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**The 1st Sriwijaya University Learning and
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held by FKIP Unsri in Collaboration
with Communication Forum for Indonesian
State FKIP Deans**

Improving the Quality of Education to Strengthen the Global Competitiveness: A Response to the Current Curriculum

Presented by :



**Palembang, May 16-18, 2014
Chief Editor: Hartono**

**Faculty of Teacher Training and Education
Sriwijaya University
South Sumatra - Indonesia**



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The 1st Sriwijaya University Learning and Education International Conference
“Improving the Quality of Education to Strengthen the Global Competitiveness:
A Respond to the Current Curriculum”

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Preface

Assalaamu'alaikum Warahmatullaahi Wabarakatuh.

First of all, we would like to say alhamdulillah, thank to Allah SWT, the most gracious and merciful, that the proceedings of the First Sriwijaya University Learning Education International Conference (SULE-IC) can successfully be completed. The conference was held on May 16-18, 2014 by the Faculty of Teacher Training and Education Sriwijaya University in collaboration with the Communication Forum (*FORKOM*) for Indonesian Deans of State Teacher Training and Education Faculties. It is an honor for us to be entrusted by the Communication Forum to organize the meeting of FORKOM and the First Sriwijaya University Learning and Education International Conference (SULE-IC). The theme of the conference was "Improving the Quality of Education to Strengthen the Global Competitiveness: A Respond to the Current Curriculum".

We are very happy and proud because we have seventh keynote speakers in their expertise and five invited speakers from five continents such as H. Alex Noerdin, Sofendi, M.A., Ph.D. from Indonesia; Prof. Dr. Maarten Dolk from the Netherlands; Prof. Dr. Bruce Waldrup from Australia; Prof. Dr. Mahzan B, Arshad from Malaysia; Mr. Eran M. Williams from the United State of America; Moses Phahlane from Republic of South Africa. We are also very happy since we have numerous participants from Indonesia, Oman, Shanghai, Malaysia, and Australia. Alhamdulillah, there were 131 papers related to language education, mathematics education, science education, early childhood and elementary education, vocational and technology education, and social studies that have been presented on the conference parallel sessions.

We are very grateful to all editors who have been dedicated to editing the articles of the proceedings. The editors are: Hartono (Sriwijaya University), Maarten Dolk (Utrecht University), Bruce Waldrup (Tasmania University), Mahzan B, Arshad (University Pendidikan Sultan Idris), Mr. Eran M. Williams (RELO, United State of America), Nurhayati, (Sriwijaya University), Ratu Ilma Indra Putri (Sriwijaya University), Ismail Petrus (Sriwijaya University), Machdalena Vianty (Sriwijaya University), Rita Hayati (Sriwijaya University), Zainal A. Naning (Sriwijaya University).

The proceedings contain as many as 131 articles. The authors of the articles came from several institutions. We hope that the proceedings would be useful not only for the authors but also the readers to get creative and innovative ideas that can improve the quality of education to strengthen the global competitiveness especially in Indonesia.

Palembang, May 2014
Chairman of the Committee,

Prof. Dr. Zulkardi, M.I.Kom., M.Sc.

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INCREASED MASTERY OF CONCEPTUAL AND PROCEDURAL KNOWLEDGE THROUGH PROBLEM SOLVING APPLICATION OF LEARNING STRATEGIES IN WAVE SUBJECTS

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Abstract

This study aims to improve the quality of teaching physics, especially in the wave subjects this research is a classroom action research using a minimum of three cycles and performed with the application of learning strategies Problem Solving. At each cycle of analysis and calculations using the N-gain, the analysis of the cycle compared to the next cycle to obtain improvement when compared with the cycle of learning before. A good learning quality be the ultimate goal of this research. In the first cycle, the average value of the wave of students in a course using problem-solving method is 52.22 with absorption values of 52, 22% and 28.57% learning completeness In the second cycle, the average value of the wave of students in a course using problem-solving method is 54.57 with absorption values of 54, 57% and 31.42% learning completeness. In the third cycle, the average value of the wave of students in a course using problem-solving method is 58 with absorption values of 57, 62% and 37.14% learning completeness

Key words: Learning Physics, Action research, Problem Solving

INTRODUCTION

Educational institutions have made various reforms and improvement in education system as whole so that this nation can compete in an increasingly competitive global era. Renewal and improvement of such education has been done through curriculum changes in higher education that the 2004 curriculum called competency-based curriculum (CBC).

Curriculum changes this time to understand not only the substance of the material and format adjustment to the demands of the curriculum, but a paradigm shift from input-oriented approach to education (input) to a results-oriented approach to education (outcome) or standard. Simply put it means that what should be defined as a curricular policy shifted from the question of "what should be taught (curriculum)" to the question of "what should be controlled by the child (standard kompetensi)" the extent and level of education. Implications of the implementation of standards of competence is assessment process conducted by professors in the classroom, both formative and summative criteria should use reference and learning to apply the principles of learning more thoroughly. Furthermore, to ensure the achievement and mastery of competencies necessary to develop classroom assessments that are authentic (authentic assessment). One of the characteristics of classroom assessment is formative assessment, with the aim of assessment is to improve the quality of student learning. As a team of professors of physics, we observe that the learning outcomes of students in learning basic physics from year to year is still less than satisfactory. Therefore, efforts are needed to realize such improvements (innovations) are constantly in learning physics. A treatment (treatment) should be placed so that the process of learning physics in college went well and students can learn optimally, in order to reach the ultimate goal is produce a satisfactory quality of learning outcomes.

