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The Effectiveness of Problem Based Learning Toward Students' Science Learning Outcomes

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ABSTRAK

Hasil belajar IPA siswa kelas IV di Sekolah Dasar masih cenderung rendah. Model pembelajaran yang digunakan oleh guru masih mendominasi pembelajaran konvensioal. Penelitian ini merupakan eksperimen semu (*Quasi Eksperimen*), dengan desain *Non Equivalen post-test only control group desain*. Populasi dalam penelitian ini adalah seluruh siswa kelas IV SD, dan dengan menggunakan metode random sampling maka di peroleh dua sample penelitian yaitu kelompok eksperimen dan siswa kelas kelompok kontrol. Tes pilihan ganda dipilih sebagai metode pengumpulan data, untuk analisis data dalam penelitian ini digunakan teknik analisis statistik deskriptif dan uji-t. Setelah data dianalisis maka diperoleh hasil t_{hitung} (4,84) < t_{tabel} (2,01), ini menunjukan bahwa model *Problem Based Learning* berpengaruh signifikan terhadap hasil belajar IPA siswa kelas IV. Berdasarkan hasil penelitian yang telah dilakukan model *Problem Based Learning* berpengaruh signifikan terhadap hasil belajar IPA siswa kelas IV.

ABSTRACT

Science learning outcomes of fourth-grade students in elementary schools still tend to be low. The learning model used by teachers still dominates conventional learning. This research is a quasi-experimental (Quasi Experiment), with a Non Equivalent post-test only control group design. The population in this study were all grade IV elementary school students. It uses the random sampling method. Two research samples were obtained, the experimental group and the control group class. Multiple-choice tests were chosen as a data collection method for analyzing the data in this study, descriptive statistical analysis techniques, and t-tests. After analyzing the data, the result of t_{count} (4.84) <t_{table} (2.01) shows that the Problem Based Learning model has a significant effect on the science learning outcomes of Grade IV students. Based on the research results that have done the Problem Based Learning model has a significant effect on the learning outcomes of Natural Sciences.

1. Introduction

The 2013 curriculum is a curriculum loaded with character education (Unit & Curriculum, 2015). One of the lesson content integrated with other learning content, Science. According to Trianto (2007: 100) Natural Science that studies nature and everything in it. As a science of natural challenges, which in Indonesian is called natural science, it can be classified into three parts: natural science as a product, process and attitude. Natural science as a product is a collection of research results that have been carried out and have formed concepts studied as empirical and analytical activities in facts, concepts, principles, laws, and science theories.

The main problem in learning science in elementary school education is students' low absorption in understanding science lessons. It can be seen from the average score of the fourth-grade students' science learning outcomes in SD 1, Kecamatan Payangan, Academic Year 2019/2020, which is still under the KKM. Learning that is still conventional is students who are less active without the PBL learning model. The

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teacher only acts as a transformer. This pattern will make students less active, students only receive material from the teacher. It will have an impact on the low learning outcomes of students. However, teachers still have not implemented model-free learning because teachers do not need tools and materials; they only explain textbooks' concepts. This study aimed to determine the significant effect of science learning outcomes by being taught the problem-based learning (PBL) model to fourth-grade elementary school students in Gugus I, Kecamatan Payangan Academic Year 2019/2020.

IPA is essentially a product, process and application. As a science product, it collects knowledge and a set of concepts and concept charts (Widiana, 2016). Science is one of the subjects taught from elementary to tertiary education. They have done none other than because science is an important subject, of course, it is said like that because, by learning science, students learn to know themselves and their surroundings (Trianto, 2007). However, the reality is that in school learning, especially elementary schools, not all students can understand the science material taught by the teacher. When conducting observations and interviews with elementary students related to learning models, science learning outcomes and student interest in subjects. IPA. At the elementary school level, Natural Science or science is one of the subjects that play an important role in education. It is because science can be a provision for students to face various challenges in the global era (Yuliati, 2017). Based on the observations and interviews, several problems were found in science subjects' learning and teaching process, such as the lack of instructional media, low student enthusiasm for science lessons, and monotonous learning models. These problems will directly impact student learning outcomes, but what is more crucial is that students' knowledge and insights about the environment and themselves will be limited (Hariata et al., 2017).

