



Does problem based learning through outdoor learning enhance creative thinking skills?





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ARTICLE INFO	ABSTRACT
<p>Article history Received November 7, 2018 Revised April 22, 2019 Accepted December 13, 2019</p> <p>Keyword: Creative thinking ability Outdoor learning Problem based learning model</p>	<p>Studies of PBL and outdoor learning in improving creative thinking skills in Indonesia are still conducted separately. Although there are studies that combine PBL with outdoor learning, the dependent variables are still learning outcomes and motivation, not yet reaching creative thinking ability. This study aimed to determine the influence of the PBL model through outdoor learning in improving students' creative thinking ability on Environmental Changes at grade X SMA PGRI Tanah Abang PALI. This study used the quasi-experimental design (using nonequivalent control group design) — the sampling technique used purposive sampling. The instrument used essay questions consisting of aspects of fluency, flexibility, originality, elaboration, and evaluation. The descriptive data analysis used gain score and inferential data analysis used independent sample t-test supported by the effect size r independent t-test. The results showed there was the influence of the PBL model through outdoor learning to improve students' creative thinking ability on Environmental Changes at grade X SMA PGRI Tanah Abang PALI (sig 0.00 < α 0.05/2). The limitation of this study is the determination of the observation location of pollution objects. If the PBL model through outdoor learning wants to be used, the purpose of the observed problem should be a more real problem and directly to the location of pollution, so that outdoor learning becomes more optimal.</p>
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Introduction

Learning is a process of helping students to get information, ideas, skills, values, and ways of thinking. The learning process should pay attention to students' contributions so that they were actively involved in constructing their understanding of the concept deeply. When they can construct their understanding than the learning process will be meaningful

(Purnamaningrum, Dwiastuti, Probosari, & Noviawati, 2012). However, this condition is not relevant to the learning reality in most of the Indonesian schools, particularly in SMA PGRI Tanah Abang Kabupaten PALI, Sumatera Selatan.

Based on an interview that conducted by the researcher at 7 Agustus 2017 to Biology teacher in SMA PGRI Tanah Abang PALI, it shows that the learning process is

still delivered in conventional ways such as teacher used expository approach with a long explanation, tasks and exercises. The learning process was not actively involving students' contributions and digging students' understanding. In addition, based on the review, it reveals a learning model used in the learning process. The learning model is Picture And Picture in environmental change material in grade 10th. The teacher said that he got an obstacle while he implemented that learning model. The obstacle was about the transformation from one topic of the problem to the real objects which is connected to the material and the case study of the students' solution. The problems are caused by the learning model Picture and Picture is just depended on a picture as the media of learning (Syahrudin, 2014). The characteristics of this model were not suitable to the changing environment. Based on the content of Basic Competence 3.11 the characteristics of competence in the concept of changing environment, the students are not only to know nature phenomena but also they are able to analyze complex problems caused by human activity in the environment. Based on that, the environmental change concept can be delivered using Problem Based Learning Model (PBL).

PBL Model has characteristics in delivering students to find an idea while solving problems scientifically especially in environmental change material (Bridges, 2019). PBL Model facilitates students with problems as an orientation to start the learning process (Becker, Lauterbach, Spengler, Dettweiler, & Mess, 2017). PBL Model is effective if it is compared with the conventional model (Strobel & van Barneveld, 2009), In addition, it has been proved that PBL is effective to improve the cognitive skill of the students (Hmelo, 1998; Mergendoller, Maxwell, & Bellisimo, 2006). PBL Model is known has a positive impact on pedagogic implementation (Lee & Blanchard, 2018). PBL Model has potential retention in improving knowledge, conceptual development, and attitude (Merritt, Lee, Rillero, & Kinach, 2017). PBL Model gives a positive impact on improving critical and creative thinking skills (Ulger, 2018). By considering the characteristics of a material that is studied, the PBL model should be supported with the outdoor learning activity by using an environmental

change caused by pollution around SMA PGRI Tanah Abang PALL.

