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Problem Based Learning Approach as an Effort to Improve Students Understanding

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ABSTRACT
This study aims to examine the application of the problem-based learning approach to improve the understanding of static fluid concepts among 11th-grade students at Public Senior High School Mojoagung. The study utilized a one-group pretest-posttest design. The population consisted of 11th-grade students from class XI-5 at Public Senior High School Mojoagung Jombang, and the sample was taken from the same class. Data collection techniques involved administering pretests and posttests. The research instrument was a multiple-choice test consisting of 30 questions. Data analysis was conducted using the N-Gain test. Results showed a significant improvement in students' understanding of static fluid concepts, as reflected in the average pretest score of 48.30, which increased to 76.07 in the posttest. The average N-Gain score was 0.51, categorized as moderate. This study concludes that the implementation of the problem-based learning approach is an effective method to improve students' understanding of physics concepts, especially static fluids, and offers opportunities for further development of teaching methods in the future.n.

***Keywords**: Problem Based Learning; Static Fluids; Concept Understanding*

INTRODUCTION
Static fluids are one of the essential concepts in physics education, encompassing various topics related to the properties of stationary fluids. These concepts include fundamental laws such as pressure, buoyant force, and static equilibrium in fluids, applicable to various natural and technological phenomena. However, students often exhibit a low understanding of static fluid concepts. This is a serious concern, given the importance of a deep understanding of physics concepts to develop students' critical and logical thinking skills. Therefore, efforts are needed to enhance students' understanding of these concepts through innovative and effective teaching approaches.

Many students face difficulties in understanding fundamental physics concepts, including static fluids. Observations at Public Senior High School Mojoagung revealed that despite learning about static fluids, most students still struggle to apply the concepts in real-world situations and to connect theory with practice. The lack of understanding of basic principles such as Pascal's law, Archimedes' law, and the relationship between pressure and depth in fluids indicates a gap between curriculum expectations and the reality in classrooms.

One contributing factor to this issue is the conventional teaching method, which often emphasizes lectures and theoretical material without giving students opportunities to engage directly in applying concepts through experiments or real-world cases. Consequently, students find it challenging to understand and retain the taught concepts. As noted in prior studies, problem-based learning has proven effective in enhancing students' understanding of various physics concepts. Problem-Based Learning is a teaching approach that uses real-world problems as a context for students to learn critical thinking and problem-solving skills while acquiring essential knowledge and concepts.

This study differs from previous ones by focusing specifically on applying Problem-Based Learning to the teaching of static fluid concepts at Public Senior High School Mojoagung. By utilizing Problem-Based Learning, students not only learn theory but also engage in critical thinking, discussion, and problem-solving related to static fluids. This approach is expected to motivate students to actively participate in learning and understand physics concepts more effectively.

METHOD

This research adopted a one-group pretest-posttest design, a type of experiment involving a single group of subjects. Measurements were taken before (pretest) and after (posttest) treatment. The study was conducted at Public Senior High School Mojoagung, Jombang, involving class XI-5 students during the even semester of the 2024/2025 academic year. The sample consisted of 30 students. Data collection involved concept comprehension tests, which included multiple-choice and essay questions administered as pretests and posttests.

Descriptive statistical analysis was used to describe the general characteristics of the learning outcomes. Students' learning outcomes were calculated by comparing their scores to the maximum score and converting them into percentages.

Table 1. The success levels were categorized as follows

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

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

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

N- Gain criteria (increasing students' concept understanding), can be seen in Table 2 below.

Table 2. Gain Value Categorization

Gain Value Interval (N-Gain)	Category
N-Gain ≥ 0,7	High
0,3 ≤ N-Gain < 0,7	Moderate
N-Gain < 0,3	Low

RESULT AND DISCUSSION

Result

This research was conducted at Public Senior High School Mojoagung Jombang with the research subjects being students of class XI-5 in the 2024/2025 academic year. The number of students involved in this study was 30 people. The focus of learning that is used as a topic in this study is the material about Static Fluid. The research design used is a re-treatment design (one group pre-test and post-test design), which is an experimental method that only involves one group of subjects (single case), with measurements taken before and after treatment. The purpose of this study was to measure students' concept understanding after the application of learning methods with the Problem-Based Learning approach to static fluid material. The treatment flow to measure concept understanding is done by giving a test in the form of multiple-choice questions after the application of the Problem-Based Learning method.

