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The Effect of Discovery Learning Model Towards Biology Problem Solving

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Abstract

This research was a Quasy research experiment. This study aimed to determine the differences in Problem Solving Abilities (KPM) using Discovery Learning models and Conventional learning models. The study was conducted in March-October 2018. The population in this study was class X in one of the private high schools in Bogor Regency 2017/2018 academic year. The sampling technique uses purposive sampling techniques. The sample for the experimental class was class X MIPA B treated by using the Discovery Learning learning model with a total of 40 students and class X MIPA A being treated using a conventional learning model with 40 students with instruments to solved problems (KPM). Based on the results of the t test shows that there are differences in problem solving abilities between students who learn to use the Discovery Learning model and Conventional learning models. Discovery Learning class groups are higher than Conventional class groups, this can be seen from the average N-Gain score of problem solving abilities in the Discovery Learning class can be use 50 and Conventional class groups of 42. Therefore, the Discovery Learning learning model used in biodiversity material to improve students' biological problem solving capability.

Keywords: discovery learning model; problem solving; biology

INTRODUCTION

Science and technology development includes all life aspects, among them is education. This development gives big impact to education. Education system teaches student capability in solving problem. This capability is important for each student. This capability helps student to make decision precisely, systematic, and logic (*in* Daryanto *dkk.* 2017). Thus, teacher are managed in using learning strategy properly to produce high quality student in problem solving. On the other hand, in fact, teachers rarely use this strategy. Consequently, student has no problem solving capability.

Based on observation, there is one school in Bogor Regency which applicated some learning models. Pre test on Biodiversity subject for class X Science B showed 10% average, 28% poor, and 62% very poor. Every problem number has indicator for problem solving. The indicators are identify problem, analyse problem, find solution alternative, find main solution, and conclude student problem solution.

Students are included both physic and mental in gaining knowledge. Through this learning model, student will experience much more meaningful learning process. Student will be more interested in active learning and also increase his/her capability in solving problem among high school student in Bogor Regency.

Solving problem capability is a capability to find solution through information gaining and organizing process. This capability needs student special skill in problem solving. This capability heads on student's effort in determining solution on facing problem. Problem solving includes a proper way to reach goal (Azizah dkk, 2016). Problem solving capability uses past experiences and knowledge organizely and systematically. In conclusion, learning model triggering student problem solving capability is highly needed (Wena, 2011). One of learning models related to this capability is discovery learning.

Discovery learning is a student centered model, on the other hand teacher supervises and guides student in studying. In addition, discovery learning model also encourages student desire in studying, allows student to be creative, and manages the learning process by his/her own style. Therefore, student is included and self-motivated in studying (Marantika, dkk, 2015).

Bruner (in Nurrohmi dkk, 2017) explains two aims of discovery learning, they are (1) discovery of learning theory should act as a soft extended theory based on large construction that individu oriented; (2) learning theory should function as the way to define and give structure of self-study so can be a guide for education research. There are four components of Bruner's discovery learning theory: (1) curiosity and unstable moment; (2) knowledge structure; (3) sequencing; and (4) motivation. Based on Nurrohmi, dkk (2017), 3 principals related to Bruner's discovery learning theory: (1) instruction based on experience and contex that encourage student to study (readiness); (2) organized instruction so it will be well understood by student; (3) manageable instruction for extrapolation and emptiness filling. Biodiversity is one of subjects for encouraging problem solving capability. Biodiversity roles as ecosystem stability factor. A stabil ecosystem happened when population density tends to equilibrium point after distraction. Rate of diversity is determined by species number in ecosystem. Ninis (2017) stated six factors to determine organism diversity dynamic in ecosystem.

In summary, this research is important for knowing the difference of discovery learning and conventional model in problem solving capability. This research aims to describe problem solving capability difference.

METHOD

The research has been done in high school of Bogor Regency from March to October 2018. Research style was quasy experiment design with nonequivalent control group design. It had two variables, dependent variable and treatment variable. Dependent variable was problem solving capability. Meanwhile, treatment variable was discovery learning and learning model. Research design could be seen in Table 1.

