# Application of the Problem Based Learning Model (PBL) To Improve Critical Thinking Skills and Mastery of Concepts on Environmental Pollution Materials

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**Abstract:** The Problem Based Learning Model (PBL) is a learning model that is highly recommended in the implementation of the National Curriculum. This research is to obtain an overview of the implementation of PBL in learning environmental pollution in an effort to improve critical thinking skills and mastery of concepts. This research was carried out by the quasi-experimental method, namely the pretes-postes control design. The study subjects were 73 students who were divided into control groups and experimental groups. The data obtained comes from the completion of the critical thinking test problem in the form of a description and mastery of the concept in the form of multiple choices. The results of the study explain that the acquisition of critical thinking skills with higher value PBL learning (average - = 82.1) compared with conventional learning (average - = 61.4) with a calculated t value of 28.34 ($p < 0.05$). Mastery of concepts with PBL learning gets a higher score (average - average = 76) compared to conventional learning (average - 0.05<TAG. The results showed that the PBL learning model was able to improve critical thinking and mastery of the concept of students in class X environmental pollution material at Senior High School 1 Dramaga.

**Keywords:** *Critical Thinking; Mastery of Concepts; Problem-Based Learning (PBL)*.

## INTRODUCTION

The learning process that trains students to think at high levels is still an obstacle. One is the overly dominant role of teachers in schools as disseminators of science or sources of science (teacher center) not yet a student center, and the focus of education in schools is more on memorizing / factual knowledge. Students are only considered as a container that will be filled with science by teachers. Another obstacle that is actually quite classic but indeed difficult to solve, is the student achievement assessment system which is based more on the test - test which tests low-level cognitive abilities. Students who are labeled as smart or successful


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students are students who pass the exam. This is an old problem that until now is still a pretty exciting polemic for the world of education in Indonesia. Higher-Order Questions (rich questions) are needed, questions that ask students to conclude, hypothesize, analyze, apply, synthesize, evaluate, compare, contrast, or imagine, and show high-level answers. To answer Higher Order Questions (rich questions) high-level reasoning is needed, high logical thinking, high logical thinking is needed for students in the learning process in class especially in answering questions, because students need to use their knowledge, understanding, and skills and connect them to new situations.

In the 2013 curriculum learning uses a scientific approach, there are five main activities in the learning process using a scientific approach, namely: (1) Observing, (2) Asking, (3) Trying, (4) Associating, (5 Communicating. A scientific approach is an approach in the learning process mandated in the 2013 curriculum, while one of the suggested learning models for use in the implementation of the 2013 curriculum is Problem-based learning (PBL).

Johnson (2011) defines critical thinking skills as a directed and clear process used in mental activities such as solving problems, making decisions, persuading, analyzing assumptions, and conducting scientific research. mastery of concepts is the ability of students to understand the concept of - concept after learning activities. The ability to think critically is needed to analyze a problem up to the stage of finding a solution to solve the problem. People who have critical thinking skills don't only know an answer. They will try to develop the possibility of other answers based on analysis and information that has been obtained from a problem. Critical thinking skills mean carrying out a process of reasoning for a problem to the complex stage of "why" and "how" the process of solving it. Mastery of concepts can be interpreted as the ability of students to understand the meaning scientifically both theory and its application in daily life - day (Dahar, 2003).

*PBL learning model a learning model that involves students to solve a problem through the stage - stage of the scientific method so that students can learn knowledge related to the problem and at the same time have the skills to solve the problem. PBL is learning that uses real problems (autentik) which are unstructured and open in nature as a context for students to develop skills to solve problems and critical thinking and at the same time build new knowledge (Rusman, 2011).*

## METHOD

The design used in this study was the draft pretest-posttest non-equivalent control group design with a 2x2 factorial pattern consisting of control classes and experimental classes with two variables namely mastery of concepts and thinking critically. The free variable in this study is the PBL model and conventional


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learning while the bound variable in understanding biological concepts and critical thinking skills. Steps - quasi-experimental steps 1). Conduct literature review, especially those related to problems to be examined, 2 ) Identify and limit research problems, 3) Formulate research hypotheses, 4) Compile a complete and operational plan, including (a) Determine free and bound variables, (b) Choose the design used, (c) Choose groups - groups of subjects that are sampled, (d) Develop measurement instruments or choose raw measurement instruments, (e) Make a basic plan and steps - steps in conducting experimental quasi and data collection. 5). Conducting quasi-experiments, 6). Selection and compiling data to facilitate analysis, 7). Determine the level of significance to be used in testing hypotheses, 8) Analyzing data with relevant statistic methods (testing hypotheses based on data collect)