The data collected in this study are in the form of pre-test and post-test scores related to students' concept understanding of the material that has been taught after the use of the Problem-Based Learning method. This test aims to determine the extent to which students can achieve learning objectives and how well they master the knowledge or concepts that have been learned. The concept understanding test for the pre-test consists of 20 multiple-choice questions, while the post-test also consists of 20 multiple-choice questions with cognitive levels C1, C2, C3, and C4. This research includes two tests, namely the initial test (pre-test) and the final test (post-test). The results of the pre-test and post-test can be seen in Table 3, while a summary of the concept understanding test results is presented in Table 3.

Table 3. Nilai pre-test, post-test, dan N-Gain

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

Discussion

Based on Table 3, it can be seen the results of tests conducted by students, namely the results of the pre-test and post-test. The pre-test results show that only a small proportion of students have mastered the Static Fluid material, which is reflected in the test scores that exceed the KKM, which is 75. Table 4.5 illustrates the number of students who have understood the concept before the application of the learning method with the Problem-Based Learning approach to static fluid material. The classification of pre-test scores can be seen in Table 4.

Table 4. Classification Result of Pretest Score

No.	Value	Frequency	Category
1	90 – 100	0	Very Good
2	75 – 89	0	Good
3	60 – 74	10	Less
4	45 – 59	10	least
5	0 - 44	10	poorest

Based on Table 4, it can be seen that there are no learners who have an understanding of the material in the very good and good categories. Meanwhile, 10 learners still do not understand the material. The other 20 learners have not completed and are included in the very poor or very poor category. Based on the results of this pretest, the researcher hopes that there will be an increase in students' concept understanding, one of which is through the application of learning methods with the Problem-Based Learning approach to static fluid material. After learning is applied using the Problem-Based Learning approach to the material, the results can be seen in Table 3. Furthermore, Table 5 shows the number of students who already understand the concept after learning with the Problem-Based Learning method on static fluid material. The results of the classification of post-test scores can be seen in Table 5.

Table 5. Post-Test Score Classification Results

No.	Value	Frequency	Category
1	90 – 100	1	Very Good
2	75 – 89	17	Good
3	60 – 74	10	Less
4	45 – 59	2	least
.	0 - 44	0	poorest

Based on Table 5, it can be seen that 18 learners have shown an understanding of the material in the very good and good categories. Meanwhile, 10 students still have a poor understanding of the material, and 2 other students are classified as incomplete with very poor and very poor categories. This study determines that students are said to understand the concept of the post-test score after using the learning method with the Problem-Based Learning approach on static fluid material is higher than the pre-test score and is above the KKM, which is 75. Based on Table 5, these results show that most students have understood the concept, as evidenced by the number of students who get scores in the very good and good categories. This indicates that the application of learning methods with the Problem-Based Learning approach to static fluid material is effective in improving students' concept understanding.

Based on Table 3, the average value of the N-Gain value is 0.51 where the value is included in the moderate category. The N-Gain value shows that the understanding of the concept of Static Fluid at Public Senior High School Negeri Mojoagung Jombang has increased significantly. The N-Gain value itself is obtained from analyzing the results of the pre-test and post-test. In summary, the results of the concept understanding test can also be seen in Figure 1 below.

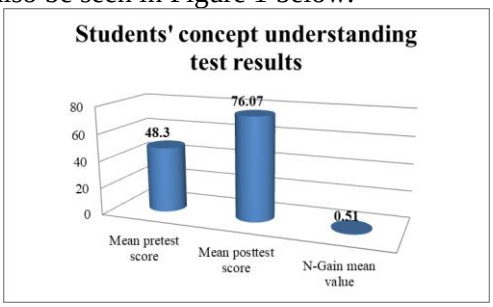

Figure 1. Graph of students' concept understanding of test results

Based on the data obtained, the increase in understanding of the concept of static fluid can be seen through the comparison of pre-test and post-test scores and the calculation of the N-Gain value of 30 respondents. The average pre-test score was 48.30, while the average post-test score reached 76.07. This shows a significant increase in understanding in all students after learning using the Problem-Based Learning approach.

From the N-Gain results, various categories describe how much students' understanding has increased. The average N-Gain value for all respondents is 0.51, which falls into the “medium” category. Although most learners were in the moderate category, some respondents showed higher improvement with an N-Gain above 0.7, which falls into the “high” category. For example, Respondent 2 (N-Gain 0.72), Respondent 3 (N-Gain 0.76), Respondent 14 (N-Gain 0.75), and Respondent 28 (N-Gain 0.77) showed excellent results after the learning.

However, some respondents experienced lower improvements, with an N-Gain below 0.3, which is categorized as "low". For example, Respondent 1 (N-Gain 0.24), Respondent 4 (N-Gain 0.21), and Respondent 19 (N-Gain 0.29) fall into this category. Although there were variations in the level of improvement, most of the respondents (more than half) showed adequate results in the medium and high categories, indicating that the use of the Problem-Based Learning method had a positive impact on improving students' understanding of the concept of static fluid.

