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PROBLEM SOLVING SKILLS IN LEARNING PHYSICS

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ABSTRACT

Physics aimed at developing thinking skills inductive and deductive analysis using the concepts and principles of physics to explain these events and resolve problems both qualitatively and quantitatively. Problem solving is one type of cognitive processing associated with the thinking skills of students and involve the application of concepts that have been held so that an indication of the transfer of learning. Resolution can develop high-level intellectual skills. Students' skills in problem solving is not only influenced by the inability of students to use the knowledge he already has, but is also influenced by the ability of the teacher in teaching. In this study using IDEAL problem solving as an indicator of problem-solving skills in students. The results show problem-solving skills in students need to be trained in order to become a better problem solver.
Keywords: problem-solving skills, IDEAL problem solving, physics instruction.

Introduction

Education is an investment in human resources that have a long-term strategic value for the survival of human civilization in the world. Almost all countries, including Indonesia, to put education as something important and major. It can be seen from the contents of the fourth paragraph of the UUD 1945 which stipulates that one of the national goals of Indonesia is the intellectual life of the nation. Enforcement of the national goal of empowering all citizens of Indonesia develop into quality human so capable and proactive answer the challenges of changing times. Rotherham and Willingham (2009) expressed his opinion about the importance of the mastery of 21st century skills, especially problem-solving skills. Based on these opinions, life skills need to be trained from an early age that is at the level of the education unit. Gagne (Susiana, 2010) believe that the center of education is to teach students to think, to use their rational powers, and become a better problem solver.

Sutrisno (2006) states that the essence of physics is the same as the nature of science or science. The essence of physics is as a product, as a gesture of physics, and physics as a process. Physics as a collection of knowledge products can be facts, concepts, principles, laws, formulas, theories and models. Learning the science of physics can not be separated with the concepts of the laws, and theories that are fundamental (Aziz et al., 2006). Understanding of physics as a process strongly associated with expectations, observations, measurements, investigations, and publications. The nature of physics as the attitude is curiosity, objective, honest and open and willing to listen to other people's opinions. Physics aimed at developing thinking skills inductive and deductive analysis using the concepts and principles of physics to explain these events and resolve problems both qualitatively and quantitatively. Thus, students will be trained to find their own various concepts holistically, meaningful, authentic and applicable to the interest of solving problems.

Elliot, et al (2000) states that the problem is a mismatch between reality and expectations. Mayer (in Kirkley and Foshay, 2003) suggested three characteristics of problem solving: 1) Problem solving is a cognitive but is inferred from behavior; 2) Problem solving results in behavior that leads to a solution; 3) Problem solving is a process that involves manipulation of or operations on previous knowledge (Funkhouser and Dennis, 1992). Learning to solve the problem is to learn to use scientific methods or thinking in a systematic, logical, orderly and meticulous to acquire skills and cognitive skills in solving problems in a rational, straightforward, and complete (Shah, 2003). Gagne (Ibrahim, 2012) state that the problem solving skills of the highest learning results. Problem solving is one type of cognitive processing associated with the thinking skills of students and involve the application of concepts that have been held so that an indication of the transfer of learning (Schunk, 2012; Snyder, 2008; Anderson, 1993).

Gagne (Susiana, 2010) state that settlement of problems can develop high-level intellectual skills. Resolution is important to be trained because: 1) authenticity, in everyday life and in the world of work is problem-solving activities that can be found everywhere; 2) relevance, problem, especially given to students to complete, useful and can motivate students to learn; 3) the settlement of the problem requires deeper learning; 4) knowledge of the issues presented

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built a more meaningful learning. Students who learn to solve problems can learn two things at once, the first students to find answers to the problem and the second student knows how the process / how to resolve the problem.

Some researchers have developed and implemented learning model associated with problem solving skills (Kuo and Hwang, 2014; Bautista, 2013; Kapur, et al, 2005). Students participate actively in the learning of a five-phase learning cycle so that the performance of students in solving the problem of web-based increase (Kwo and Hwang, 2014). Kapur, et al (2005) present a quantitative, analytical method for characterizing and analyzing the process of computer-supported, collaborative problem solving. It was developed the methodological tools to analysis of computer-supported, collaborative, problem-solving processes. Hasil penelitian lain was designed to analyze the procedural fluency and written-mathematical explanation to select constructed response tasks of students in Thermodynamics problems. It was found out that their procedural fluency on constructed response tasks is significantly related to their written-mathematical explanation ability, and a significant difference on their performance when grouped according to their mathematical and English ability. The students' procedural fluency is dependent to their mathematical ability, both algebraic and trigonometric, while their written-mathematical explanation is associated to their English ability (Bautista, 2013)

Learning can be defined as a change in skills, attitudes, or behavior of students as a result of experience or training (Bukhaari, 2012). According to Fuchs et al. (in Slavin, 2011) is a problem-solving skills that can be taught, learned and trained to students. Skills of students in mastering the concepts, principles and generalizations are indispensable (Shah, 2003).