**The research flow is displayed in the diagram below:**

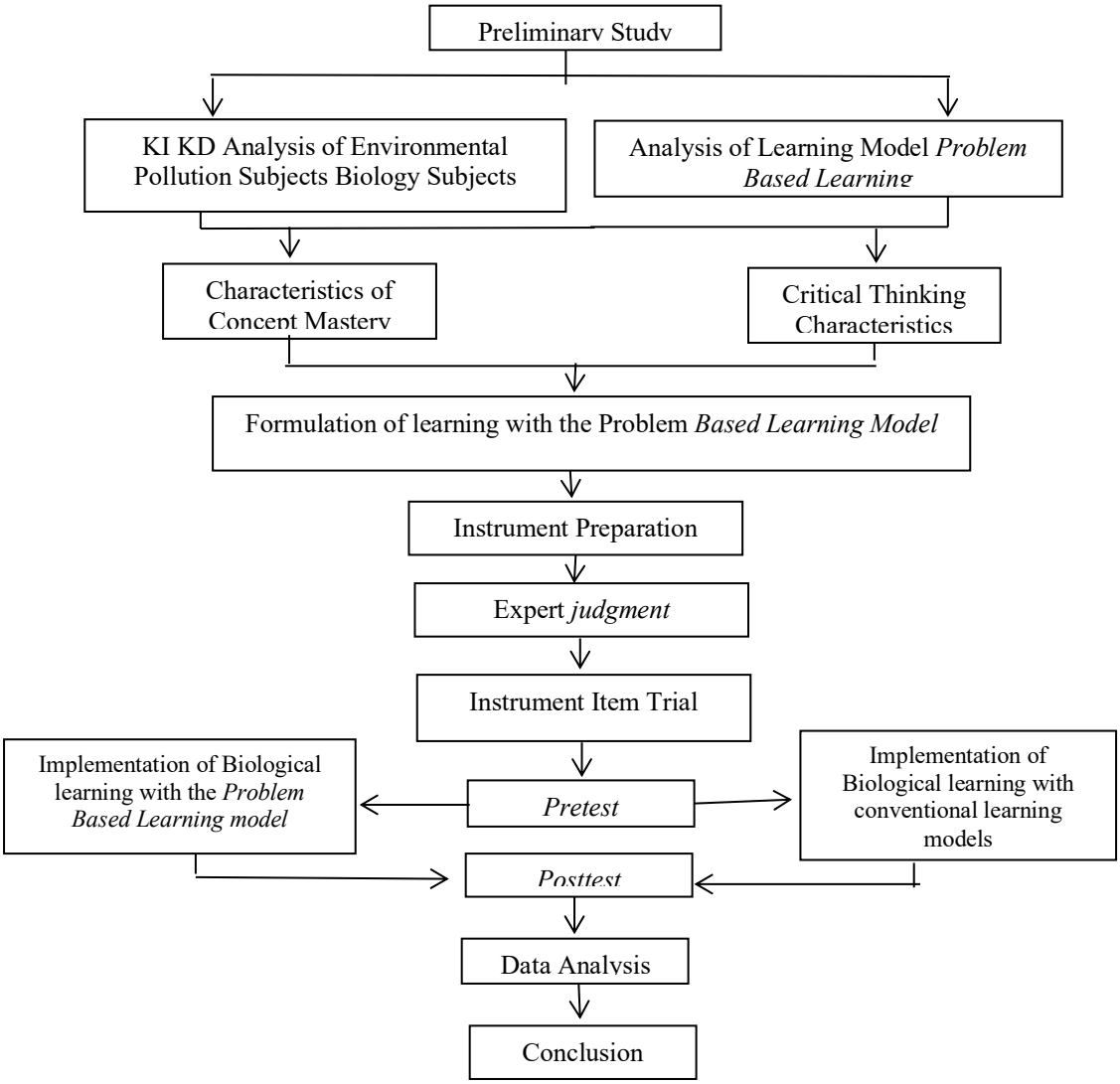


**Image: Research Flow Chart**


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Research is carried out in two different classes; one experimental class gets PBL learning and one control class gets conventional learning. The study was conducted at Senior High School 1 Dramaga while the study time was conducted on May 1 June 2017. The study population was that all X class students numbered 73 people from class X Science 1 and X Science 6.

