

IMPROVING STUDENTS' SCIENCE PROCESS SKILLS THROUGH THE APPLICATION OF LEARNING MODELS DISCOVERY LEARNING IN SENIOR HIGH SCHOOL

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Abstract

This study aims to describe the improvement of learning outcomes of students' science process skills by applying the Discovery Learning model. This research method uses Classroom Action Research which is carried out over a period of three months, where each cycle contains stages of planning, implementing, observing, and reflecting on the actions given. The research subjects were class XI MIPA 1 students with a total of 32 people. The data collection method uses a student science process skills learning outcomes test, which includes ten indicators: observation, grouping, interpreting, predicting, asking, hypothesizing, utilizing tools/materials, conducting experiments, applying concepts, and communicating. The results showed that the average student learning outcomes in the first cycle were obtained at 65.94 with a classical completeness of 68.75% (sufficient category) and an N-Gain Score of 0.37, and cycle II obtained an average student learning outcome of 86.09 with a classical completion of 100% (excellent category) and an N-Gain Score of 0.60. Student learning outcomes between cycle I and cycle II show that through the application of the learning model, discovery learning effectively improves students' science process skills.

Keywords

Discovery Learning, Science Process Skills, Learning Outcomes



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INTRODUCTION

Science process skills are skills that can be trained and developed in students towards the learning process. "This scientific process consists of several indicators, including observation, grouping, observation, predicting, asking, hypothesizing, conducting experiments, utilizing tools or materials, applying concepts, and communicating (Kemendikbud, 2013; Rustaman, n.d.; Yuliati, 2016)". The importance of this skill is not only based on basic knowledge in collecting data based on observation but also makes it easier for students to solve various problems in learning when connected with students' daily lives.

In this 21st century, one of the skills that must be developed in students in the 2013 curriculum is science process skills. It aims to help make it easier for students to face and find solutions to solving problems in learning (Furoidah et al., n.d.; IAIN Batusangkar dan IAIN Batusangkar Press et al., 2020). In addition, important science process skills are built and applied in the classroom learning process so that students not only gain knowledge from theory but also obtained from experimental activities carried out by activity-based students. This is what can arouse students' curiosity to gain new knowledge because the science process skills contain scientific methods in seeking, finding, and developing the knowledge they have because they are directly involved in the learning process in the classroom (Vivi Ningrum & Indrasari, 2019).

Some of the fundamental reasons for the need to train science process skills in students are that the teacher's activities in teaching in the classroom are not enough time to teach all the subject matter contained in the curriculum. For this reason, one of the solutions to the problem is to involve students directly in the process of learning activities where the role of the teacher as a facilitator in the success of the goals to be achieved based on the Education curriculum by applying the right learning model, namely Discovery Learning (Kasanova et al., 2022; Lidiana & Taufik, 2018).

However, the results of observations that have been carried out at SMA Negeri 1 Onohazumba in class XI MIPA 1 by researchers, the physics learning taught tends to be centered solely on cognitive aspects such as memorizing and doing questions so that it results in students' science process skills not being optimal. Some indicators of students' science process skills, such as observing, grouping, interpreting, asking, predicting, hypothesizing in learning, applying concepts, and communicating classroom learning are poorly understood by students. Based on the data that has been obtained on the elasticity material of static fluids, the average learning outcomes of science process skills of class XI MIPA 1 students are still low. The data showed as many as 18 students on

incomplete material elasticity material and 19 students on incomplete static fluid material with 34 students. The average daily test score obtained by students on material elasticity of materials was 65.14 and the average score obtained by students on static fluid materials was 64.56. Based on these data, the classical completion of the learning outcomes of daily test scores of science process skills of class XI MIPA 1 SMA Negeri 1 Onohazumba students has not been maximized and is still in the sufficient category (Minister of Education and Culture Regulation No. 53 of 2015). The indicator of expected success in learning the 2013 curriculum is classical completion of 85% (Ishag dalam Wijaya, 2013).

