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# Application of Discovery Learning Model to Improve Student Science Process Skills in Colloid Material on Senior High School

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## Abstract

*The purpose of this study was to describe the improvement of students' science skills by applying the discovery learning model to the colloid material of class XI IPA SMA Negeri 1 Ampibabo. The research method used was pre-experiment with one group pretest-posttest. The sample in this study consisted of students from class XI IPA as experimental class 1, which was planned for 30 students, and class XI IPA B as class experiment 2, which meant 30 students. The instrument used was a science skills test, student activity observation sheets measured using six aspects, namely, observation, asking questions, hypothesizing, classification, interpreting data, and communicating) and student response questionnaires. The study's findings were obtained from the science skills test scores, the pretest, and the hottest of the two classes; namely, the average pretest score for class XI IPA A was 11.66 % and class XI IPA B was 13.3 %, while the average posttest score was 11.66 %. Obtained from class XI IPA B of 75.48% and class XI IPA B of 75.97 % The results of the analysis of the six aspects of science process skills of students in class XI IPA A obtained an average of 75.52 % and class XI IPA B was obtained an average of 78.64 %. Based on the study results, it can be ignored that the application of discovery learning models can improve students' skills in colloid material in class XI IPA SMA Negeri 1 Ampibabo. This can be seen from the proportion of the average student response, which is 90.61 % strongly agree with the discovery learning model.*

**Keywords:** Science process skills, discovery learning, colloids

## Introduction

Curriculum 2013 implies that students are directed to have Higher Level Thinking Skills (HOTS) in the learning process. This aligns with Swart's opinion that thinking skills are important in learning. Learning activities must motivate students to achieve predetermined competencies optimally and are expected to develop students' potential to think at a high level (Cents-Boonstra et al., 2021). However, in the learning process, there is still a lack of student involvement in learning activities, making it difficult to achieve predetermined competencies (Yulianti et al., 2020). This problem often occurs because learning activities are boring and ineffective, so things must be done so that learning activities are not boring and run effectively. Namely, selecting and using appropriate methods for the subject matter is important, like chemistry (Rahmi & Alberida, 2017).

Chemistry is one of the fields of study of Natural Sciences (IPA) that has been introduced to students from an early age. Chemistry subjects are very important in society because chemistry is involved in everyday life (Pernaa et al., 2022). However, learners often cannot find chemistry's relevance to everyday life (Gilbert, 2006). The existence of student difficulties with learning chemistry can be caused by two factors, namely internal factors that come from within students and external factors that come from outside students (Munawwarah & Side, 2022). This internal factor is influenced by two factors, namely physical and psychological factors. Family, school, and environmental factors affect students' learning activities (Slameto, 2013).

The description above also occurs at SMA Negeri 1 Ampibabo. Based on the results of interviews show that students think that chemistry is a difficult and less attractive subject, so they have difficulty learning. This is due to the lack of attention from students when learning takes place. Because of this, the teacher changed the learning model, which can make students pay more attention while learning. After implementing the new learning model, it was found that students still lacked attention when learning took place, impacting their thinking patterns. Accoding to Sirait & Hutabarat (2015) students who struggle to comprehend and apply chemical concepts take the quickest route by memorization. This results in the concepts that students learn tend not to last long and are easily

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lost, and sometimes students do not understand or do not understand the concepts learned.

In this regard, Cahyo (2013) revealed that the application of the Discovery Learning model can foster students' scientific attitudes so that students will become more active, which involves students in the process of mental activity by measuring opinions and trying themselves so that students can learn independently. The Discovery Learning paradigm involves comprehending concepts, meanings, and relationships through skills in science to ultimately reach conclusions. Discovery Learning transpires when individuals engage actively, particularly by employing their cognitive processes to uncover concepts and principles (Budiningsih, 2005).

Science process skills in chemistry learning involve cognitive, effective, and psychomotor abilities. Mental abilities (mins on) are formed because, in learning, students think; psychomotor skills (hands-on) are formed because students are involved in using tools and materials, measuring, preparing, or assembling tools, and affective abilities (hearts on) are formed because students interact with each other in carrying out teaching and learning activities. Types of skills include making observations (observation), interpreting observations (interpretation), classifying, predicting (prediction), communicating, hypothesizing, planning experiments or research, and applying concepts. Asking questions and using tools and materials (Rustaman et al., 2005). This study aims to elucidate the enhancement of students' skills in science through the implementation of a discovery learning model focused on colloidal materials.

## Methods

This study used a pre-experimental research design. According to Sukmadinata (2011), Pre-experimental research is characterized by the absence of randomization and lack of variable control.