Overall, it can be concluded that the use of the Problem-Based Learning approach provides a significant improvement in the understanding of static fluid concepts in class XI of Mojoagung State Senior High School. Learning with Problem-Based Learning not only helps students understand the basic theory but also improves their skills in solving problems related to the topic, which in turn contributes to a deeper mastery of the concept (Hidayati et al, 2024).

CONCLUSIONS

Based on the results of research on the use of the Problem-Based Learning approach to improve the understanding of static fluid concepts in class XI students at Mojoagung State Senior High School, it can be concluded that the application of this method has a significant impact on students' concept understanding. This is proven by the increase in the average pre-test score of 48.30 to 76.07 in the post-test, which shows that students managed to improve their understanding after learning using the Problem-Based Learning method. Based on the results of the N-Gain value calculation, the majority of students were in the medium category, with some students showing high improvement, while a small percentage experienced low improvement. Overall, the use of Problem-Based Learning proved to be effective in helping students understand static fluid material and improving their ability to solve problems related to the topic.

However, despite the significant improvement, not all students showed optimal results. Some students still show results with low improvement, which may be influenced by individual factors or classroom conditions that need further attention. Therefore, there is an opportunity to further develop the Problem-Based Learning approach by modifying the method or introducing a variety of learning techniques to overcome differences in student abilities.

In this study, some limitations were found, such as variations in the level of understanding between students which could be influenced by their respective backgrounds and readiness to participate in the learning process. Future researchers can further examine the factors that influence the effectiveness of Problem-Based Learning, such as the role of learning media used, the level of student involvement in group discussions, and the different strategies applied by teachers in facilitating the learning process.

The prospect of developing this research is to implement the Problem-Based Learning approach in other physics learning contexts or other topics in the curriculum and involve more variables that can affect student learning outcomes, such as motivation, active participation, and soft skills development. Future research could include a control group for a clearer comparison of the effectiveness of Problem-Based Learning compared to traditional learning methods.

Thus, it can be concluded that despite the challenges in implementing Problem-Based Learning this approach has proven to be beneficial in improving the understanding of static fluid concepts and has great potential to be applied in various learning contexts in the future.

REFERENCES

Al-Tabany, T. I. B. (2017). Mendesain model pembelajaran inovatif, progresif, dan konteksual. Prenada Media.

Anas, M., & PdI, M. (2014). Mengenal Metodologi Pembelajaran. Muhammad Anas.

Erlangga, S. Y., Poort, E. A., Manasikana, O., & Dimas, A. (2023). Meta-analisis: effect size model pembelajaran berbasis masalah pada kemampuan berpikir tingkat tinggi (HOTS) dan pemahaman konseptual siswa dalam fisika. Compton: Jurnal Ilmiah Pendidikan Fisika, 9(2), 185-198.

Esema, D., Susari, E., & Kurniawan, D. (2012). Problem-Based Learning. Satya Widya, 28(2), 167-174.

Hidayati, A. U., Maulidin, S., & Kholifah, S. (2024). Implementasi Problem-Based Learning (PBL) Pada Proses Pembelajaran Pai: Studi Di SMK Pelita Bangun Rejo. Action: Jurnal Inovasi Penelitian Tindakan Kelas dan Sekolah, 4(2), 53-62.

Pertiwi, R. S. (2017). Pengembangan lembar kerja siswa dengan pendekatan STEM (Science, Technology, Engineering, Mathematics) untuk melatih keterampilan berpikir kreatif siswa pada materi fluida statis (Doctoral dissertation, universitas lampung).

Prihatiningtyas, S., & Sholihah, F. N. (2020). Project-based learning e-module to teach straight-motion material to prospective physics teachers. Jurnal Pendidikan Fisika, 8(3), 223-234.

Riduwan. (2015). Dasar-Dasar Statistika. Bandung: Alfabeta

Yulianti, E., & Gunawan, I. (2019). Model pembelajaran problem based learning (PBL): Efeknya terhadap pemahaman konsep dan berpikir kritis. Indonesian Journal of Science and Mathematics Education, 2(3), 399-408.

Zubaidah, S., & UM, J. (2017, May). Pembelajaran kontekstual berbasis pemecahan masalah untuk mengembangkan kemampuan berpikir kritis. In Makalah disampaikan pada Seminar Nasional dengan tema Inovasi Pembelajaran Berbasis pemecahan Masalah dalam Pembelajaran Biologi di Universitas Muhammadiyah Makasar, Makasar (Vol. 6).