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IMPROVING GRADE 9 SCIENCE PROCESS SKILLS OF SMPN 5 PROBOLINGGO USING DISCOVERY LEARNING MODEL

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Abstract

Science process skills are important for students when learning science and their applications in everyday life because through a series of process skills, the knowledge gained becomes more meaningful and, in the end, students have a way of thinking and doing activities as a scientist through the scientific method. In reality, the science's students process skills have not been maximal, especially in formulating problems and hypotheses. This research is a Class Action Research conducted with two cycles consisting of the stages of planning, implementation, observation, and reflection. The research subjects were grade 9 students of IXA class of SMPN 5 Probolinggo. Data collection using documentation, observation, and test methods. The data in this study include learning implementation data and science process skills of students. The results of this study indicate that discovery learning can improve the science process skills of students in the IXA class of SMP Negeri 5 Probolinggo. The percentage of learning implementation increased from 88.87% to 97.92%, while the students' science process skills increased from 73.50% to 96.50%.

Keywords: *science process skills, classroom action research, discovery learning*

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PENDAHULUAN

Learning is a scientific process where a scientific approach is needed in the process of learning. The scientific approach is believed to be a golden bridge for the development and development of students' attitudes, skills, and knowledge. In approaches or work processes that meet scientific criteria, scientists prioritize inductive reasoning rather than deductive reasoning. Deductive reasoning looks at general phenomena to then draw specific conclusions. On the contrary, inductive reasoning views specific phenomena or situations and then draws conclusions as a whole (Kemendikbud, 2013).

The learning process in the 2013 Curriculum for junior high school or equivalent is carried out using a scientific approach. The scientific approach to teaching and learning is the interaction between the teacher and students, the teacher more involved the role of students in learning. But in reality, currently there are still many obstacles, learning conditions in the field have not provided more opportunities for students to develop their own abilities. Learning centered on students requires the role of the teacher in optimizing the activeness of students in learning and maximizing the interaction of teachers with students as well as interactions between students. Based on this statement, students gain learning experience if a teacher facilitates learning activities oriented to the acquisition of students' learning skills where the learning process and outcomes are two important things in learning.

Each subject has special characteristics in the learning approach. Science learning places more emphasis on the application of process skills. Aspects of the scientific approach (scientific approach) are integrated into the process skills approach and the scientific method. Process skills are a set of skills used by scientists in conducting scientific investigations. These skills that are trained are known as science process skills. Process skills need to be developed through direct experiences as learning experiences. Through direct experience, a person can better appreciate the process or activity being carried out.

Science process skills are very important for everyone to learn and master. If someone has mastered the process skills, then that person has mastered the skills needed in high-level learning, namely conducting research and solving problems. Problem-solving and research skills are life skills and therefore are the highest learning outcomes students must learn. Therefore, learning becomes less optimal if students are only listeners, students themselves need to master the science learning concept so that the learning process they receive becomes more meaningful. Science process skills are skills that apply the whole scientific method. According to Nur (2011) states that process skills consist of observing, measuring, calculating, classifying, making and using tables, making and using graphs, asking questions, developing hypotheses, planning experiments, identifying variables, controlling variables, formulating operational definitions, interpreting data, make a model, making conclusions, prediction, and communication.

The results of observations at SMP Negeri 5 Probolinggo, the science learning process has implemented various methods, such as demonstrations, experiments, or discussions. In the teaching and learning process, especially experimental activities, the teacher prepares student worksheets that contain the steps of the activities carried out namely collecting data, analyzing data, and making conclusions. In fact, students are not used to and find it difficult to apply scientific approaches, especially the skills of formulating problems and hypotheses. In addition, the participation of students in investigative activities through practicum is still not optimal even though the participation can encourage students to ask questions, formulate hypotheses, conduct experiments, use tools to collect data, analyze data, conclude and argue to develop students' science process skills and make students learn actively in finding concepts.