Outdoor learning is a learning strategy that involves students' physical activity (Hyndman & Mahony, 2018). Some research shows that outdoor learning has benefits in the development of cognitive, emotional, health, and social skills (Bundy et al., 2009; Engelen et al., 2013; Ginsburg, 2007). Outdoor learning is known can improve creative thinking (Hyndman & Mahony, 2018). Moreover, outdoor learning helps students to learn the material factually and strengthen the understanding of the given problems (Becker et al., 2017; Thomas, 2019).

In addition to the problem of the learning model applied, the results of the interview also revealed other problems. The problem is that the teacher has not directed students to develop creative thinking skills. This is also evidenced by the results of the dominance of the final semester exam (UAS) questions given by the teacher to students. The questions are only composed of cognitive indicators such as explaining, writing and differentiating. Based on this the researcher measured the ability to think creatively. This measurement is useful to dig deeper into information about the creative thinking abilities of students at Tanah Abang PGRI High School. The initial measurement results show that the creative thinking ability of students is only 35%, these results are categorized in less creative conditions. This condition is certainly very contrary to the expectations of 21st Century learning that requires the facilitation of creative competence in the learning process (Ananiadou & Claro, 2009). The ability to think creatively is also needed because it can foster student thinking activities to produce something creative and original (Guilford, 1967). This ability will make students directly involved in constructing their own understanding to develop skills, ideas, and ways of thinking.

Based on the description of the results of the interview, we need a learning process that can improve students' creative thinking skills while also in accordance with the material characteristics of environmental change. This is the basis of this research conducted by raising topics that show the influence of PBL models through outdoor learning in improving students' creative thinking abilities on the material changes in grade X SMA PGRI Tanah Abang PALL. This topic was also chosen on the basis of the

consideration of several studies on PBL and outdoor learning in improving the ability to think creatively. The study of several studies shows that PBL research and outdoor learning in improving thinking skills in Indonesia are still conducted separately. Although it is found that research combining PBL with outdoor learning the dependent variable is still the result of learning and motivation, it has not touched on the ability to think creatively (Abdurrozak, Jayadinata, & Isrok'atun, 2016; Agusta, Setyosari, & Sa'dijah, 2018; Chorida, 2013; Dwiastruti & Aryanto, 2010; Happy & Widjajanti, 2014; Khoiri, Rochmad, & Cahyono, 2013). Based on that, the results of PBL combination research through outdoor learning in enhancing the ability to think creatively are expected to provide novelty that is different from previous research. This topic will be discussed with the formulation of the question of whether there is an influence of the PBL model through outdoor learning in improving students' creative thinking skills on the material changes in grade X environment of SMA Abri PALRI High School PALI? The formulation of this question will then be examined in the method, results, discussion and conclusions of the study.

Method

This research was conducted in the form of a quasi-experimental design because the purpose of this study was to show the effect of PBL models through outdoor learning in improving the creative thinking skills of grade X students of Tanah Abang PALI High School, PALI Academic Year 2017/2018. Based on that to answer the problem formulation that has been described in the introduction, the quasi-experimental design chosen was the non-equivalent control group design. The sample selection technique in this study uses purposive sampling based on daily scores or student test scores. Because there are only two classes (X1 and X2), X1 is the treatment class and X2 is the control class. Students of class X1 uses the PBL model and learning takes place in outdoor learning, while class X2 uses conventional learning, which is accompanied by lectures, explanations, assignments, and group discussions. A technical description of the realization of PBL through outdoor learning in improving creative thinking skills can be seen in [Appendix A](#).