To improve these learning outcomes, one way that can be done is to apply the Discovery Learning learning model to physics lessons on the elasticity of static materials and fluids. This is also in line with the opinion expressed by (Apsari & Budiyanto, 2021; Fauziati, 2021; L. Handayani & Khanafiyah, 2014; Hasil et al., 2019; Leni Mardiana, 2021; Novebrini et al., 2021; Nurcahyo et al., 2018; Rahman & Azizah, 2019; Rinaldi et al., 2018; *SAPUTRO*, n.d.), which states that "The Discovery Learning learning model is effective to use and can improve the learning outcomes of students' science process skills." The study showed that the average learning outcome of students' science process skills after applying the Discovery Learning learning model was obtained at 85.04 and categorized as an excellent criterion.

The Discovery Learning learning model is a certain planning or pattern that can be used as a reference for the implementation of teaching and learning activities that are designed in such a way in the classroom. "The Discovery Learning learning model is not only based on mastering the concept of the subject matter but also exposes students to a problem that then finds a solution to the problem solving itself (Gede Oki Artawan et al., 2020)."

In addition, the Discovery Learning learning model is not only based on mastering the concept of the subject matter but exposes students to a problem that then finds a solution to the problem itself (Gede Oki Artawan et al., 2020). "The implementation of the Discovery Learning learning model is carried out through several phases, including providing stimulus, identifying problems, collecting data, processing data, verifying, and drawing learning conclusions (Hasil et al., 2019; Nurcahyo et al., 2018)."

Previous research was conducted by (Oktofika et al., 2018) with the title "Efforts to Improve Science Process Skills and Student Learning Outcomes through the Application of Discovery Learning Models in Class X Science 3". Looking at the results of the data that have been obtained,

this shows a significant increase in the results of mastering the ability of the science process, where student learning outcomes in cycle I are 70.5%, cycle II is 76.5%, and cycle III is 83.6%. The research is carried out in three cycles, while the exploration directed by the creators is currently limited to 2 cycles with material elasticity of static materials and fluids.

Hotang conducted the same research using the Discovery Learning model to improve the learning outcomes of class XI science 3 SMAN 6 Pekanbaru students (Hotang, 2019). In his research, he succeeded in achieving the goal carried out where in the implementation of cycle II, there was an increase in student learning outcomes with a percentage of 91.7%.

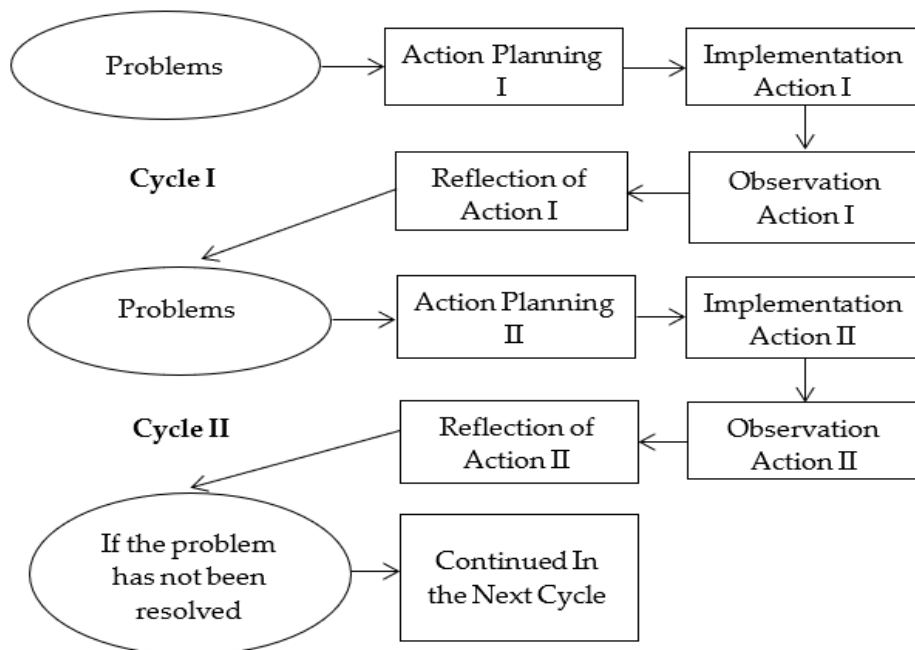
Leni applies the same model to improve children's learning outcomes (Leni Mardiana, 2021). The research is an Action study that aims to improve the cognitive outcomes of class X science children on circular motion physics material. Data shows that the implementation of Action is cyclical to II, the completeness of student learning outcomes is at a percentage of 100%. So the whole child is said to be classically complete.

