the Influence of the Discovery Learning Model on Students' Collaboration Ability at Sman 2 Padang

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ABSTRACT

This research aims to see whether there is an influence of the discovery learning model on the collaboration abilities of students at SMAN 2 Padang. The research method used was quasi-experimental with a posttest control design. Sampling in this study used purposive sampling and class XI phase F (physics 5) was obtained as the experimental class and class XI phase F (physics 2) was the control class. Data on students' collaboration abilities was taken using an observation sheet assessing students' collaboration abilities which was analyzed descriptively. To see the magnitude of the influence of the discovery learning model on students' collaboration abilities, effect size calculations are used. The results of the research showed that the average value of collaboration ability of students in the experimental class was (68.19 ± 2.49) with good criteria, whereas the average value of collaboration ability of students in the control class was (63.43 ± 2.45) with good criteria. The magnitude of the influence of the discover learning model on students' collaboration abilities is obtained from an effect size index of 1.9 and has a high category in improving students' collaboration abilities. The discovery learning model can be concluded to have an influence on students' collaboration abilities.

Keywords: *discovery learning model; collaboration abilities*

I. INTRODUCTION

The rapid development of technology and information has brought changes in the order of social life, including in the field of education. One effort to anticipate and respond to changes that are occurring and will occur in the future is to improve the quality of education [1]. The quality of education can be improved by preparing a more innovative learning system and increasing the competency of graduates who have 21st century skills [2]. Increasing students' skills in both academic and non-academic fields will also improve students' quality of life in many ways. One of the most important elements in education today is students' high-level thinking abilities.

Students must be equipped with 21st century skills to be able to keep pace with the rapid developments in science and technology. Special 21st century skills that students must develop in learning activities such as critical thinking skills, problem solving, creative thinking skills, communication skills, and the ability to collaborate with other people[3]. These 21st century skills are integrated into the 2013 curriculum to be used as a reference in learning activities [4]. One of the skills that students need to have in the learning process is collaboration ability [5].

Collaboration ability is an ability that can help in working together with other people. Students who have collaboration skills will be able to work together in different groups to solve problems and achieve common goals [6]. To prepare students to face the globalization era of the 21st century, it is very important to develop collaboration skills so that students can work together in diverse groups [1]. That when working on a project, a

person does not always work individually but often together, so the ability to collaborate is important for students in preparing themselves to enter the world of work [7]. Students who have the ability to collaborate will find it easy to exchange ideas, reconsider perspectives, and consider, reject, and accept their own opinions and the opinions of others.

Collaboration capabilities are very important in the learning process. Collaboration abilities can improve students' problemsolving skills [8]. Students who have collaboration skills can easily expand their knowledge through interaction and sharing information with each other, peers, and teachers and improve their learning skills at a higher level [9]. Stated that collaborative learning influences student learning outcomes [10]. The discussion process between students is more active compared to the control class. This discussion process aims to enable students to interact with each other, exchange knowledge and solve problems together. Therefore, if the ability to collaborate continues to be trained and utilized optimally in the learning process, students' problemsolving abilities will increase and influence better learning outcomes.

When conducting observations at school, it was discovered that students' collaboration abilities were still low. This can be seen from the results of observations of students' collaboration abilities carried out during observations of class XI phase F (Physics) at SMAN 2 Padang in the 2023/2024 academic year. Students' collaboration abilities are shown in Table 1

Table 1. Students' Collaboration Ability

Class	Number of Students	Average Score Collaboration Ability	Category
Physics 2	37 students	34,64	not enough
Physics 3	37 students	33,95	not enough
Physics 4	40 students	35,05	not enough
Physics 5	35 students	34,40	not enough

(Source. Observation results of students' collaboration abilities).

Table 1 shows that the average score for students' collaboration abilities in the Phase F (Physics) class at SMAN 2 Padang is low. The contribution of students in the learning process is also still low. This can be seen from the absence of students providing ideas and active students being the same person. Students also do not compromise with other people when solving problems.

One way to improve students' collaboration abilities is to use a learning model that makes students very active, collaborative and communicate well through a process of discovery and experimentation. One suitable model is the Discovery Learning model. The discovery learning model is a learning process where students are given the opportunity to be more active in managing their own learning methods when discovering concepts, and educators guide and direct students' learning activities in accordance with learning objectives [11]. Using the Discovery Learning learning model can encourage students to be more active in learning [12]. Learning through the discovery learning model leads to interactions that support the smooth learning process and students show high enthusiasm during the learning process [13].

