The Effect of Problem Based Learning Models on Student Learning Outcomes in Material Structure and Functions of Plants

Jelika Aulia[1], Suyud Abadi[2], Rindi Novitri Antika[3]

[1,2,3] Biology Education Study Program, FKIP, Palembang Muhammadiyah University
Coresponding Author. E-mail:
[3]rindi.ump@gmail.com

Abstract

This study aims to determine the effect of the Problem Based Learning (PBL) model on student learning outcomes on plant structure and function material. This research is a quasi-experimental study with a pretest-posttest control group design. The population of this research is SMP Muhammadiyah 1 Palembang students. The sample in this study were students of class VIIIA as the experimental class and VIIIB as the control class which were selected by purposive sampling. The learning outcomes analyzed are cognitive learning outcomes. Test analysis using independent sample T-test. The results showed that there was an influence of the Problem Based Learning model on students' cognitive learning outcomes, it was known from the sig value on the t test 0.038 <0.05. Then it is supported by the average post-test score of the experimental class (82.46) which is higher than the control class (73.50).

Keywords: Problem Based Learning, Learning Outcomes, Structure and Function of Plants

INTRODUCTION

Education is a process in order to influence students so that they are able to adapt as well as possible to their environment and which will cause changes in themselves that allow them to function according to their competence in community life (Sagala, 2016). Education aims to develop the potential of students to become quality human resources. In the current 21st century, the learning objectives are that students are expected to have 4C characteristics, namely: Communication, Collaboration, Critical Thinking and Problem Solving, Creativity and Innovation. Learning at school does not only aim to understand the material being taught, but the main goal is for students to have reasoning, communication, representation and problem solving skills (Ariawan & Nufus, 2017). Classroom learning is one of the vehicles to achieve the expected abilities in the 21st century.

In fact, currently, the quality of education in Indonesia has not yet achieved the expected results, the results of the 2018 PISA survey put Indonesia in 74th place or sixth from the bottom. Indonesian students' reading ability with a score of 371 is in 74th position, Mathematics ability with 379 is in 73rd position, and Science ability with a score of 396 is in 71st position.

One of the factors causing the low ranking of Indonesian students in PISA is their weak or high-level problem-solving abilities. Because the questions tested in PISA range from level 1 to level 6 questions. Meanwhile, most Indonesian students are only familiar with level 1 and 2 routine questions (Inayah, 2018). This was also expressed by Oktaviana, et al (2018) that the ability to solve problems is found in the questions tested by PISA. With the low PISA results of Indonesian students, it can be said that the problem solving abilities of Indonesian students are also low.

Low learning outcomes also occur in schools. One of them is at SMP Muhammadiyah 1 Palembang. Based on the results of interviews with biology teachers, it is known that students rarely ask questions during discussions and are not critical of phenomena that are often given as a stimulus when learning. In addition, based on the analysis of students' mid-semester results, it was found that more than 50% of students were unable to answer questions at C4-C6 levels or questions on higher order thinking.

Biology learning is closely related to everyday life, so that in learning biology, learning models are needed that are able to help students solve authentic problems that often occur in everyday life. One appropriate learning model is Problem Based Learning. According to Bern and Erickson (Komalasari, 2011: 5) "Problem Based Learning (PBL) is a learning strategy that involves students in solving problems by integrating various concepts and skills from various disciplines. This strategy includes gathering and synthesizing information, and presenting findings.

The PBL model is learning that is carried out by giving a problem to students, then asking several questions, facilitating investigations, and opening dialogue. The PBL model requires students to be actively involved in the learning process, and prepares students to think critically and analytically, as well as being able to obtain and use learning resources appropriately. With the PBL model students will be skilled in solving problems, digging up information, and working together in groups (Royani, 2016). Improving problem solving abilities is expected to improve student learning outcomes.

The PBL model consists of five steps, namely: 1) student orientation to problems, a2) organizing students to learn, 3) guiding individual and group investigations, 4) developing and presenting work, 5) analyzing and evaluating the problem-solving process. (Hosnan, 2014).

Appropriate biology learning materials are studied using the PBL model, one of which is the structure and function of plants. In this material, initially students are given problems that are often found in certain plants, analyze, formulate problems, and finally do problem solving.

