

Problem-Solving Proficiency Profile in Problem-Based Learning Model for Eighth-Grade Students on the Subject of Pressure in Matter

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Abstract - The Problem Based Learning (PBL) model is considered as one of the effective approaches to develop problem-solving skills in students. Hence, the purpose of this study is to assess the problem-solving abilities of eighth-grade students in SMPN 3 Samarinda using the PBL model. The research design employed in this study is descriptive quantitative. The data collection took place at SMPN 3 Samarinda with a total sample of 26 class VIII students. This research yielded the finding that the ability to solve problems for the indicator of understanding the problem reaches 73.50%, then the indicator of making plans obtains the proportion of 49.15%, then the indicator of carrying out the plan 40.17% and finally the indicator of re-examination is obtained 37.18%. So that the average proportion of all indicators capable of solving problems is 50%, this proportion is included in the sufficient category. In accordance with these findings, it can be interpreted that more science material is needed which is taught using the PBL model so that the profile of the problem-solving skills of the students can be better.

Keywords: Problem-Based Learning; Problem-Solving Ability.

INTRODUCTION

In the 21st century, technological advancements have reached various sectors, including the education sector. Education plays an essential role for individuals, as it is expected to produce individuals with the ability to contribute to social and knowledge development (Jayadi et al., 2020). In enhancing the quality of education, one method that can be implemented is improving individual quality.

The primary need for students in this 21st-century era is the ability to solve problems. This skill is crucial as it significantly influences students' daily activities. By possessing problem-solving skills, students can implement their knowledge and skills in various situations (Elita et al., 2019). Moreover, in the context of physics learning, the ability to solve problems is a crucial aspect in applying physics concepts (Purnamasari et al., 2021). However, the fact remains that students' proficiency in problem-solving is still

relatively low (Asih & Ramdhani, 2019). It is evident in the results of the Program for International Student Assessment survey in 2018, where Indonesian students' science skills scored 396 and ranked 71 out of 79 countries (Dian, 2022).

Results from observations and interviews with eighth-grade science teachers at SMP Negeri 3 Samarinda indicate that the majority of students in the science field have unsatisfactory learning achievements, with most not reaching the Minimum Completion Criteria (KKM) set at 70. Student participation in the learning process is suboptimal because it still relies on the material explained by the teacher. Students are usually given examples to facilitate understanding of the material, but if given different problems than the examples, students find it difficult to solve. Overall, the teachers explain that students' problem-solving abilities have not yet reached the expected level.

The Problem-Based Learning (PBL) model implemented in teaching can sharpen students' problem-solving skills. This statement aligns with the research by Rahayu & Ismawati (2019), which explains that the PBL model involves contextual problems that can train students to solve problems and stimulate students' curiosity about learning. PBL actively involves students in problem-solving, thereby also developing high-level thinking skills in students (Syamsudin et al., 2022).

The use of the Problem-Based Learning (PBL) model can be accompanied by the use of PhET simulations to enhance students' problem-solving abilities. This is consistent with research by (Lestari et al., 2022), which suggests that classes applying the PBL model and PhET simulations have more effective learning processes and better outcomes compared to classes that do not implement the PBL model and PhET simulations. Another alternative learning model that can be used is the Project-Based Learning (PJBL) model. According to (Lase & Mendrofa, 2023), the PJBL model can improve students' capabilities in solving problems related to problem-solving skills and enhance teamwork within a team or group. In its implementation, the PJBL model requires students to stay engaged in learning and be able to create a project or outcome from the learning they have undergone.

While problem-solving is crucial, research in this field, especially on the subject of pressure in matter, has not been extensively conducted. The aim of this research is to depict students' problem-solving abilities, and it can serve as a guide for planning the learning process.

RESEARCH METHODS

The research employed a quantitative descriptive research design, meaning it was

utilized to investigate the state or condition by describing previously gathered data. The primary objective of this research is to comprehend the problem-solving abilities of eighth-grade students.

