Jurnal Pijar MIPA
https://jurnalfkip.unram.ac.id/index.php/JPM

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

Effects of Discovery Learning Model Towards Science Process Skills and Learning Retention

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Received: December 30, 2023. Accepted: January 5, 2024. Published: January 15, 2024

Abstract: This research aims to determine the effect of the Discovery Learning learning model on science process skills and student learning retention. The population in this study were all 4th-grade students at SDN 6 Cakranegara, totalling 66 students. Samples were taken using a non-probability sampling technique with a saturated sampling type. This research uses a Pretest-Posttest Nonequivalent Control Group Design research design. The instruments used are observation sheets to measure science process skills and multiple-choice test questions to measure learning retention. Analysis in this study used the One Way ANOVA test with the help of SPSS 21.0 for Windows. The experimental class's average science process skill score was greater than the control class at 77.95%, as was student learning retention at 65%. The statistical analysis results show that the significance value of the influence of treatment on science process skills is 0.000, while the significance value of the influence of treatment on student learning retention is 0.000. So, it can be concluded that H0 is rejected and Ha is accepted, which means a) the discovery learning model influences the science process skills of class IV students, and b) the discovery learning model influences the learning retention of class IV students.

Keywords: Discovery Learning, Science Process Skills, Learning Retention

Introduction

Science is a scientific discipline whose object of study is closest to human life. Science learning teaches students to be more active and think critically about things they do not yet understand. Apart from that, in science learning, we often find materials that are investigative or discovery in nature, which can increase student activity in the learning process [1]. This follows the objectives of science learning taught in elementary schools as stated in the 2013 curriculum, which aims to develop students' attitudes, knowledge, and skill competence [2]. In this learning activity, students are required to search for themselves actively. In this curriculum, students are expected to be able to apply the learning carried out in the life of society, nation, and state.

The description above clearly explains that science subjects in elementary schools should provide opportunities to foster students' natural curiosity. This will help students learn to ask questions, find answers to natural phenomena based on evidence, and develop scientific thinking. Therefore, the science learning process in elementary schools should be carried out in conditions that allow students to be actively involved in searching, discovering, exploring, and solving the problems they are facing [3].

Science learning, especially in elementary schools, should allow students to ask questions, generate ideas, and build the skills needed to foster students' natural curiosity through a direct learning process [4]. Science learning in elementary schools can train and provide opportunities for students to develop process skills. It can train students to think and act rationally and critically towards scientific problems in their environment [5]. Science learning in elementary schools emphasizes providing direct learning experiences through using and developing process skills and scientific attitudes. This means that science learning in elementary schools is taught conventionally and through various practices where students can understand the changes in the surrounding environment [6].

Based on this statement, science learning is very important, and students must understand it and be able to learn through the surrounding environment. Natural science learning should aim to build curiosity about everything around them and can develop students' abilities through direct experience. For this reason, in order for science learning to run optimally, it is necessary to use innovative learning models. The science learning model is suitable for elementary school-age children and adapts students' learning situations to real-life situations in society. Students can use learning tools and media in their environment and apply them in everyday life [7].

The facts above show that the importance of learning science is to develop students' science process skills and increase student retention (memory). So that students can understand what they have learned and apply it in everyday life. However, in reality, observations show that students' understanding in elementary school is still low. This can be seen from the mid-semester summative scores resulting from the pre-observation of 33 students in class IVB at SDN 6 Cakranegara. Only 20 students completed or obtained a score above the KKM (75), averaging 71.61. Apart from

How to Cite:
Olvyana, A. ., Ermiana, I., & Astria, F. P. . (2024). Effects of Discovery Learning Model Towards Science Process Skills and Learning Retention. *Jurnal Pijar Mipa*, *19*(1), 6–12. https://doi.org/10.29303/jpm.v19i1.6394

that, based on interviews with class IV science teachers, students rarely participated in experimental design activities, including determining tools and materials, variables, and experimental work steps. The experimental activities carried out were only guided by the teacher's instructions. This shows that the level of student involvement in learning is minimal, resulting in poorly trained students' science process skills and learning carried out in the classroom, only emphasizing mastery of concepts and learning activities that do not yet explore students' science process skills.

