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# Student participation and cognitive learning outcomes in biology learning through the discovery learning approach

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**ABSTRACT**

Judging from the low learning outcomes of students and student participation during the learning process, this study aims to determine the effectiveness of the application of the discovery learning model to cognitive learning outcomes and student participation during the learning process of grade X SMA Ppm Al-Ikhlash on environmental change material. This type of research is a Pre-Experimental Design with a One-Shot Case Study research design. The population in this study was all grade X students of SMA Ppm Al-Ikhlash. The sample of this study was selected by a simple random sampling technique. The data collection technique used is in the form of a test in the form of an essay of 10 questions and observation sheets of student participation. The collected data were analyzed statistically descriptively using SPSS 24 (Statistical Package for the Social Sciences). The results of the statistical test showed the average post-test score in class X Mipa 1 which was 86.59. The percentage of student learning outcomes is 77.8% which is classified as very good and 22.2% which is classified as good. The average participation of students during the learning process in class is 62% in the active category. The conclusion of this study is the application of the discovery learning model effectively to cognitive learning outcomes and learning participation of grade X students of SMA Ppm Al-Ikhlas on environmental change material.



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## INTRODUCTION

Education in Indonesia as we can see at this time is still lacking, so building a life based on education in the present and the future requires continuous improvement. Therefore, the quality of education must always be improved along with technological developments and curriculum changes (Ainurridho, et al. 2021). Therefore, the curriculum is used as a basic reference for national

education that has undergone changes and improvements following the times. The latest curriculum is the 2013 curriculum which is an effort to correct the shortcomings of the previous curriculum both in terms of students, teachers and the demands of compatibility standards to be achieved. The 2013 curriculum is Graduate competency standards by paying attention to the quality of skills that include attitudes, knowledge, and skills so that the 2013 curriculum cannot be separated from the core activity, namely the learning process (Kamaruddin, et al. 2020).

Biology is one of the subjects that also requires active student participation during the learning process. Biology subjects at school require students to have the ability to understand, analyze, and apply them in problem-solving. The 2013 curriculum according to Permendikbud number 22 of 2016 concerns process standards, namely the active involvement of students to find out to build their understanding (Alonemarera et al, 2023). The fact that occurs today in biology learning is that there are still many students who have difficulty understanding the concept of biology. Biology learning is considered a learning that is difficult for students to understand because it contains many scientific concepts and words that are difficult to understand and abstract. In addition, teachers also still use the lecture method so that learning is still teacher-centered, so that students do not respond to questions given by the teacher and only a few students actively participate in compiling their knowledge (Lestari et al. 2017). Therefore, teacher skills are needed in teaching in class to increase student participation and learning outcomes in the classroom.

Learning participation is the participation of a person to do part of something that must be done by the perpetrator. This shows that learning participation is the participation of students to be actively involved in the learning process. Participation can be measured by how much involvement students have in classroom activities during the learning process. Participation can increase if the implementation of learning uses a different method than usual or if there are things that attract the attention of students in class so that they are actively involved in learning (Fatmawati, 2019).

Learning outcomes are a process or effort carried out by students to obtain a change regarding student progress or achievement after receiving their learning experience. Learning outcomes have an important role in achieving learning objectives, from learning outcomes, it can be known the level of student understanding of the material in the learning process that has been implemented (Suarmawan, et al. 2019). Poor cognitive learning outcomes can be seen from the value of cognitive learning outcomes of students who have not reached the minimum completeness criteria determined by the school, namely there are still many students who have not completed learning. The value obtained is still below the minimum completeness value (KKM) (Queen, 2019). The learning outcomes achieved by students can be influenced by two factors, namely internal and external factors. Internal factors are factors that come from within a person while external factors are factors that come from outside oneself (Salim, et al. 2022).

Judging from the low learning outcomes of student biology are caused by several factors including, a lack of initial understanding of students, difficulty in solving problems, and lack of students' ability to solve problems and express opinions when answering problems given by teachers during the learning process. One of the appropriate learning models used to support the learning process in the classroom in improving student learning outcomes is a discovery-based learning model also known as Discovery Learning (Putriani, et al. 2022).

The discovery learning model is a learning model used to help students learn more effectively. This model has a learning approach that develops a more active way of learning students by discovering (Hosnan, 2014). According to Nurjannah (2019), a discovery-based learning model requires students to try to find their own problem-solving and other related knowledge through mental processes to produce meaningful knowledge firmly embedded in memory. The stages in the discovery learning model are a stimulus to stimulate students, problem

identification students are allowed to identify as many problems as possible, student data collection of relevant information, data processing, evidence, and the last activity is concluding the learning results carried out (Putri, et al. 2017). At the stage of Discovery Learning that most affect learning outcomes and student participation, namely information collection, students are required to actively participate in collecting as much information as possible, managing student data, managing all data that has been collected, and making conclusions students conclude the material after going through the previous stage process. The advantages of this model are instilling students' curiosity, improving students' reasoning, students are more actively involved in learning, training cognitive skills, long-lasting knowledge, and easy to remember (Syarifah, 2022).