Tabel 1. *Nonequivalent Control Group*

Sample	***Pretest***	**Perlakuan**	***Postest***
Conventional	O_1	X	O_2
DL	O_1	X_1	O_2

O_1 : Pre test score before treatment
O_2 : Post test score after treatment
X_1 : Treatment by discovery learning model

Population was student of class X (2018-2019 batch). Meanwhile, the sample was SMA Nagrak, Bogor from class X science A (40 students) and class X science B (40 students). Sampling used purposive sampling which was determining sample based on available classes or groups (Sugiyono, 2007).

Two homogeny classes were chosen based on student number. One class roled as experiment class using discovery learning model, meanwhile the other class used STAD (*Student Team Achievement Division*) model.

Research design used pre test scoring-before treatment and post test scoring-after treatment. Next was N-Gain calculation. N-Gain formula was:

$$\text{N} - \text{Gain} = \frac{\text{S } postest - \text{S } pretest}{\text{S } maks - \text{S } pretest} X\ 100$$

N-Gain : Normalized Gain
Spretest : Pre test score
Sposttest : Post test score
Smaks : Ideal maximum score

Contract validity is evaluated by judgement experts. Instruments were constructed by aspects based on special theory. Then it was consulted to experts. The final step was analyzing judgment expert evaluation by Aiken's V formula (Sugiyono, 2007).

Essay test was used for data sampling. Essay test consisted of describing problem with 5 total number. Furthermore, each of problem had indicators to identify problem, analyze problem, find solution alternative, determine main solution, and conclude problem solving (Wena, 2011).

Data analysis was used normality and homogeneity test before continued by statistic test. Normality test tested for normal distribution or not. Meanwhile, normality test was used chi quadrat technique with test criteria if $\chi^2_{count} \geq \chi^2_{table}$ means Ho refused with abnormal distribution. In contrast, if $\chi^2_{count} < \chi^2_{table}$ means normal distribution.

Homogenity test was done to prove the homogeneity of sample diversity. It used fisher test with criteria if $F_{count} \geq F_{table}$, so Ho is declined or non homogent data distribution. In contrast, if $F_{count} < F_{table}$, so Ho is accepted or homogent data distribution. After that, unpair-T test was used to analyze difference among two groups (independent). From T-test if Ho was accepted, so Ha (alternative hypothesis) is declined and if $t_{count} \geq t_{table}$ so Ho is declined and Ha is accepted.

RESULT AND DISCUSSION

The research data are grouped into two parts, consisting of two groups of data from the variable problem-solving ability using the Discovery Learning model and the ability to solve problems using a conventional model. The number of data sources was 80 students consisting of two class groups which were the research class groups. The number of students is divided into 40 groups of Discovery Learning classes and 40 groups of conventional class groups.

Based on the data, the ability to solve problems before and after learning is assessed through two stages, namely the pretest assessment which is carried out before the learning activities and the posttest which is carried out after the learning activities. Class X IPA B obtained a maximum value of 79, a minimum value of 33, an average N-Gain 49.40 mode 45.5 and a median of 41.

The results of the calculation of the N-Gain value for the Discovery Learning class group are presented in the form of a frequency distribution which can be seen in Figure 1.

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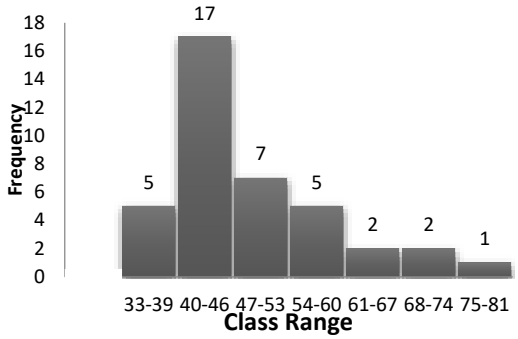

Figure 1. Frequency Distribution of the N-Gain Value of the Discovery Learning class group

Based on Figure 1 above, the highest number of frequencies is at the 40-46 interval as many as 17 people and the lowest frequency is at the 75-81 interval as many as 1 person.