Based on these observations, the researcher strives to make the science process skills of students in accordance with expectations. One alternative problem solving is that in the learning process the teacher gives students the opportunity to identify as many agendas as possible that are relevant to the subject matter, then one of them is chosen and formulated in the form of problem formulation. The goal is that students are accustomed to finding problems and formulating hypotheses. Teachers need to design a science learning so that learning objectives are realized as expected, namely that students are active in building their own knowledge, and are able to use their reasoning in understanding and solving problems faced. Learning that emphasizes the activeness of students to find their own concepts including discovery learning. Discovery learning is a learning model developed by Bruner based on a cognitive view of learning and constructivism principles (Depdiknas, 2005). Slavin states that learners learn through active involvement with concepts and principles for themselves (Depdiknas, 2005).

Discovery learning emphasizes the discovery of concepts or principles that were previously unknown. The principle of learning that seems

clear in discovery is the material or lesson material delivered is not conveyed in the final form but students are encouraged to identify what they want to know followed by finding their own information then organizing or forming (constructive) what they know and understand. in a final form (Kemendikbud, 2013). Learning discovery is learning that involves students in solving problems for the development of knowledge and skills (Istiana, Nugroho, Saputro, & Sukardjo, 2015). Through discovery, students learn intensively by following the scientific investigation method under the supervision of the teacher. So learning is designed, supervised, followed by investigative methods. Three main characteristics of learning to find (discovery), namely: exploring and solving problems to create, combine and generalize knowledge; student-centered; and activities to combine new knowledge and existing knowledge.

Implementation of discovery learning repeatedly can improve the ability of self-discovery of the individual concerned. The use of discovery wants to change the passive learning conditions into active and creative. Changing teacher-oriented learning to student-oriented. Thus discovery learning can improve students' science process skills.

METHOD

This research is a Classroom Action Research (CAR) carried out with two cycles consisting of the stages of planning, implementation, observation, and reflection carried out in each cycle. The research subjects were 32 grade 9 students (16 female and 16 male). Data collection in this research was carried out by the method of documentation and observation. The data in this study include data: (1) the implementation of discovery learning, (2) the science process skills of students. The following data, data sources, and instruments used in this study are presented in the following Table 1.

Table 1. Data, Data Sources, and Instruments

Data Types	Data Sources	Instrument(s)
The implementation of discovery learning	Teachers and students	Observation sheet on the implementation of learning & field notes
Students' science process skills	Students	Performance observation form

Data collected in this study were further analyzed descriptively. This analysis is done to describe the implementation of learning and science process skills of students.

RESULT AND DISCUSSION

1. Results of Cycle I

a. Planning

At the planning stage a syllabus is prepared, lesson plans (RPP), student worksheets (LKS), Learning Implementation Observation Form, Student Science Process Observation Form. and Field Notes Form. In cycle I discussed about Reproduction in Plants.

b. Action Implementation

Cycle I held 3 (three) meetings. The first meeting was Tuesday 30 August, the second meeting was Wednesday 31 August, and the third meeting was Tuesday 6 September. The first meeting discussed asexual reproduction material on angiosperms plants, the second meeting, sexual reproduction material on angiosperms plants, the third meeting, fertilization material, and seed distribution. Each meeting, the teacher applies the discovery learning steps, namely: 1) stimulation (stimulation) to develop and assist students in exploring the material. The teacher asks the question "how are sansevieria plants planted?". The teacher lures students to ask questions related to reproduction in plants and gives students the opportunity to explore based on the questions asked. 2) problem statements (identifying problems) that are relevant to the lesson material, then one of them is selected and formulated in the form of a hypothesis.

The third step is data collection (collecting data) various relevant information, reading books, observing plant objects. The teacher guides and directs students to continue the activities of finding and collecting data. As a group of students observe a variety of plants to identify asexual reproduction in plants. 4) data processing (processing data) from observations. Data processing is also linked to answering questions in student worksheets.

The fifth step is verification by doing careful scrutiny to prove whether or not the hypothesis set earlier with alternative findings and related to the results of data processing. Learners discuss to verify the data of the results of experiments/observations made with the data in the relevant sourcebook. 6) generalization which can be used as a general principle and applies to all events or problems that are the same, taking into account the results of verification. One group presented the results of observations and

discussions that had been done, the other group gave responses, opinions, questions, and suggestions. The teacher guides students to draw conclusions and provide reinforcement for the material they have learned.