This study used One Group Pretest - Posttes. In this design, there is a pretest before treatment and a posttest after treatment. Thus, the learning outcomes can be known more accurately because they can be compared with the situation before treatment. The Population of this research comprised all students from class XI IPA at SMA Negeri 1 Ampibabo, enrolled for the 2019/2020 academic year. The sample in this study comprised two classes: class XI IPA, designated as experimental class 1, with 30 students, and class XI IPA B, designated as experimental class 2, also with 30 students.. The purpose of using this method is to describe the improvement of students' science process skills with the application of the discovery learning model.

The research results were obtained from the students' science process skills test scores, student activity observation sheets, and student response questionnaires. Each aspect of science process skills is measured using the number of items for each element. The following formula was used to determine the achievement percentage of science process skills ability (Widodo & Widayanti, 2013).

$$NP = \frac{R}{SM} \times 100\% \qquad (1)$$

Description:
NP = Percentage value sought or expected
R = Raw score obtained by students
SM = Ideal maximum score of the above concerned.

The percentage of science process skills is grouped into five categories (Sudijono, 2008). This can be seen in **Table 1**.

**Table 1**. Categories of science process skills

| Category | Percentage |
|---|---|
| Very high | 90% - 100% |
| High | 75% - 89% |
| Medium | 55% - 74% |
| Low | 31% - 54% |
| Very low | < 30% |

Questionnaires will be employed to assess student reactions to Discovery Learning for the development of science process skills. The instrument employed in this study is a Likert scale questionnaire. (Agustina & Chandra, 2017).

Where on this scale, students respond to response statements by choosing:
SA : Strongly agree (4)
A : Agree (3)
DA : Disagree (2)
SDA : Strongly disagree (1)

**Table 2**. Student response categories

| Category | Percentage |
|---|---|
| Very high | 76% - 100% |
| High | 51% - 74% |
| Medium | 20% - 50% |
| Low | 31% - 54% |
| Very high | 76% - 100% |

Analysis of the percentage of student responses can be calculated using the formula.

$$Y = \frac{P}{Q} \times 100\% \qquad \rightarrow \qquad (2)$$

Description:
Y = Total score with percentage
P = Number of question answers (score = weight *frequency of answers)
Q = Number of questions answered (highest score = highest weight* frequency highest answer)

## Results and Discussion

### *Student initial proficiency test*

The initial ability test was conducted to determine students' initial ability before learning colloidal material in classes XI IPA A and XI IPA B. The results of the initial ability test in class XI IPA A obtained an average of 16.66, and in class XI

IPA B, the average value was 13.34. The results of the initial ability test in class XI IPA A obtained an average of 16.66, and in class XI IPA B, an average value of 13.34. As shown in **Table 3**.

**Table 3.** Data Analysis results of pretest class XI IPA A and XI IPA B

| Description | Initial Test *(Pretest)* | |
|---|---|---|
| | Class XI IPA A | Class XI IPA |
| Sample | 30 | 30 |
| Lowest score | 8.33 | 8.33 |
| Highest score | 25 | 18.7 |
| Number of students who have not completed | 30 | 30 |
| Average score | 11.66 | 13.34 |

The mean value of the pretest in class XI IPA B is lower than the mean value in class XI IPA A, but the difference is not too significant. This means that students' initial abilities in classes XI IPA A and XI IPA B are not much different.

***Student's final proficiency test (posttest)***

Table 4 presents the findings from the post-test data analysis on students' science process skills.

**Table 4.** Results of posttest data analysis of class XI IPA A and XI IPA B

| Description | Initial Test *(Pretest)* | |
|---|---|---|
| | Class XI IPA A | Class XI IPA |
| Sample | 30 | 30 |
| Lowest score | 70,83 | 66,67 |
| Highest score | 81,25 | 83,33 |
| Number of students who have not completed | 9 | 5 |
| Average score | 75,48 | 75,97 |

Table 4 indicates that the mean posttest score of students' science process skills in class XI IPA B surpasses that of class XI IPA A. The efficacy of the discovery learning approach in enhancing students' science process abilities can be demonstrated by the analysis of average post-test scores..

***Analysis of science process skills***

Science process skills are measured using written test instruments in the form of essays, as many as 12 numbers of questions that experts have validated. Science process skills questions are given to students before (pretest) and after (posttest) given learning. The science process skills measured in this study were six aspects, namely, aspects of observation, classification, asking questions, making hypotheses, interpreting data, and communicating. **Figure 1** shows the improvement in the results of observations of science process skills in class XI IPA A.