In general, the factors that influence students' low science process skills and learning retention occur due to a lack of learning optimization involving the role of students, which can be indicated by using less varied learning models [8]. The problems listed above are also caused by students not fully knowing the problems they face in learning. At SDN 6, Cakranegara has used several learning models, such as cooperative learning. However, science process skills and student retention are still low due to learning focusing more on delivering material to students. In the learning model, only a few stages are by science process skills such as observing, grouping, asking, and communicating. This learning model for solving problems does not reach the level of critical thinking, does not establish knowledge in the form of graphs, uses tools and materials, applies concepts, and carries out experiments. So, researchers chose the discovery learning model to help improve students' science process skills and learning retention.

From the problems above, a solution is needed, namely by using models in learning. The model that can be used is the discovery learning model. Hosnan stated that the discovery learning model is a model for developing students' active learning methods by discovering for themselves and investigating themselves so that the results obtained will be loyal, long-lasting in the memory, and will not be easily forgotten by students [9]. Discovery Learning encourages students to actively participate in finding out, thinking critically, asking questions, and understanding scientific concepts. Through this direct experience, students will be more likely to use science process skills such as observing, asking questions and searching for answers independently to improve process skills science students [10].

In the discovery learning model, students can develop science process skills well. Learning based on discovery learning (finding yourself) emphasizes students' ability to discover knowledge based on learning experiences, laws, principles, and generalizations, thus providing opportunities for developing students' science process skills [11]. Discovery Learning allows students to relate abstract concepts to real experiences. This can help increase student learning retention because knowledge will last longer or be remembered longer, which is easier to remember when compared to knowledge learned in other ways [12]. Discovery learning encourages students to develop systematic, critical, logical search and exploration activities for deeper understanding. This deep understanding tends to be more durable and useful in long-term memory [13].

Based on these problems, this research proves that the discovery learning model affects science process skills and learning retention for grade 4 students at SDN 6 Cakranegara. So, the various problems above illustrate how important science process skills and student learning retention are to be researched. So, researchers are interested in conducting research titled "The Effect of the Discovery Learning Learning Model on Science Process Skills and Learning Retention of Class 4 Students at SDN 6 Cakranegara".

Research Methods

Research methods are a scientific way to obtain valid data to develop and prove certain knowledge so that it can be used to understand, solve, and anticipate problems in the field of education [14]. This research uses quantitative research methods because the data is in numbers, and it uses statistical analysis. The type of research used is a quasi-experimental design. A quasi-experiment is research that approaches a real experiment. This research aims to directly test the influence of a variable on other variables and test the hypothesis of a cause-and-effect relationship. A quasi-experimental design has an experimental class and a control class. However, the control class cannot function fully to control external variables that influence the implementation of the experiment [15], with a pretest-posttest nonequivalent control group design. This design was used because, in this design, the experimental group and control group were not chosen randomly [16].

This research was conducted at SDN 6 Cakranegara, located on Jl. Peternakan, Selagalas, Mataram City from November 6 to November 25, 2023.The population is all class IV students at SDN 6 Cakranegara for the 2023/2024 academic year, using a non-probability sampling technique with a saturated sampling type. Non-probability sampling is a technique that does not provide an equal opportunity or chance for each element or member of the population to be selected as a sample. The sampling technique used was a saturated sample. The saturated sampling technique uses all population members as samples [17]. The sample in the research was 66 people. This research has three variables, including one independent variable and two dependent variables. Before carrying out the prerequisite analysis test, the data from the pretest and posttest will go through the N-Gain test. to see the difference in scores or averages of the experimental and control classes before and after using the discovery learning model. In this research, the N-Gain value was sought with the help of the SPSS 21.0 program.The independent variable (X) is the discovery learning model, the dependent variable (Y1) is science process skills, and the dependent variable (Y2) is student learning retention. Data was collected using observation sheet instruments and multiple choice test questions, which had been tested for validity, reliability, level of difficulty, and differentiability. Then, it was analyzed using prerequisite tests, including the Kolmogrov Smirnov normality test, homogeneity test using the

