



Discovery Learning Model as an Effort to Improve Students' Understanding

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ABSTRACT

This study aimed to determine the effect and improvement of Class X students' understanding of the concept of energy through the Discovery Learning approach at Public Senior High School 1 Mojoagung Jombang. The research used one Group Pre-test and Post-test Design. The population of this study consisted of students in class X-1 at Public Senior High School 1 Mojoagung Jombang. The sample was taken from class X-1 at Public Senior High School 1 Mojoagung Jombang. Data collection techniques in this study involved administering pre-tests and post-tests. The research instrument used was a 10-item multiple-choice test. Data analysis was performed using prerequisite tests and N-gain tests. The results of the study indicated that the average N-Gain score in this study was 0.51, which fell into the moderate category. The conclusion of this study showed that the Discovery Learning approach could improve the understanding of energy concepts among Class X-1 students at Public Senior High School 1 Mojoagung Jombang.

Keywords: *Discovery Learning; Students Understanding; Energy*

INTRODUCTION

Understanding the concept of energy is an essential foundation in physics learning, as energy is a key concept encompassing various natural phenomena, such as kinetic energy, potential energy, and mechanical energy. However, in practice, many students struggle to deeply understand this concept. This is influenced by teacher-centered teaching approaches, a lack of active student engagement, and the minimal application of exploration-based learning that suits students' characteristics in the digital age (Hakim et al., 2023). National and international studies, such as PISA (Programme for International Student Assessment), show that Indonesian students' science literacy, including understanding of energy concepts, is still below the international average (OECD-PISA, 2016). At Public Senior High School 1 Mojoagung, initial observations revealed that Class X students often struggle to connect the concept of energy with its real-life applications, even though the energy topic is taught according to the curriculum. This indicates a gap between the curriculum's expectations and the student's learning outcomes.

The Discovery Learning approach is introduced as one solution to improve students' understanding of energy concepts. Discovery Learning is an active learning model where students gain and analyze knowledge independently, making it easier for them to remember the acquired knowledge (Hosnan, 2016). By using this learning method, students can also learn to think critically, analyze, and solve problems (Prasetyo & Abduh, 2021). Discovery Learning encourages students to learn actively by discovering the concepts they are studying through exploration, investigation, and analysis. This approach aligns with the constructivism theory, which asserts that students build knowledge based on the learning experiences they undergo (Bruner, 1961 in Supardan, 2016). Previous research has shown that Discovery Learning is effective in improving students' conceptual understanding and critical thinking skills (Khofiyah & Santoso, 2019; Istiqamah et al., 2019). However, research specifically addressing the implementation of Discovery Learning in energy learning at the high school level is still limited. This study presents novelty by not only supporting previous research findings on the effectiveness of Discovery Learning but also addressing research gaps concerning its application in energy learning. This study aims to provide empirical evidence on how the Discovery Learning approach can improve Class X students' understanding of energy concepts at Public Senior High School 1 Mojoagung. Furthermore, this article is expected to contribute to the development of more effective and contextual physics learning strategies in line with the *Merdeka Belajar* curriculum implementation.

The purpose of this study is to analyze the effectiveness of the Discovery Learning approach in improving Class X students' understanding of energy concepts at Public Senior High School 1 Mojoagung. This study is expected to support the improvement of physics learning quality, particularly in mastering energy concepts.

METHOD

This study used a One Group Pre-test Post-test Design, an experimental design that involved only one subject group (a single case) and measured their performance before (pre-test) and after (post-test) treatment. The difference between the two measurements, pre-test and post-test, was considered the effect of the treatment. The research was conducted at Public Senior High School Negeri 1 Mojoagung Jombang, located in Mojoagung, Jombang. The population in this study consisted of all students in class X-1, semester 2, Public Senior High School 1 Mojoagung Jombang for the 2024/2025 academic year. The sample used in this study was 30 students from class X-1 at Public Senior High School 1 Mojoagung Jombang. Data collection techniques involved a concept understanding test using multiple-choice questions. The test was administered in two stages: pre-test and post-test. Data analysis was performed using descriptive statistical analysis techniques to provide an overview of the student's learning achievement characteristics. The students' learning results were calculated by comparing the scores obtained with the maximum score and then multiplying by 100%. The achievement levels were categorized based on the following criteria:

Table 1. Achievement Level Categories

Achievement Level (%)	Category
81-100	Very High
66-80	Good
56-65	Fair
0-55	Poor

The improvement in student's conceptual understanding was analyzed using the pre-test and post-test results, with a normality test (N-Gain) using the formula (Meltzer, 2002 in Prihatiningtyas, 2020):

$$N - gain = \frac{\text{post test score} - \text{pre test score}}{\text{maximum score} - \text{pre test score}}$$

The N-Gain criteria (improvement in students' understanding of concepts) can be seen in Table 2 below.

Table 2. N-Gain Value Categorization

N-Gain Value Interval	category
$N\text{-Gain} \geq 0,7$	High
$0,3 \leq N\text{-Gain} < 0,7$	Moderate
$N\text{-Gain} < 0,3$	Low

RESULT AND DISCUSSION

Result

This research was conducted at Public Senior High School 1 Mojoagung Jombang. The research subjects were students of Class X-1 at Public Senior High School 1 Mojoagung Jombang for the 2024/2025 academic year, with a total of 30 students. The main topic discussed in this study was the concept of energy through the Discovery Learning approach. Table 3 shows the results of the pre-test and post-test, while a summary of the test results is displayed in Table 3.