The instrument used in this study was a written test (in the form of an essay). The theoretical basis for developing creative thinking instruments refers to indicators of fluency, flexibility, originality, elaboration, and evaluation (Guilford, 1967; Treffinger, Renzulli, & Feldhusen, 1971). The elaboration grid and assessment rubric can be seen in [Appendix B](#) and [C](#). The instrument that will be used in the research process is to test the validity and reliability first and be analyzed using the Rasch model assisted by the Winstep program version 3.37. The validity test of questions based on Rasch uses the item fit order parameter, while to see the reliability value of the items can be seen through the summary statistics table by looking at the value of the reliability items of the real RMSE section (Sumintono & Widhiarso, 2015). The test results show that of the 20 questions there are 14 valid questions and the instrument has an item reliability value of 0.86. This reliability value means that the instrument has very good reliability (Sumintono & Widhiarso, 2015).

The test results were analyzed using the g factor (N-Gain) to determine the increase in competence that occurred before and after learning. The calculation of the g factor (N-Gain) uses the equation from Hake (1998) for each experimental class and the control class. Criteria or categories of N-Gain scores can be seen in [Table 1](#).

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

(Hake, 1998)

Table 1. N-Gain Category

Value	Category
≥ 0.7	High
$0.7 > g \geq 0.3$	Medium
$g < 0.3$	Low

(Hake, 1998)

After knowing the increased competence that occurs before and after learning, data analysis is performed to answer the problem formulation (research objectives) using the posttest data from the control class and the experimental class. Analysis of the data used is the unpaired t-test or independent sample t-test. The unpaired t-test results are if the significance value (2-tailed) is greater than $\alpha / 2$ (0.025), then H_0 is rejected and H_a is accepted, meaning that there is an influence of the PBL model through outdoor learning in

improving students' creative thinking abilities in the classroom environment change material X Tanah Abang PGRI High School PALI.

Before the unpaired t-test is tested, the analysis prerequisites are the normality test (using the Kolmogorov-Smirnov test) and the homogeneity test (using the variance homogeneity test/test of homogeneity of variance). A normality test is performed to determine whether the data obtained is

normally distributed or not. Data is said to be normal if the significance value (2-tailed) is greater or equal to $\alpha / 2$ (0.025). A homogeneity test is performed to determine the data obtained homogeneous or heterogeneous. Data is said to be homogeneous if the significance value (2-tailed) is greater or equal to $\alpha / 2$ (0.025). The results of normality and homogeneity tests can be seen in [Table 2](#).

Table 2. Normality and Homogeneity Data of Posttest

Data	Kolmogorov-Smirnov Test (Normality Test)	Levene Test (Homogeneity Test)	Note
Posttest of Eksperimen Class	0.164	-	Normal
Posttest of Control Class	0.092	-	Normal
Posttest of Eksperimen-Kontrol Class	-	0.890	Homogen

$$\text{effect size } r = \sqrt{\frac{t^2}{t^2 + df}} \quad (\text{Latan, 2014})$$

Note:

t : the value of t count of Independent t-test
df : degrees of freedom two independent groups $((n_1+n_2)-2)$

Furthermore, to strengthen the results of the unpaired t-test, an independent t-test effect size r was calculated (Latan, 2014). If the effect size value of r is independent t-test > 0.25 , then there is a very big difference between the two groups. The formula effect size r independent t-test is displayed as follows.

Results and Discussion

Students' creative thinking grade X SMA PGRI Tanah Abang PALI

The results showed an increase in the value of creative thinking, both the experimental class and the control class, based on the pretest and the posttest that indicated the difference in [Table 3](#). [Table 3](#) presents the difference between the pretest scores and the posttest based on creative thinking indicators.