homogeneity of variance test, and hypothesis testing using the one-way ANOVA test with the help of SPSS 21.0.

Results and Discussion

Pretest-Posttest Values

According to Costa, Pre-Test/Post-Test is a highly recommended assessment tool because it is a concise and effective direct evaluation that can be used to improve student learning outcomes [18]. Pre-test and post-test scores are obtained by giving tests to students. The test questions consist of 10 questions for the pre-test and ten questions for the post-test. The pre-test is given before treatment or treatment is carried out. Meanwhile, the post-test is given after treatment or treatment, both in the control and experimental classes [19]. Below are the results of the recapitulation of pre-test and post-test scores.

Table 1. Recapitulation of Pretest-Posttest Data

Score	Pretest		Posttest	
	Exp	Cont	Exp	Cont
Max Score	80	70	90	70
Min Score	10	10	10	20
average	46.97%	39.09%	53.94%	47.27%

Based on the table above, it is known that the average value of the experimental class was 46.97%, while the control class got an average of 39.09%. For the post-test score, the experimental class obtained an average score of 53.94% and the control class 47.27%. The results of the average value indicate that there are differences between the research sample classes. Then, after obtaining the pretest-posttest scores, the N-Gain test is carried out to determine how much influence the treatment given before and after treatment has.

N-Gain Test Results

The N-Gain test aims to determine the effectiveness of using a learning model in research using experimental and control groups [20]. This research used the N-Gain test to determine the difference in scores between the pre-test and post-test scores of classes that implemented learning using the discovery learning model (experiment) and those that did not or used conventional learning with lectures (control). Calculations were carried out with the help of the SPSS 21.0 for Windows program. The results of the N-Gain score test are as follows.

Based on the test table *N-Gain*above, the N-Gain value in the experimental class was 0.475<0.7. Meanwhile, the control class obtained a value of 0.194<0.7. From the mean value, it can be concluded that there are differences in scores before and after treatment in the experimental class, which uses the discovery learning model. Then, there is a difference in the N-gain value in the experimental and control classes, where the class that uses the discovery learning model gets a greater N-gain than the control class.

Table 2. Experimental Class N-Gain Test

	N	Min	Max	Mean	Std
*Ngain*_Score	33	.10	.80	.48	.154
*Ngain*_Percent	33	10	80	47.6	15.4
Valid N(listwise)					

Table 3. Control Class N-Gain Test

	N	Min	Max	Mean	Std
*Ngain*_Score	33	0	44	.19	.14
*Ngain*_Percent	33	.00	44	19.4	13.97
Valid N(listwise)					

Data Analysis Results

Normality test

The normality test in this study, the Kolmogrov-Smirnov test, was used with a significance level of ≥ 0.05 using SPSS 21. This test was carried out for science process skills and student learning retention variables. The normality test results can be seen in the following table.

Table 4. Pretest-Posttest Normality Test and Science Process Skills

	Pert-	Class	*Kolmogrov-Smirnov*		
			Statistics	df	Sig.
Pretest-Posttest	Pert-1	Exp	.143	33	.082
		Control	.146	33	.071
	Pert-2	Esp	.148	33	.065
		Control	.152	33	.052
PPP	Pert-1	Exp	.142	33	.087
		Control	.143	33	.086
	Per-2	Exp	.151	33	.053
		Control	.134	33	.143

From the table of normality test results above, the sig value is known as pretest-posttest significance in the experimental class and control class at meeting 1 obtained a value of 0.082, and the control class obtained a value of 0.071, then at meeting two it obtained a value of 0.065 and the control class obtained a value of 0.052. Meanwhile, in the results of the KPS normality test at meeting 1, the experimental and control classes obtained significance values, namely 0.087 and 0.086. At meeting two, it was 0.053 and 0.143. The significance value is greater than 0.05, so the pretest-posttest and KPS data are normally distributed.

