



Improvement Students' Understanding through Problem Based Learning

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ABSTRACT

This study aims to improve grade X students' understanding of environmental pollution concepts by applying the Problem-Based Learning (PBL) model at Islamic Senior High School Ghozaliyah. Using an experimental design with a quantitative approach, the research employed a One Group Pre-test Post-test Design. The subjects were 30 grade X students at Islamic Senior High School Ghozaliyah. Data were collected through concept understanding tests administered in two phases: pre-test before treatment and post-test after treatment. The data analysis employed descriptive statistical methods to describe the students' learning outcomes and compared pre-test and post-test scores to measure improvement. The results showed an improvement in students' understanding of environmental pollution concepts after implementing the Problem-Based Learning model. This is evident from the lower average pre-test scores compared to the higher post-test scores and the significant improvement in N-Gain. This research is expected to contribute to developing effective learning models to enhance environmental concept understanding in schools.

Keywords: *Problem Based Learning, Students Understanding; Environmental Pollution*

INTRODUCTION

Environmental pollution is a global issue that has yet to find a comprehensive solution (Supriatna, 2021). The negative impacts on humans, flora, and fauna are increasingly concerning, with water, air, and soil pollution caused by industrial waste, plastic waste, motor vehicle emissions, and harmful chemical use exacerbating environmental quality (Mulyani, 2021). In Indonesia, educating the younger generation on environmental awareness remains a significant challenge. Environmental education plays a crucial role in fostering ecological awareness among students (Sawitri et al., 2024).

In grade X at Islamic Senior High School Ghozaliyah, the concept of environmental pollution is often taught through conventional lecture methods, leading to low student comprehension as indicated by learning outcomes. Initial observations showed only about 45% of students achieved scores above the Minimum Competency Criteria (KKM) for this material. A study by Yulianti & Gunawan (2019) also confirmed the ineffectiveness of lecture-based learning in developing critical thinking skills.

One potential solution is Problem-Based Learning, which emphasizes problem-solving. Through Problem-Based Learning, students identify problems, analyze relevant information, and collaboratively find solutions (Wardani, 2023). Research has shown that Problem-Based Learning effectively enhances concept understanding and critical thinking skills (Martir et al., 2024). Implementing Problem-Based Learning in environmental pollution topics at Islamic Senior High School Ghozaliyah aims to address these gaps and improve student engagement and comprehension.

However, although many studies have proven the effectiveness of Problem-Based Learning, its implementation in learning environmental pollution at the Islamic Senior High School level is still minimal. Research by Sari et al (2022) shows that the majority of teachers still find it difficult to design Problem-Based Learning -based learning, especially in integrating contextual problems that are relevant to students' lives. In addition, a study by Acim et al (2024) revealed that students tend to be more actively involved in PBL-based learning compared to conventional methods, but adequate support from facilities and infrastructure is needed to achieve optimal results.

This research offers novelty value in the form of implementing Problem-Based Learning which is specifically designed to increase class X students' understanding of the concept of environmental pollution at Islamic Senior High School Ghozaliyah. This research not only aims to prove the effectiveness of Problem-Based Learning but also to provide practical guidance for teachers in designing Problem-Based Learning -based learning that is relevant to the local context. Thus, this research not only provides theoretical contributions but also practical benefits for the world of education, especially in the context of learning at Islamic Senior High School.

In supporting this research, several relevant theories are used. Constructivism theory, as proposed by Piaget (1950) and Vygotsky (1978), is the main basis for Problem-Based Learning -based learning. According to this theory, effective learning occurs when students actively build their knowledge through experience and social interaction. Apart from that, the environmental theory developed by Suhartono et al (2023) is a reference for understanding the basic concepts of environmental pollution and its impact on ecosystems.

Several studies are the main references in this article. A study by Fauzan et al (2017) found that the analysis results in the experimental class showed that the N-gain for cognitive learning outcomes was 53.18%, while the control class was 38.86%, so it can be concluded that the application of the Problem-Based Learning model can improve student learning outcomes. Meanwhile, research by Armana et al (2020) shows that groups of students who study with Problem-Based Learning have better critical thinking and creative thinking skills compared to groups of students who study with conventional learning models. Similar results were also found in a study by Wiraningtyas (2024) which emphasized the importance of Problem-Based Learning -based learning design to increase student relevance and engagement.

This research seeks to support previous research while providing innovation in the application of PBL to environmental pollution material. In this case, the author intends to support previous findings regarding the effectiveness of Problem-Based Learning, but with a focus on Islamic Senior High School Ghozaliyah. This approach is expected to fill the gap in previous research which paid less attention to Problem-Based Learning -based learning design in the Islamic Senior High School environment. This research aims to increase class X students' understanding of the concept of environmental pollution through the Problem-Based Learning approach at Islamic Senior High School Ghozaliyah.