Fostering interest in learning in students also applies to science subjects. Science tends to learn things that exist in nature and the children themselves. It feels good if the teacher uses a problem-based learning model. One learning model used is the Problem Based Learning (PBL) learning model (Ngalimun, 2015). Problem-based learning greatly influences student knowledge, providing greater opportunities for students to learn with more involvement and increasing active participation. Using a problem-based learning model, students will learn to solve the material being taught and know many things directly because they jump in and handle it themselves (Rafli et al., 2018). Students will also be trained to think critically and creatively in solving a problem. In this case, the teacher must guide students to solve the problem according to the context, and students understand what they are doing. The ability to think is very important to be trained since elementary school age because the ability to think critically is one way that will contribute to solving various problems experienced in everyday life (Ability to Think et al., N.d.). So if students already understand and like the material being taught, it will directly impact learning outcomes. The most prominent feature of the problem-based learning model is the use of problems found by students or problems given by the teacher. The problem-based learning model is one of the learning models that is associated with contextual learning. Learning means being faced with a problem, which then by starting problem-solving, students learn more basic skills (Kesuma, Hendra, 2017).

The main problem in learning science in elementary school education is students' low absorption in understanding science lessons. It can be seen from the average score of the fourth-grade students' science learning outcomes in the Class I Elementary School, Kecamatan Payangan, Academic Year 2019/2020, which is still under the KKM Learning that is still conventional is students who are less active without the PBL learning model, the teacher only acts as a transformer, this pattern will make students less active, students only receive material from the teacher. It will have an impact on the low learning outcomes of students. However, teachers still have not implemented model-free learning because teachers do not need tools and materials; they only explain the textbooks' concepts. This study aimed to determine the significant effect of science learning outcomes by being taught the problem-based learning (PBL) model to fourth-grade elementary school students in Gugus I, Kecamatan Payangan Academic Year 2019/2020.

Based on observations and interviews, it is known that science learning for fourth-grade elementary school students in Gugus I Kecamatan Payangan still uses conventional learning models. Conventional learning is a common learning method using lectures, questions and answers, and assignments. Teachers only use conventional learning models, so learning tends to be one-way and makes teachers the centre of information sources, lack of use of learning media in the learning process by teachers, lack of feedback provided by teachers when starting learning or during the learning process, the learning model used by teachers not based on problems, students learn less in groups. It can be strengthened by recording documents that show the average Odd Mid-Semester Assessment (PTS) score in the fourth-grade students' science lesson content in Gugus I Kecamatan Payangan for the 2019/2020 Academic Year. Based on the Mid-Semester Odd Assessment score on science lessons' content, it can be seen that student learning outcomes in science lessons are still low. It can be seen in the table that shows the five schools in Gugus 1, Kecamatan Payangan, 74 students did not complete the content of science lessons, and only 24 students completed. It can be said that students who complete are only in the range

of 24.4% of the total students in the Gugus. Of course, this is due to learning that is not optimal, so it is not according to the predetermined target. It can be concluded that the problem in SD Gugus I Kecamatan Payangan is that the teacher does not use a learning model that is following the learning material that can affect student learning outcomes. As a result, students 'science learning outcomes are low, and teachers do not involve authentic problems in students' daily lives.

However, the reality is that science learning is not following the expectations of the National Education System, with teachers still dominating the learning process. At the same time, students only listen to lectures from the teacher. Teachers do not involve students directly in the learning process, and students only become recipients of the information. In the learning process, the teacher does not invite students to learn to solve science problems related to everyday life.

