Natural Sciences on the subject of the human respiratory system. (3) research conducted by (Ardithayasa & Yudiana, 2020), obtained the result that the tri hita karana-based group investigation (GI) learning model had an effect on science learning outcomes.

Based on some of these studies, no one has researched the effectiveness of using guided science discovery learning to improve student learning outcomes. The purpose of this study was to determine the effectiveness of guided science discovery learning on improving student learning outcomes.

2. Method

This type of research is a classroom action research. This study used an experimental method with a pre-experimental design type one group pretest-posttest design. This design can compare the situation before being treated (Sugiyono, 2015).

The sampling technique used was nonprobability sampling model, namely purposive sampling, which is a sampling technique that does not provide equal opportunities for each member of the population to be selected as a sample. Meanwhile, purposive sampling is a technique of determining the sample with certain considerations (Sugiyono, 2015). So that the sample used in this study were fifth grade students of SD Negeri 28 Cakranegara.

The data used in this study came from students who were obtained from student learning motivation questionnaire data, student response questionnaires to guided science discovery learning, and student concept mastery tests. While the data sourced from teachers and students were obtained from the observation sheet of the guided science discovery learning process in the form of teacher and student activity data in the application of guided science discovery learning.

The stages of this research include:

1) Analyze problems at school,
2) Creating a research instrument,
3) Coordinating with class teachers;
4) Develop learning strategies;
5) Carry out the pretest,
6) Conduct learning by applying guided science discovery learning
7) Doing a posttest after completing the experiment;
8) Analyze data
9) Prepare reports

This research was conducted by first doing a pretest which aims to determine the initial understanding of students. After that, guided science discovery learning was applied and at the end of the lesson, a posttest was given to determine the ability of students to understand the material.

Data analysis was performed using descriptive statistics and inferential statistics. Descriptive statistics are used to describe, describe, describe, or describe data so that it is easy to understand. The data described in this study are in the form of pretest, posttest scores. From these data, the mean of mode, median, variance, and standard deviation was calculated. Inferential statistics are used to study, estimate and draw conclusions based on the data obtained. Hypothesis testing in research research uses the t test which is basically to find out the difference in the mean of two samples or two variables using SPPSS 21.

3. Result and Discussion

This research is a classroom action research consisting of two variables, namely guided science learning discovery (X) and learning outcomes (Y). The research data were obtained from questionnaires and tests in the form of questions, as well as observation data on teacher and student activities. The questionnaire was used to measure guided science discovery learning, the score obtained was using a linkert scale consisting of 4 answer options, namely: S, R, KK, TP. The questions used to measure student learning outcomes with the Guttman scale.

Guided science discovery learning data, obtained through a questionnaire consisting of 17 questions with 4 choices, namely always (S); often (SR); sometimes (KK); and never (TP). Research data using guided science discovery learning can be seen in Table 3.

Table 3. Statistical Test Results Data Guided Science Discovery Learning Method

	Statistic
N Valid	28
Missing	0
Mean	47,25

Median	48,00
Mode	48
Std. Deviation	6,450
Variance	41,602
Range	24
Minimum	35
Maximum	59
Sum	1323

Based the table above, it can be obtained an average value of 47.25; with a median of 48.00 and a mode of 48; Standard deviation is 6.450, variance is 41.602 with a range of 24. The minimum value is 35 and the maximum value is 59 and the total score is 1323.Table 3 above shows that the guided science discovery learning method can provide a learning process that is carried out quite well for science lessons. with an average obtained of 47.25%. It can indicate if the method can be applied to the teaching and learning process at the elementary school level.

The distribution of the frequency of guided science discovery learning can be seen in Table 4 as follows.

Table 4. Frequency Distribution of Guided Science Discovery Learning

Interval	Frequency	Relative frequency (%)	Cumulative frequency (%)
35 – 39	4	14,3	14,3
40 – 44	3	10,7	25
45 – 49	13	46,4	71,4
50 – 54	5	17,9	89,3
55 – 59	3	10,7	100
Total	28	100	-

Student Learning Outcomes and Data The number of questions given was 25 items in multiple choice form. In the following, the research data on the cognitive learning outcomes of students on the use of guided science discovery learning are presented in Table 5.

Table 5. Descriptive Statistics Data on Student Cognitive Learning Outcomes

Statistic		
	Pretest	***Posttest***
N Valid	28	28
Missing	0	0
Mean	59,29	75,07
Median	58,00	76,00
Mode	52	72
Std. Deviation	8,981	6,242
Variance	80,656	38,958
Range	36	24
Minimum	44	64
Maximum	80	88
Sum	1660	2102

Based on the table above, it can be seen that (1) the pretest data were obtained from 28 respondents with an average value of 59.29, a median of 58, a mode of 52, a standard deviation of 8.981, a variance of 80.656, with a range of 36, value a minimum of 44, and a maximum value of 80 with a total score of 1660; and (2) posttest value data obtained from respondents totaling 28 students with an average value of 75.07, a median of 76.00, a mode of 72, a standard deviation of 6.242, a variance of 38.958, with a range of 24, the minimum value. of 64, and the maximum value of 88 with a total score of 2102.