The use of discovery learning models in learning can increase students' learning activeness. [14] introduced three main characteristics of the discovery learning model. One of the main characteristics of the discovery learning model is the activity of exploring and solving problems to create, combine and generalize knowledge. This discovery learning also focuses on student activities. Apart from that, this learning model also combines new and existing knowledge in learning activities.

Using the discovery learning model can also improve students' skills. [6] stated that the Discovery Learning model influences students' collaboration skills. This is proven by findings showing that the average assessment of students' collaboration skills is higher in the experimental class than in the control class. The use of discovery learning models in classroom learning also improves students' communication and collaboration skills [9]. [15] using the Discovery Learning model in the learning process can improve students' collaboration skills. Apart from that, this model can also be used to improve students' high-level thinking abilities.

The hope is that by implementing this discovery learning model, collaboration abilities can increase. By increasing this ability, it is hoped that students' high-level abilities will also increase, which will ultimately have an impact on learning outcomes. Therefore, researchers are interested in conducting experimental research at

SMAN 2 Padang. The title of this research is "The Influence of the Discovery Learning Model on Students' Collaboration Ability at SMAN 2 Padang"

II. METHOD

This research uses a quasi-experimental method consisting of an experimental class using the discovery learning model and a control class using conventional learning. The form of this research design is a posttest-only control design which is shown in table 2.

Table 2. Form of Posttest-Only Control Design

Group	Treatment	Results
Experiment	X	O
control	-	O

In this design there are two groups, namely the experimental and control groups. The experimental group was treated using the discovery learning model (X) and the group that was not treated (-) was called the control group. The effect of treatment is students' collaboration abilities (O)[16]

This research was conducted at SMAN 2 Padang in five meetings from October to November in the odd semester of the 2023/2024 academic year. The population of this study was all students in class XI phase F (physics). The sample taken for this research used a purposive sampling technique which was obtained from Physics 5 class as an experimental class with a total of 35 students and Physics 2 class as a control class with a total of 37 students. The data collection technique is carried out by observing the collaboration abilities demonstrated by each student during the learning process using an observation sheet. Data analysis was carried out by giving a score to each statement regarding the collaborative abilities of each student. Next, add up the points obtained by each student for each collaboration ability statement and use the formula to determine the percentage of scores obtained for each collaboration ability statement and use the formula to determine the percentage of scores obtained for each collaboration ability statement.

$$\% \ score \ each \ statement = \frac{the \ total \ score \ of \ all \ students}{maximum \ score} \times 100\%$$

Then, using the average percentage assessment for each statement obtained, determine the average percentage assessment of collaboration ability using the following formula:

$$\% \ average \ score \ = \frac{the \ total \ \% \ score \ for \ each \ statement}{number \ of \ statements} \times 100\%$$

The assessments obtained are then divided into intervals using appropriate criteria [17] converted

Table 3. Guidelines for Conversion of Score Intervals into Categories

No.	Score	Category
1.	$80 < n \geq 100$	Very good
2.	$60 < n \leq 80$	Good
3.	$40 < n \leq 60$	Enough
4.	$20 < n \leq 40$	Not enough
5.	$0 < n \leq 20$	Very less

To see the magnitude of the influence of the discovery learning model on students' collaboration abilities, the effect size was calculated. To calculate the effect size, Cohen's formula is used which is referred to from [18]:

$$Effect \ size \ = \frac{\mu_1 - \mu_2}{\sqrt{\frac{Sd_E{}^2 + Sd_K{}^2}{2}}}$$

μ_1 is the average value of the experimental class. μ_2 is the average value of the control class. Sd_E is the experimental class deviation standard and Sd_K is the control class deviation standard.

