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The Effectiveness of *Problem Based Learning* Model in Environmental Changes Material Toward Learning Achievement of Senior High School Students

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Info articles	Abstract
	Biology was a branch of Natural Sciences (IPA) that studies living things and life. Biology learning will be more meaningful when learning can be done outside the classroom. The results of observations conducted at Jakenan Senior High School, showed that biology learning activities more often use student textbooks. This causes students to be less active in expressing their opinions because they only listen to the teacher's explanation. One model that can be applied to the material of environmental change was the Problem Based Learning (PBL) model. This study aims to determine the effectiveness of PBL learning models on student learning outcomes and environmental care attitudes on material changes in the environment. The research population was used all students of class X Science at Jakenan Senior High School in the academic year 2017/2018. The research design used Quasi experimental with the Nonequivalent control group design. The sampling technique uses purposive. Class X IPA 1 as the control of class and class X IPA 3 as the experimental of class. Cognitive learning outcomes were obtained from the pretest-posttest score. Students' environmental care attitudes were obtained from the questionnaire scale of environmental care attitudes. Psychomotor learning outcomes were obtained from students' psychomotor assessment sheets. The results of the analysis t-test showed that learning outcomes and environmental care attitudes of students in the experimental of class differ significantly compared to the control of class. The n-gain test on cognitive learning results show the average value of n-gain in the experimental class higher than the control of class (0,68> 0.48). The conclusion of this study indicate that the application of the PBL model to the material of environmental change was effective towards learning outcomes and environmental care attitudes of high school students.

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INTRODUCTION

Biology was a branch of Natural Sciences (IPA) that studies living things and life. Biology learning about closely related to the surrounding environment. Biology learning will be more meaningful when learning can be done outside the classroom. Sugiyono (2008) states that learning concepts that were associated with the surrounding natural environment can facilitate students in learning them. One of the biological material in high school that was related to the surrounding environment was the material of environmental change.

Environmental change material requires direct understanding and experience from students and the surrounding environment was a representative learning resource. Environmental change material in biology has an important role in instilling cognitive aspects as well as attitudes related to environmental problems that occur (Haniyya & Bintari, 2017). Environmental change material was considered not too difficult when compared with other biological material, so this material was often not emphasized in learning and students were reluctant to study this material more deeply. di references tidak adaThe results of observations conducted at Jakenan Senior High School, showed that biology learning activities more often use student textbooks. This causes students to be less active in expressing their opinions because they only listen to the teacher's explanation. Besides that the interaction of learning was not good enough. It can be seen from the few students who expressed their opinions to the teacher. Based on the midterm test results, class X showed an average value of 66 and has not met the minimum completeness criteria (≥70). This showed the ability of students who were still lacking in understanding the material that has been delivered.

Jakenan Senior High School was located in the middle of the rice fields of Puluhan Central Village, Jakenan District, Pati Regency. Various cases of environmental changes that occurred in Pati Regency, for example, the conversion of land in the North Kendeng area, environmental pollution in the Juwana river, disposal of factory waste to the river and deforestation in the Pati region. Changes in the environment were naturally caused by human activities didnt responsible for the environment. Human activities didnt responsible will reduce the role of environmental components so that it will an impact on the environment as well as for the living things that live in it.

Various cases of environmental problems that occur around Jakenan Senior High School students can be used as learning resources on material changes in the environment. One of the appropriate learning models to overcome the above problems was the PBL model. PBL model emphasizes authentic issues that were the focus of learning (Haniyya & Bintari, 2017). The problemwasthen solved by discussion in small groups by collecting supporting data and solving problems with the scientific method, so that students find valid solutions. PBL in addition to helping students to solve problems can also develop collaboration skills among students so that students can foster social attitudes (Novitasari et al 2015). Students' active involvement in learning was able to motivate students to learn so that they can understand the material being learned.

The application of the PBL modelwasexpected to be able to overcome problems in teacher-centered learning so as to optimize student learning outcomes, both in the cognitive, affective, and psychomotor domains. Although the application of the PBL model has been done a lot, research on the effectiveness of the PBL model on material changes in the environment towards learning outcomes and environmental care attitudes has never been done in Jakenan Senior High School. In addition, the PBL model was expected to be able to provide meaningful learning experiences that can ultimately have a positive impact on students' environmental care attitudes. The attitude of caring for the environment didnt appear instantly, but requires habituation. The habit of environmental care can be done through education. This study aims to analyze the effectiveness of PBL models in the material of environmental changes to the learning outcomes of high school students.

