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The Effectiveness of Discovery Learning Model on Students' Metacognitive

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Abstract: Studying science in school provides scientific knowledge and can also provide students with a good learning experience. The problem is the low metacognitive ability of sixth graders in the district of Demak due to the use of inappropriate learning models so that students are not active in learning. This research goal is to analyze the effect of the Discovery Learning model on the metacognitive abilities of sixth-grade elementary school students in the Demak District. The type of research is experimental (experimental research) with a quasi-experimental design, pretest-posttest group design method. The population in this research was the sixth-grade elementary school in Demak District as many as 246 students. The research sample is Karangmlati 1 public elementary school as an experimental class (discovery learning) and Karangmlati 2 public elementary school as a class with a purposeful sampling technique. The research variable is the discovery learning model as the independent variable (X) the dependent variable is the metacognitive ability (Y) test. Data analysis uses data description, the prerequisite test includes a normality test and homogeneity test, hypothesis test uses an independent sample t-test. The result of the research is that there is an effect of the Discovery Learning model on the metacognitive abilities of sixth-grade elementary school students in Demak District with t count > t-table (15.076> 2,003). The conclusion is that the sixth graders' metacognitive skills improved after the application of the discovery learning model. Teachers should use discovery learning style in classroom teaching activities as an option to improve students' metacognitive skills.

Keywords: Effectiveness, discovery learning, metacognitive ability

1. Introduction

Science learning at school provides knowledge about the natural sciences, besides that it can provide a good learning experience for students. In addition, science also provides several other learning experiences for students, such as character learning experiences which will later affect students' success in relationships with fellow humans and nature. Success in learning science cannot be separated from the motivation to learn students, both external and internal motivation (Pratama, Firman, & Neviyarni, 2019).

The process of learning science will involve the nature of science. According to Smith et al., science is essentially a product, process, and application. As a product, science is a collection of knowledge and a set of concepts and concepts. As a process, science is a process used to study objects of study, discover and develop science products, and as an application of scientific theories will produce technology that can make life easier (Smith et al., 2009).

Natural Sciences deals with how to find out about nature systematically so that it is not only mastery of a collection of knowledge in the form of facts, concepts, or principles but also a process of discovery (Susanto et al., 2022). So effective strategies are needed that make information meaningful so that it can be stored in students' long-term memory, one of which is learning strategies that can improve students' metacognition (Ramdani et al., 2021).

Metacognition is a person's knowledge of their cognitive processes or awareness of anything related to themselves. explains that metacognition is a concept related to the ability and awareness of one's thinking (Gomes & Golino, 2014). Metacognition is a person's awareness of his thought process, which is a form of cognition or thought process of two or more levels that involves controlling cognitive activity (Bahri & Idris, 2017). Metacognitive abilities as part of the self-regulation process, although we are aware that self-regulation cannot be reduced to metacognitive abilities (Fathurohman & Cahyaningsih, 2021).

Metacognition is awareness of self-cognition, how cognition works and how to regulate cognition itself (Fleming & Lau, 2014). The metacognitive component of Flavell consists of two components, namely: 1) metacognitive

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knowledge; and 2) metacognitive experience or regulation (Nurkaeti, 2018). Students need to have metacognitive abilities because in principle if it is associated with the learning process, students who have good metacognitive abilities will show better learning achievements than students who have low metacognitive abilities.

The facts at the Karangmlati 1 Demak elementary school show that the average mid-semester assessment result on September 14, 2021, in science subjects only reached 48 of the minimum completeness criteria of 70, and students who finished studying only reached 35%. This is because the teacher's learning process is only on cognitive goals, without paying attention to the dimensions of cognitive processes, especially knowledge and metacognitive abilities. Students are not active and do not pay attention when learning. Educators have an active role in the learning process compared to students who only receive, record, and memorize subject matter and making educators the only source of acquiring knowledge. The low understanding of students because students do not have an awareness of how he learns. This results in the awareness of students to achieve learning goals which are still low.