Based on the data, the ability to solve this problem is carried out in two stages, namely before learning activities (pretest) and after learning activities (postest). Based on the assessment that has been done, the results of the descriptive statistical calculation of N-Gain ability to solve conventional class problems carried out in class X IPA A, obtained a maximum value of 54, a minimum value of 33, an average of N-Gain 41.95, mode 43 and median. 42.5. The results of the calculation of the N-Gain value for the Conventional class group are presented in the form of a frequency distribution which can be seen in Figure 2.

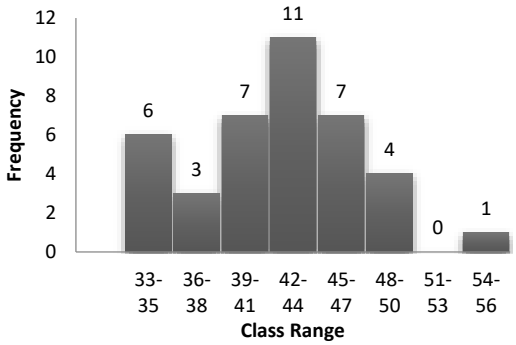

Figure 2. Frequency Distribution of the N-Gain Value for the Conventional class group

Based on Figure 2 above, the highest number of frequencies is at the 42-44 interval with 11 people and the lowest frequency is in the 51-53 interval, totaling 0 people.

In each class group with the Discovery Learning and conventional learning models, the prerequisite analysis of the research data was tested by calculating the hypothesis test using the t test technique. Before analyzing the data, the normality and homogeneity tests were first carried out.

Based on the results of the calculation of the normality test of the N-Gain data, the ability to solve problems, X2 count for the Discovery Learning group of -80.18 and the Conventional class group of -107.49.

Table 1. Normality distribution of problem-solving capability

No	Treatment Group Distribution	X^2 count	X^2 table	Conclusion
1.	*Discovery Learning*	-80,18	7,81	Normal
2.	Conventional	-107,49	7,81	Normal

The X2 table for the Discovery Learning and Conventional groups is 7.81 with a sample size of 40 Discovery Learning and 40 at the conventional level of significance $\alpha = 0.05$. Based on the calculation of the normality test using the chi-squared technique, it can be concluded that all class groups have X2 count <X2 table so that the N-Gain data distribution of the ability to solve problems in Discovery Learning and conventional classes comes from a normally distributed population.

The homogeneity test was carried out to analyze whether the data from the two sample populations had a homogeneous variance or not. Homogeneity testing was carried out using Fisher's exact test. After calculating the homogeneity of the variance of the N-Gain distribution, the ability to solve problems using the F test. The results of the homogeneity test for the ability to solve problems can be seen in table 2.

Table 2. Homogeneity distribution of problem-solving abilities

No	Class group	N	S^2	F^2 count	F^2 table
1.	*Discovery Learning*	40	216,78		
2.	Conventional	40	216,78		
				3,98	35,17

Based on the calculation of the homogeneity test for the variance of the N-Gain distribution, the ability to solve problems for the Discovery Learning class group and the conventional class group obtained Fcount = 3.98 and Ftable = 35.17 at $\alpha = 0.05$ so that it can be concluded that Fcount <Ftable so that the variance distribution N- The gain of students' problem-solving abilities in Discovery Learning and Conventional classes comes from a homogeneous population.

Based on the data obtained, it is stated normal and homogeneous, the next step is to test the hypothesis. It can be seen in table 3.

Table 3. Hypothesis test of problem-solving abilities

No	Class group	Mean	tcount	t_{table} (0,05)
1.	*Discovery Learning*	49,40		
2.	Conventional	41,95		
			4,028	1,994

Based on the calculation of the t test which states that there are differences in the ability to solve biological problems learned by using the Discovery Learning and conventional learning models, it is accepted. The results of this analysis can be seen that there are differences in the ability to solve problems learned by using the Discovery Learning and conventional learning models.