Based on the problems that have been described, the researchers conducted a study entitled The Influence of the Problem Based Learning Model on Student Learning Outcomes on Plant Structure and Function Material.

METHOD

The research method used is quantitative with the type of quasi-experimental research. This research was carried out at SMP Muhammadiyah 1 Palembang which was conducted within a period of one month, starting from August-September 2022. The population in this study were all class VIII students at SMP Muhammadiyah 1 Palembang. This study used 2 classes, namely Class VIII A which applied the Problem Based Learning (PBL) learning model, and VIII B as the control class.

The sampling technique in this study was to use purposive sampling. The design used in this study was a non-equivalent control group design that used a pretest to measure students' initial abilities and a posttest to measure students' abilities after being given treatment (Sugiyono, 2018). The following is the research design used can be seen in table 1.

Table 1 Research Design

Class	Pretest	Treatment	Postest
Experiment	O_1	X	O_2
Control	O_3	-	O_4

The research instrument used in this study was a question to assess students' cognitive learning outcomes. Data analysis includes, normality test homogeneity test t-test.

RESULTS AND DISCUSSION

The data obtained from the research results are test data on student learning outcomes on the structure and function of plants. The experimental class applies the PBL model, while the control class uses the usual learning method, namely the lecture method combined with question and answer.

Before being given treatment, both classes were given a pretest first. Based on the results of the pretest, the following data are obtained in table 2.

Table 2. Pretest Experiment and Control class

Variable	Pretest	
	Experiment	Control
N	35	36
Maximum score	72,93	70,24
Minimum score	16,39	17,12
Average	50,90	49,18
Standard Deviation	18,33	16,55

Based on the data, it was found that the mean of the two classes was almost the same, so it could be said that the two classes had equal abilities. The standard deviation of the experimental class shows a greater value than the control class, meaning that the data distribution is more diverse.

After the pre-test was carried out in both classes, then they were given different treatment between the experimental and control classes, then the post-test was carried out. A summary of the posttest results is presented in table 3.

Table 3 Posttest Class Experiment and Control Results

Variable	Postest	
	Experiment	Control
N	35	36
Maximum score	100	92,65
Minimum score	69,25	46,20
Average	82,46	73,50
Standard Deviation	9,52	12,14

Based on the data, it was found that the highest and lowest scores in the experimental class were greater than the control class, with an average indicating that the control class was higher than the experimental class. Furthermore, the standard deviation of the experimental class is lower than that of the control class. Referring to the higher average value of the experimental class, it means that there is a large distribution of high scores in the experimental class.

Furthermore, to see the effect of the Problem Based Learning learning model on student learning outcomes, a hypothesis test was carried out using the t-test. Before testing the hypothesis, the normality test and homogeneity test were previously carried out on the pretest and posttest data. The normality test is carried out to find out whether the data distribution is normally distributed or not, while the homogeneity test is to test whether the two data are homogeneous. The following is a summary of the results of data analysis in this study can be seen in table 4.

Table 4. Results of Research Data Analysis

Learning outcomes	Class	Normality Test (sig)	Homogeneity Test (sig)	t-test (sig)
Pretest	Exp	0,082 > 0,05	0,582 > 0,05	0,599 >0,05
	Con	0,200 > 0,05		
Postest	Exp	0,130 > 0,05	0,255 > 0,05	0,038 < 0,05
	Con	0,053 > 0,05		

Information:
Exp : Experiment class
Con : Control Class

Table 4 shows a deeper analysis of the pretest scores, it can be concluded that there is no significant difference in the pretest scores in the two classes (0.0599 > 0.05). However, in the posttest results there was a significant difference between the experimental and control classes (0.038 <0.05). Then associated with the average experimental value which is higher than the control class, it can be concluded that there is an influence of the PBL model on student learning outcomes on the material structure and function of plants.

This is also in line with the research of Anggraini, Agus, and Anwari (2020) which states that based on classroom action research activities conducted at X IPA 3 SMA Negeri 1 Bulu in the 2018/2019 academic year, it can be concluded that "Implementation of the Problem Based Learning model can improve students' cognitive biology learning outcomes in environmental change learning materials. In addition, in Rini's research (2020), research results showed that problem-based learning significantly improved cognitive outcome, this can be seen from the increase in the post-test in the experimental group compared to the control group (74.43> 68.23). Based on the results of these studies indicate that the use of Problem Based Learning affects the learning of science on the cognitive outcomes of 7th grade at junior high school on the topic of water pollution.