RESEARCH METHOD

This research was carried out at Jakenan Senior High School in the even semester of 2017/2018 school year. The population in this study wa sall class X in Jakenan Senior High School. The research sample was class X IPA 1 as the control class (applying the lecture and discussion method) and X IPA 3 as the experimental class (applying the PBL model). The sampling technique was done purposively.

This study uses an experimental method with Quasi Experimental Design research design with Nonequivalent Control Group Design. This study involves dependent variables and independent variables. The independent variable tested in this study was the PBL model on environmental change material. While the dependent variable was learning outcomes include cognitive, affective and psychomotor domains. The research procedure includes the preparation stage, the implementation stage and the data processing stage.

The data learning outcomes in students 'cognitive domains obtained from pretest and posttest scores, data on students' environmental care attitudes obtained from psychology questionnaire scores on environmental care attitudes, psychomotor learning outcomes obtained from student presentations and learning accomplishments obtained from observation sheets . These data were then analyzed by quantitative methods. The pretest value data used to test homogeneity, then the posttest value data used to test for normality and then t test. Furthermore, cognitive learning outcomes data in the n-gain test to determine the improvement of student learning outcomes between the experimental of class and the control of class. The supporting data of this study were teacher responses and students' responses to the PBL model.

RESULTS AND DISCUSSION

Cognitive Learning Outcomes

In this study the treatment in the experimental class was the application of PBL models on material changes in the environment, while in the control class applied the lecture and discussion methods. Before learning activities were carried out, the pretest was first carried out. The pretest data was then tested for homogeneity to find out whether the sample class has the same variant or not. The homogeneity test results show the significance criteria of 0.375> 0.05 so that Ho was accepted, which means the sample class has the same variant. After the learning process the sample class was given a posttest. Posttest data used to test for normality and t test. The results of the calculation of the normality test showed that in the control class obtained a significance value of 0.139> 0.05 and in the experimental class a significance value of 0.071> 0.05 so that Ho was accepted, it can be concluded that the posttest data of the control class and experimental class were normally distributed. Research data has met the requirements for parametric tests. Then the posttest data of the control class and experimental class in the parametric test (t test). The results of the t-test can be seen that the criteria of sig (2 tailed) <0.05 was equal to 0,000 so that Ho was rejected and Ha was accepted. This showed that there were significant differences in cognitive abilities between the control of class and the experimental of class. The large increase in student learning outcomes in the research sample class was measured by n-gain test (Tabel 1).

The result of n-gain test in the experimental class was 0.68 which was included in the medium (near high) category. Meanwhile, the results of n-gain in the control of class was 0.48 which was included in the medium category. Although the two classes of samples got the medium category but the average value of n-gain was higher in the experimental of class than in the control of class. This showed that the increase in learning outcomes in the experimental of class was higher than the increase in learning outcomes in the control of class. Based on the results of the study it can be seen that the application of PBL models to the material of environmental change was effective in improving student

learning outcomes. PBL model was said to be effective in the experimental class because students who achieve a value of asan 70 (completeness criteria for environmental change material) were more than 75%, which was 88.89% and 100% of students achieve medium and high category gains.

Table 1 n-gain control of class and the experimental of class

Criteria		Control class		Experiment class	
Number	Alphabet	The number of student	Percentage (%)	The number of student	Percentage (%)
N – gain			0,48		0,68
Category			Medium		Medium

The application of the PBL model to material changes in the environment can improve the score of student learning outcomes in the experimental class (the class treated with the PBL model). This statement was supported by Wena's research (2011), PBL was a learning strategy by directing students to practical problems as a foundation in learning or in other words students learn through problems. This PBL model was characterized by the use of real life problems as something that enhances critical thinking skills and resolves problems and gets knowledge of important concepts. The involvement of students in learning activities makes students motivated to learn. This was supported by Ayuningrum & Susilowati (2015) that, PBL was able to increase cooperation between students through a discussion process that aims to solve problems.

PBL in learning will make students discuss intensively with other group members to find solutions related to cases given by the teacher, so that verbally they will ask each other questions, answer, criticize, correct, and clarify each concept or argument that arises in the discussion. In accordance with the research of Haniyya & Bintari (2017) which states, that the application of PBL models in learning was able to improve understanding because the learning process was more emphasized on the application of techniques and procedures so that it was easier to understand the concepts and their application. Kurniatunnisa (2016) added, students were trained to solve problems and present the results of discussions in front of the class, students were required to actively participate in asking questions and responding to questions so that students were able to develop their critical thinking skills. Thinking was an ability that must be trained and cannot be obtained instantly.

Environmental Concern

The attitude of caring for one's environment can be known by giving a questionnaire on the psychological scale of environmental care attitudes. Scores of environmental care attitudes scale were measured by non-test techniques. The scale of environmental care attitude in this study was divided into four aspects, namely, knowledge, awareness, concern, and role and action. The percentage of each aspect of environmental care attitude was shown in Figure 1. Overall the percentage of each aspect of the attitude of the environment in the experimental of class was higher than in the control of class.