One alternative that can be done by the teacher is empowering students in the learning process by applying the PBL learning model. PBL learning model is a model based on the constructivist understanding that accommodates student involvement in learning and problem-solving processes. Problem-based learning as a learning approach that starts with presenting a problem is designed in a context relevant to the material to be studied to encourage students to gain knowledge and understanding of concepts (Malmia et al., 2019). Through the PBL model, students obtain information and understand the subject matter. Students can learn how to argue about solving problems faced. Students also learn to work individually and collaborate with groups in solving problems. Through PBL Students can discuss professionally relevant problems in small groups. The problem is first discussed before the preparations that have been made to initiate students' initial knowledge (Dolmans et al., 2016). It can be concluded that the PBL learning model is more effective than conventional learning models.

Based on the explanation above, there is a difference between the PBL learning model and the conventional learning model on science learning outcomes. Thus, the PBL learning model can improve students' understanding of the learning process. The more often you use the PBL learning model on appropriate material, it will affect improving student learning outcomes. Project-based learning and problem-based learning models can also be used to develop 21st-century skills (Anazifa & Djukri, 2017). PBL also provides opportunities for students to be responsible for their learning, and teachers to become facilitators of the learning process (Ulger, 2018). This statement follows research that shows a significant effect of social studies learning outcomes between students who take the problem-based learning model assisted by PowerPoint media and students who take conventional learning from grade III students. This can be seen from the results of the t-test (t-test = 5.73> t table = 2.004) with dk = 54 and a significance level of 5% (Krispayani, 2018). Khusna shows differences in students' abilities in the cognitive, affective, and psychomotor domains. The results showed that the Sig score was 0.275, which means Sig. score> 0.05.

Normal and homogeneous distributions mean that the mean experimental class treated by the science literacy problem-based learning model was 85.27. The control class average score using the direct learning model was 78.87 (Khusna, 2018). Research conducted by Rafli. The results showed differences in problem-based learning models in students' self-confidence, the p score obtained for learning was 0.028 <0.05. Then H0 is rejected, and H1 is accepted (Rafli et al., 2018). The research conducted at SD Gugus I had a significant effect on science learning outcomes with a significance score = 0.00, this sig score was smaller than 0.05. This can be seen from the t-test t = 4.84 and t table (db = 50 at the 5% significance level) = 2.01. Thus Ho is rejected. There are differences in science learning outcomes between groups of students who are taught using the problem-based learning model with groups of students who are taught using conventional learning.

Based on the explanation above, this study aims to determine the significant effect of science learning outcomes by being taught the problem-based learning (PBL) model to fourth-grade elementary school students in Gugus I, Kecamatan Payangan, Academic Year 2019/2020.

2. Method

The data collection method is a method that can be used by researchers to collect research data. The data collected were fourth-grade students' science learning outcomes. To collect the learning result data in this study, the method used was the test method. According to Agung (2014: 92), the test method is a way of processing data that students worked on through this test method. Researchers will get data in the form of scores. The type of test used is an objective test. This test will be given to students who have finished studying a post-test subject or subject. The instrument used in this study was an expert's assessment (judges) before being designated as an instrument for further research. The research instrument was analyzed using the test validity test, test reliability, difficulty level, and different power.

The first procedure of this research is 1) determining the primary school that will be used as the research location, 2) observing and observing the predetermined primary school regarding the teaching and learning process in class and the learning activities carried out by the teacher, 3) determining a sample of the class available by conducting an equivalence test, doing a lottery for the experimental class and the control class, 4) visiting the school that has been selected and asking permission from the principal to carry out research, 5) preparing material to be discussed during the research. This research discusses Theme 7 The Beauty of Diversity in My Country. Furthermore, preparing learning tools and materials, : (1) preparing lesson plans (RPP) on the subject of various styles with the PBL learning model, (2) preparing various styles in student worksheets (LKS), 6) consulted the learning devices and instruments to be used for research with the supervisor, 7) tested the instruments including validity, reliability, difficulty level, and instrument differentiation, 8) provided the studied learning treatment, 9) gave the class post-test experiment and control class. 10) giving a post-test carried out after the learning treatment, 11) analyzing the learning outcome data according to the data obtained, 12) compiling a research report.

