The analysis of olympic tutors problem-solving skill of the national science olympic for elementary school level

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Abstract. This study aims to describe the olympic tutors problem-solving skill of the National Science Olympic for elementary school level and analyze based on the type of problem-solving skill. In a National Science Olympic competition, the selection is made based on the ability of students to solve questions, so that the teacher as olympic tutors need to apply correct problem-solving skills as the main key to solving olympic questions. This research was a qualitative descriptive study that aimed to determine the condition of an object through a case study for olympic tutors of the National Science Olympics for elementary school level in Barru Regency, South Sulawesi. The data collection methods were tests and interview. This study showed the olympic tutors problem-solving skill of the National Science Olympic for elementary school level in Barru Regency at the moderate category which revolved around the score 25 - 49. Based on the result of the analysis, in terms of the types and stages of problem-solving, most of the olympic tutors of the National Science Olympic for elementary school level did not understand systematic problem solving and still needed accuracy in choosing the most appropriate equations to use when solving problems.

1. Introduction

A professional teacher needs to update his competence through various efforts to increase competence, in terms of pedagogical, professional, personal, and social competence. One of the competencies needed by a teacher is guide students in gaining knowledge and thinking skills to solve problems. Problem-solving skills is defined as a method of problem-solving to find a solution through problem-solving stages [1]. One of the stages to train problem-solving skills is to encourage students to participate in various science competitions such as National Science Olympic (OSN). The National Science Olympic is a science competition that is followed by students at the elementary, junior high, and high school levels through a systematic selection stage at the district or city and provincial levels in Indonesia [2]. As the first step in the selection process, the teacher has an important role to guide their students actively and carrying out the selection stage carefully. At the stage of tutoring students to face the olympic questions, it takes into basic problem-solving skills or known with techniques of problem-solving because one of the main keys to the success of participating in the National Science Olympic competition is to be familiar and skilled at solving problems in the field of natural science.

Currently, students are required to be able to solve problems creatively. Therefore, the learning system need to produce a creative problem solver who can overcome various challenges through a lot of creative ideas to apply [3]. Teachers assume that teaching concepts are easier than solving complex
problems so that students are not trained to solve complex problems. Starting from these problems, it is necessary to identify problem-solving skills because students are required to be able to solve complex questions or problems in a relatively short period in the implementation of the olympics. Solving complex problems need high-level thought processes such as analysis and synthesis. Basic problem-solving skills are a process that includes visualization, association, abstraction, understanding, manipulation, reasoning, analysis, synthesis, and generalization, each of which is procedurally arranged and coordinated. Problem-solving as behavioral processes of cognitive can be conducted in stages of identifying problems, transform problems into goals, finding and applying various alternative approaches to achieve the objectives [4].

The problem is a situation faced by an individual or group that needs a solution, whether it seems unclear or real or there is little chance of finding a solution [5]. Problem-solving can also be said to be the first step for students to develop their ideas to build new knowledge and develop skills [6]. Problem-solving skills are always identified with critical and creative thinking, so it takes the strategy of convergent or divergent thinking to get a best solution. The convergent and divergent thinking skills needed to solve the problem [7]. It takes the right steps of problem-solving, including identifying the problem, understanding the relevant concepts to the problem, and finding a way to solve the problem appropriately. The olympic problem-solving very requires a basic problem-solving skill that can lead students to solve problems complicated by systematic and right. The comparison between the stage of problem-solving stated by Dewey (1933), Polya (1988), and Krulik and Rudnick (1980) can be described in the following table [8].