Several studies have been conducted previously in applying the discovery learning learning model. According to Yuliana et al. (2017), in science learning by applying the discovery learning model students are trained in making hypotheses, the problems given are related to daily life, the division of groups according to the level of student ability, conducting experiments with various variations so that students are more interested, and involving all students to be active in conveying the results of the discussion. This activity is carried out to make students' cognitive learning outcomes increase. Furthermore, in the research of Pangaribowo et al. (2017) in applying the discovery learning model, teachers direct students to look for learning resources in the surrounding environment and on the personal experiences of each student so that students are easier to remember the learning material delivered. Using this method can make students develop quickly according to their ability to understand the material and can improve their learning outcomes. Then, research conducted by Ali & Dini (2018) stated that during the implementation of learning using the discovery learning model, students work on LKS in groups and each group will look for data with a discovery process both from literature studies and in the surrounding environment. The discovery process is carried out in the surrounding environment and literature studies support the learning process through interviews or conducting experiments. So that the learning process emphasizes students learn more actively and can understand the concept of the material well in the learning process, this process can affect their learning outcomes.

Based on the background described above, researchers feel the need to conduct research aimed at determining the effectiveness of the application of the discovery learning model on cognitive learning outcomes and student participation during the learning process of grade X SMA Ppm Al-Ikhlash on environmental change material.

## RESEARCH METHODS

### Research Design

This research used a Pre-Experimental Design research which only involves one class that is treated using a discovery learning model. The research design used in this study is a One-Shot Case Study where researchers only provide treatment (discovery learning model) and then give a final test (posttest) to see the results of student cognitive learning outcomes and student learning participation data taken during the learning process.

### Population and Samples

The population in this study was all grade X students of SMA Ppm Al-Ikhlash. Class X of SMA Ppm Al-Ikhlash consists of 2 classes with a total of 55 students and does not have certain criteria for the placement of students in each class. The sample was class X Mipa I students totaling 27 students. Sampling in this study used the Simple Random Sampling technique to obtain one class randomly taught using the Discovery Learning model without paying attention to certain criteria. Because sampling does not pay attention to the criteria that exist in the population so that the collection it the collection is carried out randomly as well and the population there are no criteria in the placement of each class. This Simple Random Sampling technique is a sampling

technique carried out randomly and does not pay attention to the criteria contained in the population.

## Instruments

The instruments used in this study were observation sheets of student participation and tests of cognitive learning outcomes. Student participation observation sheets are used to obtain student activities during the learning process in class. The aspects on the observation sheet refer to the syntax of the discovery learning learning model. The learning outcomes test developed by researchers in the form of an essay consists of 10 questions that are first validated by expert validators, this cognitive learning outcome test is only through expert validators and made several improvements so that the test is suitable for use. The test is used to measure the level of student understanding of the material after following the learning process for a certain time.

## Procedures

This study only had a treatment group using a discovery learning model. The learning process was carried out in the treatment group for 3 meetings, namely the first meeting was given material on environmental change, the second meeting was given material on environmental pollution and the third meeting was given material on environmental conservation and waste recycling. Each meeting consists of 2 hours of lessons (2x45 minutes). Observation sheets of student participation are filled in during the learning process. Furthermore, at the end of the meeting, the treatment group was given a posttest (final test) to find out the student's grades. After all the data is collected, the data is analyzed and conclusions are drawn from all data.

## Data Analysis

Data analysis in this study was observation sheets of student participation and tests of cognitive learning outcomes. On the student participation observation sheet, to find out the value obtained by each activity, the score is converted in percentage form using the formula, the number of students of each activity divided by the total number of students multiplied by 100%. Student participation is grouped by referring to the categorization according to Ranti (2016) as in Table 1.

**Table 1.** Student Participation Categories

| No | Average Score | Category |
|---|---|---|
| 1 | 81% - 100% | Very Active |
| 2 | 61% - 80% | Active |
| 3 | 41% - 60% | Enough |
| 4 | 21% - 40% | Less Active |
| 5 | 0% - 20% | Not Active |

Source: (Ranti, 2016).

**Table 2.** Learning Outcomes Category

| Value Interval | Category |
|---|---|
| 80 – 100 | Very Good |
| 66 – 79 | Good |
| 56 – 65 | Enough |
| 41 – 55 | Less |
| 0 – 40 | Very Less |

Source: (Arikunto, 2013).

Student learning outcome data was analyzed by using descriptive statistical analysis to determine the mean, median, percentage of learning outcomes, maximum score, and minimum

student score. Data analysis using SPSS 24. Learning outcomes are grouped by referring to the categories of learning outcomes according to Arikunto (2013) as in Table 2.