The study was conducted at SMP Negeri 3 Samarinda during the first semester of the academic year 2022/2023, with a sample size of 26 eighth-grade students. The sampling method applied in this research was purposive sampling, chosen based on considerations such as the class's schedule aligning with the required research timeframe.

Data were collected using the test technique, comprising descriptive-based questions created using material sensitive to pressure. The test was administered at the end of the pressure-related learning session.

Upon data collection, the subsequent step involved analysis. The analysis was conducted based on indicators of problem-solving abilities found in students' responses. The acquired data were then processed to determine the average scores of all students regarding each assessed aspect. The following is the equation used to calculate students' scores.

$$P = \frac{x}{x_i} \times 100\%$$

Description:

P = Percentage

x = The score obtained by students in one aspect.

x_i = The maximum score achievable by a student in one aspect.

Subsequently, the percentage scores for each aspect obtained are categorized based on Table 1 (Mustofa & Rusdiana, 2016). The categorization of these scores is done to facilitate the researcher in assessing the extent of students' abilities in each problem-solving step.

Table 1. Guidelines for Categorizing Problem-Solving Ability Scores

Percentage (%)	Category
$80 \leq P \leq 100$	Highest
$60 \leq P < 80$	High
$40 \leq P < 60$	Sufficient
$20 \leq P < 40$	Low
$0 \leq P < 20$	Lowest

RESULTS AND DISCUSSION

Data on problem-solving abilities were obtained through recording students' post-test scores. The students' responses were then analyzed and scored on each aspect of problem-solving abilities. The

results of the scores obtained by students for each problem-solving skill indicator are listed in Table 2.

The average problem-solving ability of students overall is 50%, and this value falls within the "sufficient" category. When examined for each aspect of problem-solving ability, the highest percentage is in understanding the problem, which is 73.50%, while the lowest percentage for an indicator is in checking back, amounting to 37.18%.

Table 2. Percentage of Students' Problem-Solving Abilities

No	Indicators	Percentage	Category
1	Understanding the Problem	73,50 %	High
2	Creating a Plan	49,15 %	Sufficient
3	Implementing the Plan	40,17 %	Sufficient
4	Checking Back	37,18 %	Low
	Rata-rata	50 %	Sufficient

The first indicator, understanding the problem, obtained the highest percentage at 73.50%, categorized as high. This is attributed to the students' honed skills in understanding the presented problems in the conducted learning, allowing them to comprehend the problem accurately. This aligns with the explanation by Santoso et al., (2020). However, 26.50% of students still struggle to understand the problem well. According to Maulina & Wahyuni, (2022), students face difficulties in understanding the problem due to a lack of conceptual understanding of the given problem and errors in writing data into quantities or units.

The next indicator is the ability to formulate a problem-solving plan. This second indicator obtained a percentage of 49.15%, categorized as sufficient. Students can formulate plans effectively because they have engaged in group discussions during learning to plan problem-solving solutions presented in the given worksheets. Thus, this

activity helps train students in formulating problem-solving plans, in line with statements made by Sumiantari et al., (2019). However, 50.85% of students still struggle to formulate problem-solving plans effectively. According to Maulina & Wahyuni, (2022), students face difficulties in this stage because of a lack of understanding of the presented problem, resulting in inaccuracies in the written equations.

The following indicator is the implementation of the problem-solving plan. This indicator obtained a percentage of 40.17%, categorized as sufficient. According to Bhenge et al., (2022), students who formulate problem-solving strategies accurately tend to implement them more smoothly. However, about 59.83% of students face difficulties in executing problem-solving strategies. It is because students do not clearly write equations, are not meticulous in calculations, or may not

understand the presented problem from the beginning, resulting in less accurate solutions. This statement is in line with Damayanti & Kartini, (2022).