The series of activities above was also carried out for the second and third meetings. Two observers made observations by completing the Learning Implementation Observation Sheet, the Student Science Process Observation Sheet and the field notes sheet that was used to record matters related to activities that had not been recorded in the observation sheet. At the fourth meeting, a written test was carried out to describe the level of student learning achievement after studying reproduction material on angiosperms.

c. Observation Results and Evaluation

1). Teacher Activities during Learning Processes

Learning activities are one of the focuses in this action research. Observations made on the implementation of the stages of learning in accordance with the discovery learning model. The following data are the results of observations during Cycle I (Table 2).

Table 2. The Observations Result in the Cycle I

The Syntax of Discovery	Average Score of Learning Implementation		
	TM 1	TM 2	TM 3
Stimulation	3	3	4
Problem Statement	3	4	4
Data Collection	4	4	4
Data Processing	3	3	4
Verification	4	4	4
Generalization	3	3	3
Average	**3.33**	**3.67**	**3.83**
Average (%)	**83.30**	**87.50**	**95.80**
Average	**88.87%**		

Notes: TM: meeting. Criteria for percentage: 80% - 100% = very good, 60% - 79% = good, 55% - 59% = sufficient, 50% - 54% = low, and ≤ 49% = very low.

Based on the results of observations of the implementation of discovery learning in the first cycle it is found that in general the average percentage of implementation of discovery learning observed was 88.87% or categorized as very good, while the average of each meeting experience increased from 83.30% in the first meeting to 87.50% on the second meeting and 95.80% on the third meeting.

The implementation of learning in class in the data collection and verification steps in the reproduction material in plants is carried out well according to the rules as evidenced by an average score of 4 (four) for the first to the third meeting. On the other hand, the generalization step provides the lowest average score, which is 3 (three) for the three learning meetings in the class going quite well and in accordance with the learning rules.

2). Science Process Skills

Science process skills are a form of science as a process. In learning science, it is very important to help students especially in solving problems faced by students in their interactions in class. In solving these problems, teachers can elaborate on 21st-century learning, especially discovery learning. Intellectual process skills expected in learning science are based on inductive principles, namely how to explain and predict, observe and record data, identify and control variables, make graphs to find relationships, design and carry out scientific investigations, use technology and mathematics during investigations (Verawati & Prayogi, 2016). Data on students' science process skills obtained from the observation sheets of students' science process skills (SPS) are presented in Table 3.

Table 3. The Average Score and Percentage of SPS Observations in the cycle I

Level of Performance Capability	SPS Score	Percentage of SPS Results	Achievement Categories	Letter Grade
Formulating problems and hypotheses	2.7	67.50%	Sufficient	C
Doing an experiment	2.9	72.50%	Good	B
Processing data from experiments/observations	3.0	75%	Good	B
Making a conclusion	3.0	75%	Good	B
Presenting and respond to the results	3.1	77.50%	Good	B
Average	**2.94**	**73.50%**	**Good**	**B**

Based on Table 3 above it can be seen that the average results of the ability of process skills based on the results of observations in the first cycle of 73.50% with a good category. The average score of the results of the science process skills in students' performance abilities is still below 3.0, but the ability to present and respond to the presentation of results is the performance ability of students who get the highest score, which is 3.1.

Based on the results of the first cycle of the application of discovery learning to improve the science process skills have shortcomings so that reflection is carried out in the following cases: (1) the implementation of learning reaches 90.50% must still be improved because there are several steps in the implementation of discovery learning that is not perfect; (2) takes longer than the direct method. This is because understanding this strategy requires long stages and the ability to make the best use of time. (3) students are still experiencing difficulties and need a long time to submit problems and formulate hypotheses; and (4) the results of the observation of science process skills still need to be improved even though the average is already in the good category, but when students formulate the problem and the hypothesis is still obtained a score of 2.7 or 67.50% with a sufficient category. The reflection activities above are used as an evaluation, identification and also guidelines which the teacher tries to improve in the second cycle.