(Made Astra & Syarifatul Wahidah, 2017) conducted the same study with the application of the Discovery Learning Model. Such a study aims to find out how much the improvement in students' science process skills is through worksheets on temperature and heat material after applying Action using the model. This research was carried out in three cycles, where in the implementation of cycle III actions obtained an average achievement result of 81%.

Based on all the descriptions above, the author raised a research topic namely Efforts to Improve Students' Science Process Skills through the Application of Discovery Learning Learning Models. The purpose of conducting this research is to improve the learning outcomes of science process skills of class XI MIPA 1 SMA Negeri 1 Onohazumba students on the elasticity of materials and static fluids.

METHOD

This research is a Classroom Action Research that refers to the opinion expressed by Arikunto who said that the class action research cycle consists of four stages, namely: planning, implementation, observation, and reflection (John Elliot; Y. Handayani et al., n.d.; Hotang, 2019; Oktofika et al., 2018; Yosephien Retna Tinon Kawuri et al., 2020). The four stages of class action research can be seen in the following figure:

Figure 1. Classroom Action Research

This research was carried out in class XI MIPA 1 SMA Negeri 1 Onohazumba. The data collection instrument uses a written test based on ten indicators of students' science process skills which include aspects of observing, grouping, interpreting, predicting, asking, hypothesizing, utilizing tools/materials, conducting experiments, applying concepts, and communicating (Kemdikbud, 2013; Yuliati, 2016). The test is arranged in the form of multiple choices of twenty questions each cycle. The main objective of this Classroom Action Research is to find out how much improvement in learning outcomes before and after implementing actions through the application of the Discovery Learning learning model. An indicator of success in this study is the classical completeness of student learning outcomes of 85%. The data analysis used is descriptive qualitative and quantitative.

1. Individual Completion Analysis

Students are said to be complete in learning if they meet the minimum completion criteria set by each school in each subject. The KKM that has been set in class XI MIPA 1 SMA Negeri 1 Onohazumba in physics subjects is 68. If the student's score is below 68, it is categorized as incomplete.

2. Analysis of Each Students' Earned Data

To get the value of student acquisition in the implementation of pretests and posted at the end of each cycle, data analysis was carried out using the following formula:

$$X = \frac{\text{Scores obtained}}{\text{Maximum Score}} \dots \dots \dots (1)$$

3. Data Analysis of Improved Student Learning Outcomes

According to Hake (Apsari & Budiyanto, 2021; Desy Rochmadona & Nurita, 2021) said that each score obtained by students on the implementation of the pretest and posttest is collected and analyzed using the following N-gain Score formula:

$$g = \frac{S_{\text{post}} - S_{\text{pre}}}{S_{\text{max}}} \times 100\% \quad (2)$$

Information:

g = N-Gain Score

S_{post} = Postes Score

S_{pre} = Pretest Score

100% = Maximum score from test results

The following are the N-Gain Score criteria used in the study to see how much improvement in the learning outcomes of students' science process skills through the application of the Discovery Learning learning model:

Table 1. N-Gain Score Criteria

No	Range	Criteria
1	$g \leq 0,3$	Low
2	$0,3 < g \leq 0,7$	Currently
3	$g > 0,7$	High

Source: Hake (Desy Rochmadona & Nurita, 2021)

Based on Table 1. Above, the application of the Discovery Learning learning model is said to be effective to use if student learning outcomes obtain the results of the N-Gain Score test analysis $\geq 0,3$.

