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The Effectiveness of Problem Based Learning and Project Based Learning Model to Improve Natural Science Study Outcomes

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Abstract

The limited creativity of teachers in choosing the right learning model has an impact on the students' learning outcomes. This study aims to compare the effectiveness of problem-based learning and project-based learning model in improving the outcomes of science learning. The type of research is experimental research with pretest-posttest design. The population is the students in the seventh grade of SMP Bina Insani Semarang. The samples were taken by cluster random sampling technique. Research data were analyzed by using independent test sample t test at α 0.05. The results show: (1) there were differences of cognitive learning outcomes between group based learning and project based learning with significance value 0.001 < 0.05, (2) there was no significant difference between problem based learning and project based learning groups in improving students' caring attitude toward environment with a significance value of 0.666 > 0.05. So, the conclusion is problem based learning models is more effective to improve students' cognitive learning outcomes than project based learning models. Both models do not show significant differences in improving students' environmental care attitudes. The benefits of this research can find a synthesis to add khasanah in the field of science learning.

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INTRODUCTION

The learning process can be said successful if it can realize the goals of education but to apply them, there are many factors that influenced technically and non-technically. Not only teachers and students play a role, but also supported by some aspects of teaching and learning strategies to facilitate the learning process. Teaching and learning strategies are prepared by the teacher's decision what learning approaches will be used and appropriated to the learning objectives and learning materials will be taught.

The result of observation at SMP Bina Insani Semarang on December 2, 2017, in the process of learning, teachers are still dominant, it is still visible clearly so that students still depend completely to the teacher. The students expect teachers to be more dynamic and innovative in choosing a learning model so that students are motivated to follow the learning activities. There is a need for improvements that teachers can do by applying science-based learning.

The scientific approach in the 2013 curriculum includes observing, asking, trying, organizing, presenting, summarizing, and creating for all subjects (dedicating, 2013). The scientific approach is a learning approach that gives students widespread opportunities to explore and elaborate the material learned, in addition, to giving learners the opportunity to actualize their abilities through learning activities that have been designed by the teacher, (Rusman, 2015).

The materials about environmental pollution in SMP/MTs are instrumental to help students' understanding the impact of environmental pollution. In addition, the learning process of science emphasizes on the provision of direct experience so it can help the students to gain a deeper understanding of the natural environment. Therefore, it is necessary to model the learning in accordance with the objectives of science learning, such as learning-based model of learning-based learning and project-based learning model.

According to Hosnan (2014) PBL is a learning that uses authentic problem which is ill-structured (real) illiterate and open-minded problems as a context for learners to develop problem-solving skills and critical thinking while building new knowledge.

Fathurrohman (2015) states that project-based learning is a learning model that uses problems as a first step in integrating new knowledge based on real-world experiences.

Previous research on the use of problem-based learning model (Fatchurrohmah, et al. 2017) showed that after applying PBL learning model through demonstration able to help students who have difficulties in understanding story problem so as to increase students' understanding of the problem on math story questions. From the research results (Dzulfikar, et al. 2012) showed that implementing eliciting activities and problem based learning models is very effective in improving students' problem solving abilities.

The results of Munawaroh, et al. (2012) show the application of project based learning model is more effective in improving learning outcomes and building four learning pillars than cooperative learning model. Based on the research that has been done there are differences in this study. In this study analyze how the cognitive learning outcomes and affective (environmental attitudes) students in science learning by using the model of learning problem based learning and project based learning.

The purpose of this study was to compare the effectiveness of problem-based learning model and project-based learning in improving science learning outcomes. Benefits in this study to analyze the synthesis of differences in the effectiveness of learning model problem based learning and project based learning in improving the results of learning science.

METHODS

This research is quasi experimental with pretest-posttest design that uses two classes as experiment group. The first experimental class, the learners were given treatment with the

problem-based learning model and the second experimental class, the students were given treatment with the learning-based project learning model.