Kolmogrov Smirnov for the experimental class is 0.052, and the control class is 0.053, where this value is greater than 0.05. So that student learning retention data is normally distributed.

Table 5. Normality Test for Learning Retention

Tests of Normality			
Learning Retention	Kolmogorov-Smirnov		
	Statistics	df	Sig.
Experiment	.152	33	.052
Control	.151	33	.053

a. Lilliefors Significance Correction

Homogeneity Test

After the data is normally distributed, a homogeneity test is conducted to determine whether the data is homogeneously distributed. The results of the homogeneity test are as follows. Then, the results of the one-way ANOVA test of science process skills can be seen in the table below.

Table 6. Pretest-Posttest Homogeneity Test and Science Process Skills

Test of Homogeneity of Variances				
	Levene Statistics	df1	df2	Sig.
Pretest-posttest	.157	3	128	.925
	.105	3	128	.957
	.105	3	122.836	.957
	.164	3	128	.921
PPP	1.237	3	128	.299
	1.047	3	128	.374
	1.047	3	118.178	.374
	1.211	3	128	.309

From the results of the pretest-posttest data homogeneity test and science process skills, significant values of 0.925 and 0.299, greater than 0.05, were obtained, so it can be concluded that the data has a homogeneous distribution.

Table 7. Learning Retention Homogeneity Test

	Levene Statistics	df1	df2	Sig.
Learning Retention	.381	1	64	.539
	.201	1	64	.655
	.201	1	62.100	.656
	.315	1	64	.577

Based on the homogeneity test results of student learning retention data in Table 7 above, it can be seen that the sig column shows a value of 0.539 > 0.05, which means the learning retention data is homogeneously distributed.

After the pretest-posttest, KPS and learning retention data were declared normally distributed and homogeneous, and hypothesis testing was carried out. Hypothesis testing was carried out to determine whether there was a significant difference between science process skills and learning retention for students who studied using the discovery learning model. The hypothesis test used is One Way Anova with the help of SPSS 21.

Table 8. One-Way Anova Test Results

Tests of Between-Subjects Effects					
Dependent Variable: Mark					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.233a	1	2.233	10.017	.002
Intercept	139.688	1	139.688	626.625	.000
PPP	47.127	1	2.244	9.156	.000
Retention	7464.34	2	746.434	5.069	.000
PPP*Retention	75.243	2	732.200	4.075	.000
Error	14.267	64	.223		
Total	165.000	66			
Corrected Total	16.500	65			

a. R Squared = .135 (Adjusted R Squared = .122)

Based on the table above, the Fcount value of 9.156 is greater than the Ftable with df1 (numerator) = 1 and df2 (denominator) = 64, namely 3.999, so that Fcount > Ftable (9.156 > 3.999), the sig value. For science process skills, namely 0.000 < 0.05, this value shows a difference in results between students who take part in discovery learning and students who do not take part in discovery learning regarding science process skills. So, according to the basis for decision-making in the One Way Anova test, it can be concluded that H0 is rejected and Ha is accepted, which means that there is an influence of the discovery learning model on the science process skills of grade 4 students at SDN 6 Cakranegara. The discovery learning learning model gives results that there is an influence on comparing students' science process skills. It can be seen from the comparison of science process skills in the experimental class, which learns using the discovery learning model, which is greater than the control class, which learns using the conventional learning model.