Quantitative data is pretest and post-test assessment results in learning understanding concepts and critical thinking skills. The data source consists of students from class X Science 1 and X Science 6 which will be grouped by lottery into experimental classes and control classes. Critical thinking skills data are obtained from critical thinking tests based on the correctness of the answers given by benchmarking on the rubric of judgment. The data includes the critical thinking skills of students in terms: (1) interpret, (2) analyze, (3) infect, (4) evaluate, (5) explain, and (6) do self-partial, (2) evaluate (C5), and (3) create (C6). Whereas concept understanding data is data on students' abilities in the cognitive process dimension including: (1) analyze (C4), (2) evaluate (C5), and (3) create (C6). Whereas concept understanding data is data on students' abilities in the cognitive process dimension including: (1) considering (C1), (2) understanding (C2), applying, (C3). Pretest and posttest are used to obtain critical thinking results data and mastery of concepts. Data on the implementation of the PBL model were obtained from the activities of students (students of the experimental and control classes) during learning. Learning is carried out during two meetings on the subject of environmental pollution. Data on mastery of biological concepts and critical thinking skills of students are collected using tests. The biological concept understanding test consists of 15 multiple choice test items developed in this study based on the cognitive realm of Bloom's taxonomy which was revised by Anderson & Krathwohl (2010). Critical thinking skills tests consist of 4 test items in the form of description tests with item scores of 0 – 5. The description test is chosen to assume that by answering the description test, the critical thinking skills of students are more easily observed compared to answering objective tests. The use of this description test can be sought to foster students' thinking abilities. Furthermore, the results of observations and tests of learning outcomes will be analyzed and interpreted.

The instrument used in this study is an instrument in the form of a dual choice form learning test used to measure students' learning outcomes on mastery of concepts and a test of learning outcomes for students in the form of an essay to measure students' learning outcomes on critical thinking skills. Before the research instrument is used in research, the instrument is first carried out a validity test, reliability, level of difficulty of the item, and a test of the different power test.

## RESULTS AND DISCUSSION

Validation results of the concept mastery item obtained 15 data questions that meet valid criteria, whereas in the validation results the critical thinking skills


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item obtained 4 questions that meet valid criteria. PRasarate tests are carried out on student study outcome data before and after treatment, both in the experimental group and in the control group. Before conducting a hypothesis test two tests were first carried out on the results of the study, namely the normality test and the homogeneity test. Data normality tests are carried out on student learning outcome score data, both students who are treated with PBL learning models and students who are treated with conventional learning. In testing, this normality tested are the pretest results and posttest experimental classes and control classes. Data normality test is carried out using the Kolmogorov - sample test -Smirnov at the significance level $\alpha = 0.05$. The test criterion is if a significant value of $p > 0.05$ is obtained then the data is said to be normally distributed. Based on pretest study results data - posttest that is processed and analyzed using SPSS version 17 assistance, all data can be started normally. For homogeneity testing obtained pre-trip results and critical thinking postes $1.55 < 1.75$ Then homogeneous data and mastery of the concept of students are obtained. $1.04 < 1.75$ then homogeneous data.

Description of increased Critical Thinking on each indicator represented by the average N_gain N_gain each - each indicator. From Figure 4.1 can be seen indicators that stand out for improvement in the experimental class compared to the control class namely indicators 1 and 2. The first indicator in the experimental class is better with an average of 83.5% N_gain while in the control class it is 32.3%. Better N_gain grades in the Experiment class because students undergo the problem-based learning syntax that begins with formulating problems and define problems where students ask and formulate problems regarding environmental pollution that occur in the surrounding environment. The activity of asking questions supports the process of collecting student data by finding out for themself what they want to know and then implementing it in learning activities. This is in line with the results of research conducted by Rahmad Kano, et al (2016) which states that the PBL model is able to improve the critical thinking skills of students learning students. The second indicator of the experimental class has a better N_gain than the control class which is 51.8% while the control class is 35.6%. etter N_gain grades in the Experiment class because students undergo a problem-based learning syntax by interpreting various - various information that can be related to environmental pollution that occurs in the surrounding environment. The third indicator of the experimental class has a better N_gain value than the control class which is 39.0% while the control class is 12.9%. This can happen if students in the experimental class can develop or enrich other people's ideas related to environmental pollution material. The fourth indicator, which analyzes and interprets data in the experimental class, has a higher N_gain gain of 76.8% while in the control class it is 16.2%. This can happen to be wared by students in the experimental class experiencing problem-based learning required to solve problems with one's own ideas.


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Description of increased Concept Mastery on each indicator represented by the average N_gain N_gain each - each indicator. From Figure 4.2 can be seen a prominent indicator of improvement in the experimental class compared to the control class ie indicator 4, while a prominent indicator of improvement in the control class is indicator 1. The first indicator in the control class is better with an average N_gain of 71.8% while in the control class it is 48.7%. N_gain values are better in the control class because students in the experimental class do not yet know the characteristics of - characteristic of a good concept with regard to environmental pollution that occurs in the surrounding environment. The second indicator of the experimental class has a better N_gain than the control class which is 46.5% while the control class is 30.0%. N_gain values are better in the Experiment class because students know several examples and not examples of these concepts with regard to environmental pollution. The third indicator of the experimental class has a better N_gain value than the control class which is 49.7% while the control class is 29.3%. This can happen to be wared by students in the experimental class can connect between concepts related to environmental pollution material. The fourth indicator, in the experimental class, has a higher N_gain gain of 87.5% while in the control class it is 78.9%. This can happen if students in the experimental class can use the concept to solve problems related to environmental pollution.

