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Facilitating of fourth grade student's problem solving skills on friction

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Abstract. This research purposes to designate students' problem-solving skills on friction concerning elementary level through experiential learning. The indicators of problem-solving skills applied in this research were the indicators convinced to the problem-solving skills on force and impulse. A descriptive-qualitative design has already been contented to collect data from fourth-grade elementary students in one of school in Bandung Barat Regency (37 participants: 9-10 years old). The instrument which is developed formed essay with the interview process. The result appearances that every single characteristic of problem-solving skills has been developed and described such as identification, arguments hypothesis, reasoning and alternate solution. To summarize, the experiential learning is able to designate the 4th-grade elementary students' problem-solving skills on friction.

1. Introduction

As humans' life has been a 4th industrial revolution, science and technology developed very rapidly [1, 2]. The development has been extremely supporting humans' life. This evidence demands people to possess capable skills to go with the rapid development of science and technology in balance [3, 4]. Four skill groups to conquer in this 4th industrial revolution are ways of thinking, ways for working, tools for working and ways for living in the world [5, 6]. One of those four skill groups that will deeply investigate later is the skill group of the ways of thinking. It belongs to a set of thinking skills. Among those thinking skills are: 1) creative and innovative, 2) critical thinking and problem-solving, and 3) learning how to accomplish metacognitive competency. However, problem-solving turn into essential thinking skills to directing in this revolution.

Problem solving skills are adjustable tools for successfully handling various kinds of unfamiliar problems which enhances constructive and adaptive behaviors in these new and demanding settings. These skills are crucial for all children, especially for the gifted children who are hoped to be the leaders and creators of the change in this uncertain and dynamic environment [7, 8]. A problem might be defined as a situation with a goal and an obstacle, or a gap between a current and a desired situation, in which a problem solver wants to achieve a goal, but first the obstacles need to be dealt with. However, at this argument is a chart in identifying problem solving skills in figure 1.



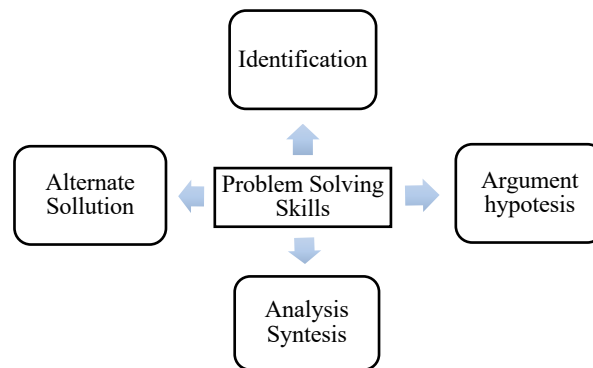


Figure 1. Indicators on problem solving skills.

Based on the figure, the problem-solving skills consists of four aspects that are identification, argument hypothesis, analysis synthesis and alternate solution. Focus in this research is to identify the problem-solving skills of students on friction. The definition of Friction is a concept long presumed by early civilizations when humans activated to use tools, build monuments, and design shoes to control slippery paths. Yet its beginning and nature have avoided understanding. On one hand, gravitation crops mass and weight and when the mass has to transfer athwart the gravitational fields, horizontal forces requirement to be exerted to overwhelmed the gravitational forces. In tribology, friction is intrinsically attached to the wear switch and reliability aspects of all affecting parts under various operating surroundings and environments. Therefore, the struggle of friction growths with the rapid rise in designs and equipment. Our understanding of the essential nature of friction requires a critical review. The existing thought of friction is that friction is an energy dissipative process. Frictional energy from opposition to sliding scatters into resistance, heat, and resources deformation and fracture [9]

$$F_{\cdot T} = F_{\cdot} + f_{\cdot} + (N - W) \hat{j} \quad (1)$$

$$F_{\cdot T} = \hat{i}(F \cos\theta - fs) + \hat{j}(F \sin\theta + N - W) \quad (2)$$

The emphasis of this paper deceptions on these different conceptions of problem-solving skills inside friction concept. By reviewing on the four problem-solving aspects and by evaluating them from an integrative perspective, we try to connect cognitive research and educational assessment into a joint and comprehensive understanding, thus bridging the gap between assessment in education as well as between different types of problem-solving skills [1, 5, 10]. Thus, this paper is not expected at facilitating a specific theory or importance of problem-solving skills, but rather at showing how a construct such as problem-solving skills can be implicit in different ways at different points in elementary student specifically in fourth grade.