4. Classical Completion Analysis

A class is said to be complete in learning if the class has 85% of the total number of individuals (Ishag, Wijaya: 2013). Calculate the classical completeness of the class can be done using the following formula:

$$K = \frac{JT}{JS} \times 100\% \quad (3)$$

Information:

KK = Classical Completeness

JS = Number of overall students

JT = Number of students completed

The results of obtaining the score are then categorized based on the criteria in the following

table:

Table 2. Learning Outcomes Percentage Interval

No	Percentage	Category
1	$\geq 85\%$	Very High
2	76 % - 85%	High
3	56% - 69 %	Quite
4	41% - 55%	Less
5	$\leq 40\%$	Very Less

Source: Adaptation of (Education & Offices, 2016)

FINDINGS AND DISCUSSION

Findings

Description of Cycle I

a. Cycle I Action Planning Phase

At this stage, researchers set competency standards and basic learning competencies, prepare learning implementation plans by applying Discovery Learning learning scenarios, prepare student worksheets, prepare tools and materials used as supporting tools in research, prepare test instruments for learning outcomes in student science process skills, and prepare a format for assessing student science process skills learning outcomes. All previous learning tools have been validated by Expert Lecturers (experts) to get better inputs so that the device is suitable for use.

b. Stage of Implementation of Cycle I Actions

Before carrying out the actions in cycle I, the teacher gives a pretest to determine the student's initial ability to master the science process skills in the form of a multiple-choice written test of twenty items. Then, the researcher begins the implementation of the cycle I by applying actions to each meeting. The execution of actions is based on the scenario of applying the Discovery Learning learning model. The material that has been determined in cyclamI is Material Elasticity where the implementation is for three meetings with an allocation of 4x45 minutes (every class hour). And at the end of the cycle, researchers give posts to students.

c. Observation Stage of Cycle I

Observation of actions on cycle I am carried out simultaneously with the execution of actions. At this stage, to obtain valid data on the learning outcomes of students' science process skills, researchers are assisted by two physics teachers as observers whose task is to observe all teacher and student activities in the teaching and learning process in the classroom through the application of actions, namely teaching using the Discovery Learning model to support improving the learning

outcomes of students' science process skills on material elasticity materials. The acquisition of student learning outcomes before and after applying the learning actions is shown in the following Table:

Table 3. Cycle I Learn Outcomes

No	Description	Pretest	Posttest I
1	Highest Score Students	65	85
2	Lowest score Student	30	50
3	Average Value Gain	46,56	65,94

Table 3. Shows that the acquisition of learning outcomes for the implementation of pretests and posts at the end of the cyclam is in the sufficient category. The following is a diagram of the drawings of the results of the implementation of pretests and posttest cycle I:

Figure 2. First Cycle Student Learning Outcomes

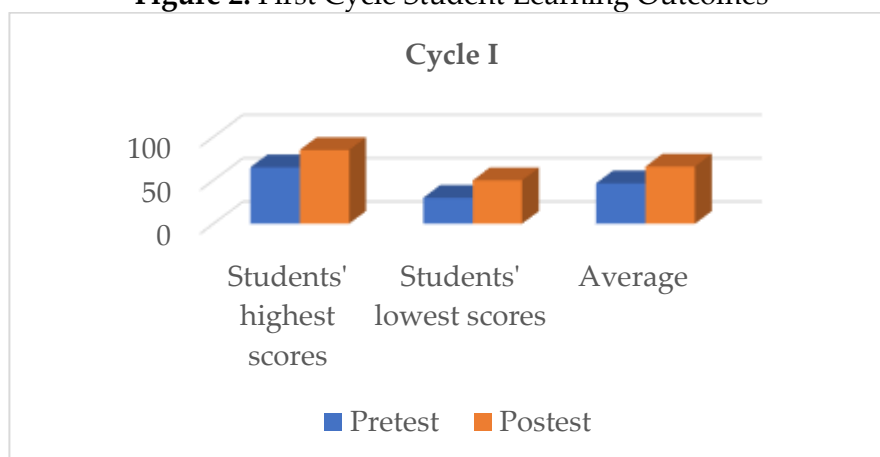


Figure. 2 Indicates that there is an increase in student learning scores before and after applying actions in cyclical learning with a difference of 19.38 points. To see how much improvement in student learning outcomes in the implementation of the cycle I learn, data analysis was carried out on the average student gain score in the implementation of pretests and posted at the end of the meeting using the N-gain Score which was then categorized based on the N-Gain criteria. The results of the data analysis are shown in the following Table:

Table 4. N-Gain Score Cycle I

Average Pretest	Average Posttest	N-Gain	Criteria
46,56	65,94	0,37	Medium

Table 4. It shows that in the implementation of the pretest cycle I obtained an average score of 46.56 (less category) and the implementation of postes at the end of the cycle obtained a retata score of 65.94 (sufficient category) with an N-gain of 0.37 (medium criteria).

d. Reflection Stage of Cycle I

Based on the description of previous data, the results of learning students' science process skills in the form of written tests obtained an average of 65.94 (sufficient category) with a percentage of classical completeness of classes of 68.75% while the success indicator has been set by researchers is class completion of 85% (good category). Thus, it is concluded that the implementation of the cycle has been successful and continued in cycle II with the hope that the application of the Discovery Learning learning model meets the indicators set.

Description of Cycle II

a. Cycle II Action Planning Phase

In this second cycle of learning planning, teachers again prepare learning instruments used in research to support training and improve student learning outcomes. All devices used in the implementation of cycle II learning such as learning implementation plans, student worksheets, and student science process skills questions are again consulted by expert lecturers (experts) to see the feasibility of the instruments used which are then validated.

b. Phase of Implementation of Cycle II Actions

The implementation of cycle II actions continues to apply the Discovery Learning learning model which is carried out optimally. The implementation of cycle II actions is carried out three times with a time of 4x45 minutes (every class hour), the difference is that the material taught is a continuation of the material from cycle I, namely Static Fluid where at the end of the cycle will be given a student learning outcomes test of twenty items of multiple-choice questions.

c. Cycle II Observation Stage

After carrying out actions in cycle II learning, the teacher and the observer again observed the suitability of planning with the learning actions that had been carried out during the learning process through the application of the Discovery Learning learning model to improve the learning outcomes of students' science process skills. Observation of actions on cycle II is carried out simultaneously with the execution of actions. The acquisition of student learning outcomes in the implementation of cycle II learning is shown based on the Table:

Table 5. Learning Outcomes of Cycle II Implementation

No	Description	Posttest II
1	Highest Score Students	95
2	Lowest score Student	70
3	Average	86,09
4	Classical Completeness	100%

5	Category	very high
6	Conclusion	Meet the Indicators

Table. 5 Shows that the acquisition of learning outcomes on students' science process skills tests in cycle II with static fluid material is in the excellent category and has exceeded the established performance indicators. The comparison between the acquisition of student learning outcomes in the implementation of postes cycle I and postes cycle II is shown in the figure.