The application of learning with PBL in the material on the structure and function of plants during the research went smoothly. The results obtained show the application of the PBL model in improving learning outcomes. The study consisted of five PBL phases. Learning begins with the teacher explaining the purpose of implementing learning with the PBL model, explaining the tools needed in PBL and the activities to be carried out by the teacher and students. The teacher divides the class into 6 groups. Each group is given worksheets based on the Problem Based Learning model with problems that often occur in the student's environment. Each group must determine for themselves what learning tasks are needed related to efforts to solve the problem and also determine what equipment and materials are needed in solving the problem. In this study, the researcher acts as a teacher and is assisted by a teacher who acts as a collaborator.

The main role of the teacher in PBL is as a facilitator. Students study in a group environment to carry out experiments. Each group conducts an investigation of PC damage starting with identifying symptoms of damage or certain plant diseases, interpreting the symptoms of damage correctly, formulating research steps and carrying out research. In this stage students will learn about various symptoms of damage or disease in plant parts. Students must determine their own tools and materials used as research materials. Students must be able to utilize existing reference sources, so that students gain learning experiences that are directly experienced. Learning with PBL ends with each group presenting the results of experiments or research results so that other groups also gain new knowledge from other groups.

This research was conducted in 2 meetings, at the second meeting, the teacher again explained the learning objectives and learning steps to be taken so that learning was more optimal. To avoid passive students, the teacher encourages each group leader to always involve his group members in every stage of learning. To encourage students who are still passive in learning and presentations, the teacher appoints students in each group to be the main presenters in the next presentation so that all students take part in presenting experimental results and all students have the opportunity to express their thoughts.

The increase in learning outcomes using the PBL model is caused by the application of learning that begins with discourse or problems in the worksheet as a stimulus to activate cognitive conflict. In addition, having LKPD can improve problem solving skills and students are more active in the learning process with the aim of solving problems more optimally. When the learning process is carried out using the PBL model students are able to solve problems and can express opinions and work together in finding information related to existing problems. In addition, students can work hard on their own initiative to be able to think so they can solve the problem at hand.

The problems used in this study are problems encountered in the real world. Even though individual abilities are required for each student, in the learning process in PBL students study in groups to understand the problems they face. Then students study individually to obtain additional information related to problem solving. The teacher's role in PBL is as a facilitator in the learning process. With such a learning process, there is also an increase in student learning outcomes.

The PBL model is able to provide opportunities for students to behave scientifically and meet the demands of 21st century skills. In this learning model knowledge is sought and formed by students in an effort to solve examples of problems faced by them as subjects who carry out learning activities, students do not act as passive recipients of information, but are directed to find relevant information and design solutions to existing problems so that Problem Based Learning according to Tosun & Senocak (2013) can create an atmosphere of metacognitive knowledge, namely students can think how to think and students can control their own cognition processes.

Orhan & Ruhan (2007), stated that the PBL model had a positive impact on student academic achievement and students' attitudes towards science. In the implementation of PBL in health schools, PBL has a positive impact on the competence of doctors in social and cognitive dimensions (Gerald Choon Huat Koh, Hoon Eng Khoo, Mee Lian Wong & David Koh, 2008). In addition, Samsudin's research (2022) states that the Problem Based Learning model has a significant positive effect on the process skills and cognitive learning outcomes of science students in grade IV SD in Cluster III Godean Sleman.

CONCLUSION

Based on the results of the research and discussion conducted, it can be concluded that there is an influence of the Problem Based Learning model on student learning outcomes. This is reinforced by the average experimental value (82.46) which is higher than the control class (73.50).

REFERENCES

Akinoglu, Orhan dan Ruhan Ozkardes., (2007). The Effects of Problem Based Active Learning in Science Education on Student's Academic Achievment, Attitude, and Concept Learning, Educational Journal, 3:71-81.

