



The profile of students' problem-solving skills toward environmental pollution topic

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ABSTRACT

Problem-solving is an essential skill that must be possessed by students, especially in learning biology. The purpose of this research is to determine the profile of students' problem-solving skills in Senior High School 10 Palembang on environmental pollution material. The research method is descriptive with a qualitative approach. Participants were 30 students of 12th grade Science 3 of Senior High School 10 Palembang in 2022/2023, which selected based on purposive sampling. The instrument consisted of five items with the indicators of problem-solving skills, including identifying problems, reviewing problems, planning solutions, implementing plans that have been made, and evaluating. The data collected for the study also included results from the teacher interview as a supporting instrument. Data analysis was carried out by calculating the average achievement score of students' problem-solving skill indicators in the form of percentages. The results showed that the percentage of students' problem-solving skills was 30.67% in the lack category. The percentage of problem-solving skill indicators is identifying problems by 26.7%, collecting data and planning solutions by 40%, implementing plans made by 33.3%, and evaluating by 13.33%. The ability to solve problems can be improved by innovating teachers in choosing learning strategies such as using approaches, methods, models, and media that can improve problem-solving abilities, especially in learning biology.



INTRODUCTION

The curriculum in Indonesia currently requires students to have skills known as twenty-first-century skills (Nurhayati et al., 2020). One of the skill competencies that students have to achieve in their learning in accordance with twenty-first-century skills is problem-solving (Saputri, 2018; Susetyo et al., 2021). According to Rahma et al. (2020), if students have problem-solving and critical-thinking skills, they can analyze, synthesize, evaluate, and also can apply the information they get to different situations.

Lestari & Djukri (2019) states that problem-solving includes explaining the description of the problem, analyzing the cause, recognizing and compiling an alternative solution, selecting the best alternative solutions to solve the problem, and judging whether the problem is truly solved. Proficiency of this ability can be provision for students to face problems properly in the future. If students' analytical skills are getting better, they will be better to provide solutions in the form of action plans or decisions. Problem-solving skills are seen as a fundamental part of science learning, especially biology learning.

The biology learning process emphasizes students' experiences and combines them with their thinking skills to solve problems (Rindah et al., 2019). According to (Ummah & Yulianti, 2020), one of the characteristics of biological learning is a conceptual object. This characteristic affects students' biological concepts to be inappropriate, causing them to experience difficulties in understanding biological concepts. In line with Chatila & Al Husseiny (2017), the difficulties in learning biology are due to the abstract, complex, and emphasis on memorization concepts. The results of research conducted by Broman et al. (2018) showed that almost all students who were the objects of their research were able to process some information from the context of each given problem, but not all students were able to integrate information and their own knowledge to develop explanations of the problems they faced in everyday life..

One of the biology materials that possibly use problem-solving is environmental pollution. Environmental pollution material is contextual and involves variety of topics related to comprehension in problem-solving. According to Asseptianova (2019), environmental pollution material discusses many problems, such as trash heap in the markets, rivers pollution, and sore breath due to exhaust fumes or factory chimneys. Other characteristics is also indicated by the occurrence of phenomena in the environment in which makes students experience difficulties in understanding the concept (Azizah et al., 2017). Therefore, students must be able to portray the depth of ideas related to environmental pollution problems and capable of answering the problems given.

Learning biology cannot develop students' ability to think critically, systematically, and develop problem-solving skills if the strategies for thinking are not used properly in the classroom. In biology learning, teachers have yet to implement meaningful learning, so students have difficulty thinking and not reaching high-level thinking skills, called problem-solving (Lestari et al., 2017). Previous studies have shown that students' problem-solving abilities in Indonesia are still lacking (Harapit et al., 2018; Karmana et al., 2020). It is because students still cannot write and formulate problems to be relevant to the given discourse (Suwandi et al., 2016). In addition, they have not been able to provide the best solution regarding the problems that have been formulated previously (Rindah et al., 2019). Another factor that causes low problem-solving abilities that have occurred in learning is the ability of students who are only seen the final result without considering the process, if students can answer the questions correctly, they are considered for being mastered the concept without reviewing how the process was carried out to get the final result.

