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The Effect of Combining the Discovery Learning with Problem Based Learning on Students' Problem Solving Ability in Biology Learning

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ABSTRACT

This study aims to determine the effect of a combination of Discovery Learning and Problem Based Learning on the problem solving abilities of class X students at SMA Negeri 9 Malang. The method used in this research is quasi-experimental with a quantitative approach. Data collection techniques used were interviews, problem-solving ability tests, sheet validation and documentation. The results showed that there was a significant influence on the problem solving abilities of students using a combination of Discovery Learning and Problem Based Learning models in biology class X IPA Malang State High School which can be seen from the sig (2tailed) value of 0.002<0.05. The combination of the Discovery Learning model with Problem Based Learning provides opportunities for students to be actively involved in the learning process to solve problems that occur in everyday life starting from finding problems, analyzing problems to drawing conclusions

KEYWORDS

Problem Based Learning
Discovery Learning
Biology

1. Introduction

Education is a conscious and planned effort to create learning and learning process situations so that students are active and able to increase their potential to have religious strength, personality, character, skills, and skills needed by themselves, the people. , nation and state. Talking about education is certainly inseparable from the process of interaction between individuals and the surrounding environment in order to achieve a goal called learning (Sugiyono, 2013). According to Hosnan (2014) learning is a process that is intended by students to obtain a new behavior change as a whole, consciously, and that change is relatively permanent and brings positive influences and benefits for students in interacting with the surrounding environment. Education is one of the most important needs so that almost all aspects of life require education. Putrayasa (2014) explains that education must be carried out as well as possible in order to obtain maximum results achieved by implementing education that is timely and appropriate in order to achieve learning objectives.

Learning biology should be carried out with a scientific approach with the aim of cultivating the ability to think in problem solving, work and act scientifically and communicate it as an important aspect (Ayuliasari, 2017). Therefore high school biology learning emphasizes providing direct learning experiences through the use and development of process skills and scientific attitudes. In the 2013 curriculum teachers must use a scientific approach to become the basic model in learning coupled with the Problem Based Learning model. Aris Shohimin (2014) explains that Problem Based Learning is learning that simultaneously develops problem solving strategies, basic knowledge and skills by placing students to be active in learning.

Based on the results of interviews at SMA Negeri 9 Malang that the current learning process is conceptual learning. The goal of conceptual learning is learning that makes students understand ideas in a subject, not just remembering isolated facts. As for the fact that the learning outcomes of the students are quite good, but from the point of view of the students they have not been able to solve the problem seen from the students who have not been able to analyze, solve problems or conclude a problem. Students who have analytical skills to conclude are very low in a successful Biology lesson must be supported by learning models that are interesting and fun and in accordance with the material

being taught. The learning model is a design or pattern that is used as a guide in carrying out a learning process in the classroom. Through the learning model applied by the teacher helps students get good information. Rusman (2011) says that learning is a system, which consists of several components that are interrelated with one another. Djamarah and Zain (2010) stated that the objectives of teaching and learning activities are not achieved if these components are not considered, one of which is a model which is a tool to achieve the goal. Teachers are able to use learning models accurately so as to achieve teaching objectives. The goal is formulated so that students have the skills, the model needed must be in accordance with that purpose. Models in learning must support the achievement of teaching objectives. If it does not support it, the formulation will be in vain.

Based on the statement above, it is necessary to find a solution so that the learning process can take place actively and effectively so as to improve problem solving abilities in students. One learning model that can improve this, in accordance with the nature of learning is to use a combination of Discovery Learning and Problem Based Learning (PBL). According to Hosnan (2014), the advantages of this model are not developing active student learning methods by finding themselves but also investigating themselves so that the results obtained will be long-lasting in memory and not easy for students to forget. In addition, the Discovery Learning model also has links to activities, according to Wulandari, (2015), namely in the stimulation phase students listen and answer motivational questions in the form of problems. Then the problem statement phase, students identify problems and formulate hypotheses. Next is the data collection phase, students analyze and seek information to complete the answers to the questions in the student worksheets, then in the verification phase, students present their observations on the student worksheets and then draw conclusions. The purpose of using this learning model according to Wina Sanjaya (2009) namely in order to increase student activity in problem solving, help how to transfer their abilities to understand problems in real life, develop new knowledge and be responsible for the learning they do and problem solving can develop critical thinking skills and develop their knowledge to adapt with new knowledge.