Table 3. Analysis result in each indicator of students' creative thinking grade X SMA PGRI Tanah Abang

Creative Thinking Indicators	Pretest		Posttest		Deviation	
	Eksperimen	Control	Eksperimen	Control	Eksperimen	Control
Fluency	65	56	84	66	19	10
Flexibility	68	63	86	70	18	7
Originality	65	62	84	75	19	13
Elaboration	64	59	84	76	20	17
Evaluation	63	63	82	75	19	12

[Table 3](#) shows that the difference of each indicator of experimental class creative thinking for fluency is 19, flexible is 18, originality is 19, and thinking evaluates is 19. While the difference is for elaboration thinking of 20, it is the highest acquisition value difference in the experimental class. [Table 3](#) also shows that the difference per indicator of creative thinking in the control class for the ability to think fluently (fluency) by 10, flexible

thinking by 7, original thinking (originality) by 13, and thinking back (evaluation) by 12. While the difference for elaboration thinking of 17, is the acquisition of the highest difference in the control class. Difference data from the pretest and the posttest were analyzed by N-gain (calculated using the g factor formula). The results of the N-Gain test are presented in [Table 4](#).

Table 4. N-Gain Test Result of each Indicators Creative Thinking Problems of grade X SMA PGRI Tanah Abang PALI students

Type of Problems	N-Gain		Category	
	Eksperiment	Control	Eksperiment	Control
Fluency	0.5	0.2	Medium	Low
Flexibility	0.6	0.2	Medium	Low
Originality	0.6	0.3	Medium	Medium
Elaboration	0.6	0.4	Medium	Medium
Evaluation	0.5	0.3	Medium	Medium

Based on Table 3 and Table 4, it is known that in the experimental class the highest value difference was obtained in the elaboration thinking ability by 20 so that the highest N-Gain score was shown by the elaboration thinking problem by 0.6 in the medium category. For the control class, the highest value difference was also obtained in the elaboration thinking ability (elaboration) of 17, with an N-Gain score of 0.4 in the medium category.

The effect of problem based learning model through outdoor learning in improving students' creative thinking

The N-Gain score obtained is used for t-test unpaired data. Based on the results of the t-test analysis of data obtained no significant value of $0.000 < 0.025$ ($\alpha 0.05 / 2$), then there is the influence of PBL models through outdoor learning to improve students' creative thinking abilities. While

the value of the effect size r independent t-test $0.52 > 0.25$, meaning that the increase occurred in the experimental class and there was a very big difference between the final results of the experimental class and the control class.

The improvement of students' creative thinking on fluency indicators is related to the PBL learning steps of students' orientation to problems, namely the teacher presents a real question or problem through the surrounding environment related to environmental change material, so students are required to think about conveying their ideas. Students with their groups discuss the existing problems and students write their ideas on student worksheets (LKS). Each group is so fluent in expressing their ideas, such as explaining the problems, the types of pollution and the consequences of pollution. Figure 1 is an idea written by students in LKS related to the ability to think fluently.

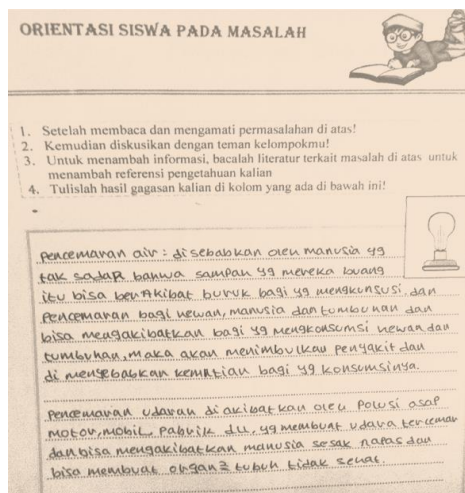
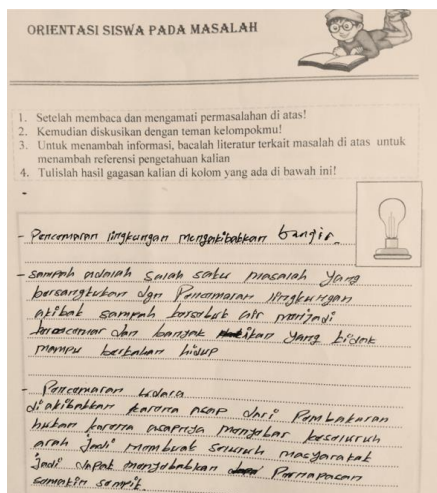


Figure 1. Group 4 (left) and 6 (right) ideas related to the ability to think smoothly in the step of student orientation to the problem

Groups 4 and 6 (Figure 1) are one of the groups that express their ideas well in the ability to think smoothly. Fluency about an idea when solving a problem gives a picture of the condition of student understanding.