The population in this study are students of class VII SMP Bina Insani Semarang. The sampling of research used cluster random sampling technique. Problem based learning and project based learning are as independent variable and dependent variable is result of cognitive learning and environmental cares attitude.

The technique of data collection in this research is by test and non-test. Pretest and posttest tests were used to determine students' cognitive learning outcomes, and non-test using questionnaires with questionnaires were used to look at students' caring attitudes. Data analysis techniques used prerequisite test (normality test, homogeneity test), and N-gain test.

RESULTS AND DISCUSSION

This research was conducted in April until May 2018. Based on the research that has been done, the following results are obtained:

Results of Cognitive Learning

Student's Pretest and Posttest Score

The pretest and posttest results of both experimental classes are presented in Table 1.

Table 1. Pretest and Posttest Results of Student Cognitive Learning

Information	Experiment 1		Experiment 2	
	Pretest	Posttest	Pretest	Posttest
The number of students	22	22	22	22
Average	42.04	85.45	40.68	79.54
Lowest value	30.00	75.00	30.00	70.00
The highest score	55.00	95.00	50.00	90.00

Table 1 shows that the average of both experimental classes in pretest is almost the same, but on average the posttest grade of the first experimental class is better than the second experimental classes. From the results of research analysis, it is known that the learning that used problem based learning is more effectively to improve student learning outcomes. This is indicated by the difference in average learning outcomes. Supported by Shoimin theory (2016) this learning model trains and develops the ability to solve problems that are oriented to the authentic problems of the students' actual lives, to stimulate higher-order thinking skills.

This conclusion is strengthened with the research result (Kharida, et al. 2009) that exhibited problem-based teaching learning process evidently can increase student activity and learning outcomes. Furthermore, the results study (Setyorini, et al. 2011) showed an critical thinking skills after following the problem based learning learning model.

These results provide an illustration that the problem-based learning model is able to increase the activity of students in learning activities that have a positive relationship to learning outcomes. The positive relationship student activeness can be seen from the use of problem-based learning model in learning science. The problem-based learning model is designed to provide some problems and require students to acquire essential knowledge, then the students can solve problem, they have their own learning models and can explore their skills in team work. The problem that is given in the problem based learning model that has a context with the real world, if the students are closer with the real world, it will be better influence on improving the students' skills. It proves that by applying problem based learning models can improve students' cognitive learning outcomes.

Test The Difference in Effectiveness in Improving Students' Cognitive Learning Outcomes

The effectiveness difference test is used to determine whether the two classes different significantly or not. The effectiveness difference test is performed on the post-test value. The results of the effectiveness difference test are presented in Table 2.

Table 2 shows that the mean of posttest data analysis results obtained t = 0.3469; df = 42; P = 0.001, $P_{value} < 0.05$ then H_a is accepted. From the test results, it can be concluded that the final ability of students between the classes taught by the problem-based learning model and project-based learning there are significant differences.

Tabel 2. Test of The Differences in The Effectiveness of Post-Test Second Class Experiments

		Levene's test for equality of variances		t-Test for equality of means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference
Posttest value	Equal variances assumed	.165	.687	3.469	42	.001	5.90909	1.70364
	Equal variances not assumed			3.469	41.942	.001	5.90909	1.70364

From the analysis research known that problem based learning is more effective in improving students' cognitive learning outcomes than project based learning. These results are reinforced by the results of research (Hartini, et al. 2014) shows that $t_{value} > t_{table}$ is 2.53 > 1.994 it can be concluded that using PBL model can improve student's learning achievement. The Research (Downing & Ning, 2010) shows students who involved in problem-based learning can increase the study effectiveness as seen from students' metacognitive experience and abilities.

N-gain Test

Aims to find out the great improvement in student learning outcomes. The results of the N-gain test are presented in Table 3.

Table 3. Increased N-gain Students' Cognitive Values

Class	The number of students	Average	Criteria
Experiment 1	22	0.75	High
Experiment 2	22	0.65	Medium

Table 3 shows that there is a difference in the improvement of student learning outcomes in the first experimental class is in the high criterion, the result is 0.75. In the experimental class, the two mean improvements in student learning outcomes in the medium criterion were 0.65. The improvement of cognitive learning outcomes of one high experiment compared to the second experiment was seen from the N-Gain criteria.