Problem Based Learning model with Discovery Learning has scientific learning characteristics (Fauzia et al, 2014). This can be corroborated by previous researchers who stated that there was an effect after applying the Problem Based Learning with Discovery Learning to students' problem solving abilities Tayeb (2013), Destalia, et al (2014); and Zahid (2016). Based on research by Khohitmah (2016), Lasisi (2016), Wulan, et al (2017), Ekawati (2017) and Yusry (2018) shows that the Problem Based Learning model combined with the Discovery Learning model further improves students' problem solving abilities when compared to conventional learning.

2. Method

The design in this study is a quasi-experimental research design using a quantitative approach. The population in this study is the entire student who will be given treatment. For the population in this study, all students in class X with a total of 6th grade and 204 students at SMA Negeri 9 Malang in the 2021/2022 program.

This type of research is classified into quasi-experimental research with a quantitative approach. According to Arikunto (2006) experimental research is research that is used to find out or try to research whether there is a causal relationship by comparing the experimental group that was given treatment with a comparison group that was not given treatment. Where the treatment referred to in this study is the use of a combination of Discovery Learning with Problem Based Learning as a supporter of active and effective learning in class X IPA students at SMA Negeri 9 Malang. The location of this research was carried out at SMA Negeri 9 Malang which is located on Jl. Borobudur Peak No. 1 Mojolangu, Kec. Lowokwaru, Malang City, East Java, with the population in this study being students of class X IPA at SMA Negeri 9 Malang for the 2021/2022 academic year. The samples in this study were the Science 1 class which consisted of 34 students and the Science class 2 which consisted of 34 students. Sampling in this study used a purposive sampling technique, namely a sampling technique with certain considerations in a study with the aim of making it easier to measure hypothesis testing.

The data collection technique used was interviews during the research with the aim of obtaining accurate information by meeting in person or online for interviews. The instrument used was a written test (paper and pencil test) in the form of an essay test in the form (pre-test questions are the same as post-test). The total number of questions used in this study were 9 questions. The device validation sheet used to obtain information about the quality and learning materials based on expert validator

research. The validation sheet used is the instrument validation sheet in the form of lesson plans, worksheets, and assessments. Documentation is a tool for collecting written or printed data regarding facts that are to be used as physical evidence of research and the results of this documentation research have a very strong position.

The technique used for data analysis of problem solving ability is inferential statistical analysis. Sugiyono (2014) says that inferential statistics are statistical techniques used in analyzing sample data and the results apply to the population. Hypothesis testing in this study used the Covariate analysis technique (anacova) to measure students' problem-solving abilities based on pre-test and post-test data. There are two main things that are done in the data analysis, namely the requirements test and the hypothesis test, with the steps that are, converting the scores obtained by students into scores on a scale of 1-100 using the formula: Score = (score obtained by students) / (maximum score) x 100, then to calculate the average for each variable Formula:

$$\bar{x} = \frac{\Sigma xi}{n},$$

Determine the standard deviation of each variable with the Formula:

$$S_D = \sqrt{\frac{n\Sigma X_i^2 - (\Sigma X_i)^2}{n(n-1)}}$$

The prerequisite test used is the normality test used to check sample data obtained from the population whether it has a normal distribution or not. The significant level for accepting or rejecting a normal decision or not in the data distribution is by comparing the asymp value Sig (2-tailed) with the value $\alpha = 0.05$. The data normality test was analyzed using the Lilliefors test or approach. Homogeneity test, used to determine the relationship between the control class (X) and the experimental class (Y). The purpose of this test is to test whether the sampled groups come from the same population, which is said to be homogeneous in distribution. Hypothesis testing is a different sample test conducted to find out whether there is a significant effect between the two samples studied with a level of 0.05. To test the hypothesis using covariate analysis (anacova) the results of problem solving abilities in students.

3. Results and Discussion

Description of Research Data

This research was conducted to determine the effect of a combination of Discovery Learning and Problem Based Learning on students' problem solving abilities in class X SMA Negeri 9 Malang. The data in the study were obtained through pre-test scores to determine students' problem-solving abilities at the beginning of learning and post-test scores to determine problem-solving abilities at the end of learning. The control class is a class that uses conventional learning with the lecture method while the experimental class uses a combination of Discovery Learning models and Problem Based Learning models. The following is an explanation of the results of the control class research which can be seen in the table 1:

Table 1. List of Statistical Measures of Problem Solving Ability Tests of Control Class and Experiment Class Students

Statistical data *size*	*Pre-test Control Class*	*Post-test Control Class*	*Pre-test Experiment Class*	*Post-test Experiment Class*
Number of respondents	34	34	34	34
Average	65	77	57	79
Varians	124	94	142	93
Deviation Standart	11	11	12	10

In order to make it easier to understand the comparison of the average pre-test and post-test values of the control class and the experimental class can be seen in Figure 1.