The results of statistical tests in Table 5 above indicate that student learning outcomes using guided science discovery learning methods are as expected by researchers. Of the 28 students who were sampled, the lowest score was 44 and the highest score was 80. The pretest average score obtained was 59.29%.

Based on the results of the calculation of the posttest data from 28 samples, the lowest score was 64 and the highest score was 88. The average score obtained by students was 75.07%. The average posttest stage of learning outcomes with the application of the guided science discovery learning method is greater than the average value of student learning outcomes using conventional methods which are only able to produce an average per semester of 64% to 70%. This can prove that the guided science discovery learning method is effective in improving student learning outcomes. This is in line with the research results obtained by (Nupita, 2013) which states that the guided discovery learning model can improve student learning outcomes, especially in science learning, where students can get learning outcomes at grades 70 and above. Then the research conducted by (Tias, 2017) Obtained research results which also state that learning using the guided discovery learning model can improve science learning outcomes in class V SD Negeri 10 Metro Timur, which is shown in the percentage of completeness of learning outcomes from cycle I of 63.33% to 86.67% in cycle II . The following shows the results of the T test research which can be seen based on table 6.

Table 6. The Result of T-Test

	Unstandaridized Coefficients		Standardized Coefficients		
Model	**B**	**Std. Error**	**Beta**	**T**	**Sig.**
1 (Constant)	56.205	8.241	.413	6.820	.000
Penemuan IPA Terbimbing	.399	.173		2.310	.029

Dependensi Variabel: Hasil belajar *posttest*

According to the table above, it can be seen that tcount = 2.310> ttable = 2.0555 with a significance of 0.029 <0.05, so Ho is rejected and H1 is accepted. Thus, it can be concluded that there is a positive and significant effect of using guided science discovery learning methods on student learning outcomes. These results are in line with research conducted by (Nasri et al., 2015) where the research obtained results-tcount <-ttable (-14.26 <-2.042) so that it was stated that the guided discovery learning model could improve student science learning outcomes in class VII MTsN Sigli.

Based on the results of quantitative observations of guided science discovery learning, the mean score was 41.19 with a percentage of 93.60 which could state that guided science discovery learning took place very well in accordance with the planned learning scenario. The learning stages have been running according to the learning stages that apply the guided science discovery approach. Almost all students responded to learning activities by applying the guided science discovery approach positively. All students participate actively in learning activities. Based on the results of qualitative observations, it shows that students have started to show an attitude that is oriented towards the discovery of new knowledge. Students seem enthusiastic when carrying out observation activities, and the teacher intensively provides guidance. This illustrates that the learning that takes place is oriented towards the discovery of guided science, which is based on student centered using directions and guidance from the teacher that is more intensified.

Student responses to guided science discovery learning show that students give a positive response to guided science discovery learning. Students say they like guided science discovery learning, where students are free to express their opinions, are motivated, are not difficult to understand science learning, are not forced and can work together in the learning process. All students or research subjects show seriousness in doing assignments and show great curiosity. Meanwhile, in the learning process using a conventional approach, students are very lacking in expressing various ideas, students are also less varied in their efforts to do assignments during the learning process. Students tend to be passive and accept whatever the teacher says. Students are not brave enough to ask questions, especially to propose ideas to the teacher. Communication activities between teachers and students tend to be dominated by teachers, namely teachers explaining and occasionally asking questions. In guided science discovery learning students dare to propose opinions and ideas that are different from those of friends or teachers. The response given by the teacher is in the form of motivational treatment of students, namely by not hesitate to give appreciation to students. The responses obtained from these students were reinforced by opinions (Lestari et al., 2019) which states that one solution to improve student learning outcomes is to use active learning, where students do most of the work that must be done either individually or in groups. The positive response shown by students has an effect on learning outcomes. one of the relevant studies

regarding the effect of learning model-based learning on learning outcomes is conveyed by (Ardithayasa & Yudiana, 2020) that student learning outcomes increased with the use of Group Investigation learning amounted to 19.62 with the very good category. Compared with conventional learning with the acquisition of an average value of 15.16.

This research is supported by relevant previous studies such as: Research conducted by (Khaidir, 2013), The results showed that students taught using the guided discovery method with a cooperative setting are higher than those taught by conventional methods. Then research conducted byresearch conducted by (Sobarna et al., 2014), obtain the results that the learning of students and the learning outcomes of their participants in learning Natural Sciences on the subject of the human respiratory system. Research conducted by (Ardithayasa & Yudiana, 2020), obtained the result that the tri hita karana-based group investigation (GI) learning model had an effect on science learning outcomes.

Based on some of these studies, no one has researched the effectiveness of using guided science discovery learning to improve student learning outcomes. By applying guided science discovery learning can affect the learning outcomes of fifth grade elementary school students, and students give a positive response to science discovery learning terbimbing.

4. Conclusions

Based on data analysis and discussion, it can be concluded that the guided science discovery learning method is more effective in improving student cognitive learning outcomes compared to conventional learning. The cognitive learning outcomes of students taught by guided science discovery learning methods are higher than students taught by conventional learning. The learning motivation of students taught by guided science discovery learning is higher than students taught by conventional learning. So, it can be stated that the guided science discovery learning method has a significant influence on the learning outcomes of elementary school students. This method is effective when applied by teachers in an effort to improve student learning outcomes and outcomes.

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