2. Results of Cycle II

a. Planning

Based on the reflection on the implementation of discovery learning model in cycle I, it is necessary to make an improvement plan to proceed to cycle II. Improvements in cycle II in the form of (1) implementation of discovery learning that has not been optimally implemented in cycle I needs to be optimized in cycle II learning; (2) time management is tightened; (3) the teacher gives more intensive guidance in formulating problems and hypotheses; and (4) students' science process skills are maximized. The teachers need to look for levels of science process skill indicators which values are still low and improved in the next cycle.

b. *Action Implementation*

In cycle II, 2 meetings were held. The first meeting was Tuesday, September 13, the second meeting was Wednesday on September 14. The syntax of learning used in cycle II is the same as cycle I with the material Reproduction in Animals.

c. Observation Results and Evaluation

1). Teacher Activities during Learning Processes

Data from observations of the implementation of discovery learning in cycle II can be seen in the following Table 4.

Table 4.The Observations Result in the Cycle II

The Syntax of Discovery	Average Score of Learning Implementation	
	TM 1	TM 2
Stimulation	4	4
Problem Statement	4	4
Data Collection	4	4
Data Processing	3	4
Verification	4	4
Generalization	3	3
Average	**3.66**	**3.83**
Average (%)	**91.67**	**95.83**
Average	**93,85%**	

Based on observations data on the implementation of discovery learning, the average percentage of learning achievement in the second cycle was 93.85% with details of the 1st meeting was 91.67%, and the 2nd meeting was 95.83%.

2). Science Process Skills

Based on the average score of observations of scientific workability for each meeting in the second cycle, obtained the average score and percentage in Table 5.

Table 5. The Average Score and Percentage of SPS Observations in the cycle II

Level of Performance Capability	SPS Score	Percentage of SPS Results	Achievement Categories	Letter Grade
Formulating problems and hypotheses	3.8	95.00%	Very Good	A
Doing an experiment	3.9	97.50%	Very Good	A
Processing data from experiments/observations	3.9	97.50%	Very Good	A
Making a conclusion	3.8	95.00%	Very Good	A
Presenting and respond	3.9	97.50%	Very Good	A

Level of Performance Capability	SPS Score	Percentage of SPS Results	Achievement Categories	Letter Grade
to the results				
Average	**3.86**	**96.50%**	**Very Good**	**A**

Based on Table 5 above it can be seen that the average results of the science process skills of students in the second cycle amounted to 96.50% with a success rate included in the very good category (A). Based on data exposure at the observation stage of the implementation of learning in the second cycle of 93.85% to conduct activities/experiments, process data on the results of experiments / observations, and present and respond to the presentation of results. In general, the average science process skills of students averaged 96.50%.

3. Discussion

The implementation of discovery learning in cycle I give a percentage of 88.87%, because, in learning reproduction in animals, teachers still need more time, especially when formulating problems and hypotheses. This is supported by the opinion of Sanjaya (2006) where one of the weaknesses of discovery learning, which requires a long time in its implementation. The ability of the teacher in the first cycle in terms of applying the data collection and verification step is very good, in the sense, the interaction between the teacher and students when the two steps go according to the rules made by the teacher in the learning implementation plan. On the other hand, the implementation of discovery learning in the generalization step provides the lowest average score, which is 3 (three) for three meetings where the interaction between the teacher and students in the class runs quite well and in accordance with the learning rules contained in the lesson plan.