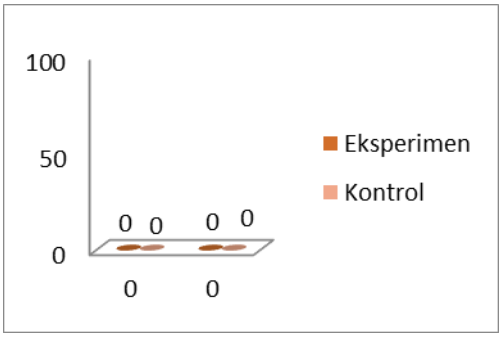

Figure 1. Pre-Test and Post-Test Values

Figure 1 shows that there is a difference in the increase in the average pre-test and post-test scores in the experimental class which has increased because it is influenced by the learning model used, namely a combination of the Discovery Learning and Problem Based Learning while the control class uses conventional learning as well experienced an increase in post-test scores. Both of these classes used a problem solving ability test with the same essay questions and only differed in the learning model used, where the control class used conventional learning with the lecture method while the experimental class used a combination of Discovery Learning and Problem Based Learning

Hypothesis Test

The prerequisite test is carried out before the hypothesis test to see normal and homogeneous data. The normality test for the distribution of pre-test and post-test data for students' problem solving abilities using a combination of Discovery Learning and Problem Based Learning can be seen in Table 2.

Table 2. Normality Test Data of Pre-Test and Post-Test of Student's Problem Solving Ability

	Kolmogorov-smirnov			
Model	***Pre-test***		***Post-test***	
	Sig	***Interpretation***	***Sig***	***Interpretation***
PBL with Discovery	0,200	Normal	0,200	Normal
Convensional	0,23	Normal	0,200	Normal

Table 2 shows that the results of testing the normality of the data on the pre-test and post-test of students' problem solving abilities in the control class using conventional learning with the lecture method while the experimental class uses a combination of Discovery Learning and Problem Based Learning shows that the distribution of data is distributed normal because the significant value is >0.05.

The homogeneity test of the pre-test and post-test data of students' problem-solving abilities shows that students' problem-solving abilities are declared homogeneous with a significant value of 0.540> 0.05 and the post-test data of students' problem-solving abilities is also stated to be homogeneous with a significant value of 0.635> 0.05.

After the prerequisite tests are met and the data is declared to be normally distributed and homogeneous, it can proceed to hypothesis testing using the covariate test (Anacova). This covariate test was conducted to determine the significant value of the pre-test and post-test of students' problem solving abilities in the control class and the experimental class.

Table 3. of Independent Anacova Test Results of Students' Problem Solving Ability

Test Type	***Mean Square***	***F***	***Sig 2 Tailed***	***Partial Eta Squared***	***Kesimpulan signifikansi <α(0,05)=H_1 Accepted***
Post-test (Control and Experiment Class)	1102,27	10,753	0,002	0,142	H_1=Diterima

The results of the covariate analysis (anacova) in table 4.5 with the help of IBM SPSS 23. The covariate test (anacova) shows that this learning model has an effect on students' problem solving abilities which can be seen from the value t = 0.002 with a sig value (2tailed) 0.002 <0, 05. So the testing criteria are significant <0.05, it can be concluded that H1 is accepted and H0 is rejected, meaning that there is an influence between students who are taught using a combination of Discovery Learning and Problem Based Learning and students who use conventional learning with the lecture method.

Combination of Discovery Learning with Problem Based Learning

The process of learning biology in class X IPA SMA Negeri 9 Malang uses a conventional learning model with the lecture method which according to Barry and King (2004) the conventional learning method is learning that takes place from teacher to student. In conventional learning it can be seen that the learning process is more dominated by teachers who transfer knowledge, while students are more passive as recipients of information. As Ruseffendi (2005) said conventional learning generally has certain characteristics, for example prioritizing memorization rather than understanding, teacher-centered teaching, prioritizing results not processes, students as recipients of information, teachers as determinants of the course of the learning process.

The learning material in this study is kingdom monera material using a combination of Discovery Learning and Problem Based Learning to hone students' problem solving abilities. Cognitive tests were given to students at the beginning of learning, namely the pre-test to determine students' initial abilities and tests at the end of learning, namely the post-test to determine students' final abilities. The questions in the pre-test and post-test are in the form of essays that refer to indicators of problem-solving ability.