This study uses internal and external validity controls. Internal validity is one of the factors that can affect the research results. The internal validity of sources from the implementation of research related to the treatment that has been given. Whether the treatment that has been given can lead to the results observed in the study. Setyosari (2015: 180) suggests that several factors can affect internal validity in this study, History, Maturity or masturation, Effect of instrument use (instrumentation), Regression, Mortality, Group Selection, According to Setyosari (2015: 180), the external validity of research treatments that come from outside the study. There are several threats related to external validity, : (1) interaction between treatment and person, (2) interaction between treatment and setting, and (3) interaction between treatment and time. The term interaction is a combination of treatment with the person, setting and time but not the treatment that causes differences in results. The way that can be done to be able to control the external validity is by showing the results of observations to SD Gugus I Kecamatan Payangan qualitatively which states that there are no certain or special people and backgrounds and historical events that will be able to hinder the generalization of the research results.

Learning outcomes are abilities that students have after they have received learning experiences in the learning process. Learning achievement is the result obtained by a person after participating in learning activities. Learning achievement is usually expressed in numbers, symbols, letters or sentences (Nurdyansyah & Toyiba, 2016). To produce high student learning achievement, teachers must educate and teach students using the learning methods needed in the learning process in the classroom (Nasution, 2017).

The data collected in this study were students' science learning outcomes data—the data collection using the test method. Tests are measurements that are described in numbers, scales, and categorical systems regarding objective behavior. The test grid guides the outcome test instrument's preparation based on the competencies achieved. The grid's arrangement is intended to avoid the preparation of research instruments that deviate from the predetermined indicators. Indicators are used as benchmarks, and test items are described based on these indicators. The test grid is used to facilitate testing the test content's validity to make it more systematic. The test grid is presented in a table containing the serial number, indicators, dimensions of knowledge, item numbers, and the number of items for each measured indicator. There are 30 items. Each item is accompanied by four alternative answers chosen by students (alternatives a, b, c, and d). Each item is given a score of 1 if the student answers correctly, and the student who answers incorrectly or cannot answer is given a score of 0. The validity test, reliability test, differential power test, and test are carried out the test's difficulty level for the instrument to meet the good requirements.

In this study, the population is all fourth-grade elementary school students in Gugus I Kecamatan Payangan with 99 students. To determine the research sample, it was carried out by using a random sampling technique. The goal is to provide equal opportunities for all populations to become research samples (Agung, 2010). Based on this random sampling, two schools became the research sample, the fourth grade at SDN 4 Melinggih as the experimental group, and the fourth grade at SDN 2 Melinggih as the control group. This study's independent variable is the Problem Based Learning model, while the dependent variable is the science learning outcome. In this study, the experimental class will be taught using the Problem Based Learning model, while the control group will still be taught using the conventional model. The data collection method used in this study was a test method with an instrument in the form of a multiple-choice test consisting of 30 items. The data analysis methods and techniques used are descriptive analysis techniques and inferential statistics. To test the hypothesis, the t-test was used with the prerequisite test for the normality of the data distribution using the Square test and the homogeneity of the variance calculated using the F-test.

3. Result and Discussion

This research was conducted at SD Gugus I Kecamatan Payangan, using two samples, SD Negeri 4 Melinggih as the experimental group and SD Negeri 2 Melinggih as the control group. After the experimental group was given the Problem Based Learning (PBL) model treatment and the control group used conventional learning, it was followed by giving post-tests to the two sample groups. The instrument used for the post-test was valid based on the criteria determined from the research instrument trial analysis results. The number of post-test questions on science learning outcomes is 30 multiple-choice items representing all indicators in learning. Post-test was given to 26 students in the experimental group and 26 students in the control group. The post-test result data obtained can be seen in the recapitulation of calculating the student's science learning outcomes in Table 1.