III. RESULTS AND DISCUSSION

The data obtained in this research is data from the observation sheet on students' collaboration abilities. Based on research that has been carried out, an average score of indicators of students' collaboration abilities was obtained at each meeting. This observation sheet consists of five indicators, namely as follows:

Contribution is an indicator of collaboration ability. This collaboration ability indicator consists of three statements. The percentage of the average score of students' collaboration abilities on the contribution indicator in the experimental class is presented in Figure 1
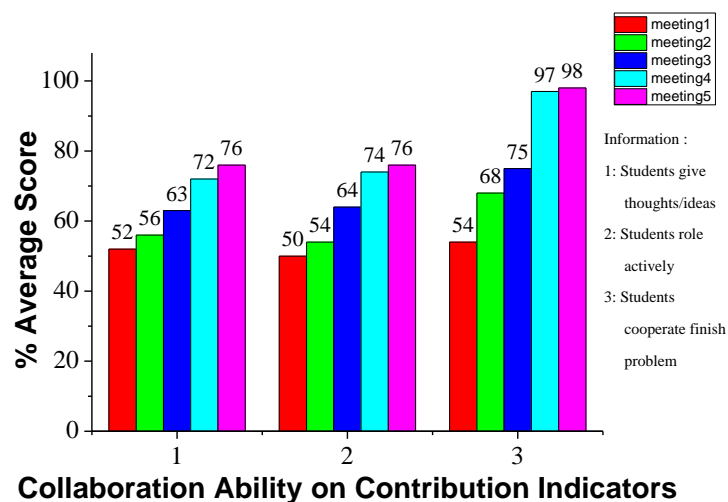

Figure 1. Percentage of the Average Score for Collaboration Ability in the Contribution Indicator in the Experimental Class

Based on Figure 1, it can be seen that students' collaboration abilities are based on the contribution indicator which consists of three statements. The first statement is that students provide thoughts or ideas. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first and second meetings the average score percentage for collaboration ability for this statement was 52% and 56% in the sufficient category, then for the third, fourth and fifth meetings the average score percentage for collaboration ability for this statement was 63%. 72%, and 76% in the good category. The second statement is that students play an active role. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first and second meetings the percentage of the average score for collaboration ability for this statement was 50% and 54% in the sufficient category, then for the third, fourth and fifth meetings the percentage of the average score for collaboration ability for this statement was 64%. 74%, and 76% in the good category.

The third statement is that students work together to solve problems. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first meeting, the percentage of the average score of collaboration ability for this statement was 54% in the sufficient category, then in the second and third meetings the percentage of the average score of collaboration ability for this statement was 68% and 75% in the good category, while the fourth and fifth, the average score percentage for collaboration ability was 97%, and 98% in the very good category.

The second indicator of collaboration ability is inquiry techniques. The investigation technique indicator consists of two statements. The percentage of the average score of students' collaboration abilities on the investigation technique indicators in the experimental class is presented in Figure 2
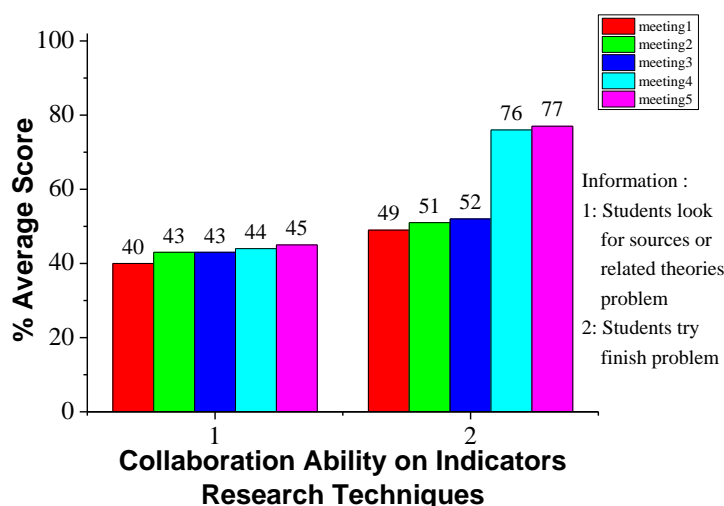
Figure 2. Percentage of Average Score for Collaboration Ability in Research Technique Indicators in the Experimental Class

Based on Figure 2, it can be seen that students' collaboration abilities in the investigation technique indicator consist of two statements. The first statement is that students look for sources or theories related to the problem being discussed. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first, second, third, fourth, and fifth meetings the average score percentage for collaboration ability for this statement was 40%, 43%, 43%, 44%, and 45% with the sufficient category,

The second statement is that students try to solve problems. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first, second and third meetings, the percentage of the average score of collaboration ability for this statement was 49%, 51% and 52% in the sufficient category, then for the fourth and fifth meetings, the percentage of the average score of collaboration ability for the statement This is 76% and 77% in the good category.