Based on the description above, we can conclude that problem-solving skills being the most complex intellectual functions, including thinking and reasoning, metacognitive skills, and critical thinking (Amanda, 2021). Therefore, teachers need to know how students process a problem through various processes that students do in solving a problem. The process can be seen from the description/profile, so it is necessary to research to determine the profile of problem-solving

skills on environmental pollution materials. By that, it can be used to design plans for developing students' ability to solve problems appropriately during the learning process in class.

METHODS

The purpose of this study was to describe profile of problem-solving skills in Senior High School 10 Palembang on environmental pollutions material by conducted descriptive study. Descriptive method is research that describes and interprets objects according to what they are. This method is generally carried out for the main purpose, which is to describe the facts and characteristics of the object or subject being studied correctly and systematically. The approach used is qualitative and quantitative. A qualitative approach is an approach that tends to focus on a problem (Barua, 2013), while a quantitative approach is used because the analysis in this study uses statistical calculations, which are averages that have been presented in the form of percentages and relative frequency distributions.

The sample consisted of 30 students enrolled from 12th grade Science 3 of Senior High School 10 Palembang with environmental pollution material in the academic year of 2022/2023. They were selected by purposive sampling with certain criteria. It was considered based on the number of students who have studied environmental pollution material and their activeness in learning based on information from the class biology teacher.

The research instrument used was a problem-solving skill test which is integrated into environmental pollution material and consisted of five multiple-choice questions. Test instruments have been tested using validity tests and reliability tests with Microsoft Excel 2016 and SPSS 25. The questions are adjusted to five indicators of problem-solving skill according to Rahma et al. (2020) which are identifying problems, analyzing problems, planning solutions, implementing plans that have been made, and evaluating. Another instrument used as a research support tool is an interview sheet with the teacher.

This research was conducted on May 18, 2022. Firstly, the research began with preliminary activities, including the planning stage and determining research subjects through a preliminary questionnaire interview technique. Secondly, the researcher compiled problem-solving skill test questions. Then, data were collected from the results obtained from student activities working on test questions. Furthermore, researchers process and analyze the data that has been collected. Finally, conclusions are made to obtain answers from this study. Research data analysis was conducted by calculating the average score of students' problem-solving abilities per indicator in the form of a percentage. The method for calculating the percentage value of the average achievement score for students' problem-solving skills uses the following formula:

$$\text{Percentage Value} = \frac{\text{acquisition score}}{\text{maximal score}} \times 100\%$$

The average score achieved is then categorized based on the scoring criteria for problem-solving skills in Table 1.

Table 1. The category of students' problem-solving skills

No.	Percentage (%)	Category
1	81-100	Excellent
2	61-80	Good
3	41-60	Moderate
4	21-40	Low
5	0-20	Very low

(Suwandi et al., 2016)

RESULTS AND DISCUSSION

The results of this study were obtained from the problem-solving skill test questions in the form of the percentage of average student achievement. The questions given are five choice questions that are integrated on environmental pollution material and including five indicators of problem-solving ability according to Rahma et al. (2020) as mentioned above. The percentage value of students' problem-solving skills shown in Table 2.

Table 2. Descriptive Statistic of Problem-Solving Skill Indicators

No.	Problem-Solving Skill Indicator	Percentage Value (%)	Category
1	Identifying problems	26,7%	Low
2	Analyzing the cause of problems	40%	Low
3	Planning solutions	40%	Low
4	Implementing plans	33,3%	Low
5	Evaluating	13,33%	Very low
Average		30,67%	Low

As regards the quantitative analysis, the results revealed that students in 12th grade of Senior High School 10 Palembang lack in problem-solving skills. Problem-solving skills generally belong to the low category, with a mean percentage value showed 30,67%. The low category showed identifying problems for about 26.7%, collecting data and planning solutions is 40%, and carrying out plans made by 33.3%. Then, the very low category includes evaluating indicators of 13.33%. The mean percentage value of students' problem-solving indicators shown in Figure 1.