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

Nu.	Name Student	Pretest	Posttest	N-Gain	Category
1	Student 1	60	73	0.33	Medium
2	Student 2	42	66	0.41	Medium
3	Student 3	47	75	0.53	Medium
4	Student 4	34	73	0.59	Medium
5	Student 5	49	73	0.47	Medium
6	Student 6	71	77	0.21	Low
7	Student 7	62	71	0.24	Low

8	Student 8	62	73	0.29	Low
9	Student 9	47	86	0.74	High
10	Student 10	22	82	0.77	High
11	Student 11	64	90	0.72	High
12	Student 12	55	89	0.76	High
13	Student 13	35	47	0.18	Low
14	Student 14	45	77	0.58	Medium
15	Student 15	44	86	0.75	high
16	Student 16	55	84	0.64	Medium
17	Student 17	59	76	0.41	Medium
18	Student 18	48	77	0.56	Medium
19	Student 19	60	75	0.38	Medium
20	Student 20	18	73	0.67	Medium
21	Student 21	45	75	0.55	Medium
22	Student 22	60	75	0.38	Medium
23	Student 23	43	79	0.63	Medium
24	Student 24	43	81	0.67	Medium
25	Student 25	52	74	0.46	Medium
26	Student 26	70	81	0.37	Medium
27	Student 27	28	53	0.35	Medium
28	Student 28	60	68	0.20	low
29	Student 29	34	65	0.47	Medium
30	Student 30	37	77	0.63	Medium
	Average pretest	48.30			
	Average posttest	76.07			
	Average N-Gain	0.51			

The study results indicated a significant improvement in students' conceptual understanding after the implementation of the Discovery Learning approach to the topic of static fluids. The pre-test and post-test data showed significant changes in students' understanding of the taught material. The average pre-test score was 48.30, while the average post-test score was 76.07. This change indicated that students experienced substantial improvement in understanding, with an average N-Gain score of 0.51, categorized as moderate.

Based on the individual analysis, 9 students showed a high improvement with an N-Gain ≥ 0.7 , 18 students showed moderate improvement ($0.3 \leq \text{N-Gain} < 0.7$), and 3 students showed low improvement ($\text{N-Gain} < 0.3$). Table 3 details the pre-test, post-test, and N-Gain results for each student. While most students experienced good improvement, some students showed lower improvement, which could be a focus for further improvement. Based on Table 3, the average N-Gain score is 0.51, which fell into the moderate category. This N-Gain value indicated that students' understanding of energy concepts at Public Senior High School 1 Mojoagung has significantly improved. The N-Gain value was obtained from the analysis of the pre-test and post-test results. A summary of the conceptual understanding test results was also presented in Figure 1.

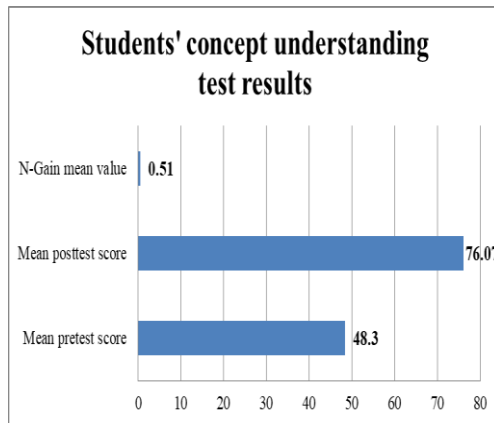


Figure 1. Graph of students' concept understanding of test results

Discussion

The results of this study indicate that the implementation of the Discovery Learning model could enhance students' understanding of the concept of energy, although there were significant variations in the level of improvement among students. This model provided students with opportunities to explore knowledge through direct experiences, aligning with the core principle of Discovery Learning, which emphasized student-centered learning. These findings were consistent with previous studies that demonstrated the effectiveness of this model in improving students' understanding of physics concepts (Fajri, 2019; Prihatiningtyas, 2024).

However, there was variation in the outcomes among students, with some achieving high N-Gain scores while others recorded low N-Gain scores. This phenomenon could be explained by various factors, such as students' motivation levels and prior knowledge. Research by Puspitasari et al. (2020) revealed that students' initial abilities significantly influence learning success, and the lower results among some students might stem from differences in their foundational understanding before the learning process began. This study also noted that although there was a significant average improvement, the model still required adjustments in its implementation to accommodate students with different levels of understanding. This aligned with findings from Suyanto (2017), which highlighted the need for adaptation to students' learning needs to maximize learning outcomes.

The findings also highlighted that while there was a significant average improvement, the implementation of this model requires adjustments to accommodate students with varying levels of understanding. This aligned with the findings of Hidayati et al. (2024), which emphasized the importance of adapting to students' learning needs to maximize learning outcomes.

The application of this model to the energy topic had proven to facilitate better understanding, particularly for students who actively participated in experiments and group discussions. These results supported the study by Widiadnyana et al. (2014), which showed that the use of Discovery Learning enhanced students' engagement in learning and deepened their understanding of scientific concepts.

Overall, this study concluded that the Discovery Learning model was effective in improving students' understanding of the concept of energy. However, improvements in teaching strategies were necessary to address the variations in outcomes among students with differing initial abilities.

CONCLUSIONS

Based on the research results, it can be concluded that the implementation of the Discovery Learning model can improve Class X students' understanding of energy concepts at Public Senior High School 1 Mojoagung Jombang. This is evidenced by a significant increase in the average post-test score compared to the pre-test score, with an average N-Gain of 0.51, categorized as moderate. However, there is variation in students' levels of understanding, with some students showing significant improvement, while others still show low results. Therefore, this model is effective in improving understanding, but further adjustments are needed to accommodate students' diverse abilities. This study also shows that the Discovery Learning model can encourage active student involvement in the learning process, thereby deepening their understanding of scientific concepts.

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