The third indicator of collaboration ability is problem solving. This indicator contains two statements. The percentage of the average score of students' collaboration abilities on the problem solving indicator in the experimental class is presented in Figure 3.
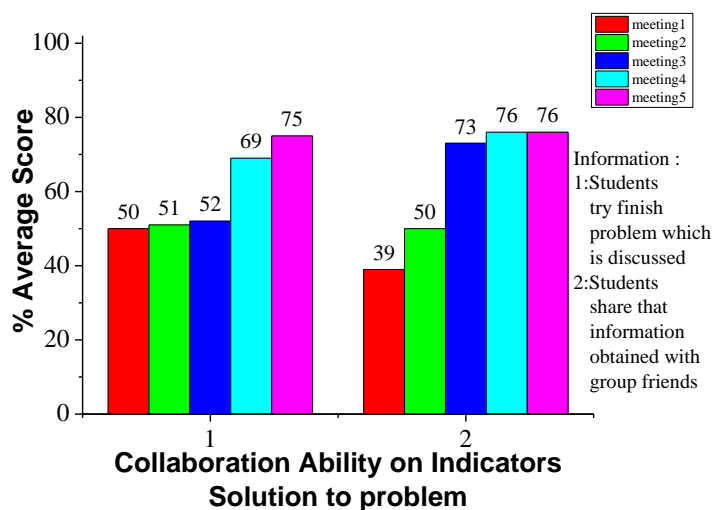

Figure 3. Percentage of Average Score for Collaboration Ability in the Problem Solving Indicator in the Experimental Class

Based on Figure 3, it can be seen that students' collaboration abilities in the problem solving indicator consist of two statements. In the first statement, students try to solve the problem being discussed. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first, second and third meetings, the percentage of average collaboration ability scores for this statement was 50%, 51% and 52% with the sufficient category, then for the fourth and fifth meetings it increased to 69% and 75% with the category Good.

The second statement is that students share the information obtained with a group of friends. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first meeting the

average score percentage for collaboration ability for this statement was 39% in the low category, then at the second meeting it increased to 50% in the sufficient category. while at the third, fourth and fifth meetings, the average score percentage for collaboration ability was 73%, 76% and 76% in the good category.

The fourth indicator of collaboration ability is working together with other people. This indicator consists of four statements. The percentage of the average score of students' collaboration abilities on the indicator of working together with other people in the experimental class is presented in Figure 4.
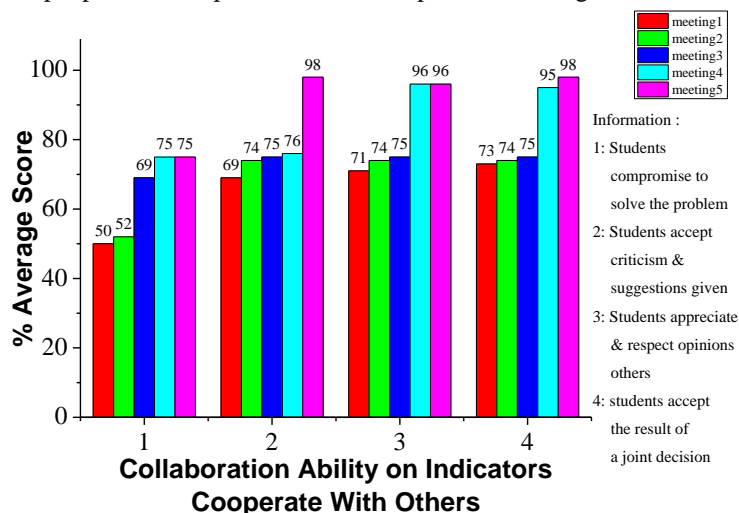

Figure 4. Percentage of Average Score for Collaboration Ability in the Indicator of Working Together with Others in the Experimental Class

Based on Figure 4, it can be seen that students' collaboration abilities in the indicator of working together with other people consist of four statements. The first statement is that students compromise to solve problems. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first and second meetings, the average score percentage of collaboration ability for this statement was 50% and 52% with the sufficient category, then for the third, fourth and fifth meetings it increased to 69%, 75% and 75% with good category.

The second statement is that students accept the criticism and suggestions given. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first, second, third, and fourth meetings, the average score percentage of collaboration ability for this statement was 69%, 74%, 75%, and 76% in the good category, then for the fifth meeting it increased to 98% with very good category.

