The problem solving skills and student generated representations (SGRs) profile of senior high school students in Bandung on the topic of work and energy

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Abstract. Based on recommendations from the Physics Education literature recommend the use of multiple representations to help students solve problems. The use of some good representations is considered important to study physics, so many good motivations to learn how students use multiple representations while solving problems and to learn how to solve problems using multiple representations. This study aims to explore the profile of high school students’ problem solving abilities and this study is part of a larger research focus on improving this ability in students in physics. The data is needed to determine the appropriate treatment to be used in subsequent research. A purposive sampling technique was used in this study and a survey was conducted to collect data. 74 students from one high school in Bandung were involved in this research.

1. Introduction

Physics is a subject that can foster students' thinking skills that are useful for solving problems in everyday life. In this study only limited to problem-solving abilities. Physics education literature recommends using multiple representations to help students understand concepts and solve problems.

The ability to solve problems in physics is necessary for the students. In line with 21st century skills, the 21st century learning paradigm emphasizes students' ability to solve problems, be able to connect science and the real world, master information technology, communicate and collaborate.

Problem-solving skills are important because they are included in high-level thinking skills and in accordance with the demands of the existing curriculum. Based on Permen Dikbud number 24 of 2016 on Core Competence and Basic Competence of Lessons in Curriculum 2013 which states that understanding and applying factual, conceptual, procedural knowledge in science, technology, art, culture and humanities with the insight of humanity, nationality, state and civilization related phenomena and events as well as applying procedural knowledge to specific areas of study in accordance with their talents and interests to solve problems [1]. Meanwhile the problem skill is the student's skill to use physics concepts to get solutions to daily life problems (Heller P Keller) [2].

Based on the observation at school in Bandung city, it was found that the teacher emphasized the physics lesson in solving the problem directly to the calculation, the lack of delivery of physics concept, the lack of examination of students' thinking process. In discussions and arguing scientific, rare learning
activities of Student building through experimentation, and lack of explanation of conceptual linkages with applications as well as natural phenomena in everyday life.

In the learning hierarchy Gagne [3] mentioned that to solve the problem, a student must know and understand the relevant rules or principles. The rules are based on the concepts they have gained after learning. Understanding the concept is very important owned by students because it can be used to solve a problem that is related to the concept. In conceptual understanding, students are not limited to just getting to know but students must be able to connect between one concept with another [3].

Ainsworth in his research entitled the function of multi-representations suggest that multiple external representations can be used to support cognitive processes in learning and troubleshooting by using computers, and to critically examine the view that the use of multiple representations external not only motivates but also encourages learners to understand more deeply about the subject being taught. Multi representation can help learners in learning and building a concept and solve problems, help in solving problems and help address the problem [4].

Representation is a configuration (form or arrangement) that can represent, represent or symbolize a way. Representation is also something that describes, represents, or symbolizes objects and / or processes [5]. Multiple representations can also be interpreted as a way of expressing a concept through different ways, forms or formats [5].

2. Methods
This descriptive study aims to find profile of problem solving skill high school student at Bandung. Research populations are high school student of class XI at one high school in Bandung to determine research sample use purposive sampling technique.

Problem solving test consisted of essay question, each question consist of work and energy. In this research, using problem solving skill according to David Rosengrant [5] framework these are picture and translate, simplify, represent physically, and represent mathematically. To investigate score problem solving test use problem solving scoring rubric adapted from Rosengrant [5].

| Table 1. Scoring rubric |
|-------------------------|
| 0 | 1 | 2 | 3 |
| No-evidence | inadequate | needs improvement | Adequate |
| No representation is constructed | FBD is constructed but contains major errors such as missing or extra forces. Forces may be pointed in the wrong direction. | FBD contains no errors such as missing or extra forces but lacks a key feature such as labels or force are mislabeled or do not contain a labeled axis if Lengths of force arrows could be incorrect. | The diagram contains no errors and each force is labeled so that it is clear what each force represents. |

After scoring is done the next step is do the percentage of each indicator problem solving skill, the percentage of the process is done by using the following formula (1).

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\% = \frac{\text{score each indicator}}{\text{total score each indicator}} \times 100\%
\] (1)

3. Results and Discussion

3.1. Results
Problem solving skill test given to high school student in Bandung. Result of science process skill test is inadequate and need improvement.
Table 2. Score of each question science process skill

| Category                      | Number of Students and Their Categories at Each Stage |
|-------------------------------|------------------------------------------------------|
|                               | Problem 1 | Problem 2 | Problem 3 | Problem 4 |
| Score 3 (Adequate)            | 0%        | 0%        | 0%        | 0%        |
| Score 2 (Needs improvement)   | 34%       | 17%       | 15%       | 8%        |
| Score 1 (Inadequate)          | 64%       | 72%       | 76%       | 82%       |
| Score 0 (No evidence)         | 2%        | 11%       | 9%        | 10%       |

Based on the data Table 2, it was found that the quality of problem solving skills of students still in the category needs to be improved and not satisfactory. These findings indicate that students have not been able to understand to illustrate the problems presented well.

In this study, the problem-solving test consists of four questions. The first question of effort by the style that forms the angle of displacement, the second question about relations work and kinetic energy, the third question about relationships work and potential energy and the last question about the law of conservation of mechanical energy.

3.2. Discussion

The purpose of this study was to find students’ profiles of problem-solving abilities. According to table 2, the highest percentage of the unsatisfactory category is in the matter of business relations and kinetic energy, the highest percentage of the unsatisfactory category is in the matter of legal energy conservation and the need for improvement category occurs on the business by the force that forms the angle to the displacement. This shows that students have not been able to understand to illustrate the problem.

Less accustomed the ability to understand to illustrate the problems in high school students in the city of Bandung caused by the lack of students in identifying key concepts. Both the lack of ability of students in making new representations such as after simplifying the problem students can describe the physical form (free body diagram) and then write in mathematical form. The inability of students to change the form of representation to other forms of representation occurs because of the lack of teacher guidance in learning the ability at the time of learning. Thus, teachers should plan learning strategies that incorporate multi representation approaches that enable students to train their skills in translating, simplifying, describing physical forms (free body diagrams), and writing mathematical forms to solve problems.

Therefore, teachers need to make some innovations in learning to trained and improve students problem solving skills. It needs a learning strategy that can ability problem solving physics in student. A strategy that can be used is a problem-solving strategy combined with a multi representation approach.

4. Conclusion

Based on the results of research and discussion, it can be concluded that the ability of problem solving physics problems of high school students in Bandung is still in the category need to be improved based on the results obtained ability problem solving sub material work business by force shaping angle to the displacement of 34%, relations work and kinetic energy equal to 17%, relation work and potential energy of 15%, and mechanical energy conservation laws of 8%.

5. References

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