Smoothness is also an indicator of natural patterns of students' creative thinking (Guilford, 1967). While in the control class, learning that is used such as discussions, questions and answers, and lectures

accompanied by explanations and the teacher presents pictures in engaging students to solve problems related to environmental change material is an activity to help students in learning, but it is not yet optimal so students are less in conveying their ideas.

Indicators of flexible thinking (flexibility) of the experimental class on the pretest amounted to 68. The increase occurred in the posttest in the experimental class which had an achievement of 86 and the difference in the value of 18. While thinking flexible (flexibility) in the control class for the pretest was 63 and the posttest has an achievement of 70 with a difference of 7. It means that the increase occurred in the experimental class higher than the control class. The high increase in the difference in the value of flexible thinking (flexibility) of the experimental class in the control class due to the student's active learning, students respond to and answer any questions given by the teacher. This is supported by the statement that when students are active in learning activities can make it easy for students to submit varied

ideas (Fidiana, Rudibyani, & Tania, 2017). The ability to think flexibly can also be seen and trained by giving students the opportunity to answer every question from both the teacher or peers. If students can answer with logical and good answers, then their ability to think flexibly has increased (Nurcholis, Sudarisman, & Indrowati, 2013; Ulger, 2018).

The improvement of students' creative thinking on flexible thinking indicators related to PBL learning steps organizing students to learn, ie the teacher monitors students interacting with group members in issuing ideas to solve existing problems and filling answers to questions on LKS (Hmelo, 1998; Ulger, 2018). After the students know the various problems, then the students and their groups write down the cause of the problem from the various types of pollution and their effects. In this learning step, groups 1, 5, and 6 are the groups whose ability to think flexibly is more prominent and Figure 2 is the ideas written by students in the worksheet related to the ability to think flexibly.

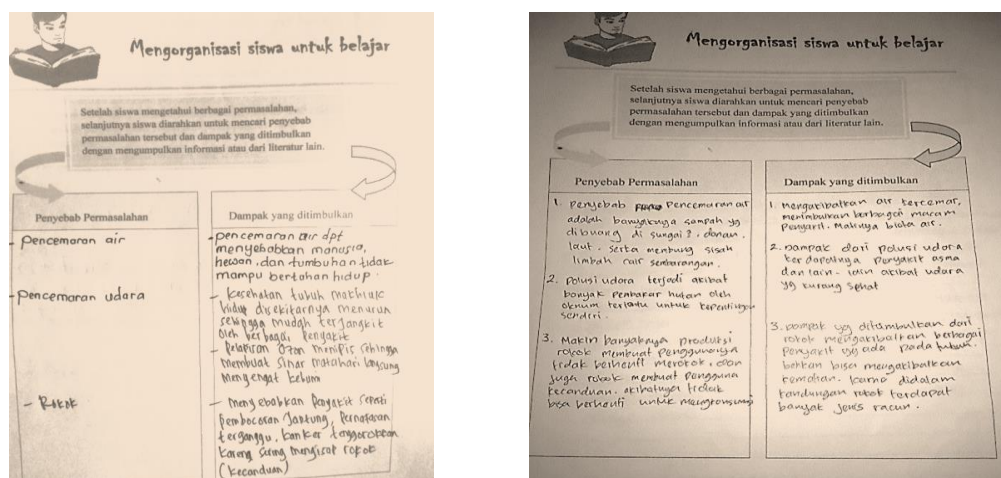


Figure 2. Group 1 and 5 ideas related to the ability to think flexibly in the steps of organizing students to learn