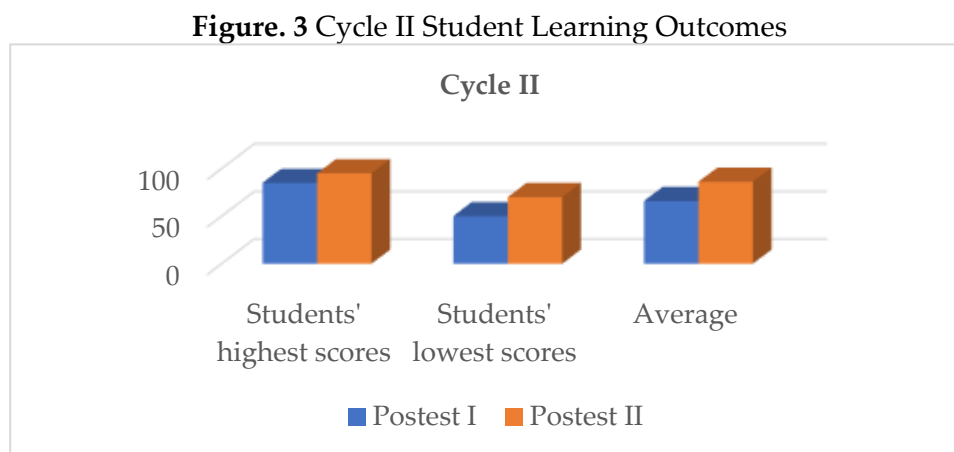


Figure. 3 above shows that the score of student learning outcomes in the implementation of postes cycle II has increased with a difference of 20.15 points. To see how much improvement in student science process skills learning outcomes between cycle I and cycle II, data analysis was carried out on the average acquisition of student scores on the implementation of postes cycle I and the implementation of postes cycle II through the N-Gain Score. The results of the analysis are shown in the following Table:

Table 6. N-Gain Score Cycle I and Cycle II			
Average Posttest Cycle I	Average Posttest Cycle II	N-Gain Score	Criteria
65,94	86,09	0,60	Medium

Table 6. Shows that in the implementation of postes cycle I, the average score of students obtained on material elasticity material of 65.94, and the implementation of postes cycle II of static fluid material obtained an average score of student learning outcomes of 86.09 with classical completeness of 100% with N-gain of 0.60 (medium criteria).

d. Cycle II Reflection Stage

Data analysis of the results of learning students' science process skills in the implementation of cycle II learning with a static fluid material, obtained an average student score of 86.09 with classical completion of 100% grade (excellent category). Meanwhile, the indicator that has been set is the classical completeness of the 85% class (good category). The data also shows that student

learning outcomes in the implementation of postes in cycle II have exceeded the established indicators of success. Based on these data, it was concluded that "The application of the Discovery Learning model can improve the learning outcomes of science process skills of class XI MIPA 1 SMA Negeri 1 Onohazumba students. Thus, the cycle can be stopped."

Discussion

Science process skills are important that must be trained in students in the learning process, but it contains scientific steps to support training, improving, and improving their learning outcomes. These skills can be trained and improved if they use the right model in the teaching and learning process carried out by the teacher in the classroom. In this study, the authors used the Discovery Learning model to improve and improve the learning outcomes of science process skills of class XI MIPA 1 SMA Negeri 1 Onahazumba students on material elasticity of materials (cycle I) and static fluid materials (cycle II). As for the data obtained, student learning outcomes in the implementation of cycle II obtained an average score of 86.09 with a classical completion of 100% (excellent category). Based on the data obtained by the researchers, it can be concluded that the application of the Discovery Learning learning model can improve student learning outcomes. This is also in line with the research conducted by (Hotang, 2019; Leni Mardiana, 2021; Oktofika et al., 2018; Rinaldi et al., 2018) which says that "The application of the Discovery Learning learning model can improve the learning outcomes of students' science process skills."

CONCLUSION

The results showed that cycle II learning with static fluid material obtained an average student learning outcome score of 86.09 with classical completeness of 100% and an N-Gain Score of 0.60. That is the predetermined indicator of research success in previous planning that says that the learning outcomes of students' science process skills are in a good category with classical 85% having been achieved and exceeded. Thus, it can be concluded that "The application of the Discovery Learning learning model to improve the science process skills of class XI MIPA 1 SMA Negeri 1 Onohazumba students is effectively used so that the cycle is stopped."

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