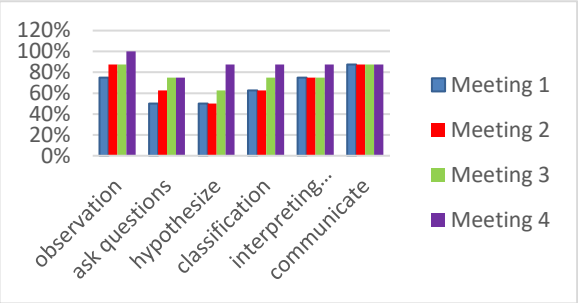


**Figure 1.** Percentage of students' science process skills in class XI IPA A

Based on Figure 1, at the observation stage, there was an increase in the percentage of students' abilities from the first to the fourth meeting, namely 87.5% - 100%. Students' ability to observe the problems given in the problem is in the very high category. In other words, students are very skilled when observing the difficulties provided by the teacher. Students can arouse curiosity and inspire responses by observing interesting events (Wenning, 2011), likewise for class XI IPA B, which became experimental class 2 with an increase in percentage from 62.5% - 100%.

The phases of making questions, making hypotheses, and classifying also increased at each meeting. However, if examined more deeply, the percentage increase is not greater. The category of student skills is in the medium - very high range. Students need to be careful in seeing the relevance of the problem so that they are not mistaken in asking questions and making hypotheses (Dewi et al., 2017). The ability of students to interpret data and communicate it is highly skilled. This activity is the stage of expressing the results of observations of colloidal material.

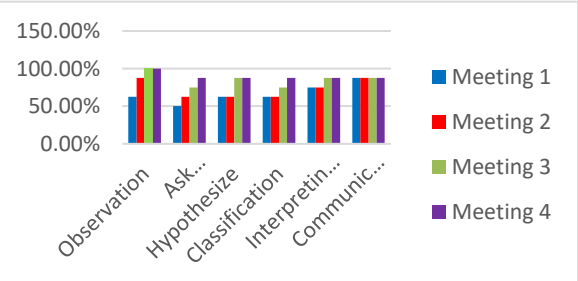


**Figure 2.** Percentage of Students' Science Process Skills in Class XI IPA B

Although the students' ability level is in this category, students need to be guided in understanding the data so that the transfer of information becomes directed (Lepiyanto, 2014).

***Student response results***

The results of the student response questionnaire after participating in learning using

the discovery learning model to improve science process skills on colloidal material in class XI IPA A obtained an average percentage of strongly agree (SS) 90.16 % and an average percentage of strongly agree (SS) in class XI IPA B obtained 90.91 %.

Student responses were obtained by filling out a questionnaire. The questionnaire is given after the post-test questionnaire is used to measure students' responses to applying the Discovery Learning learning model to improve students' science process on colloidal material. Data was collected by distributing questionnaires in class XI IPA A with as many as 30 respondents and class XI IPA B with as many as 30 respondents. Based on the questionnaire data, it can be seen that students are interested in using the Discovery Learning model on colloidal material because it is more fun, makes students more active, improves science process skills, and helps students understand the lesson faster. The results of student responses obtained are as follows: Rosdiana et al. (2017) & Yerimadesi et al. (2018), in which the Discovery Learning process received positive responses. Students generally stated that learning was interesting and easy to do, guiding students in making discoveries, identifying problems, and drawing conclusions (Darling-Hammond, 2018).

Based on the questionnaire values obtained, 90.16% of students responded to applying the Discovery Learning model to improve their science process skills on colloidal material in class XI IPA A. Class XI IPA B has 90.91 % in the Strongly Agree category, meaning students strongly agree to learn by using the Discovery Learning model to improve their science process skills on colloidal material in classes XI IPA A and XI IPA B.

The improvement results obtained follow research conducted by Wibowo (2020), which states that based on the student response questionnaire using the Discovery Learning model in science learning, more than half of the class respondents answered yes to each statement. The existing percentage price makes this learning model feasible if included in the criteria.

## Conclusions

The Discovery Learning model enhances students' science process skills, as evidenced by the average percentage across six observed aspects: observation, asking question, hypothesizing, classification, data interpretation, and communication. The analysis results were based on the observation sheet in class XI IPA A, which obtained 75.52 %, and class XI IPA B, which received 78.64 %.

The analysis results based on student responses in class XI IPA A obtained a percentage of 90.16 %, and class XI IPA B obtained a rate of 90.91 % with the category Strongly Agree.

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