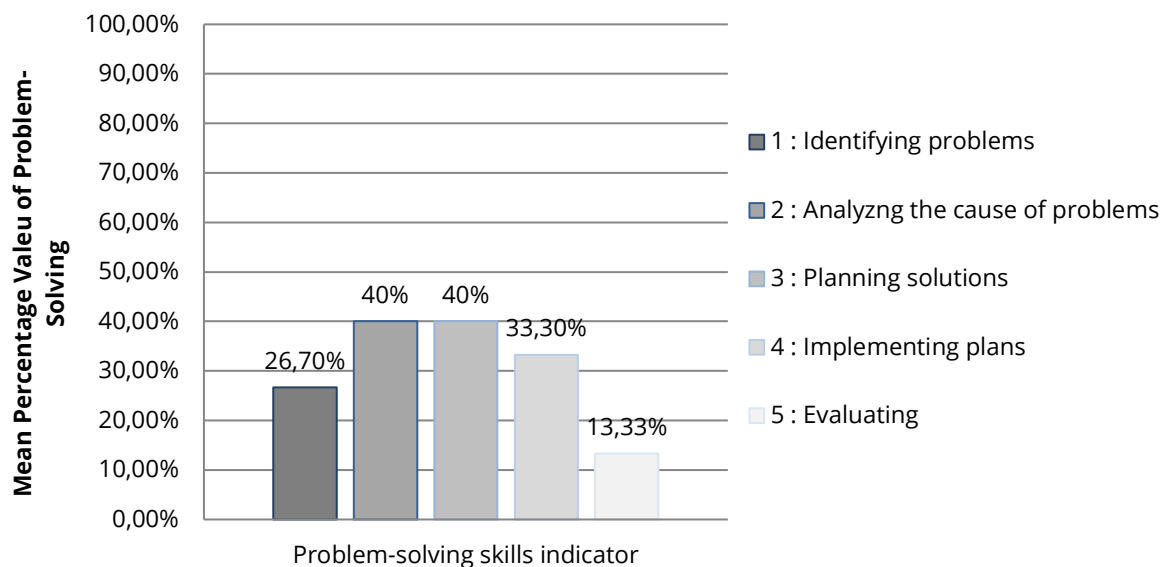


Figure 1. Mean percentage value of each indicator for problem-solving skills

Overall, the results obtained show that the problem-solving skills of 12th grade from Senior High School 10 Palembang is in a low category. In line with Nurhayati et al. (2020), the average proportion of students' problem-solving skills is 40.3%, so it is classified as in the low category. (Ummah & Yuliati, 2020) also state the problem-solving skills of class XI students of a public high school in Biringkanaya District, Makassar, in the excretory system material are in the very low category. The lack of student's ability to solve problems can result in the habit of conducting various activities without knowing the study's purpose and reasons. Also, the inability to determine

good and appropriate strategies for implementing solutions (Khoiriyah & Husamah, 2018; Rindah et al., 2019).

The lack of problem-solving skills of 12th grade from Senior High School 10 Palembang is caused by several factors from interviews with biology teachers and the students. The results showed that teachers had not fully developed problem-solving skills in the learning process, such as in determining approaches, methods, models, and learning media. The results of interviews with biology teachers in 12th grade from Senior High School 10 Palembang show that teachers have attempted to develop problem-solving skills because teachers often use a scientific approach with commonly used media, such as infocus, cell phone, printed books, internet, and videos during learning activities. However, there is no further information on the use of models and methods used by teachers. In line with (Ummah & Yuliati, 2020), most of lesson plans used by teachers do not use student-centered learning towards the problem-solving process. Even though the lesson plan used has used a problem-based learning model, the teacher is often not applicable in its implementation.