The Influence of the Discovery Learning Model on Science Process Skills

The results of calculating the percentage of science process skills for each indicator (observing, classifying, communicating, and predicting) can be seen in the figure 1 and figure 2.

The percentage of 5 indicators of science process skills in the experimental and control classes above shows that the average value of science process skills in the experimental class is greater than the control class, namely 77.95% and 60.62%. It is shown that the highest indicator percentage value in the experimental class is observed with results of 81.94%, communicating with results of 81.08% and concluding 81.73%. Meanwhile, the control class obtained the highest indicator percentage results, observing 61.31% and concluding 80.33%. Both classes achieved the highest percentage indicators with different categories in classes that used the discovery learning model to help improve students' science process skills, which were carried out through

experiments during learning by the stages of the discovery learning model.

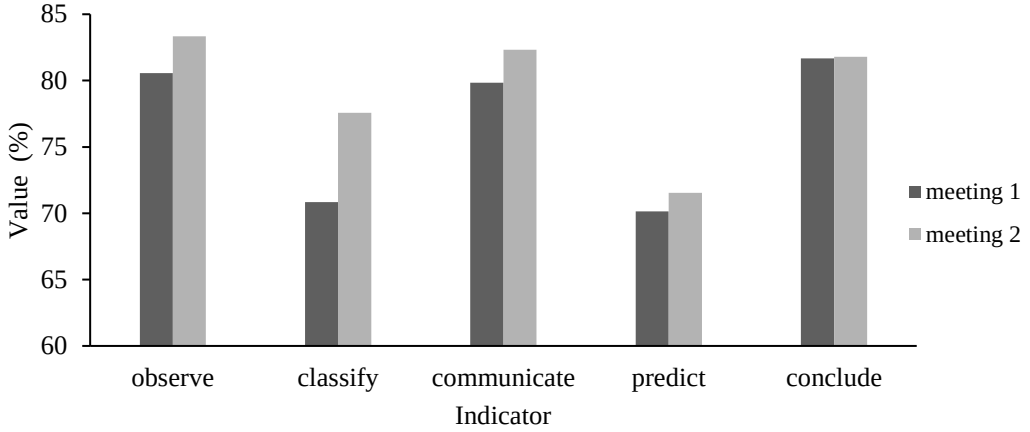

Figure 1. Comparison graph of the percentage values of the experimental class for each indicator of science process skills

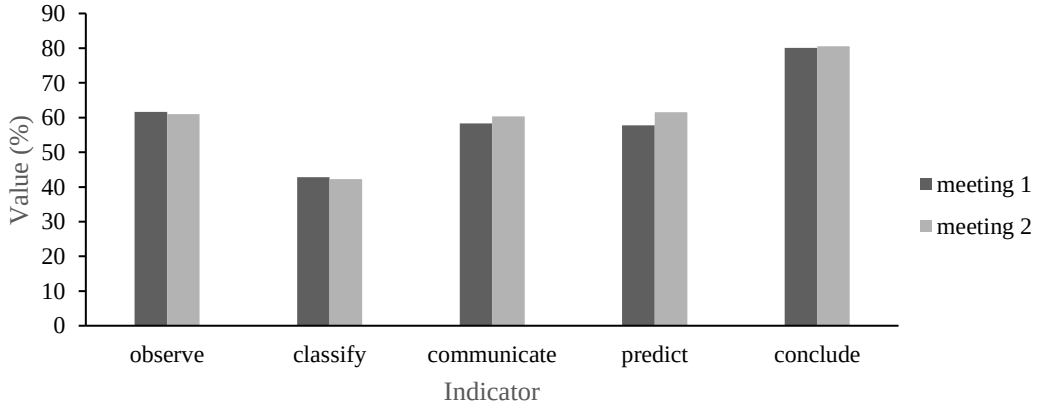

Figure 2. Comparison graph of control class percentage values for each science process skill indicator

This is in line with the results of research conducted bySepti, SE, Deswalman., Maison., & Kurniawan, D. A proved that the discovery learning model affected students' science process skills in physics subjects at SMAN 10 Jambi City [21]. Amelia, D. also expresses that the discovery learning model influences students' science process skills in acid-base indicator material at Patriot Nusantara Vocational School [22]. Research conducted by Novita, I., Mayub, A., & Swistoro, E proves that using the discovery learning model with discovery-based worksheets influences science process skills [23].