The literature results have shown the adjustments associate the suggestion of the problem-solving skill with the state of being prosperous. Teacher's contribution on students' problem-solving skills is also viewed as substantial. Consequently, from the fact of sight of making cognizance, emphasizing the problem-solving skill at the fourth grade elementary schools in Bandung Barat Indonesia, this paper requisites to be carried out.

2. Methods

This research procedures a qualitative-descriptive method that purposes to understanding by students on friction without giving treatment to the research subjects then the results are obtainable in a forthright and straight way. The subjects of this research are 41 students of 4th-grade student's elementary school, Bandung Barat Regency, West Java. The instruments that used in this research are data collection and interviews. The data collection has indicators choices which each problem represents each indicator that will be used to measure students' how they can use problem solving on friction conception. The test result obtained and then analyzed each question by looking at the answers.

3. Results and Discussion

3.1. Problem Solving Skill Review

There are several things that are developed in increasing the aptitude of student in elementary school in problem-solving skills. Based on the test results about the friction given to students there is error to give answering and provide alternate solution answering the problem. The proposed structure is designed as a theoretical foundation for the measurement of problem-solving skills [1, 10]. The results of the outline of student test results can be seen in Figure 2

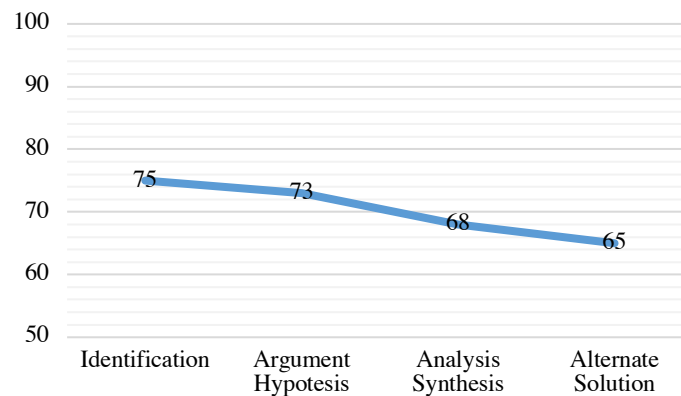


Figure 2. Recapitulation of student test of problem-solving skill on friction.

Figure 2 shows the recapitulation of students' test of problem-solving skill on friction with some indicators that measure the concept of friction effect. The research results indicate that there is direct in science on how students solve problems in Bandung Barat elementary school. This can be seen from the percentage that indications the average of students who answered correctly with a percentage of 75% to identify the answer and only 73% percentage student convey argument hypothesis. For the third indicator of analysis synthesis the problem of the friction the average percentage of students who answered correctly is 68% greater than the students who answered correctly on how to give alternate solution is 65%.

3.2. Problem Solving Skill Indicators

This research explains how students comprehend every characteristic of problem-solving skills. The first aptitude that students should know is to identify, students are questioned to identify based on the given problem. In this case the ability to identify has a score of 75%. Students are still difficult to describe the appropriate problems. This is because students do not recognize the concept of physics. In addition, students do not realize the questions assumed. First, we disputed that the type of information offered during knowledge compeers will impress how to solve the problem, and we concentration on two types: factual and range. With the enormous arrangement of material that is available to a person at any supposed time. The way student identify, the cognitive processes give the impression to be anxious upon during idea generation: practical memory/ information and declarative memory / indulgent [11].

The second skill is argument hypothesis, at this phase the students are less competent to give an understanding of the hypothesis or the clarification assumed to explain the problem. The variety information is not unswervingly applicable for coming up with problem solving. In other words, range information may involve a more reserved or immaterial conceptual association to the task/problem at hand. It may seem irrelevant at first, but range information is typically explored after the obvious options are drained [12], so it may encouragement the idea generation process by encouraging novel relations. Range information may cause personalities to think of an extensive range of solutions (i.e., flexibility), because range information prompts thoughts countenancing individuals to overwhelmed purposeful

fixedness. In fact, presenting apparently dissimilar ideas has been found to generate more original category labels [13, 14]. Thus, range information should assistance personalities in generating original responses to a solve problem [13].

A third capability is the analysis of synthesis, it proceeds the ability to describe logically to give scientific explanations. At this point of ability required conceptual understanding and explain well. These findings are dependable with the model that student must not only attain applicable science knowledge, but also be able to standardize their intelligent, to engage excellently in science-related reasoning [15]. The fourth competence is the alternate solution, the competence required to give new concepts in solving the problem. This competence has the lowest assessment compared to all indicators. This is because compound understanding is required in providing altered solutions. The resulting is a comparison between male and female students on problem-solving skills, shown at figure 3.