Anggraini, W.N., Agus, P.., dan Anwari, A.N. (2020). Peningkatan Hasil Belajar Kognitif Biologi Melalui Problem Based Learning Pada Siswa Kelas X SMA Negeri 1 Bulu Sukoharjo. *Indonesian Journal of Integrated Science Education.* 2(1): 55-62.

Ariawan, R., & Nufus, H. (2017). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematis Siswa. *Theorems (The Original Research of Mathematics)*, 1(2).

Arikunto,S. (2012). *Dasar-dasar Evaluasi Pendidikan.* Jakrta : Bumi Aksara

Asyafah, A. (2019). Menimbang Model Pembelajaran. *Indoseian Jurnal Of Islamic Education.* 6(1):19-23.

Cahyati. (2010). *Tahapan dan Metode Pembelajaran.* Jakarta : Rineka Cipta

Foshay. (2003). For Teaching Problem Solving . Teaching Paper : Indiana University.

Hosnan. (2014). Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21. Bogor: Ghalia Indonesia.

Inayah, Sarah. (2018). Penerapan Pembelajaran Kuantum Untuk Meningkatkan Kemampuan Pemecahan Masalah Dan Representasi Multipel Matematis Siswa. *Jurnal Pendidikan Matematika.* 3(1).

Komalasari, Kokom. (2011). *Pembelajaran Kontekstual Konsep dan Aplikasi.* PT Refika Aditama.

Magdalena, R. (2016). Penerapan Model Pembelajaran *Problem Based Learning* serta pengaruhnya Terhadap Hasil Belajar Biologi Siswa SMA Negri 5 Kelas. XI. Kota Samarinda Tahun Ajaran 2015. *Jurnal Procedding Biologi Edicatition Conference.* Vol 13 (1); 299-306.

Mahsun, (2005). *Starategi Belajar Mengajar.* Jakarta : Bumi Aksara

Rahman, M. (2019). 21 Century skill "Problem Solvings. Boston : *Temple Asian J. Interdiscip.Res.,* 71-81.

Rini, E. S. (2020). The Effect of Problem Based Learning on Cognitive Outcome in Science Subject in Junior High School : Topic Water Pollution. *Indonesian Journal Integrated Science Education.* 2(2): 108-113.

Samsudin, E.N. (2022). *Pengaruh Model Pembelajaran Problem Based Learning terhadap Keterampilan Proses dan Hasil Belajar Kognitif Siswa Kelas IV SD se gugus III Kecamatan Godean Kabupaten Sleman. Lumbung Pustaka Universitas Negeri Yogyakarta.* Thesis.

Sani, R.A. dan Anggraini, D.P. (2015). Analisis Model Pembelajaran Scientific Inquiry dan

Kemampuan Berpikir Kreatif terhadap Keterampilan Proses Sains Siswa SMA. *Jurnal Pendidikan Fisika*, 4(2): 47-54

Sagala, (2016). *Metode Pembelajaran*. Jakarta : Cemerlang.

Simatupang, H. (2020). Pengaruh Problem Based Learning Terhadap Keamampuan Pemecahan Masalah Materi Pencemaran Lingkungan Siswa SMA Negri Medan. *Jurnal Biolokus*. 3 (1): 2621-3720

Sugiyono. (2018). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Supiandi, M. I & Hedrian J. (2016). Pengaruh Model Pembelajaran Problem Based Learning (PBL) Terhadap Kemampuan Pemecahan Masalah dan Hasil Belajar Kognitif Siswa Biologi SMA. *Jurnal Pendidikan Sains*. 4(2):60-64

Tibahary, R. A. (2018). Model-model Pembelajaran Inovatif. *Journal of Pedagogy*. 1(1):54-64.

Tirtarahardja, Sulo. (2014). *Model-model Pembelajaran Inivatif Berorientasi Konstruktivistik*. Jakarta: Prestasi Pustaka.

Tosun dan Senocak. (2013). The Effects of Problem-Based Learning on Metacognitive Awareness and Attitudes toward Chemistry of Prospective Teachers with Different Academic Backgrounds, *Australian Journal of Teacher Education*. 38(3).

Zubaidah, S. (2016). *Ilmu Pengetahuan Alam SMP Kelas VIII*. Jakarta: Kementerian Pendidikan dan Kebudayaan.