Research shows that fashion discovery learning positively influences students' science process skills. However, the applied discovery learning model still has many shortcomings, including the fact that not all students can follow the learning according to the stages of the discovery learning model and that during the experiment, the class atmosphere is not conducive. The stimulation stage requires understanding from students so that they can understand the problem. Alternatively, questions are expected to be solved through self-designed trials or experiments.

The Influence of Learning Models on Student Learning Retention

In this study, retention assessment was carried out after the post-test in the experimental class and control class using test question instruments. Learning retention is obtained from retest. Retest questions are given at intervals of two weeks after the learning process is complete. The retention question indicators used are the same as those for the pre-test and post-test questions. The retention results can be seen in the table below.

Table 9. Recapitulation of Student Learning Retention Results Data

Acquisition	Retention	
	Experiment	Control
Max Score	90	83.33
Min Score	40	35.71
Average value	65	59.52

The analysis results show that retention in the experimental class where learning was applied using the discovery learning model was higher than retention in the control class, which did not use the discovery learning model. From the table above, the maximum score in the experimental class is 90, and the minimum score is 40, while the maximum score in the control class is 83.33, and the minimum score is 35.71. Retention of good student memory influences the average retention score for the experimental and control classes, namely 65 in the medium category and 59.52 in the control class in the low category. Then, looking at

the comparison of the average retention value with the average post-test value for the experimental class and the control class with the post-test value, namely 53.94 and 47.27, the average retention value is greater and the post-test value. The average retention results were categorized according to the criteria in Hasanah, according to Setiawan [24].

From the results of hypothesis testing using the test Way ANOVA in Table 8 get Fcount for learning retention, namely 5.069, is greater than Ftable with df1 = 2 and df2 = 64, which is 3.999, so the Fcount > Ftable (5.069 > 3.999), the sig value. For learning retention, namely 0.000 < 0.05, this value shows a difference in results between classes that apply the discovery learning model and those that do not regarding student learning retention. So, according to the basis for decision making in the way anova test, it can be concluded that H0 is rejected and Ha is accepted, which means that there is an influence of the application of the discovery learning model on the learning retention of grade 4 students at SDN 6 Cakranegara.

Implementation of the Discovery Learning Learning Model

The assessment was carried out in two meetings to ensure the implementation of the learning model discovery learning used an observation sheet assessed by the observer, namely the class IVB teacher. The results of the observations that have been carried out obtained the following data:

Table 10. Data on the Implementation of the Discovery Learning Learning Model

Meeting	Total score	Percentage	Category
1	53	78.33%	Good
2	58	96.67%	Very good
Amount	111	87.5%	Very good

Table 10 above shows the results of the assessment of the implementation of the discovery learning model, which observers carried out during two meetings. This assessment obtains data at each meeting. The first meeting received an assessment of 78.33%. The second meeting obtained an assessment with a result of 96.67%. The two meetings resulted in an average of 87.5% in the very good category. So, it can be said that the discovery learning model implemented in the experimental class was implemented very well.

Conclusion

The analysis results using the One Way Anova test with the help of the SPSS 21.0 for Windows program show a significant value for science process skills of 0.000 and student learning retention of 0.000. This significance value shows that science process skills and student learning retention are less than (α= 0.05), then according to the basis of decision-making, H0 is rejected, and Ha is accepted. Therefore, it can be concluded that a) the discovery learning model has a positive effect on the science process skills of grade 4 students, b) the discovery learning model has a positive effect on learning retention.

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