The learning process during the Covid-19 pandemic certainly really needed appropriate facilities and infrastructure, namely Blended Learning at the first and second meeting where half of the students used zoom and half of the students were face-to-face in class. Means in learning
namely using PPT and student worksheets which are given via e-front and WhatsApp class groups. student worksheets contains cases of solving problems caused by bacteria. The purpose of this student worksheets is to hone students' problem-solving skills in obtaining information based on problems that occur in the environment so that they can analyze according to what is found in the surrounding environment. This is said by the opinion of Borich (2006) problem-based learning is a learning that uses a problem to be analyzed and then a solution can be determined. Problem-based learning requires students to think more creatively in determining problem solving. This study also uses the internet media as a literature search medium.

The researcher's field notes during the learning process using a combination of Discovery Learning and Problem Based Learning models show that this learning process makes students think more critically because in this learning model it involves students to analyze problems starting from solving problems, providing solutions to concluding problems. Students can also analyze problems in the environment caused by bacteria to hone their problem-solving skills. This agrees with Nurliiawaty (2017) that problem-solving-based worksheets have a positive effect on classroom learning as evidenced by increasing students' analytical skills.

The results of the researchers' observations, during the learning process there were still many shortcomings or obstacles during the learning process, for example the learning process was not conducive because during the Covid-19 pandemic the teacher could not make direct contact with students, besides that there were also some students who were difficult to invite to work on LKPD and work on essay questions so that there is a delay in submitting assignments. This agrees with Yunitasary and Hanifah. U (2020) in his journal said that online learning is less effective because there are still some students/parents who don't have cell phones and have problems with internet signals.

The action given to students who do not submit assignments is to provide understanding and motivation to students who experience difficulties in doing their assignments and always warn students to work on student worksheets and essay questions to test students' problem solving abilities through the WhatsApp group until students can complete assignments . This agrees with Prayitno (2017) who says that task completion skills are part of the learning process, the main goal of which is to teach

students. Through this assignment students are required to do assignments and look for references, study and study further. According to Slameto (2002) so that students succeed in doing assignments, these students can reduce anxiety in themselves because they are not afraid to be scolded by their teacher.

The Effect of Discovery Learning with Problem Based Learning on Problem Solving Ability

The use of a combination of Discovery Learning and Problem Based Learning has an effect on students' problem solving abilities which can be seen from testing the hypothesis using the covariate analysis technique (anacova) with a significant value of 0.002 <0.05 thus H0 is rejected and H1 is accepted. So it can be concluded that the use of a combination of Discovery Learning with Problem Based Learning has an effect on the problem solving abilities of class X IPA students of SMA Negeri 9 Malang which can be seen from the learning model that is able to motivate students in learning so that it can lead to a combination of Discovery Learning with Problems Based Learning influences students' problem solving abilities. This is evidenced by Muzaki's research (2010) which obtained the result that student learning motivation has a significant influence on students' ability to solve problems. This shows that if students have high learning motivation, problem solving abilities will also be good, (Ulya. N.d. (2010).

The average post-test score of students' problem solving abilities is taught using a combination of Discovery Learning models with Problem Based Learning with an average score of 79 and a standard deviation of 10. Significantly higher because in the learning process students are trained to be aware of problems that occur, solve problem, analyze the problem, to conclude the problem being analyzed. This is proven by research from Lutfianah. M (2018) which says that students are taught using learning models problem-based can improve students' problem-solving abilities, this is reinforced by the opinion of Hosnan (2014) who suggests that student orientation to problems can help students understand problems, organize students for learning, guide student investigations and help students develop and present results. Meanwhile, with the problem solving abilities of students who are taught using conventional learning with the lecture method, which has an average value of 77 and a standard deviation of 10. This is because the control class does not use a combination of Discovery Learning and Problem Based Learning in the learning process.

The overall learning activities carried out in the experimental class where learning uses a combination of Discovery Learning models and Problem Based Learning provide opportunities for students to be actively involved in the learning process to solve problems that occur in everyday life starting from finding problems, analyzing problems to drawing conclusions. Whereas in the control class the learning used conventional learning with the lecture method in which the teacher explained the material and question and answer activities but did not come to the process of solving problems in everyday life. In the experimental class using a combination model of Discovery Learning and Problem Based Learning students looked enthusiastic in responding to emerging problems and actively seeking information about problems caused by bacteria from various learning sources which can be seen from the number of students working on student worksheets and student problem solving ability tests.