Table 1. Recapitulation of the calculation of students' science learning outcomes scores

Statistic Data	***Science Learning Outcomes***	
	Experiment Group	**Control Group**
Mean	25,00	21,27
Median	25	20,74
Modde	24,5	20,5
Variants	56,55	55,95
Standard Deviation	7,52	7,48
Minimum Score	20	17
Maximum Score	29	26

Based on Table 1. The mean score of the experimental group is 25.00, and the control group is 21.27. It means that the experimental group has a higher average score than the control group. In this study, the control and experimental groups were given treatment in teaching with a predetermined model. At the end of the treatment, they were given a post-test for each class related to science subjects. The following is a description of the research data in the experimental group:

Table 2. Frequency Distribution of Experimental Group Science Learning Outcomes

Kelas Interval	**Titik Tengah**	**Frekuensi**	**Frekuensi**	**Frekuensi**	**f.X**
		Absolut	**Relatif**	**Komulatif**	
20-21	20,5	3	11,54	3	61,5
22-23	22,5	5	19,23	8	112,5
24-25	24,5	7	26,92	15	171,5
26-27	26,5	5	19,23	20	132,5
28-29	28,5	6	23,08	26	171
Jumlah		**26**	**100,00**		**649**

(Sumber. Data Hasil Penelitian)

Based on Table 2, the following data are obtained, mean (M) = 25.00, median (Md) = 24.17, mode (Mo) = 24.5, variance (s2) = 56.55 and standard deviation (s) _ = 7.52. The average score of the experimental group student was 25.00. Based on the conversion results, it can be stated that the average science learning outcomes of the experimental group are in the very high category. The following is a description of the research data conducted on the control group:

Table 3. Frequency Distribution of Control Group Science Learning Outcomes

Kelas Interval	Titik Tengah	Frekuensi	Frekuensi	Frekuensi	f.X
		Absolut	Relatif	Komulatif	
17-18	17.5	5	19.23	5	87.5
19-20	19.5	6	23.08	11	117
21-22	21.5	6	23.08	17	129
23-24	23.5	5	19.23	22	117.5
25-26	25.5	4	15.38	26	102
Jumlah		**26**	**100.00**		**553**

(Sumber. Data Hasil Penelitian)

Based on Table 3, the following data are obtained, Mode (Mo) = 20.5, Median (Md) = 20.74, Mean (M) = 21.27, standard deviation (s2) = 7.48, variance = 55.95 . The average score of science learning outcomes data of control group students was 21.27. Based on the conversion results, it can be stated that the average science learning outcomes of the experimental group are in the medium category. After the data on student learning outcomes is known, hypothesis testing can be continued using the t-test. Still, before this test can be done, it must first be tested for normality and homogeneity of research data (Agung, 2014).

Using the Kolmogorov-Smirnov formula, the sig score for the experimental class and the control class is 0.20, respectively. This sig score is greater than 0.05, so that the post-test scores for both classes are normally distributed. Based on the data analysis carried out, it was obtained that F = 0.02, df1 = 1, df2 = 50, and sig. = 0.89> 0.05. Thus, the post-test score data of the experimental class and control class are homogeneous. After the normality and homogeneity tests of the data are carried out, hypothesis testing using the t-test can be done.

It is obtained a significance score = 0.00. This sig score is smaller than 0.05. Thus Ho was rejected. There were differences in science learning outcomes between groups of students who were taught using a problem-based learning model with groups of students who were taught using conventional learning in fourth-grade elementary school students in Gugus I, Kecamatan Payangan, Academic Year 2019/2020. This study's results indicate that students' science learning outcomes using the Problem Based Learning (PBL) model are different from those who learn using conventional learning. It can be seen from the difference in the average score of learning outcomes in science learning in the two groups and the results of the t-test. Descriptively, the experimental group's science learning outcomes were higher than the control group. This review is based on the average score and the tendency of the two groups' science learning outcomes scores. The average score of students 'science learning outcomes in the experimental group was 25.00 (very high category). The average score of students' science learning outcomes in the control group was 21.27 (high category). It shows that the science learning outcomes of students who learn using the Problem Based Learning (PBL) model are higher than students who learn using conventional learning.