METHOD

This study employed a One Group Pre-test-Post-test design, an experimental design involving a single group of subjects (a single case) with measurements conducted before treatment (pre-test) and after treatment (post-test). The difference in results between the two measurements was considered the impact of the treatment provided. The study was conducted at Islamic Senior High School Ghozaliyah, located in Jogoroto, Jombang. The research population consisted of all grade X students in the second semester at Islamic Senior High School Ghozaliyah, Jogoroto, Jombang, during the 2024/2025 academic year. The research sample was the grade X-2 students, totaling 30 individuals. The data collection technique used was a concept understanding test in the form of multiple-choice questions, administered in two phases: pre-test and post-test. Data analysis employed descriptive statistical techniques to provide a general overview of the student's learning achievements. Learning outcomes were calculated by comparing the student's scores to the maximum possible score and then multiplying by 100%. The student achievement categories, based on Riduwan (2015), were as follows.

Table 1. Categories of Student Achievement Levels

Achievement Level (%)	Category
81-100	Very high
66-80	Good
56-65	Sufficient
0-55	Low

Meanwhile, the improvement in students' concept understanding was analyzed using the pre-test and post-test results, applying the normality test (N-Gain) with the formula (Meltzer, 2002, as cited in Prihatiningtyas, 2020):

$$\langle g \rangle = \frac{\langle S_{post} \rangle - \langle S_{pre} \rangle}{100\% - \langle S_{pre} \rangle}$$

The N-Gain criteria (improvement in students' concept understanding) could be seen in Table 2 below.

Table 2. Gain Score Categorization

Gain Score (N-Gain) Interval	Category
$N\text{-Gain} \geq 0,7$	High
$0,3 \leq N\text{-Gain} < 0,7$	Medium
$N\text{-Gain} < 0,3$	Low

RESULT AND DISCUSSION

Result

This study aimed to analyze the improvement of grade X students' understanding of environmental pollution concepts through the Problem-Based Learning approach at Islamic Senior High School Ghozaliyah. Based on the results obtained from the pre-test and post-test, there is a significant improvement in students' understanding of environmental pollution concepts. Table 3 shows the pre-test, post-test, and N-Gain results for each respondent. The average pre-test score was 48.30, while the average post-test score reached 76.07, indicating a significant increase. The average N-Gain score was 0.51, showing that most students experienced a moderate improvement in understanding the environmental pollution material.

Table 3. Pre-test, Post-test, and N-Gain Scores

No.	Name Respondent	Pretest	Posttest	N-Gain	Category
1	Respondent 1	62	73	0.29	Low
2	Respondent 2	47	86	0.74	High
3	Respondent 3	22	82	0.77	High
4	Respondent 4	64	90	0.72	High
5	Respondent 5	55	89	0.76	High
6	Respondent 6	35	47	0.18	Low
7	Respondent 7	45	77	0.58	Medium
8	Respondent 8	44	86	0.75	High
9	Respondent 9	55	84	0.64	Medium
10	Respondent 10	59	76	0.41	Medium
11	Respondent 11	45	75	0.55	Medium
12	Respondent 12	60	75	0.38	Medium
13	Respondent 13	43	79	0.63	Medium
14	Respondent 14	37	77	0.63	Medium
15	Respondent 15	60	75	0.38	Medium
16	Respondent 16	18	73	0.67	Medium
17	Respondent 17	34	65	0.47	Medium
18	Respondent 18	43	81	0.67	Medium
19	Respondent 19	52	74	0.46	Medium
20	Respondent 20	48	77	0.56	Medium
21	Respondent 21	42	66	0.41	Medium
22	Respondent 22	60	73	0.33	Medium
23	Respondent 23	70	81	0.37	Medium
24	Respondent 24	28	53	0.35	Medium
25	Respondent 25	60	68	0.20	Low
26	Respondent 26	62	71	0.24	Low
27	Respondent 27	71	77	0.21	Low
28	Respondent 28	49	73	0.47	Medium
29	Respondent 29	34	73	0.59	Medium
30	Respondent 30	47	75	0.53	Medium
	Average pretest score	48.30			
	Average posttest score	76.07			
	Average N-Gain score	0.51			

Based on Table 3, the average value of N-Gain is 0.51, which is included in the moderate category. The N-Gain value shows that the understanding of Physics concepts at Islamic Senior High School Ghozaliyah, Jogoroto, Jombang has increased quite significantly. The N-Gain value itself is obtained from the analysis of the pretest and posttest results. In summary, the results of the concept understanding test can also be seen in Figure 1 below.