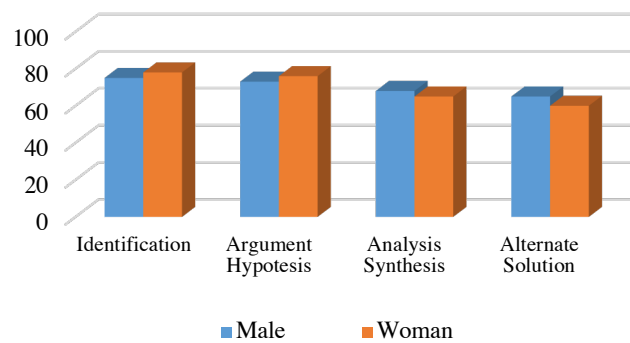


Figure 3. Comparison male and female student on problems skills.

The ability of female students is better at identifying problems and providing solutions. However, the ability to provide reasons and alternative solutions is no better than that of male students. Student's reaching on the problem-solving task expected depended, in part, on their understanding of the connecting relations uncomplicated each problem[15]. However in this case, Thoughts may performance a critical role in the student's ability to process means-end relations surrounded in a problem solving task, but also in generating new, different ideas about thinkable and plausible problem solutions [14, 16]. This is one item which already designed to product development aspect will be shown in figure 4 and 5.

Indicator : Alternate sollution
 Question : If Ahmad's house does not have a board that can be used for the incline, what alternative solutions will Yosi propose to Ahmad so that they can overcome the problems it faces?
 Answer : Yosi was asked to look for two hoists (pulleys) to make double pulleys that can be used to lift

Figure 4. Alternate solution on problem solving.

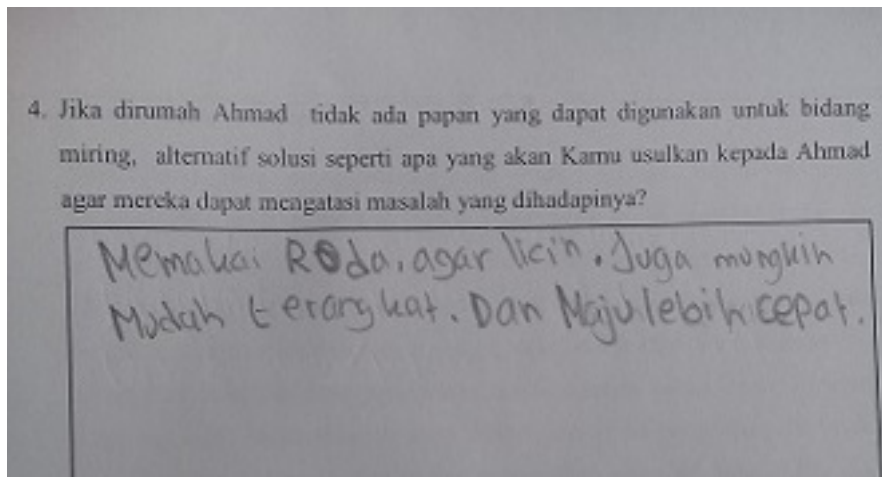


Figure 5. Answer by student

A dissimilarity has been made between problems and alternate solution. By contrast, a problem may not be solvable either unconditionally, or to a degree, and its resolution may involve, at the very least, the development of new techniques or the raising of a new hypothesis. Students arrange for alternative solutions constructed on concepts already obtained and factual that has been understood. Giving alternate solution, student should take scientific inquiry that bring up to the procedures used by scientists to study natural phenomena and to mark descriptions based on evidence attained through the investigations [17]. In order to improve conceptual understanding in a manner acceptable to scientists and teachers, student alternative conceptions and prevailing knowledge structures may need modification in a process known [18]. The low ability of students in providing an alternative solution because the problems prearranged are not in accordance with the quotidian problems. Students receive scientific concepts then practice them aimed at understanding the phenomena in routine conditions [19].

4. Conclusion

It was determined allowing to the results gained from the study that student in elementary school (Bandung Barat Indonesia) perceptions of the wide-ranging problem-solving advancement were at a high level. However, it was seen that the enthusiasm and purpose insights of the students with affections to problem solving were at a medium level. It is therefore assumed that it is desired to observe the factors that affect the readiness and purpose of the students; more comprehensive studies need to be accompanied.

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