The results of the analysis of the normality test scores on environmental care scale scores in the experimental of class and the control of class showed the value of Sig. (2-tailed) in the experimental class 0.057 > 0.05 and the value of Sig. (2-tailed) in the control class 0.109 > 0.05 so Ho was accepted which means that the experimental class and control class data were normally distributed. Furthermore, the score of environmental care attitude in t-test to find out the average score of the two sample classes.The result ofthe t-test showed the value of Sig. (2-tailed) 0,000 <0,05 so that Ho was rejected and Ha was accepted, which means there were significant differences in environmental care attitudes between the experimental class and the control class.
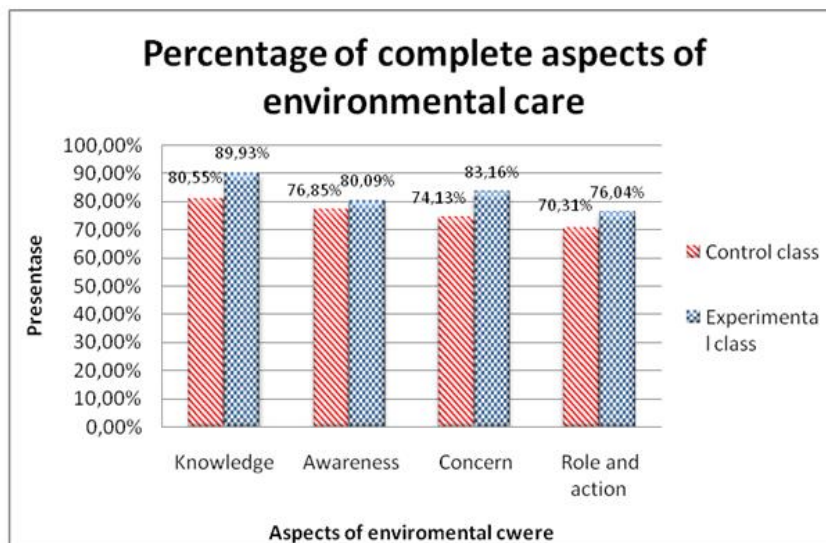
Figure 1 Recapitulation of aspects of environmental care

Learning with PBL models on environmental change material was effective towards students' environmental care attitudes. This was indicated by the achievement of the PBL model effectiveness indicators, namely the score of environmental care attitudes obtained by the experimental class students of 82.31% including in the very high category and the score of environmental care attitudes obtained by the control class by 75.46% including in the high category. This statement was reinforced by Khanafiyah's (2013) study that learning that applies PBL models can improve students' environmental care attitudes. The improvement of environmental care can be seen from the habits of students who were accustomed to throwing trash in their place, were more diligent in carrying out class hygiene pickets, and wiser to use electricity in class.

The application of the PBL model to the material of environmental change in the experimental class presents problems related to everyday life that were able to provide insight to students regarding wider environmental problems. Rahmawati & Suwanda (2015) stated that efforts to shape environmental care behavior in the community can be done through education in school. Education was one of the important aspects in shaping the behavior of environmental care for the younger generation, through environmental care education that was acquired early on was expected to motivate the community, especially the younger generation, to participate in environmental conservation and conservation. The statement was supported by Khusniyati (2012) stating that science subjects must implement character values in them, one of which was environmental care.

Psychomotor Learning Outcomes

Psychomotor learning outcomes of students in the experimental of class obtained an average percentage of 85.18% which showed very good criteria. While the control of class obtained an average percentage of 77.78% which showed good criteria. The results of the normality test of psychomotor domain assessment scores obtained experimental class significance value $0.00 < 0.05$ and control class significance value $0.03 < 0.05$, so Ho was rejected which means that the experimental of class and control of class data were not normally distributed. Because the data was not normally distributed, non-parametric statistical tests were conducted, the Mann Whitney test. The Mann Whitney test used as an alternative to the independent sample t-test, if the research data was not normally distributed.

Based on calculations by the Mann Whitney test of Asymp values. Sig. (2-tailed) $0.002 < 0.05$ so Ho was rejected and Ha was accepted, which means there were significant differences in psychomotor learning outcomes between the control of class and the experimental of class. Learning with the PBL model on material changes in the environment was effective against learning outcomes

in the psychomotor domain of students. This was indicated by the average psychomotoric score of students in the experimental class was 85.18% which includes very good criteria and the average psychomotor score of the control of class was 77.78% which includes good criteria.