The learning that has been done so far is more oriented towards evaluation and giving daily assignments. teachers only use available teaching resources and materials, namely textbooks. Student activities are only limited to doing written assignments from the teacher and working on evaluation questions. The limited role causes students to be passive. As a result, students cannot understand concepts, especially in science learning. The ability that can affect students' mastery of concepts is metacognitive. Good metacognitive awareness will encourage students to become independent learners. Students who have good metacognitive awareness will be able to know and be aware of their strengths and weaknesses and be aware of their abilities. After realizing they can do metacognition, then students will be skilled in doing metacognition if they do the exercises continuously (Ramdani et al., 2021).

An innovative learning strategy is needed which is expected to be more effective and efficient and can provide opportunities for students to construct their knowledge based on their cognitive maturity. One alternative that can be applied is discovery learning. The discovery learning model is a learning model that regulates teaching so that children gain knowledge that they previously did not know not through notification, but were discovered by themselves (Amin et al., 2021). Discovery learning is finding a concept through a series of data or information obtained through observation or experiment (Abdullah, 2013)

Discovery learning emphasizes more on students being directly involved in investigating and drawing conclusions and the teacher as a guide to help students use the ideas, concepts, and skills they have learned to find new knowledge (Karuniawati et al., 2022). The use of discovery learning models in the teaching and learning process allows students to find information for themselves that is traditionally just told or lectured.

The Discovery learning model is student-centered learning (student central learning) where this learning model requires students to be active in learning. teaching, individual, object manipulation, and other experiments, before arriving at generalizations. Discovery Learning will make students active in expressing ideas and can help students to strengthen their learning concepts so that it can indirectly increase their confidence of students (Febrian & Astuti, 2018). This will have an impact on students' metacognitive improvement.

Andriani's et al., research proves that discovery learning has very high practicality in improving students' metacognitive abilities (Andriani, Rudibyani, & Sofya, 2017). Research from Setiawati & Sari (2021) proves that the application of discovery learning models affects students' cognitive abilities. Discovery Learning is not only able to improve students' metacognitive abilities but is also able to improve communication skills and student learning outcomes, this is evidenced by several studies from Aprioda et al. (2021); Fauzi & Respati (2021); Setiaji, Suherman, & Kuswanto (2019) and Asih & Ramdhani (2019) which show that there is an influence of the discovery learning model learning on communication skills and there is an increase in students' mathematical communication skills, while the research of Pratiwi & Manuaba (2021); Simamora & Saragih (2019); Kurniawati, Anitah, & Suharno (2017) and Suryawati & Osman (2017) with the results of the research that discovery learning can improve student learning outcomes.

1.1 Conceptual Framework

Based on the results of observations showed that the average value of the mid-semester assessment in science lessons was still low. This is because in the learning process the teacher has not only emphasized cognitive goals, without paying attention to the dimensions of cognitive processes, especially metacognitive knowledge.

The low level of students' metacognitive abilities requires strategies and learning models that can improve their metacognitive abilities. Discovery learning is a learning model that arranges in such a way that children acquire knowledge that is not yet known, not through notification, partly discovered by themselves. The use of the Discovery learning model in the teaching and learning process allows students to find for themselves information that is traditionally just told or lectured. Discovery learning is finding a concept through a series of data or information obtained through observation or experimentation (Slamet et al., 2021). With discovery learning, it is hoped that students will be able to improve their metacognitive abilities through group discussions and discovery learning.

1.2 Research Objectives

The purpose of this research is to analyze the effect of the Discovery teaching and learning approach on the metacognitive abilities of fourth-grade elementary school students in the Demak District.

2. Methodology

The method used in this research is experimental. Experimental research is research conducted through a scientific approach using two sets of variables. The general purpose of experimental research is to examine the effect of a particular treatment on the symptoms of a particular group compared to other groups using different treatments (Sugiyono, 2013).

2.1 Research Design

The design of this research is a Quasi-Experimental Design with a nonequivalent control group design type. According to Sugiyono (2017), Quasi-Experimental Design is an experimental design that has a control class but does not fully function to control external variables that affect the implementation of the experimental class. The form of the research design can be seen at Table 1.