Furthermore, based on data analysis using the t-test, it is known that t count = 4.84 and t table (db = 50 at the 5% significance level) = 2.01. These calculations show that t count is greater than t table (t count> t table), so the research results are significant. It means differences in science learning outcomes between groups of students who learn using the Problem Based Learning (PBL) model and groups of students who learn using conventional learning. This difference indicates that the Problem Based Learning (PBL) model affects students' science learning outcomes. There is a greater average gain in the experimental class than the control class who gets a smaller average. The experimental class received treatment in the form of applying the Problem Based Learning (PBL) model.

Based on the research carried out in the experimental class, the treatment is taught using the Problem Based Learning model, and the control class is taught using conventional learning. The treatment given to the two classes shows that there are significant impacts of science learning outcomes between students who take the Problem Based Learning model and students who take conventional learning from fourth-grade students. This can be seen from the results of the t-test (t-test = 4.84 and t-table (db = 50 at the 5% significance level) = 2.01).

The Problem Based Learning model is an approach where students work on authentic problems to compile their knowledge, developing inquiry and higher-order thinking skills, developing independence and self-confidence. Students can solve given problems by discussing groups. Students can be more active

in meaningful learning because they involve students themselves in the learning process. This study uses the Problem Based Learning model to examine the students' learning outcomes in science, which tend to be low. Teachers who dominate conventional learning only provide information. Based on the research that has been done, there is a difference in the treatment of the experimental class with the greater the science learning outcomes while the control class has the smaller the students' science learning outcomes. The research findings in line with this statement are strengthened by research conducted by Khusna, 2018. The results show differences in students' abilities in the cognitive, affective, and psychomotor domains (Khusna, 2018). Rafli's research showed differences in problem-based learning models in students' self-confidence, the p score obtained for learning was 0.028 <0.05. Then H0 is rejected, and H1 is accepted (Rafli et al., 2018). From these two studies, there is a significant difference between the problem-based learning model and conventional learning. In using the PBL learning model, student learning outcomes increased compared to using conventional learning.

The difference is in the treatment of the experimental class and the control class. By applying the Problem Based Learning model to the fourth-grade students' science learning outcomes, students could increase students' enthusiasm for learning by learning in groups. Students were able to solve problems related to students' daily lives. Students become more active in learning. In the control group, learning is carried out conventionally, usually carried out by the teacher.

This study's findings imply that classes taught with the Problem Based Learning model have greater science learning outcomes. Classes taught with conventional learning have smaller science learning outcomes for students. The results of this study are used as input for teachers and prospective teachers. You were fixing yourself in connection with the teaching that has been done and the student achievements that have been achieved by paying attention to the appropriate learning model to improve student learning outcomes in Science.

4. Conclusion

Based on the data from the analysis in this study, it was concluded that there was a significant influence between groups of students who were taught using the Problem Based Learning model and students who were taught using conventional learning models in fourth-grade elementary school students in Gugus I, Kecamatan Payangan, Academic Year 2019/2020. The average score of the students' science learning outcomes taught with the Problem Based Learning model was higher than the average score for the group of students taught using conventional learning. Thus the Problem Based Learning model affects students' science learning outcomes. So with the end of this research, some suggestions are given. The teacher should maximize student learning outcomes by using various learning models, the Problem Based Learning model. Suggestions for students should be aware that all subjects are important and have more interest in learning, especially in science subjects. Meanwhile, other researchers should use this research to reference research related to using the Problem Based Learning model in learning.

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