Problem solving is a basic skill needed by today's learners. Guided by recent research in problem solving, changing professional standards, new workplace demands, and recent changes in learning theory, educators and trainers are revising curricula to include integrated learning environments which encourage learners to use higher order thinking skills, and in particular, problem solving skills (Kirkley and Foshay, 2003).

Students can be trained to use the model, method or technique in accordance with the objectives and learning activities that students have problem-solving skills. One simple way of solving the problem of Gick (Susiana, 2010) which consists of three stages: constructing a problem, finding a solution, and using / implementing the settlement.

Famous model of problem solving is of Polya (in Suherman 2003) which consists of four stages, namely understanding the problems, plan solutions, solve the problem according to plan, and to check back for all the measures that have been undertaken. Bransford and Stein (Schunk, 2012) formulate a heuristics that include problem solving, known as IDEAL: 1) Identify the problem; 2) Define and display issues; 3) Explore possible strategies; 4) Act (implement the strategy); 5) Look back and evaluate the effect of activity

Although there are already guidelines concerning measures and general strategies to solve a problem as mentioned above, but one still might encounter difficulties in practice. Some of the obstacles that may be encountered someone in resolving problems concerning misinterpretation among others, the size of the problem, and motivation (Dominowski, 2002). Error in the interpretation most

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likely due to the vagueness of the description of the problem, confusion language used, or inaccuracies in the use of terms, notation, images, tables or graphs used to represent the problem.

Students' skills in problem solving is not only influenced by the inability of students to use the knowledge he already has, but is also influenced by the ability of the teacher in teaching. Learning model that supposedly could be used to train the students' problem solving that inquiry, PBL and learning associated with the technology.

Based on the above it is necessary to encourage the development of problem solving skills in students in learning physics. As a first step it is necessary to develop an instrument to measure problem-solving skills. The instrument was developed problem-solving tests used to measure problem-solving skills on the material of heat. The instrument has been developed, then tested to see its quality and is used to measure the skills of high school students in problem solving. Results from this study are expected to be used as the first step in determining the appropriate strategy to develop problem-solving skills for students, especially in learning physics.

Methods

Respondents were students at the high school for 35 students. Students problem solving skills are measured using a test technique problem-solving skills calor material consists of 15 multiple choice questions. The test was developed from low level to high level and consulted education experts.

Data were collected to determine the student's skills against the criteria developed problem solving as an indicator of problem-solving skills. Bransford and Stein (Schunk, 2012) formulate a heuristics that include problem solving, known as IDEAL: 1) Identify the problem; 2) Define and display issues; 3) Explore possible strategies; 4) Act (implement the strategy); 5) Look back and evaluate the effect of the activity. IDEAL begins with analyzing the problems that need to be solved, resources and what information is available, how the problem can be symbolized and then translated into steps that lead to the answer (Slavin, 2011).

Results

Preliminary studies conducted on students who have obtained the material for the purpose of measuring the heat problem-solving skills of the students. Data from problem-solving skills of 35 students of SMAN 16 Surabaya demonstrate problem-solving skills that are low include: 1) identify the problem of 81.90%; 2) define the goal 71.43%; 3) explore possible strategies 60.95%; 4) Anticipate outcomes and act 55.24%; and 5) look back and learn 46.67%. Other data that can be known is the highest value score 73.3 which shows that the achievement of student learning outcomes is still below the minimum completeness criteria (KKM).

Early identification phase 2 study in SMAN Trenggalek to get an overview of the competence of students to demonstrate problem-solving skills that students do not understand the criteria for problem solving in particular on criteria relating

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to scientific experiments. Results of test answer obtained as many as 13 students can not determine the steps hypothesis formulation, 12 students do not understand the definition of variables trial and 15 students are not able to determine the variables trial operationally (Shanty, 2014). Interpretation of the results of tests that students need to be trained in problem-solving skills to be a good problem solver.

Questionnaire responses to the students about problem-solving skills that are analyzed include: interest and recency. Response to interest students get very interested in the percentage of 57.14%, 31.43% quite interested, and 11:43% less interested. Very interested because the material is a test item associated with the application of concepts and problems in daily life. Response recency of test to obtain a percentage value 71.43% is very new, and 28.57% is quite new. Very new because test questions used emphasize problem-solving skills that has never been obtained. Overall a positive response to test problem-solving skills are used. The positive response to support implementation of learning which aims to train problem-solving skills.

Discussion

Problem solving skills are important things that need to be developed during the learning of physics. Problem solving skills in students in learning physics can be measured using a test instrument problem-solving skills of heat consisting of 15 test items. Problem solving skills most students in learning physics is still a problem. The test results showed that the students' problem solving skills still need to be trained. Given the importance of problem-solving skills, the need for efforts to develop such skills in the learning process, including through the implementation of appropriate learning strategies. Thus, education is to teach students the students to think, to use their rational powers, and become a better problem solver in accordance with the demands of the times.

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