## RESULTS

The results of the study were obtained from student participation observation sheets and tests of student cognitive learning outcomes which were then carried out descriptive analysis. Student participation observation sheet to see student participation during three meetings. The following statistics are the results of the recapitulation of student learning participation in each meeting presented in Table 3.

**Table 3.** Recapitulation of student learning participation

| Activity | P.I (%) | P.2 (%) | P.3 (%) | Average (%) | Category |
|---|---|---|---|---|---|
| Identify the Problem | 10 (37) | 12 (44) | 12 (44) | 11 (42) | Enough |
| Giving Feedback | 12 (44) | 13 (48) | 15 (56) | 13 (49) | Enough |
| Gathering Relevant Information | 13 (48) | 15 (56) | 19 (70) | 16 (58) | Enough |
| Discussing LKPD | 12 (44) | 15 (56) | 20 (74) | 16 (58) | Enough |
| Presentation LKPD | 20 (74) | 23 (85) | 23 (85) | 22 (81) | Very Active |
| Making Conclusions | 22 (81) | 24 (89) | 24 (89) | 23 (86) | Very Active |
| Average (%) | 15 (55) | 17 (63) | 19 (70) | 17 (62) | |
| Category | Enough | Active | Active | Active | |

(P.1 = Meeting 1, P.2 = Meeting 2, P.3 = Meeting 3, P.4 = Meeting 4)

Based on Table 3, the first activity observed, namely students identifying problems from all three meetings, obtained an average of 42% with the category "enough". In the second activity observed, students gave responses from all three meetings, an average of 49% was obtained in the "enough" category. In the third activity observed, students collected relevant information from literature reading, videos, observing objects, and interviews from the three meetings, an average of 58% was obtained with the category "enough". In the fourth activity observed, students discussed with their group friends during the work on LKPD, environmental change material from the three meetings was obtained on average by 58% with the category "enough". In the fifth activity observed, students presented the results of LKPD work on environmental change material from the three meetings, an average of 81% was obtained with the category "very active". In the sixth activity observed, students assisted by teachers making conclusions from the three meetings obtained an average of 86% with the category "very active".

Judging from the average first meeting of the six activities by 55% with the category "enough". The second meeting of the six activities obtained an average of 63% with the "active" category, and the third meeting of the six activities obtained an average of 70% with the "active" category. So the overall average of the six activities for the three meetings was 62% with the category "active".

From the six activities, it was found that the first meeting of the first activity of students identified problems with as many as 10 students with an average of 37% classified as less active. This is due to differences in students' ability to understand the material and the lack of confidence in public speaking. In the second and third meetings of the sixth activity, students assisted by the teacher in making conclusions were obtained from as many as 24 students with an average of 89%

who were classified as very active, this was because almost all students had understood the material taught.

(a) (b) (c)

**Figure 1.** (a) Give Feedback, (b) Discuss LKPD Work, (c) Presentation LKPD

As seen in picture 1 (a) students give responses, whereas in the learning process in class, only some students are active in responding to the problems given and some other students see without responding. (b) students discuss and cooperate in completing LKPD environmental change material and collecting relevant information through textbooks, photocopies containing environmental change material, and observing environmental objects around the school. (c) students present the LKPD that has been done, where each group takes turns appearing in front of the class to read the results of the discussion, and the other group responds if there are things that are not understood.

Student cognitive learning outcomes are obtained from the final test (posttest) which is carried out after the treatment given. Posttest is used to see how much ability students have in understanding the material given using the discovery learning model. The following statistical data provide an overview of students' cognitive learning outcomes in biology subjects with environmental change material taught using the discovery learning learning model during the learning process Furthermore, the data analyzed descriptive statistics using SPSS 24 can be seen in Table 4.

**Table 4.** Descriptive Statistics Learning Outcomes Test

| No. | Descriptive Statistics | Value (Posttest) |
|---|---|---|
| 1 | Maximum | 100 |
| 2 | Minimum | 68 |
| 3 | Mean | 86.59 |
| 4 | Median | 88 |

Based on Table 4, it can be seen that the maximum value obtained after applying the discovery learning model in class X Mipa 1 is 100, then obtaining a minimum value of 68, for the mean value is 86.59, and the median value is 88. Thus, it can be concluded that students' posttest scores after being taught using the discovery learning learning model have a positive impact on student learning outcomes.

If the data is obtained learning outcomes tests are grouped into five categories, namely very good, good, sufficient, less, and very lacking. So the distribution of frequency and percentage of learning outcomes of grade X MIPA 1 students is obtained as in Table 5.