Table 1: Research design

Group	**Pre-test**	**Variable**	**Post-test**
Experiment Class	O_1	X_1	O_3
Control Class	O_2	X_2	O_4

Information :
O1: Pre-test in the experimental class
O2: Pre-test in the control class
O3: Post-test in the experimental class
O4: Post-test in the control class
X1: Blended learning assisted by PowerPoint media
X2: Conventional learning

2.2 Population and Sample

The population is an area of generalization of objects/subjects that have certain qualities and characteristics that are determined to be studied and then conclusions are drawn (Sugiyono, 2013). The population in this study were fourth-grade students at Elementary School No. 1 Dabin, Demak District. According to (Sugiyono, 2017), the sample is part of the number and characteristics possessed by the population. In this study, the research sample was taken using a purposive sampling technique. The following is a Table 2 of the number of samples in this study.

Table 2: Research sample

No.	**Location**	**Total students**	**Information**
1	Public Elementary School No. 3 Karangmlati	32	Discovery learning models
2	Public Elementary School No. 2 Karangmlati	28	Conventional

2.3 Data Collection Technique

Data collection techniques used in this study were documentation, observation, and tests. Documentation was used to collect data and then analyzed. The documentation used in this study includes the syllabus, lesson plans, and research photos. In addition to class administration, the documentation method was used to obtain initial data including student names, PTS scores, and test scores required at the time of the study.

Observation is the "systematic observation and recording of the elements that appear in a symptom in the object of research (Widoyoko, 2013). Observation is used to determine directly the learning that causes the average value of PTS natural science to be low. Observational data is used as data to show the learning process as a reference for carrying out learning with a better learning model. Tests are several questions that require answers or several statements that must be given response or response to measure a person's level of ability or reveal certain aspects of the person being tested. The purpose of the test in this study was to measure students' metacognitive abilities on light material at Elementary School No. 1 Dabin, Demak District.

2.4 Research Variable

Research variables are everything in any form determined by the researcher to be studied, so that information is obtained about it, then conclusions are drawn. The variables of this study include the independent variable the discovery learning model used in class IV and the dependent variable in this study is student metacognitive.

2.5 Research Instruments

The research instrument is a test. The test is used to measure students' metacognitive abilities. A test is a form of description with a total of 25 description questions in the natural science lesson of light matter. The score of the questions is 0-3. 0-did not answer, 1= answered but was wrong, 2= answered correctly without explanation, 3= correct with explanation.

2.6 Data Analysis Technique

Data analysis techniques include instrument testing (validity test, reliability test, discriminating power test, and test difficulty level). The analysis prerequisite test was carried out after the test of the validity of the questions, namely the normality test and the homogeneity test. Hypothesis testing was carried out by Independent Sample Test and normality gain test (N-gain).

3. Findings and Discussion

3.1 Metacognitive Ability

Data on students' metacognitive and communication abilities in the experimental class and control class were obtained from the posttest of students' metacognitive abilities. The following are the results of the data description based on the initial and final metacognitive in the control class and experimental class

Table 3: Early metacognitive ability

	Discovery class	Control class
N Valid	32	28
Mean	25.38	31.54
Median	26.00	30.00
Std. Deviation	6.603	8.626
Minimum	11	15
Maximum	37	54

Table 4: Final metacognitive ability

	Discovery class	Control class
N Valid	32	28
Mean	81.28	58.57
Median	81.00	57.50
Std. Deviation	7.973	12.911
Minimum	65	28

Based on the initial metacognitive table, it shows that the average value of the control class and discovery learning class is almost the same, this means that the initial metacognitive control of the control class and the experimental class is almost the same. Meanwhile, the final metacognitive shows that the average acquisition of the discovery class is higher than the control class.

The final mean value means that there is a significant difference between the control class and the experimental class. This significant difference is because in the experimental class using the discovery learning model, students can get learning models designed so that students can find concepts and principles through their mental processes. Discovery Learning students can find the concept independently and strengthen the concept of biology because it gains students' confidence to work together with others, thus strengthening students' memory and training metacognitive abilities. This is supported by research by Mawaddah & Maryanti (2016) that the discovery learning model in this study can significantly improve students' conceptual understanding abilities.