The results of critical thinking research and mastery of concepts about environmental pollution in class X MIPA 1 as a control class and X MIPA 6 as an experimental class, are displayed in the table 1.

Table 1.
Test Results of Critical Thinking and Mastery of Concepts with PBL Models

| | | Paired Differences | | | | | t | Df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval of the Difference | | | | |
| | | Mean | Std. Deviation | Std. Error Mean | Lower | Upper | | | |
| Pair 1 | Konsep Eksperimen - Konsep Kontrol | 12.167 | 3.684 | .614 | 10.920 | 13.413 | 19.816 | 35 | .000 |
| Pair 2 | Kritis Eksperimen - Kritis Kontrol | 37.583 | 7.958 | 1.326 | 34.891 | 40.276 | 28.335 | 35 | .000 |


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From the data above can be obtained pair 1 (mastery of the concept) sig.= 0,000 < 0.05 and pair 2 ( critical thinking ) sig.= 0.000 < 0.05. Thus it can be said that hypothesis zero or Ho is rejected. The conclusion is an increase in the mastery of concepts and critical thinking of students who use the Problem Based Learning learning model (PBL) compared to students who learn to use conventional models.

This research was conducted in SMAN 1 Dramaga with Science class X samples 1 as a control class and class X Science 6 as an experimental class. The concept used in this study, environmental pollution with the provisions of the experimental class, was treated with the Problem Based Learning learning model, while the control class used learning with the Scientific approach.

Before the study was conducted, the researcher first observed the state of class X students in SMAN 1 Dramaga. Based on the results of observations specifically the Science X class, it is known that the Science X class at the school has the same abilities, or in other words, there is no class grouping or differentiation between smart students and students who are less smart, this is reinforced by the average yield of - an average of the two classes which are not much different. So that it can be interpreted that there are no significant differences in learning outcomes between the two classes, meaning that both classes have the same initial knowledge, especially about environmental pollution materials.

In conducting research, researchers act as teachers in the learning process in SMAN 1 Dramaga. This research was carried out during two meetings, both in the experimental class and in the control class. After the pretest is carried out, each class gets a different treatment. As mentioned earlier that class X Science 6 as an experimental class gets learning treatment using the Problem Based Learning model, whereas class X Science 4 as a control class gets learning treatment with the *Scuntific* approach.

At the first meeting in the experimental class, students were still confused in working on the student worksheet (LKS) presented. This is rumored by students more often studying in class using group discussion methods and presentations and first learning using the Problem Based Learning model. But at the next meeting, there was a better change. Students have begun to understand the learning model carried out by researchers. So that students can properly work on the LKS presented from identifying the problem to finally making a conclusion in the form of a solution to the problem.

After the learning process is completed for both classes, the final test is in the form of a postes to find out the abilities and knowledge of students after obtaining different treatments. Based on the data from the postes results after the calculation the show that there was an increase in test results in both classes, both in the experimental class and the control class. The results of the PBL model study show that the variable has a significant influence on increasing critical thinking and


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understanding of students' concepts about biology with obtained significant values for critical thinking test results of 0,000 < 0.05 and concept understanding of 0,000 < 0.05. This conspiracy shows that the application of the PBL model can enhance critical thinking and understanding of students' concepts about the biology of SMAN class X environmental pollution material 1 Dramaga, thus there is an increase in critical thinking and understanding of students' concepts about the biology of environmental pollution materials after the PBL learning model is applied. This is in line with the results of research conducted by Rahmad Kano, et al (2016) which states that the PBL model is able to improve students' critical thinking skills while increasing mastery of students' learning concepts. A similar thing was also stated by Syahroni Ejin (2016) that PBL can improve students' critical thinking skills and conceptual understanding in biological learning. Learning outcomes are likely to be influenced by several factors, including teachers, students, and learning models applied in the learning process. The learning model applied in the learning process has quite a positive influence related to the interests and motivations of students in receiving lessons. And this in a way also impacts the high level of learning outcomes obtained by students. Based on the results of the research analysis obtained, the effect of the Problem Based Leaming learning model on the biological learning outcomes of students on environmental pollution material.

## CONCLUSION

Based on the results of data analysis and discussion that has been carried out can be stated the conclusions of this study, namely: there are differences in critical class anatara thinking skills that use PBL and conventional models. There are also differences in mastery of concepts between classes that use PBL and conventional models. Where the results of critical thinking learning and mastery of concepts using the PBL model have a higher value than the results of critical thinking learning and mastery of concepts using conventional models.

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