The third statement is that students value and respect other people's opinions. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first, second and third meetings, the average score percentage for collaboration ability for this statement was 71%, 74% and 75% in the good category, then at the fourth and fifth meetings it increased to 96% in the very good category.

Statement 4 is that students accept the results of joint decisions that have been agreed upon. Students' collaboration abilities in this statement increase with each meeting. It can be seen that at the first, second and third meetings, the average score percentage for collaboration ability for this statement was 73%, 74% and 75% in the good category, then at the fourth and fifth meetings it increased to 95% and 98% in the very good category. ,

The fifth indicator of collaboration ability is time management. The percentage of the average score of students' collaboration abilities on the time management indicator in the experimental class is presented in Figure 5.
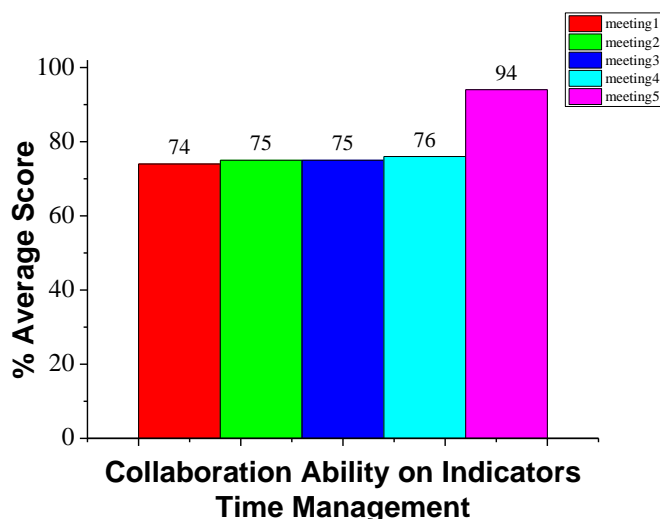
Figure 5. Percentage of Average Score for Collaboration Ability in the Time Management Indicator in the Experimental Class

From Figure 5, the collaboration abilities of students on the time management indicator in the experimental class almost increase at every meeting. At the first, second, third, and fourth meetings, the average score percentage of students' collaboration abilities in time management was 74%, 75%, 75%, and 76% in the good category. Meanwhile, at the fifth meeting, the average score percentage of students' collaboration abilities increased to 94% in the very good category.

The magnitude of the influence of the discovery learning model on students' collaboration abilities is calculated using the effect size. The data obtained is presented in the following table.

Table 4. Data Analysis of the Influence of the Discovery Learning Model on Collaboration Ability

$\bar{x}$ $\pm SD\ Class$ $Experiment$	$\bar{x}$ $\pm SD\ Class$ $Control$	Index Effect Size	Category
68,19 ± 2,49	63,43 ± 2,45	1,9	High

From table 4, it can be seen that the use of the discovery learning model in the learning process has a high influence on students' collaboration abilities.

Based on researchers' observations and research results, it shows that the collaboration ability of the experimental class is higher than that of the control class. To determine the magnitude of the influence of the discovery learning model on students' collaboration abilities, the effect size was calculated. To calculate the effect size, the Cohen's formula was used, the result of which was an effect size index for students' collaboration abilities of 1.9 and was classified as having a high influence on students' collaboration abilities. The collaboration ability of students in the experimental class increased at every meeting and also increased in each indicator compared to the control class. So the use of discovery models in learning has an influence on students' collaboration abilities.

By using this model, students are trained to work collaboratively to solve problems. According [19]stated that the discovery learning model improves students' problem solving skills, develops skills and confidence in making the right decisions, and helps students consolidate concepts. This is because it can encourage students to collaborate with other students and participate actively in the learning process, and can create a positive classroom situation, especially when students are discussing. In addition, students are encouraged to think critically when identifying problems. This is in line with [12]that the use of the Discovery Learning learning model in learning can increase students' learning activities.

IV. CONCLUSION

Based on the results obtained, students' collaboration abilities in the learning process using the discovery learning model provide an increase in each meeting. The results of the collaboration ability of students in the experimental class were 68.19 ± 2.49 in the good category and in the control class the collaboration ability of students was 63.43 ± 2.45 with good criteria. The magnitude of the influence of the discovery learning model on students' collaboration abilities, calculated using the effect size, was 1.9, which means it has a high influence in

improving collaboration abilities. It can be concluded that the discovery learning model has a high influence on students' collaboration abilities.

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