The low score on the generalization step is probably due to the teacher still having difficulty in managing time, while on the part of students is caused by the lack of students' readiness in learning the material. The problem of time allocation to the application of discovery learning is that it often happens, the allocation of time given during adventure activities in the school environment in cycle II requires more time than cycle I. The length of time is caused because students need adjustments in making observations to then be accepted as their initial knowledge (Sari, 2014). The implementation of learning in cycle I, which was only 88.87%, was caused by several steps that had not been maximally implemented, namely: (a) the implementation of the first meeting took longer because students were not accustomed to discovery learning, even though previously given an explanation of how the learning model. An example is when raising a problem and formulating a hypothesis; (b) at the stimulation stage (creating the situation), the first and second meetings, when the teacher explores the students' initial knowledge by giving introductory questions to link the concepts to be learned with the concepts students have. There are still some students who have not fully concentrated so that they do not immediately respond to questions of concentration and motivation from the teacher; (c) in the second stage, namely the problem statement (question / problem identification), the first meeting of students is still having difficulty formulating the problem and the hypothesis so the teacher needs to explain again how to formulate the problem and the correct hypothesis; (d) in stage four of the first and second meetings some did not have maximum discussion and some joked that they did not immediately complete this stage; and (e) in the final stages of learning, that is, during reflection there are still many students who do not complete their work and there are some who see the work of their friends. In the first cycle observation activities also found there are students who are still trying and see the answers from their friends (Fatmasari, 2014).

However, with great effort and some experience as an exercise, the learning can be carried out properly and precisely in accordance with the allocated time provided. The implementation of discovery learning in the second cycle increased from 88.87% to 97.92%. Based on the increase in the implementation of learning, it can be concluded that the increase in the percentage of discovery learning is due to researchers making improvements to learning. Deficiencies that occurred in cycle I was corrected in cycle II. This is in line with the statement of Arends (2008) that the implementation of learning increases due to the improvement and improvement of learning conducted, and the opinion of Albab (2012) cited in Suprihatin, Isnaeni, & Christijanti (2014) states that discovery learning places students right in the middle of the learning process, so students actively seek their own information through observation, experimentation, active discussion and exchange of opinions to prove the theory or facts about the material being studied in order to get a conclusion.

The average score of the results of the science process skills cycle I in the students' performance ability is still below 3.0 or is still classified as a

good category. The ability to present and respond to the presentation of results is the performance ability of students who get the highest score of 3.1 or categorized as good because students are very enthusiastic in doing practical activities while formulating problems & hypotheses are skills with a low score of 2.7 which is categorized This is enough because students are not accustomed to formulating problems and hypotheses.

The science process skills of students have increased from cycle I to cycle II by 23%, from 73.50% to 96.50%. This is in line with the implementation of discovery learning by providing feedback on science learning, not only helps students in understanding the material, but also increases positive feelings and attitudes during and after learning takes place, which in turn has an effect on improving Science process skills of students (Abungu, Okere, & Wachanga, 2014). Also supported by Adji & Huda's research (2016) states that the increase in the percentage of the average scientific work of students comes from observing scientific work during learning based on aspects of scientific work being trained, namely using tools and materials, collecting data, analyzing data, concluding and communicating experimental results.

Based on these results finally, discovery learning applied to 9 grade students of SMP Negeri 5 Probolinggo can improve students' science process skills. Based on the description above, an increase in the science process skills of students due to various factors. One is that the learning process must be packaged into a process of reconstructing, not receiving information/knowledge from the teacher. Learners build their own knowledge through active involvement in the learning process. The application of discovery learning has advantages in helping students to improve and enhance their cognitive skills and processes. In addition, the knowledge obtained is very personal and effective because it strengthens understanding, memory, and transfer (Widiadnyana, Sadia, & Suastra, 2014). According to Rustaman (2005), the need for science teachers to design science-based learning programs based on discovery has been emphasized for a long time by education experts and science education experts. Sardiman (2010) argues that real knowledge for students is something that is built or discovered by students themselves. So knowledge is not a set of facts, concepts or rules that students remember, but students must reconstruct that knowledge and then give meaning to real experiences. Students are trained to solve problems, find something useful for themselves and wrestle with ideas and then be able to reconstruct them.

CONCLUSION

Based on the data and discussion of research results, the conclusion is that discovery learning can improve the grade 9 students' science process skills of SMP Negeri 5 Probolinggo. The most important is the teacher who want to implement the discovery learning model should have a concrete understanding of discovery learning model and its application in the science learning process in the classroom so that it can be used as a reference to improve the learning process and management of learning in class and before carrying out learning it is necessary to plan carefully and consider the allocation of time so that the implementation of learning is in accordance with plan.

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