Psychomotor domain learning outcomes in the experimental class were higher than in the control class. Differences in learning outcomes in the psychomotor domain in the sample class due to the application of different learning models. In the experimental class the learning process applies the PBL model while the control of class applies the lecture and discussion methods as usual. Priadi (2012) states that PBL models can increase the average psychomotor achievement of students. Because the PBL model places students as active thinkers in gaining knowledge through problem solving from real experiences. So that it can be seen that the PBL model has an influence on the learning outcomes of the psychomotor domain. Setyorini et al. (2011) states that PBL was able to improve learning outcomes in the form of critical thinking skills in good categories, skills in very good categories, and good category attitudes. The application of the PBL model was able to make students more actively involved in scientific activities so that it has a significant effect on the growth of psychomotor aspects. This was supported by the research of Fauzi (2014) stating that the PBL model was able to improve the skills competency of 37% of students who complete skills competencies up to 83% of students who complete. Novitasari et al, (2015) states that learning process with PBL models involves students directly and actively, so that students were able to find facts, concepts, and build their own knowledge.

Learning Implementation with PBL Model

The implementation of the learning model in the experimental class with the PBL model was interpreted as the average score of the PBL model's implementation of the observation sheet containing PBL learning syntax. Recapitulation of observations on the feasibility of the PBL model was presented in table 2.

Table 2 Recapitulation of observations of the implementation of the PBL model on material changes in the environment

Meeting	Learning Implementation with PBL Model (%)	Information
1	100	-
2	97,2	One observer chose "no" at point 8
3	97,2	One observer chose "no" at point 10
Average	**98,1**	

Based on the level of PBL model implementation table on environmental change material in Jakenan Senior High School in the very good category with an average percentage of learning implementation was 98.1%.

The implementation of the PBL model on environmental change material was successfully applied to the experimental class. In general, students were able to follow a series of learning processes with PBL models well. Based on the results of calculating the score of learning during the three meetings obtained the value of 98.1%. Student responses obtained from student response questionnaires also showed that most students were enthusiastic about the learning applied so that the PBL model on the material of environmental change was successfully applied to the experimental class.

The successful implementation of learning with PBL models was also supported by differences in learning outcomes and environmental care attitudes between the experimental of class and the control of class. The difference in learning outcomes was due to student activity and student motivation to learn. The application of the PBL model allows students to play an active role in learning activities through group discussions. Group discussion activities make students exchange opinions to

solve problems given. Learning by giving problems as a material for discussion can lead to students' curiosity to find solutions to these problems, so that students tend to be motivated to learn. The statement supported by Susilo (2012) stated that there was a significant increase in students' motivation before and after learning using the PBL model. Student motivation increased by 67.65% after learning using the PBL model. Research conducted by Rohmawati (2013) showed 87.32% of students have good to very good category motivation after learning using the PBL model.

Response to Learning with PBL Models

The application of the PBL model in improving student learning outcomes was supported by the teacher's response, that learning using the PBL model was very good, because it can make students more active and communicative during learning activities. Presenting problems related to surrounding life into classroom learning to be discussed will stimulate students to be able to connect what was obtained during classroom learning activities with the application of daily life. The teacher also added that students' enthusiasm for learning was higher if they were involved in learning activities even through group discussions. The statement was supported by Nikmah (2017) that the PBL implementation has trained students to have the expected skills of 21st century learning, namely problem solving through the process of problem analysis, communication collaboration through the process of discussion and communication of ideas.

Students' responses regarding the implementation of the PBL model as a whole showed good responses, but not all students agreed with the application of the PBL model and preferred conventional methods. This was because not all students have initial knowledge related to the material. Through lectures students feel faster understanding of related concepts and can directly confirm to the teacher. This statement was supported by Binder & Watkins (2013) which states the precision of learning and direct learning, direct learning has several advantages where material can be delivered in large quantities. In addition, learning by applying the PBL model makes it difficult for students to connect several concepts related to the problem. This was because students feel a lack of ideas, on the other hand some students feel confused about the relationship between related concepts. This statement was supported by Heong *et al.* (2012) that the lack of an idea was a factor that causes students to have difficulty producing an idea.

During the implementation of learning with the PBL model there were still shortcomings. Therefore the teacher concerned must be able to overcome the weaknesses of the learning model applied. One way that can be done to overcome the weaknesses of the PBL model was to reward students as a form of appreciation for student achievement. Giving rewards to students can increase student motivation and improve the competitive spirit of students.

CONCLUSION

Application of Problem Based Learning model on the material of effective environmental changes to learning outcomes in the cognitive domain, affective domain (environmental care attitude) and psychomotor domain of students of Jakenan Senior High School.

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