Table 1. The stages of problem-solving according to several experts

| John Dewey (1933)          | George Polya (1988)       | Krulik and Rudnick (1980) |
|----------------------------|----------------------------|---------------------------|
| Confrontation problem      | Understand the problem     | Read                      |
| Diagnose or define the problem | Create a problem-solving plan | Explore                  |
| Inventory of several solutions | Carry out the plan         | Choose a strategy         |
| Predict the consequences of a solution | Review the problem-solving | Solving the problems     |
| Test the consequences      |                            | Review and expand         |

Table 1 shows the types and stages of problem-solving according to several expert opinions. The researcher chose the type of solution by Krulik and Rudnick to analyze stages of the problem-solving process used by the olympic tutors of the National Science Olympics for elementary school level in Barru Regency. Referring to the stages of knowledge based on the Bloom taxonomy, problem-solving skills are included in the applying, analyzing, and evaluating category [9]. As known, the National Science Olympic (OSN) is a competition that will provide an overview of the ability of students at the school [10]. Through this competition, it can be evaluating the problem-solving skills of students in solving questions and become the teacher’s reference to improve the quality of the learning process. However, the teacher’s problem when giving guidance is there is difficulty in analyzing the National Science Olympic questions. It takes reasoning power and creativity as well as critical and analytical thinking to find the right solution to solving complex problems. Therefore, this study can describe the ability of the olympic tutors of the National Science Olympics in the problem-solving process through the problem evaluation stage and make decisions and conclusions based on the knowledge they have.

2. Method
This research was a qualitative descriptive study, namely research that aimed to determine the circumstances and conditions in which the results were described in the form of a research report [11]. The form of this qualitative descriptive research was a case study, as an effort to obtain a complete and detailed description of certain events and phenomena in an object and subject that have specificities [12].
This research was conducted in Barru Regency, South Sulawesi. Research subject was olympic tutors of the National Science Olympic for elementary school level amounted to 37 people. The data collection techniques were observation, documentation, and unstructured interview. Observation and documentation was used to describe the basic problem-solving skills of the olympic tutors to solve standardize questions of the National Science Olympic for elementary school level. Interviews were used as additional information to become a reference in testing the validity of the data obtained from the documentation about problem solving test, then detect and describe the procedural problem-solving olympic tutors by Krulik and Rudnick type. The data obtained were described based on the facts in the study in order to obtain a conclusion which was a phenomenon of basic problem-solving skills of the National Science Olympic for elementary school level in Barru Regency.

3. Results and Discussion

3.1. Results
Based on the research result, the following shows the descriptive data of the olympic tutor problem-solving skills of the National Science Olympic for elementary school level.

Table 2. Descriptive statistics of olympic tutors of the national science olympic for elementary school level in barru regency

| Score interval | Categorization | Amount |
|---------------|---------------|--------|
| 0 – 24        | Low           | 17     |
| 25 – 49       | Moderate      | 20     |
| 50 – 74       | High          | -      |

Table 2 shows the description of olympic tutors problem-solving skills of the National Science Olympic for elementary school level in Barru Regency which is categorized on a moderate scale. This can be seen from the scores for the number of questions that the olympic tutors can solve correctly and quickly. The results of the interviews indicated that the olympic tutors still lacked references in solving standardize questions of the National Science Olympic. Besides, the target for achieving the
curriculum in Elementary Schools was not the same as the level of competence to be achieved in the National Science Olympics, so it was necessary to integrate the learning curriculum with the questions of the National Science Olympics. This was also expressed by one of the olympic tutors who stated that students at the district level had minimal awareness to work on olympic questions, especially physics question which were considered difficult, so that the olympic tutors limited the giving of questions to students, just questions that could be explored and completed by students. The researcher showed that the strongest reason that became a source of great difficulty for students in solving science problems including physics was belonging to quantitative because it involved the formula and application of mathematics to solve it [13].

3.2. Discussion
The following description of the type of problem-solving used by olympic tutors of the National Science Olympic for elementary school level referred to the theory from Krulik and Rudnick was as follow:

3.2.1. Stage of reading
At the reading stage, all of the olympic tutors of the National Science Olympic for elementary school level were seen reading the question carefully. However, any difference in the style of reading questions conducted by the olympic tutors of the National Science Olympics. Although the answers were given equally precise, the different looks because there are olympic tutors who just read about the questions and immediately mark the answer that is considered the most correct, there are olympic tutors who read while identifying each answer choice by looking for the meaning of each answer choice than choosing one answer that is considered the most correct. The reading stage of the problem is an important stage in problem-solving to identify the meaning of the problem and then explore the direction of the solution.