The fourth indicator or the last indicator is the checking back indicator. This indicator obtained the lowest percentage at 37.18%, categorized as low. This means that 62.82% of students have not been able to perform the checking back stage. This is because many students, once obtaining results, do not check back and write conclusions (Santoso et al., 2020). Additionally, according to Maulina & Wahyuni, (2022), students are not accustomed to drawing conclusions as evidence that they have checked back on the solutions. Students believe that writing the final result is sufficient without making conclusions.

In the learning process, the Problem-Based Learning (PBL) model was used to build a learning experience focused on student participation, engaging them actively and making learning more effective. Consequently, students are motivated to recognize and conduct research on the taught concepts, aiming to gain adequate understanding in problem-solving. PBL-based learning presents various problems related to the presented material. This is in line with the perspective of Astika et al. (2013), stating that problem-based learning focuses on presented problems, allowing students to not only concentrate on understanding concepts but also engage in the application of scientific methods to solve problems. By presenting various problems related to physics phenomena, students are assisted in honing their problem-solving skills. It aligns with the view of Rahayu & Ismawati (2019), who argue that the applied PBL model in learning has the potential to significantly support the development of students' problem-solving skills. The

implementation of PBL aims for students to be more active in solving the presented problems in learning, hence enhancing their problem-solving skills.

To train students' problem-solving abilities in terms of solving problems, the PBL syntax perspective can be considered. In the first syntax of PBL, students are presented with a problem, encouraging them to analyze the problem to obtain necessary information. This activity can train one of its aspects, namely the understanding the problem indicator. This is supported by Sumiantari et al. (2019), who state that when students can process the information they receive, the learning process occurs, making the acquired knowledge memorable. Subsequently, in the discussion or experimentation activity, students, in groups, discuss the problem-solving solutions in the provided worksheets. In this activity, students can formulate suitable plans to be used as problem-solving solutions. Thus, this activity has the potential to sharpen students' ability to formulate and implement problem-solving plans. The next activity contributing to training problem-solving skills is presenting the discussed problem-solving results. In this activity, students can evaluate and provide feedback on the results presented by other students. Through this activity, problem-solving skills in the checking back indicator can be developed. From this description, it can be concluded that the use of the PBL model can develop students' problem-solving abilities.

Through the application of the PBL model, it can also contribute complexly to the improvement of students' problem-solving abilities. Involving students in a problem-solving-centered learning process, the PBL model provides students with opportunities to hone analytical, synthesis, evaluation, and creativity skills in solving

problems. Thus, with such activities, they are motivated to actively engage in learning activities. The improvement of problem-solving abilities using the PBL model aligns with research by Sumiantari et al. (2019). Based on the findings of this study, it can be concluded that the use of the PBL model in teaching significantly hones students' problem-solving abilities. Specifically, it is more effective to teach students to apply the STAD cooperative approach. Furthermore, Santoso et al. (2020) also state that when used with the concept of straight motion, problem-based learning can sharpen students' problem-solving abilities and learning motivation.

However, the PBL model is not the only model that can improve students' problem-solving abilities. In a study by Lase & Mendrofa (2023), it is stated that the PJBL model can enhance students' problem-solving abilities. In the application of the PJBL model, students' problem-solving abilities are categorized as high. Therefore, the PJBL model can be an alternative to improving students' problem-solving abilities.

CONCLUSION

The results of the research at SMP Negeri 3 Samarinda yielded data on students' problem-solving abilities. In the understanding of the problem stage, it was found that 73.50% of students were able to gain a deep understanding of the problem. This first indicator falls into the good category. Subsequently, in the problem-solving planning stage, a percentage of 49.15% was obtained, placing this second indicator in the sufficient category. Moving on to the stage of implementing the problem-solving plan, a percentage of 40.17% was achieved, categorizing the third indicator as sufficient as well. The final stage, checking back, obtained a percentage of 37.18%,

classifying this fourth indicator as insufficient. Overall, students' ability to overcome problems can be categorized as sufficient, with an average percentage of 50%.

Additionally, for future researchers, it is recommended to delve deeper into this study by conducting interviews with students. This would allow for a more in-depth understanding of students' problem-solving abilities and provide qualitative insights.

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