The indicator of the originality of the experimental class on the pretest was 65. The increase occurred in the posttest in the experimental class which had an achievement of 84 with a difference of 19. While originality in the control class for the pretest was 62 and the posttest had the achievement of 75 with a difference in the value of 13. That is, the increase occurred in the experimental class higher than the control class. Increased creative thinking on the original thinking indicator related to the PBL learning step guiding individual or

group inquiry. This step is carried out with the guidance of the teacher through outdoor learning. Students have the opportunity to observe the environment that is the object of inquiry and students can develop their own knowledge that is not thought of by others in solving problems and finding solutions (Hyndman & Mahony, 2018; Lee & Blanchard, 2018; Thomas, 2019; Ulger, 2018). Students and their groups write the results of the discussion in the column of the worksheet provided. The solutions provided such as reforestation, providing

special organic and inorganic waste bins, do not cut down trees illegally, do not throw waste directly into rivers and utilize used goods. In this learning step, each group's original thinking ability in providing solutions is different, almost the same and adding the ideas of other friends.

Figure 3 is a solution written by students in worksheets related to original thinking skills. Groups 2 and 5 are one of the groups that provide solutions to improve original thinking skills. The ability to think originally can issue ideas or ideas that are unique and unusual for example, which is different from those in the book or different from the opinions of others (Aminingsih, Dwiastuti, & Sari, 2016; Guilford, 1967; Ulger, 2018).

The indicator of thinking elaboration (elaboration) of the experimental class on the pretest was 64. The increase occurred in the posttest in the experimental class which had an achievement of 84 with a difference of 20, where the difference in value was the difference in the highest value in the experimental class. The high increase in the difference in the value of thinking elaboration (elaboration) is reflected in the learning steps PBL develops and presents the work in the form of posters. Detailed activities in making this poster can encourage students to understand the problem to be solved, know the factors that influence environmental pollution, the impact of such pollution and its handling. In this learning step the elaboration thinking ability of each group in presenting the work in the form of posters is very diverse. The elaboration of poster presentation provides

a planned structure of thinking and links between ideas and problem solving (Guilford, 1967; Ulger, 2018).

Elaboration in the control class for the pretest of 59 and the posttest has an achievement of 76 with a difference of 17, which is the highest difference in the control class. This happens because learning in the control class uses group discussion, where students and their groups can elaborate ideas on the factors that cause damage in the environment and exchange ideas in solving problems in detail. Elaboration skills can develop, enrich, detail an idea so as to improve the quality of the idea and can solve problems in detail (Hyndman & Mahony, 2018; Ulger, 2018; Wati, Susantini, & Rahayu, 2015).

The indicator of evaluating in the experimental class on the pretest was 63. The increase occurred in the posttest in the experimental class which had an achievement of 82 with a difference of 19. While evaluating in the control class for the pretest was 63 and the posttest had the achievement of 75 with a difference in the value of 12. That is, the increase occurred in the experimental class higher than the control class. Improvement of creative thinking on the indicators of thinking (evaluating) related to the PBL learning step is analyzing and evaluating the problem-solving process, namely, the teacher helps students reflect, evaluate the thought processes of inquiry, express opinions and exchange opinions with other students. In this learning step, groups 5 and 6 (Figure 4) are the groups whose thinking abilities judge more prominently.

