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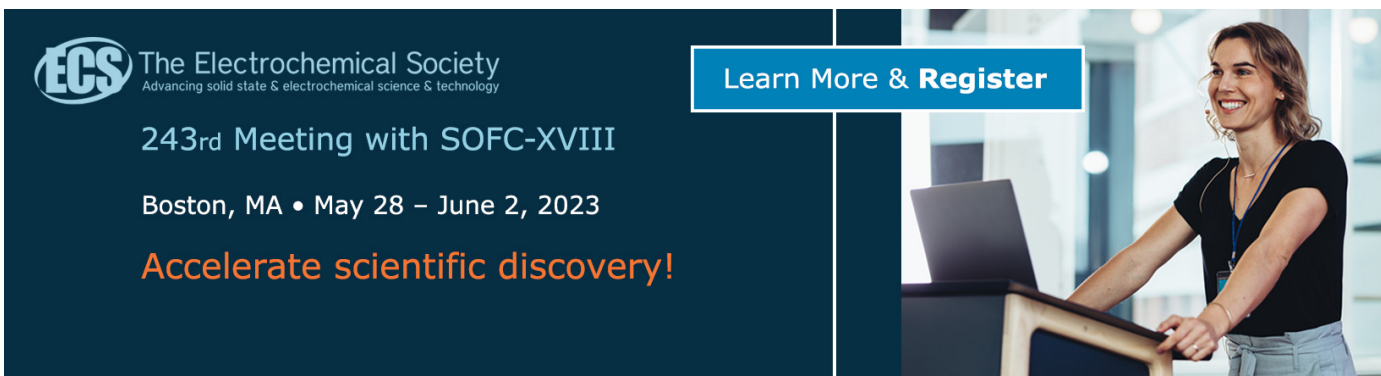
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# Identification of the ability to solve the problem of contextual physics possessed by prospective physics teachers related to basic physics content

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**Abstract.** This study aims to get an idea of the ability to solve the problem of contextual physics possessed by prospective physics teachers. The research method used is quantitative descriptive. The research subjects were 30 prospective physics teachers (27 women and 3 men) at one of the private universities in South Sulawesi Province. The instrument used for data collection is a test of the ability to solve contextual physics problems consisting of 10 items in the form of essays and problem-solving worksheets with 5 items. The use of problem-solving worksheets that include the stages of solving physical problems namely describing the problem, physical concepts, analyzing the relationship between related physical variables, representing applicable mathematics, constraints according to the problem, execution, and the results of logistical evaluation of problem-solving. The results of the study show that: 1) most students of prospective physics teachers who are the subjects of research have problem-solving abilities in the low category, 2) there is no gender bias in the ability to solve contextual physical problems. The low ability to solve the contextual problem of physics is thought to be closely related to the basic physics lecture process which is held less train the ability to solve the contextual problems.

## 1. Introduction

The ability to solve problems in learning physics is very necessary to prepare prospective physics teachers to face global competition so that they will be better prepared to engage and participate in the world of work, especially to become professional teachers. Therefore, various efforts need to be made to improve the ability to solve problems of prospective physics teachers. These efforts include improving the ability of prospective physics teachers, especially cognitive abilities, as well as improving the quality of teaching through improving methods and characteristics in the teaching and learning process. It is hoped that the prospective physics teacher will be better equipped to face problems, especially if they are already in the community, especially in the school environment. The ability to solve problems in learning physics based on the characteristics of physics learning as part of



science education has a central role in the development of 21st-century educational concept-oriented learning [1]. Understanding and experience of prospective physics teachers in learning physics can be obtained through teaching and learning process starting from what is learned and how to learn it. What is learned is related to the view of physics as a product and how to study it is related to the view of physics as a process [2] and this is the main factor in the ability to solve problems for prospective physics teachers.

The ability to solve problems is one's ability to find solutions through processes that involve the acquisition and organization of information. Problem-solving is how to find the right way to achieve goals properly [3]. In addition, the ability to solve problems is a complex cognitive activity including activities in obtaining information and the ability to organize in the form of knowledge structures. In learning physics, physics problem solving is related to the concept of physics in everyday life. Therefore, the factors that influence the ability to solve physics problems are the structure of knowledge possessed by prospective physics teachers in solving problems and character problems [4].