**Table 5.** Frequency and Percentage Distribution of Student Learning Outcomes

| No. | Value Interval | Posttest | | Note |
|---|---|---|---|---|
| | | Total | Persentace (%) | |
| 1 | 80 - 100 | 21 | 77.8 | Very Good |
| 2 | 66 - 79 | 6 | 22.2 | Good |
| 3 | 56 - 65 | 0 | 0 | Enough |
| 4 | 41 – 55 | 0 | 0 | Less |
| 5 | 0 - 40 | 0 | 0 | Very Less |
| Total | | 27 | 100 | |

Based on Table 5 shows that the posttest results of students after being taught using the discovery learning learning model show that 77.8% of students have excellent learning outcomes and 22.2% of them have good learning outcomes. This indicates that the percentage of learning outcomes (posttest) shows results that are classified into the very good category.

## DISCUSSION

Student learning participation data is obtained from observations during learning activities by emphasizing the syntax of the discovery learning learning model. In Table 1 the six activities increased from the first meeting average by 55%, then in the second meeting increased to 63%, and in the third meeting increased to 70%, this was influenced by how the role of the teacher in the learning process took place. This is by Dian's statement (2016) that increasing student participation during learning activities can be done by teachers motivating students to dare to express their ideas or ideas, controlling the progress of student assignments given, and guiding students in every step of learning.

Many factors can affect student learning participation, one of which is influenced by the teacher's skills in managing the class. The increasing role of teacher activities in managing the classroom can increase student participation during the learning process. Thus the teacher can also be said to be able to manage learners in the classroom. Student activity in this case is influenced by teacher activity because in this case, the teacher can encourage students to take advantage of active activity opportunities because the teacher in learning acts as a motivator, guide, and facilitator for students (Saroyo et al, 2016).

The overall average student participation during the learning process took place with 3 meetings for all six activities, which was 62% in the active category. These results show that the application of the discovery learning learning model for student participation is effectively used. The explanation above is supported by the research of Betari et al. (2020) with the results of the study stating that student involvement in the learning process can be seen from student participation such as listening, discussing, writing the results of activities, and so on. Participation is very necessary during the learning process because student learning participation shows whether the learning process is going well or not. According to Nisa (2017), highly active student participation in the learning process creates effective learning, namely if students actively participate in the learning process, the learning that occurs in the classroom will be more meaningful.

Learning outcome data was obtained by giving posttest questions at the end of the meeting in class X Mipa 1. Based on table 3 shows that the percentage of student learning outcomes in environmental change material reached 77.8% of students who had excellent learning outcomes and 22.2 students who had good learning outcomes after being taught using the discovery learning learning model. This shows that the cognitive learning outcomes of students taught using the discovery learning model are fulfilled.

So it can be concluded that the discovery learning learning model is effective for students' cognitive learning outcomes on environmental change material. With this learning model, classroom learning becomes more effective, besides that, it can develop a way of learning students who are more active in finding, investigating, and solving problems faced. As stated by Hosnan (2014) the discovery learning learning model has a learning approach that develops a more active way of learning students through discovery, investigation, and answering the problems presented, the results obtained will not be easily forgotten because students are directly involved in their own experiences. Meanwhile, teachers are only facilitators who deliver material and give direction on what will be done during the learning process.

According to Zulastri (2017) in his research on the effect of using the discovery learning model on student learning outcomes, it was found that there was a positive influence from the use of the discovery learning model in the treated class, this can be seen from the higher average value of student learning outcomes compared to classes taught with conventional learning methods (lectures). In this learning model, students are required to be more active in learning and find their concepts related to the material with discovery activities, so that learning is more meaningful.

The obstacle during the research is that not all students actively participate when the teacher gives stimulation about the material taught and when students are asked to give responses or ideas about the problems presented, but this can be overcome by the process of collecting data or relevant information in the form of literature, videos, images, observing objects and interviews that require students in each group to be more active in participating, Working together, then students in each group present their results in front of the class and other groups respond well, this shows students will be more active during the learning process until completion. Such constraints can affect students' cognitive learning outcomes in the end. This is supported by Kusumasari's research (2020), namely the syntax of the discovery learning model has been implemented by the teacher, but in its implementation, there are some syntaxes that students lack participation such as stimulation and giving ideas or ideas, but can be overcome with the next syntax such as discussing LKPD, presenting the results of LKPD work, and other activities that can support students to be active again in the learning process.

## CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the discovery learning model is effective for the cognitive learning outcomes of grade X Mipa I SMA Ppm Al-Ikhlash students on environmental change material seen from the average posttest score of 86.59% and the percentage of excellent learning outcomes of 77.8% and 22.2% which is good. The learning participation of grade X Mipa I SMA Ppm al-Ikhlash students during the learning process for 3 meetings received a positive response as seen from the average student participation of 62% in the active category. Thus, the discovery learning model is recommended to be applied in learning, because it has the potential to make students more actively participate during the learning process and make it easier for students to understand learning material, to improve student cognitive learning outcomes.

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