Affective Learning Outcomes

The result data of affective learning in this research is students' environmental attitude obtained from the result of questionnaire. The results of students' caring attitudes are presented in Table 4.

Table 4. Outcome Data on Student Environment Care Attitude

Information	Experiment 1	Experiment 2
The number of students	22	22
Average	82.13	81.59
Lowest value	74.00	77.00
The highest score	98.00	96.00

Table 4, shows average of students' environmental care attitude in both classes, they did not show a significant difference. Problem and project based learning models used during this study have a positive impact, certainly beneficial for students. Based on the observation of the researchers, all the students actively involved in cooperation with the group, solve the problems, decision-making process, making the project until presenting in front of the class. So, this method ensures students are fully involved and to increase the responsibility collaboration of each individual with the group.

According to Rusman (2015) the problem-based learning model deals with intelligence from within individuals within a group of people, or the environment to solve meaningful, relevant and contextual problems. Hosnan (2014) states that problem is used in project based learning as his first step in collecting and integrating new knowledge based on experience in real activities.

Innovative models in the learning process can make students participate more active in learning activities. The result of (Haryono, et al. 2017) shows that qualified teachers are able to apply various innovations in learning so as to affect student learning outcomes.

The findings of this study prove that using problem and project based learning in science can make students fully involved to find solution to problem. It improve students' affective learning outcomes. The results study (Indriawati, et al. 2016) show that applying problem-based models which focus on aquatic resources is effectively

used in classroom learning because it improves students' environmental care attitudes and science learning outcomes be better than uses electronic school books.

Using a project based model can make students not only learn content knowledge but also soft skills. Supported by research from Luthvitasari, et al. (2013) seen there is an increase in critical skills, creative thinking and generic skills of students with project-based learning. The results of the study from Hayati, et al. (2013) suggests that implementing project-based learning models can have a better effect on improving student learning outcomes and student process skills.

These results prove that using problem and project based models in teaching science can improve students' affective learning outcomes. This happens because students actively collaborate to conduct a series of learning activities in group that focused on the process of solving scientific problems to find solutions.

Test The Difference in Effectiveness iIn Improving Students' Affective Learning Outcomes

Used to find out whether the two classes are different or not. The results of differences in effectiveness are attached to Table 5.

Table 5. Test The Difference in Mean Values of Students' Caring Attitude

		Levene's test for equality of variances		t-Test for equality of means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference
Attitude	Equal variances assumed	.413	.524	.435	42	.666	.54545	1.25521
	Equal variances not assumed			.435	42	.666	.54545	1.25521

Based on Table 5, the results of independent tests t test obtained t_{value} = 0.435; df = 42; P = 0.666, P_{value} > 0.05 then H_0 is accepted. The results of analysis shows that students who are taught with problem and project based learning models do not give significant differences.

The use of problem based models has characteristics starting based on students' or teachers' problem, then, students dig their knowledge about what they already know and not to solve the problem. Problem-based models make students learn in small groups responsible for solving problems.

The learning-based learning model is a student-centered learning model which focused on creativity of thinking, problem solving, making decision, the process of finding and using various sources, creating and presenting learning products from the results of the investigation. Project based learning uses projects as media. This model encourages students to work together in teams to convey all innovative and creative ideas to complete project tasks.

Using problem-based learning and project based learning in science learning can improve the character of students on environmental care attitude. This conclusion is reinforced by Musyarofah, et al. (2013) result proves that the integration of character education in science learning can be used as an effort to obtain scientific attitude, noble/noble value, and improvement of student achievement.

CONCLUSION

The conclusions of this study is that problem based models is more effective in improving students' cognitive learning outcomes compared to project based models. Both of them do not show significant differences in improving students' environmental care attitudes.

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