The research that has been done shows the differences in the results of the ability to solve problems using the Discovery Learning and conventional learning models on biodiversity material shown by hypothesis testing. The use of the Discovery Learning learning model is higher than conventional learning in honing the ability to solve biological problems in biodiversity material, because this Discovery Learning learning model refers to students being directly involved in experiences and experiments where later they can find their own knowledge and concepts so that they are honed problem solving skills.

At first, classroom learning using the Discovery Learning model has not been seen to run optimally because students are not used to learning in groups. Students are required to process the Discovery Learning learning model in order to find knowledge and concepts independently to find information to be learned because the Discovery Learning learning model is student-centered. Marantika, et al, (2015). Meanwhile students are accustomed to learning in a passive and teacher-centered atmosphere, students who only listen to the teacher's explanation then write them down and do the exercises given by the teacher. Students also have not been able to convey ideas / ideas or have not been able to solve problems with the correct steps because students are not accustomed to independent learning such as recognizing

problems, finding their own answers and seeking information on concepts and knowledge, attitudes and skills. Good changes occur as the learning process progresses. Because these developments can be seen from the active discussion of students solving problems that exist in LDS, conveying ideas and responding to their friends' opinions and questions. Students play an active role in formulating problems related to the material when the teaching and learning process takes place.

The learning process is in the Discovery Learning model, a process that refers to students being directly involved in experiences and experiments where later they can find their own knowledge and concepts. In line with research conducted by Gusmania, et al. (2016), it is concluded that using the Discovery Learning learning model is able to hone problem-solving skills. Teaching and learning activities carried out in the Discovery Learning learning model class group are directed to seek new knowledge to solve problem solving so that students are invited to think, seek new knowledge and solve a problem in the problem directly to the field so that students can find out directly with experience the students themselves experience it so that students gain knowledge more quickly and can solve the problems that have been given in the form of these questions.

The conventional learning model with the STAD learning model applies to students to provide initial information or an outline of the material to be studied, then create a discussion group then the teacher guides students to the correct answer and guides students to really understand the material being studied. During the learning process this conventional model understands the subject matter through quizzes and conducts group discussions and this conventional model is also more focused because the problem formulation has been made together with the teacher.

In line with Febry's research, et al. (2017) that the Student Teams Achievement Division learning model students are required to pay attention to the learning steps where students can work together between groups and the teacher controls students in group formation in the Student Teams Achievement Division learning model. working together directly without different stages, students work on student worksheets and individual tests / quizzes. The use of the Student Teams Achievement Division learning model during discussions and presentations of passive students will be less active, because they rely on their friends who are smarter in the group, and there is no competition between groups in the implementation of discussions and students with low solving abilities are less aware of where lies the drawback, as a result the student's problem-solving ability is not good. Then from that the STAD learning model requires special abilities from teachers who are required to be facilitators, mediators, evaluations and the use of a relatively longer time. Whereas with Discovery Learning itself, students are required to play an active role in learning and foster curiosity in students so as to create learning experiences that spur the ability to solve problems in students because students do their own experiments and find something for themselves so that the ability to solve problems is created. biology higher than the STAD learning model.

The explanation above is that the Discovery Learning class gets a higher average N-Gain problem-solving ability than the Conventional class. Discovery learning model has stages suitable for honing the ability to solve biological problems in biodiversity material. Internal factors also support the achievement of the ability to solve biological problems using the Discovery Learning model. Internal factors such as the teacher's way of directing students to independent learning, and motivating students by asking about the biodiversity in the surrounding environment, the level of biodiversity and the distribution of flora and fauna that make students enthusiastic in responding to teacher motivation. Meanwhile, conventional learning with the STAD learning model is deemed to have directional stages from the start by the teacher so that students lack the curiosity to seek further information because it has been directed first by the teacher in the subject of biodiversity.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that there are differences in the ability to solve biological problems between students who learn to use the Discovery Learning and Conventional models in one of the Bogor Regency High Schools. The ability to solve problems using the Discovery Learning model is better than conventional learning models. This can be seen from the N-Gain average score of the results of the ability to solve problems between the two groups of Discovery Learning classes of 49.40, while the conventional was 41.95.

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