The combination of the Discovery Learning model with Problem Based Learning requires students to learn to solve problems, analyze, conclude and provide solutions to a problem, as stated by Anna Fauziah (2018) that the results of this study show that the problem-based learning model has an effect on strengthened problem solving abilities with a theoretical basis according to Sanjaya (2014) which reveals that problem-based learning can help students transfer knowledge to understand problems in everyday life. As suggested by Hosnan (2014) problem-based learning helps students learn to investigate, understand, solve and conclude a problem.

According to Ashary, et al (2017) that the Discovery Learning requires students to use all of their senses to find concepts accompanied by teacher guidance. Teacher guidance aims to help students at each learning stage so that learning becomes more directed as said by Nbina (2013) that the Discovery Learning can improve students' problem solving abilities because this learning model focuses on discovery activities that are student centered which involve participatory students are active in observing, formulating, making conjectures, explaining, analyzing and drawing conclusions so as to encourage students to formulate concepts of material principles through their own mental processes

during the learning process. The advantages of the Discovery Learning arestated by Roestiyah (2008) that this model has the advantage that it can improve students' cognitive abilities, students are more active and creative in thinking, active in learning activities, able to improve students' ability to solve problems and able to work together in solving problems and able to draw conclusions from various sources that have been collected.

Yusri (2018) suggests that the Problem Based Learning can improve students' problem solving abilities. It can be seen from the learning outcomes of students who are spent using Problem Based Learning which increases more than in conventional classes. This is in line with research conducted by Sari, et al (2014) which said that the increase in problem-solving skills of students who were taught using the Problem Based Learning was higher than students who were taught conventionally. This happens because in the application of the Problem Based Learning students better understand problems, solve problems, to provide solutions to a problem (Anggraini, Purwanto & Nugroho, 2020).

Then according to Fauziah, et al (2016) the Problem Based Learning is a learning model that is considered to have scientific characteristics. This is corroborated by research from Destalia, et al (2014); Wulan, et al (2017); Yusri (2018) who said that there was an influence after applying the Problem Based Learning on students' problem solving abilities which could be seen from students being more aware and more understanding of problems, connecting problems with experience, solving problems and being able to provide solutions. As proven by Rerung, et al (2017) in the results of his research that the Problem Based Learning can improve students' cognitive learning outcomes. Likewise with Primary (2018) an increase in the cognitive learning outcomes of students who are taught using the Problem Based Learning strategy further emphasizes that the potential of the Problem Based Learning strategy in improving student cognitive learning outcomes is maximized in learning.

The advantages in this learning process are when students can be more active in analyzing and can express their own opinions about solving a problem that exists in the surrounding environment. According to Fatimah (2015) suggests that the ability to express opinions is the ability to convey ideas or thoughts verbally in a logical manner without forcing one's own will and using good language based on experience and knowledge one has. So according to Anindawati (2015) the ability to express opinions that are mastered by students can help students obtain optimal learning outcomes. Directly this learning process can improve students' problem-solving skills. This can be seen from students being able to work on student worksheets which contains cases that occur in everyday life caused by bacteria. According to Nurhasanah (2009) who says that problem-solving abilities can be improved through problem-based learning because problem-based learning is a learning that uses real-world problems as a context for students to learn about critical thinking and problem-solving skills as well as to acquire knowledge and concepts. essential from learning material. The results of the researchers' observations, during the learning process there were still many shortcomings or obstacles during the learning process, for example the learning process was not conducive because during the Covid-19 pandemic the teacher could not make direct contact with students, besides that there were also some students who were difficult to invite to work on student worksheets and work on essay questions so that there is a delay in submitting assignments. This agrees with Yunitasary and Hanifah. U (2020) in his journal said that online learning is less effective because there are still some students/parents who don't have cell phones and have problems with internet signals.

4. Conclusion

Based on this discussion, the learning model combined with Discovery Learning and Problem Based Learning used in the biology learning process for Kingdom Monera material influences the problem solving abilities of class X IPA 1 students at SMA Negeri 9 Malang with a significance level of 0.002 <0.05. The combination of the Discovery Learning model with Problem Based Learning provides opportunities for students to be actively involved in the learning process to solve problems that occur in everyday life starting from finding problems, analyzing problems to drawing conclusions. In addition, it also requires students to learn to solve problems, analyze, conclude and provide solutions to a problem.

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