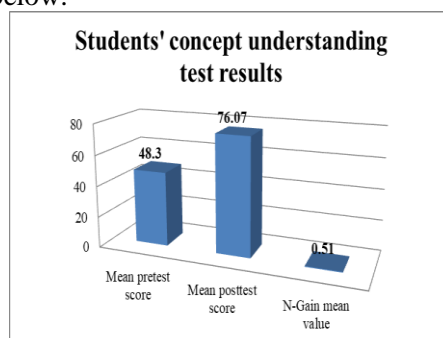


Figure 1. The graph of students' conceptual understanding test results.

Discussion

The N-Gain score is used to assess the extent of students' improvement in understanding from the pre-test to the post-test. Based on the table, some respondents showed a very high improvement (high category), while others showed low or moderate improvement.

1. Respondents with High N-Gain

Some respondents, such as Respondent 2, Respondent 3, and Respondent 4, showed significant improvement with N-Gain scores above 0.70. This indicates that Problem-Based Learning was highly effective for these students in understanding the concept of environmental pollution. The use of Problem-Based Learning provided the students with the opportunity to directly identify environmental pollution issues and find solutions independently, which enhanced their understanding.

2. Respondents with Moderate N-Gain

Most respondents fall into the moderate N-Gain category, with N-Gain scores ranging from 0.35 to 0.67. Although they showed improvement, their understanding of the concept of environmental pollution still needs further enhancement. This could be due to variations in how students study the material or differences in their mastery of critical skills in analyzing the given problems.

Respondents with Low N-Gain

Based on the data in Table 3, Some respondents, such as Respondent 1, Respondent 6, and Respondent 25, showed low N-Gain scores, indicating that they still had difficulty understanding the concept of environmental pollution despite participating in the Problem-Based Learning approach. Factors that might influence this could include a lack of motivation, difficulties in following the steps of Problem-Based Learning, or other external factors such as varying levels of intelligence and differences in prior knowledge backgrounds. the average pre-test score of the students was 48.30, while the average post-test score increased to 76.07. This indicates that the implementation of the Problem-Based Learning model successfully improved students' understanding of environmental pollution material. The average N-Gain score of 0.51 suggests that students' improvement falls in the moderate category, meaning there was considerable progress in their learning outcomes after participating in Problem-Based Learning - based instruction. From the individual analysis, most respondents showed significant improvement in understanding the concept of environmental pollution, with N-Gain categories varying between low, moderate, and high. Respondents with high N-Gain scores, such as Respondent 2 (0.74), Respondent 3 (0.77), and Respondent 4 (0.72), demonstrated substantial improvement in their understanding after the lesson. However, some respondents, like Respondent 6 (0.18) and Respondent 25 (0.20), showed lower improvement, which could be influenced by various factors, including individual difficulties in understanding the material or a lack of engagement in the learning process.

The Problem-Based Learning model had proven effective in enhancing students' understanding because this approach emphasized the development of critical thinking and problem-solving skills relevant to everyday life, such as environmental pollution. This aligned with the research conducted by Ansyah (2023), which stated that Problem-Based Learning could improve students' motivation and learning outcomes as it provides opportunities for students to engage in a more active and contextual learning process. Furthermore, these findings also support the research by Harahap et al. (2025), which shows that the implementation of Problem-Based Learning in the classroom could improve students' critical thinking skills, which in turn enhances their understanding of scientific concepts. Similar results were also found by Wardani (2023), who discovered that Problem-Based Learning improves students' understanding of complex material through problem-based learning that encourages collaboration and discussion. However, it was important to note that although the average N-Gain results show a significant improvement, there was variation in the outcomes achieved by each individual. This variation could be influenced by internal factors, such as interest and prior knowledge, as well as external factors, such as social support and the learning environment. Overall, the results of this study confirmed the effectiveness of the Problem-Based Learning model in improving students' understanding of the concept of environmental pollution, although there are still challenges that need to be addressed to ensure more uniform success among all students.

CONCLUSIONS

The conclusion of this study is that the implementation of the Problem-Based Learning model can enhance the understanding of environmental pollution concepts among tenth-grade students at Islamic Senior High School Ghozaliyah. Based on the pre-test and post-test results, there was a significant improvement in students' understanding of environmental pollution concepts after the Problem-Based Learning model was applied. This indicates that the Problem-Based Learning model is effective in helping students better understand the material through solving real-world problems related to environmental pollution. The application of the Problem-Based Learning model not only improves students' cognitive understanding but also encourages them to actively engage in discussions and collaborate within groups, which is an essential aspect of problem-based learning. Therefore, the Problem-Based Learning model can be used as an effective alternative teaching method for teaching environmental concepts, particularly pollution, to high school students.

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