The difference between prospective physics teachers who have low (beginner) and high (expert) abilities in solving physics problems is how to organize and use their knowledge, and connect one concept to another in solving physics problems [5]. Prospective physics teachers who have high ability in solving physics problems tend to use qualitative arguments based on the physics concepts that underlie the problem (in-depth features), evaluate solutions and tend to use representation tools. Conversely, students who have low ability to solve physical problems tend to recognize problems based on surface features, do not conduct evaluations, and tend to use formulas in solving physical problems [6]. As for the stages in the ability to solve problems consists of five stages. First, visualizing the problem, which is visualizing the problem from words into visual representations, making a list of known and unknown variables, identifying basic concepts. Second, describing the problem in physics description, namely visual representation is converted into physical description by making diagrams or graphs and choosing a coordinate system. Third, plan a solution, namely by changing the description of physics into a mathematical representation. Fourth, carry out the plan, namely by carrying out mathematical operations. Fifth, check and evaluate, namely by checking the completeness of answers, marks, units, and grades [7].

Other simpler opinions about problem-solving steps in learning physics are 1) identifying relevant concepts (identification). In this step, the prospective physics teachers use the conditions stated in the problem to determine the relevant physics concepts and identify the variables sought. 2) Set the problem. Prospective physics teachers in this step determine the appropriate equation to solve the problem, make a sketch that illustrates the problem and choose a coordinate system. 3) Run. Prospective physics teachers in this step use equations, replace known values into equations and carry out mathematical operations to find solutions. 4) evaluation (evaluation) answers. Prospective physics teachers examine units and check their suitability with concepts [8].

Physics is a subject that is rich in knowledge, and the laws of physics are summarized in the proper form of mathematics. Prospective physics teachers in many subjects especially introductory physics must learn to dismantle the simple laws of mathematical physics and apply them in a variety of situations to explain and predict physical phenomena. In other words, to become a professional physics teacher, prospective physics teachers must learn to interpret and understand abstract physical principles and make a conscious effort to build a coherent structure of knowledge. Categorizing or classifying physical problems based on the similarity of solutions, rather than the context or 'surface features' of the problem, is considered a hallmark of professional physics teacher expertise. One example is that an expert in physics can categorize many problems that involve conservation of energy in one category and which involve conservation of momentum in another category, even if some problems involving different conservation laws might have the same context and other problems involving energy conservation alone may have a very different context [9].

This study aims to get an overview of the ability to solve the problem of contextual physics possessed by prospective physics teacher students at one of the Private Universities in South Sulawesi Province.

## 2. Methods

The research method used is quantitative descriptive. The research subjects were 30 prospective physics teachers (27 females and 3 males) at one of the private universities in South Sulawesi Province. The instrument used for data collection is a test of the ability to solve contextual physics problems. Problem solving sheet that covers the stages of problem solving such as: problem description, relevant physics law/concept, analysis of relationships between related physical variables, applicable mathematical representations, constraints according to problems, execution and evaluation of logistical results of problem solving, used as a vehicle for do problem solving [10,11].

As for the data collection and analysis techniques used, the test of the ability to solve contextual physics problems consisting of 10 items in the form of essays and problem-solving worksheets with 5 items. The results were analysed in the form of scores and scores in the form of a physics problem-solving ability category consisting of the Very High, High, Medium, Low, and Very Low categories [12]. To see the categorization form can be seen in table 1.