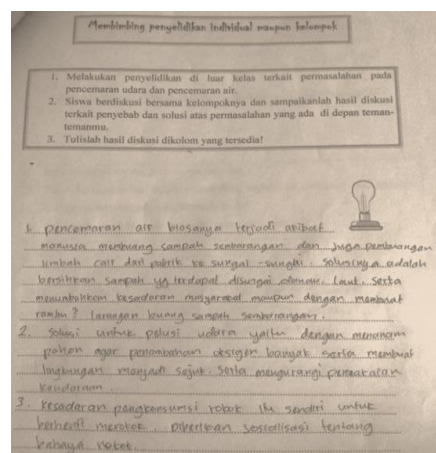
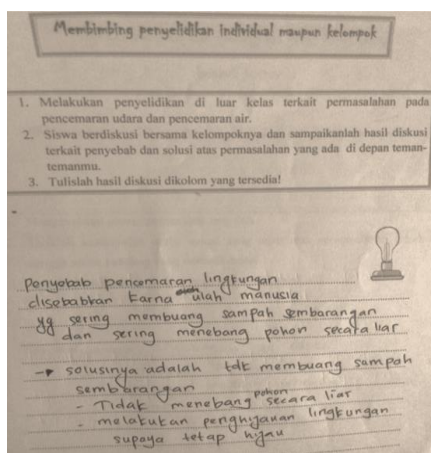


Figure 3. The Solution of Group 2 and 5 related to the ability to think originally in the step of guiding individual and group investigations

Figure 4 is the conclusion (analysis and evaluation) written by students in LKS related to the ability to think appraise. Groups 5 and 6 are one group that provides conclusions (analysis and evaluation) well in improving the ability to think appraise. The ability to analyze and evaluate is an active

ability when students are faced with unusual problems, uncertainties, and questions. The success in applying this ability can be seen from the explanation, decisions, performances and results that apply according to knowledge and experience (Ulger, 2018; Winarti, 2015).

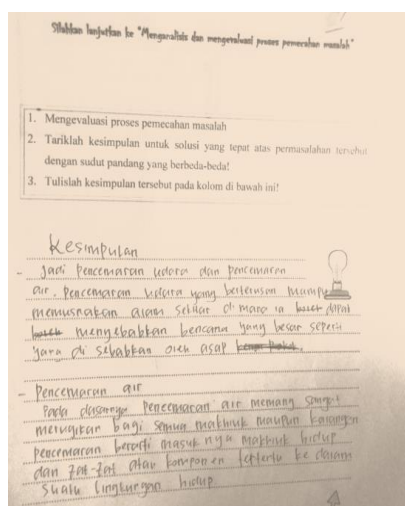
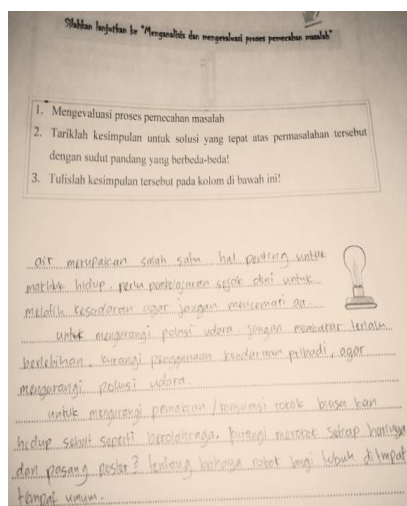


Figure 4. The conclusion of Group 5 and 6 related to the ability to think in terms of analyzing and evaluating the problem-solving process

Limitations of Research and Future Research Suggestions

This study has limitations in determining the location of pollution observation objects. The object of observation of pollution carried out is only limited to the school environment. This is because students take too much time if invited out of the classroom even outside the school environment. Outdoor learning-based PBL requires observation topics that are real problems, such as river pollution, deforested forests, and factories. If other researchers want to conduct research with the PBL model through outdoor learning, the object of the problem should be observed that is more real problem so that the role of outdoor learning becomes more optimal in supporting PBL.

Conclusion

Based on the study, it shows an increase in the value (N-Gain score) of students' creative thinking grade X of the Tanah Abang PGRI High School PALI on the subject of environmental change in the experimental class for all indicator's categories and in the control class in the low and medium categories. Furthermore, the results of the t-test analysis of the independent sample t-test showed a

significance value of $0.000 < 0.025$ ($\alpha 0.05 / 2$), there was an influence of the PBL model through outdoor learning in enhancing students' creative thinking abilities on the material changes in the classroom environment X Tanah Abang PGRI High School PALI. While the value of the effect size r independent t-test $0.52 > 0.25$, meaning that the increase occurred in the experimental class and there was a very big difference between the results of both experiment and control class.