3.2.2. Stage of exploring
At the exploration stage, some olympic tutors have not been able to explore the questions through the identification symbol of the magnitude and the unit which is known and asked. In the process of working on olympic questions, sometimes there was an outwit variable so that the olympic tutors should be able to explore the various ways to identify the variables that exist in the question. The following figure was the style of question exploration carried out by olympic tutors.

![Figure 2](image)

Figure 2. The exploration stage by marking the known and asked variables

Figure 2 showed the olympic tutors who correctly answered the question by writing down all the variables that were known and asked as a first step in choosing the most correct equation then substituting the value in an equation and solving the problem.
Figure 3. The exploration stage by directly writing the equation

Figure 3 showed the Olympic tutors who explored the questions by reading, understanding the purpose of problem-solving, and immediately substituted the value into an equation without doing the identification of variables that were known and asked to solve the problems.

3.2.3. Stage of choosing a strategy
At this stage, the Olympic tutors expected to choose a strategy in the form of selection of one-way equation or formula in the problem-solving questions. The following figure described the types of strategy selection problem-solving by Olympic tutors.

Figure 4. The stages of choosing a strategy through drawing

Figure 4 showed the Olympic tutors who choose a question problem-solving strategy through pictures and then through this picture, the Olympic tutors understood the flow of solving the questions to get equations and answer that was considered the most correct.

Figure 5. The stages of choosing a strategy through equations

Figure 5 showed that there were also Olympic tutors who choose a strategy by marking the variable as known in the problem and directly entering the variable's value into the equation. Some researcher opinions that the students was no shortage of material when were trying to solve the problem, but the lack of strategic knowledge. Though important strategic knowledge that students knew the step of analyzing the problem, find the relevant content knowledge, making plans, and solving the problems in a procedural [14].

3.2.4. Stage of solving the problem
The stages of solving problems could be seen from the Olympic tutor ability to answer questions correctly and quickly. There were Olympic tutors who solve problems systematically, namely
identifying the variables that were known and asked in the questions, then choosing a strategy to answer, and then the most appropriate answer was obtained. However, some olympic tutors answered directly to the problem without going through these stages and were immediately able to transform their knowledge based on the questions studied through a thought process without writing down the problem-solving stages at all.

3.2.5. Stage of Review and expand
Most of respondents realized the importance of the stage of a review or retesting to expand the answers so that they were believed to be correct. This can be seen from the following olympic tutors style of answering questions

![Figure 6. Stages of problem-solving without testing consequences](image)

Figure 6 showed the olympic tutors had enough if it has obtained the results of the same answer with one of option answers that’s available without review on the results of the calculation, the selection of equation or the substitution process values into the equation.

![Figure 7. Stages of problem solving by testing consequences](image)

Figure 7 showed that there was an olympic tutor who had obtained the same answer as one of the available answer options and then check the calculation result again using other relevant equations. Based on research of solving physics problems, expert problem solvers tend to analyze with qualitatively based on the concept of physics and continue with mathematical equations. As for the beginner problem solver solving the problems by directly substituting known variables into mathematical equations first then compare it with other equations that are considered the most appropriate [15].

4. Conclusion
The olympic tutors problem-solving skills of the National Science Olympic for elementary school level in Barru Regency were categorized on a moderate scale, namely in the range of score intervals of 25 – 49. Based on the analysis results, it can be described that based on the problem-solving stages according to Krulik and Rudnick, that most olympic tutors of the National Science Olympic did not understand the problem solving procedure systematically. This can also be one of the factors causing problem-solving skills that were not maximal because to do problem-solving at least it requires the ability to analyze through the process of identifying known and questioned variables then choosing a solution strategy to solving the problem.
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