3.2 Hypothesis Test

Independent sample t-Test was used to test the hypothesis. The purpose of the t-test is to compare the averages of two groups that are not related to each other (two independent samples) so that it can be seen whether the two samples have the same average or not. The decision-making for the t-test is:

- If t count t table then Ho is accepted and Ha is rejected
- If t-count > t-table, then Ho is rejected and Ha is accepted.

The statistical hypothesis is:

Ho: There is no difference in the effect of the discovery learning model on the metacognitive abilities of fourth-grade elementary school students in Demak District with conventional learning

Ha: There is a difference in the effect of the discovery learning model on the metacognitive abilities of fourth-grade elementary school students in Demak District with conventional learning.

Table 5: t-Test results

Group Statistics

	Class	N	Mean	Std. Deviation	Std. Error Mean
Nilai Metacognitive	Experiment (Discovery)	32	81.28	7.973	1.409
	Control (Conventional)	28	58.57	12.911	2.440

Table 6: Independent samples test

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai Metacognitive	Equal variances assumed	5.160	.227	8.308	58	.000	22.710	2.733	17.238	28.181
	Equal variances not assumed			8.059	43.778	.000	22.710	2.818	17.030	28.389

The results of the hypothesis t-test are the average values for the two classes there are differences in the statistical group. The discovery class is 81.28, while the control class is 58.57. The t-count value is 8.308, while the t-table with df = 58 is 2.0017, so t-count > t-table or 8.308 > 2.0017. Because t count > t table, then Ha is accepted, meaning that there is a difference in the effect of the discovery learning model on the metacognitive abilities of fourth-grade elementary school students in Demak District with conventional learning. The Discovery learning model has a greater influence than conventional learning (control class).

Constructivism learning theory emphasizes the knowledge built by students themselves as experiences that have been carried out (Clark, 2018). According to constructivism, learning is an active process of students in constructing meaning, discourse, dialogue, and physical experience in which there is a process of assimilation and linking of experiences or information that has been learned. This is following the discovery learning model. Discovery is a mental process when students assimilate a concept or a principle.

The basic idea of discovery learning is that because students can design their experiments and conclude their own rules/concepts, they are building their knowledge. Discovery learning has advantages compared to other learning models. Bruner (Ministry of Education and Culture, 2013) suggests that the learning process will run well and creatively if the teacher allows students to find a concept, theory, rule, or understanding through examples encountered in their lives. This can happen because in the discovery learning model students are involved to develop and present the results of observations to solve problems. So that through this activity, students are easier identify errors, assess answers and correct wrong or inappropriate methods. Thus, by training students through this discovery learning model, monitoring skills can be improved properly.

Research by Susanti et al. (2020) with results from research showing that: 1) there is an effect of the POE type Discovery Learning learning model on metacognitive abilities; 2) there is an effect of learning activities on students'

metacognitive abilities; 3) there is no interaction between the POE type Discovery Learning learning model and learning activities on students' metacognitive abilities. The Discovery Learning model is learning that involves active students in the learning process.

Research by Erianti & Miranda (2021) with the results of the study, the average value of the post-test and metacognitive abilities of students in the experimental group was higher than the control group. The Discovery learning model is important in the learning process because the learning model emphasizes direct experience and the importance of understanding the structure or important ideas of a discipline, through active student involvement in learning. The results of this study are reinforced by the results of research from Ramdani et al. (2021) is the application of the discovery learning model has a positive influence on students' metacognitive skills and has a positive effect on students' cognitive learning outcomes.

4. Conclusions and Recommendations

Based on the results of research and discussions that have been carried out with the title of the effect of discovery learning models on the metacognitive student's skills, it can be concluded that there is an effect of models discovery learning models approach on the metacognitive abilities of fourth-grade elementary school students in Demak District.

Teachers should implement discovery learning models into teaching and learning activities in the classroom as an alternative that can be done to improve students' metacognitive abilities.

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