**Table 1.** Category level of Problem-solving ability

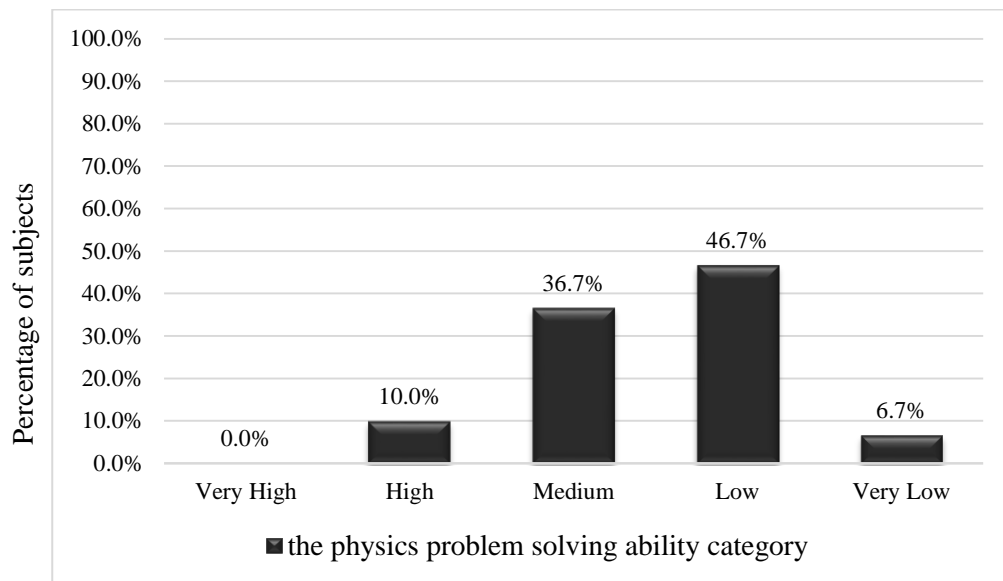
Interval	Category
81 - 100	Very High
61 – 80	High
41 - 60	Medium
21 – 40	Low
0 - 20	Very Low

After the data is arranged in the form of grouping each category interval, then each category interval is analysed in the form of a percentage of data that has been grouped according to their respective categories and tabulated in the form of bar charts. Whereas for the results of physics problem-based worksheets, that is, each stage is grouped according to the categorical interval. the results of the interval groupings are arranged based on the stages of problem-solving and tabulated in the form of bar charts.

## 3. Result and Discussion

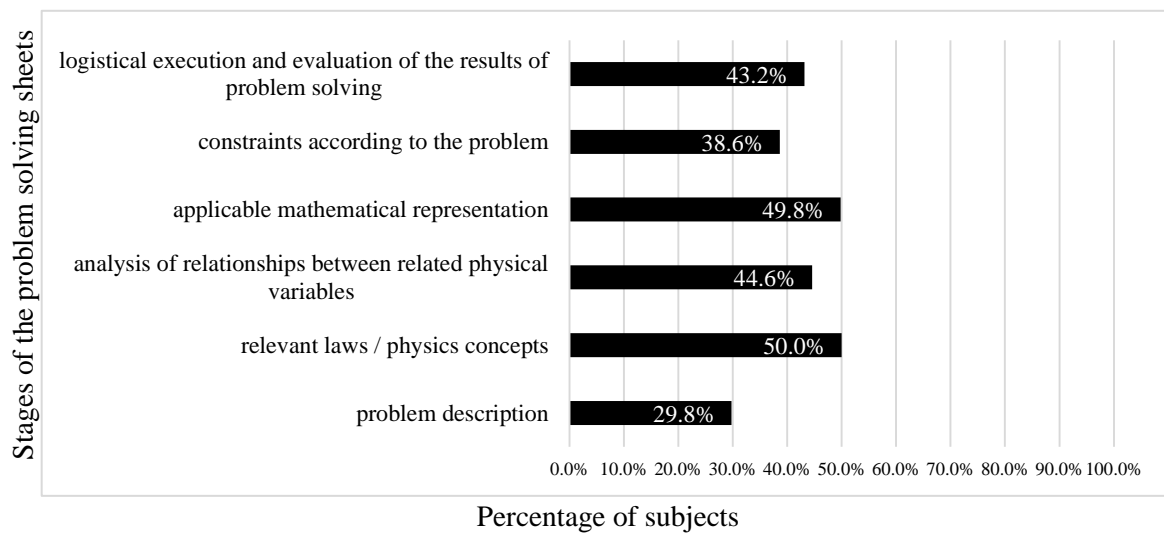
### 3.1. Result Description

Based on the test results of the ability to solve the problem of contextual physics on static electricity material at one of the private universities in South Sulawesi Province, Indonesia, the data obtained in accordance with Figure 1 is obtained.