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Appendix A

The summary of the PBL model using outdoor learning as follows:

PBL Learning Model Syntax	Teacher and Students Activity	
	Teacher	Students
	Observing	
a. Orientating Students with problems	a. Directing students to see the surrounding environment (outdoor learning), as well as explaining issues related to environmental changes such as air pollution. b. Sharing worksheets that contain work instructions. c. Guiding students to identify these problems, for example: How does air pollution affect health?	a. Paying attention to the things explained by the teacher. b. Receiving worksheets that have been distributed to further read the work instructions. c. Identifying problems that have been displayed through pictures and write their identification on the worksheet.
	Collecting information / eksperimenting	
b. Organizing students to study	a. Guiding students to find the causes of the problems above, with b. Collecting information or from other literature.	a. Looking for causes for problems that arise based on pictures with b. Collecting information or from other literature.
a. Assisting independent and group investigations	a. Directing students to discuss with their groups to solve problems related to air pollution, and water pollution that occurs outside the classroom.	a. Conducting a discussion with groups to solve problems related to air pollution and water pollution.
	Questioning and Communicating	
a. Developing and presenting works and exhibitions	a. Directing students to make posters of investigative activities obtained.	a. Making a poster of the investigation activities obtained.
	Associating information	
a. Analyzing and evaluating the problem-solving process	a. Guiding students in reflection or evaluation of the investigation and the processes they use. b. Directing other students to analyze the causes of problems and solve them from their own perspective.	a. Evaluating the investigation and the processes used. b. Analyzing the causes of problems and solve them from their own perspective.

Appendix B

Indicators of Basic Competence Achievement	Context and Problem	Creative Thinking Skills Aspect	Indicators of Creative Thinking Skills
Attribute the effect of human activities on environmental balance.	At the end of 2013, the Riau Forest Rescue Network (Jikalahari) stated that peat natural forests are still being cut down by industrial plantations and oil palm plantation corporations. The poor governance of forestry in Riau is because the Indonesian government allowed corporations to cut down natural forests, seize community land forests, engage in corrupt practices, illegal logging and ecological destruction. From the discourse above, point out the influence of these activities on environmental balance and what efforts do you make? Would you agree if we have to maintain environmental balance? Give your reasons why this should be done!	Originality	a. Thinking and giving birth to solutions to problems that no one else can think of.
		Evaluation	a. Giving consideration on the basis of his own perspective. b. Designing a work plan of ideas that are sparked.

Appendix C

No	Creative Thinking Skills Aspect	Indicators of Creative Thinking Skills	Scoring Rubric of Creative Thinking Skills	Score
1	Originality	a. Thinking and giving birth to solutions to problems that no one else can think of.	1) If it gives birth to a new idea, unique and gives an unusual answer, another from another, which is rarely given by most people by filling in the correct answer > 5.	5
			2) If it gives birth to a unique idea and gives an unusual answer, another from another, which is rarely given by most people by filling in the correct answer 5.	4
			3) If giving an unusual answer, which is different from the others, which is rarely given by most people by filling in the correct answer 4.	3
			4) If only gives unusual answers, which most people rarely give by filling in the correct answers 3.	2
			5) If the answer is only answered correctly 2.	1
			6) If not filling in the answer.	0
2	Evaluation	a. Giving consideration on the basis of his own perspective. b. Designing a work plan of ideas that are sparked.	1) If it is very good at conveying the sharpness of the argument in its own perspective.	5
			2) If it is good enough in conveying the sharpness of the argument in its own perspective.	4
			3) If it is not good in conveying the sharpness of the argument in its own perspective.	3
			4) If you only make decisions based on your own perspective.	2
			5) If the answer is answered wrong.	1
			6) If not filling in the answer.	0