Students' problem-solving skills can be influenced by whether or not with the application of contextual learning. Based on the results of teacher interviews, the lack of developing problem-solving skills in learning is due to several obstacles in its implementation. Sometimes, teachers have difficulty in making media and teaching materials due to time constraints and being in a pandemic situation. According to (Ummah & Yuliati, 2020), during the Covid-19 pandemic, teachers had to start adapting to online learning without a planned class design unlike existing online learning. Both students and teachers have difficulty adapting to online learning.

The results of another analysis regarding low problem-solving skills showed that teachers were not optimal in making questions that can stimulate problem-solving skills, and questions only focus on understanding the material. Based on the interview results, the teacher stated that developing problem-solving skills was very important, but they wanted to focus more on understanding the material first. In practice, teachers have tried to measure problem-solving abilities by making problem-based description questions originating from HOTS and creating projects containing problems from the surrounding environment. However, the average scores are low, and students experience difficulties because their understanding of the material is still lacking. According (Ummah & Yuliati, 2020), the practice questions given by the teacher do not lead to a problem-solving process or do not stimulate students to answer these questions with a more in-depth analysis. Teachers feel that students need to be more guided and directed in learning concepts, in which sometimes the time spent is just to understand the material. In line with the statement from Sukarno et al. (2013), learning in schools only emphasizes mastery of concepts. The questions used during the learning process were only in the C1-C3 category, and students were not trained to answer high-level questions (C4-C6). In fact, the questions that could measure the ability to solve problems were in the C4-C6 category (Ummah & Yuliati, 2020).

Low problem-solving skills of students also come from themselves, which is intelligence or understanding of the material that students have is still lacking. Based on the results of the interviews, the teacher focused more on understanding the material. First, it is because there were still a lot of students who were still lacking in understanding of the learning topic. According to Hidayat & Sariningsih (2018), students with high intelligence are certainly more able to overcome the difficulties they are facing. However, students with lower levels of intelligence tend to perceive difficulties as the end of the struggle and cause student learning achievement to be low. In line with Asseptianova (2019), students do not understand the learning topic because they only tend to memorize it. In addition, the environment of students is not trained to think, leading to problem-solving in various aspects. According to Merrill et al. (2017), the main effect for social support and social problem-solving skills was found in teacher-rated behavioral problems. The results showed higher levels of social support and better social problem-solving skills. According to Lestari et al. (2017), factors that influence students' problem-solving skills include concentration. Students who

do not have high concentration during learning material will be tending to prompt them to forget the subject that has been given.

In the final stage of the analysis, the results show that the main cause of the low ability to solve problems is that the learning strategies used are not optimal to improve students' problem-solving skills. The teachers are expected to be able to enhance in terms of select the learning strategies, such as the use of approaches, methods, models, and media that can improve problem-solving skills, especially in biological learning. It can be implemented through learning activities based on scientific approaches, such as STEM learning models, Project-Based Learning (PjBL), STEM-PjBL, and discovery learning (Cheng et al., 2018; Khumairah et al., 2018; Novalia et al., 2021; Purwaningsih et al., 2020). The implication of problem-based learning models to each syntax of this model can support sharpening students' ways of thinking to face the problems or phenomena that exist in learning material (Ummah & Yuliati, 2020).

CONCLUSION

This research can be concluded that the average of the percentage of students' problem-solving skills in 12th grade Science 3 of Senior High School 10 Palembang is in a low category which about 30,67%. Low category showed in identifying problems for about 26.7%, collecting data and planning solutions is 40%, and carrying out plans made by 33.3%. Then, the very low category includes evaluating indicators of 13.33%. The problem-solving skills can be improved by innovative teachers in choosing learning strategies, such as using approaches, methods, models, and media, especially in learning biology. The mean value of students' critical thinking skills.

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