**Figure 1.** Result of the ability to solve the problem of contextual physics test

In addition to giving test of the ability to solve the problem of contextual physics, instruments are also given in the form of student worksheets in the form of problem-solving sheets that cover the stages of problem-solving such as: problem description, relevant physics/law, relationship analysis between related physical variables, applicable mathematical representations, restrictions (constrain) according to the problem, execution and logical evaluation of the results of problem solving. The results of problem-solving sheet can be seen in Figure 2.



**Figure 2.** Result of the problem-solving worksheets

### 3.2. Discussion

In accordance with the data from the results of the test the ability to solve contextual physics problems in static electricity material at one of the private universities in South Sulawesi, Indonesia. The result is a very high category of 0.0% (none of which reaches very high), a high of 10.0% (3 people), medium of 36.7% (11 people), low of 46.7% (14 people) ) and very low at 6.7% (2 people). One of the factors that cause the low ability to solve physics problems is that prospective students are students who tend to memorize each formula given without understanding the physical meaning of each formula, and only a few students are able to process the problem solving well (as a problem solver).

For the results of giving student worksheets in the form of a problem-solving sheet that covers the stages of problem-solving such as problem description, relevant physics law/concept, analysis of relationships between related physical variables, applicable mathematical representations, constraints according to problems, execution and evaluation logic the results of problem-solving. The result is for the problem description stage of 29.8% (very low), the relevant legal / concept physics stage is 50% (low), the relationship analysis stage between related physical variables is 44.6% (very low), the mathematical representation stage valid for 49.8% (low), the constraint stage according to the problem is 38.6% (very low), and the logical execution and evaluation stages of the problem-solving result are 43.2% (very low).

The results of these studies are strongly supported and in line with the results of research conducted by Asizah et al. [13], which based on the results of the study obtained 26% of students experiencing difficulties in the material Temperature and Heat, 25% Optical, 21% Static Fluid, 17% Elasticity and Hooke's Law, and 11% Kinematics. One of the difficulties is caused by less optimal learning for students in the form of hands-on activity. As many as 88% of students said that physics learning that is often experienced is by the lecture method. Students have difficulty learning physics in solving problems in the problem by 32%, difficulty understanding concepts and formulas 26%, difficulty using equations or formulas in the problem 18%, difficulty analyzing graphics and images 17%, and difficulty concluding the material that has been studied 7%. These difficulties are seen when students solve problems in kinematics and temperature and heat. Obtained from the results of the questionnaire, that 76% of students had difficulty in solving problems in the problem with the reason of forgetting or not understanding, for 19% of students did not understand the problem solving solutions in the problem, and only 5% of students were able to solve problems in the problem.

Other studies also strongly support the results of this study. According to the results, it can be said that the pre-service teachers' perceptions of problem-solving ability in both the experimental group and control group were generally at the middle level. Similarly, in the literature, research conducted by Saracalođlu, Yenice and Karasakalođlu (2000) with pre-service elementary school teachers and that of Temel (2009) with pre-service chemistry teachers showed that preservice teachers were at a satisfactory level in terms of perceptions of problem-solving ability [14].

In understanding, basic physics material students more often receive material and equations without doing the process of self-discovery of a physics concept. If this problem persists in basic physics learning, it will fail to understand a concept that will have an impact on the ability to solve problems related to everyday problems.

#### 4. Conclusion

The conclusions of this study are most of the prospective physics teachers who are the subjects of the study have the ability to solve problems in the low category, there is no gender bias in the ability to solve contextual physics problems. The low ability to solve the contextual problem of physics is thought to be closely related to the basic physics lecture process which is held less train the ability to solve the contextual problem.

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