The idea of developing an understanding of concepts (conceptual knowledge acquisition) and problem solving skills (procedural knowledge) based on some theoretical conceptions: 1) The concept



of physics is subject to continuous change (Wenning, 2006); 2) Learning physics requires learning to do the problems (Oman & Oman, 1997); 3) Problem solving is a fundamental part of learning physics (Heler, Keith, & Anderson, 1992), and 4) The results of a survey conducted by the American Institute of Physics in the U.S. showed that the skills most often used by workers physics graduate S2 and S3 are in the problem-solving skills (problem solving), working groups, and communicate (Van Heuvelen, 2001).

Based on the theoretical explanation, understanding is the key to learning. Some theoretical conception underlying this conclusion are as follows. First, the conception of learning refers to the constructivist view, that the understanding of construction becomes more important than memorizing fact (Abdullah and Abbas, 2006). Second, understanding is a mental process that allows the adaptation and transformation of science (Gardner, 1999). Third, an understanding emerged from the results of self-evaluation (Wenning, 2006).

Thus, understanding the representation of the learning outcomes to be very important. Theoretical foundation as an alternative basis for understanding learning in packaging (learning for understanding) and also in the development of physics problem solving ability is as follows. First, it is recommended to reduce the physics teacher tells a story of learning, but more invites students to experiment and problem solving (Williams, 2005). Second, physics teacher recommended providing more context-rich problem-poor and reduce the problem in the context of learning. Third, learning with problem solving to foster problem-solving skills, act as problem solvers, and in the process of learning built thinking, teamwork, communication, and exchange of information (Akinoglu and Ozkardes, 2007).

The theoretical foundation emphasizes the need for teachers to make changes in the paradigm of facilitating student perspective: "teaching is a report concerning the concept of" being a theoretical scientific perspective: "teaching is a learning environment composed and prepared stimulus to students to do problem solving (Problem Solving)" (Wenning & Wenning, 2006). Teaching instead of focusing on how to teach but should be oriented on how to stimulate learning (Bryan, 2005; Novodvorsky, 2006; Popov, 2006; Wenning, 2006) and learning how to learn (Novak & Gowin, 1985).

The importance of the development of thinking skills that are supported by the results of a survey conducted by the American Institute of Physics (AIP) in the U.S.. The survey results showed that the skills most commonly used by workers physics graduate S2 and S3 are in problem solving skills (problem solving), working groups, and communicate. Knowledge of the subject matter the frequency of use in the workplace on average only about one-fourth of the use of problem solving ability (Van Heuvelen, 2001).

Problems is a situation that was clearly way to solve that confront individuals or groups to find answers. Problem solving is an individual or group effort to find answers based on the understanding that has been previously owned in order to meet the demands of the situation are not familiar / commonplace (Krulik & Rudnick, 1996 in Carson, 2007). So the problem-solving activity begins and ends with a confrontation when a reply has been made in accordance with the conditions of the problem. Learning by problem-solving strategies become very important, because in learning, learners quickly forgotten if only verbally described. They can be given if the given instance, and understand if given the opportunity to try to solve the problem.



THEORETICAL BACKGROUND

Theoretical Description

Learning Physics for Prospective Student Teachers

Physics is not just a collection of science, but also in the form of a scientific method. Teaching physics is essentially the use of scientific methods to cultivate an ability / skills required in carrying out his duties in life. The implications of the nature of teaching physics for prospective teachers that learning physics physics is directed to grow two things: understanding of the subject matter of physics and work discipline or procedural skills. Direction of emphasis depending on which parts are preferred to be grown, so the model or the applied learning strategies will vary. Basically all the topics in the physical sciences, whether simple or complex, can be used according to its nature. But in learning, success is not only determined by the approach on the part of the aspect which is more emphasized, but also depends on the components and domains which are supposed to get treatment. Brotosiswojo (2000a) suggested that the learning components that need to be addressed are (1) the communication components, (2) component form of information, (3) the component skills, (4) components of sequence learning activities, and (5) evaluation component of success. While the realm of learning in question is the realm of reasoning.

In this study, the direction of learning physics is based on the above description, the more emphasis on the conceptual and procedural aspects of capability that is how the physics lesson that can be played to develop conceptual understanding and problem solving ability of students.

Problem Solving and Problem Solving Strategies

Gagne (1985) provides limits that problem solving is a process in which students determine the combination and the rules that have been previously studied which can be used to solve problems. Limitation of problem solving, as noted above refers to the limit as a problem solving process. Limitation of problem solving as a strategy commonly use the word strategy, road, stage, or methods. Strategy is a tool that can be used to find or develop a method or procedure for achieving certain goals. Problem solving strategies designed to assist the process of solving the problem. As such problem solving strategies can be interpreted as a way of solving the problem or procedure steps designed to facilitate student thinking to find the right pattern. Strategic Problem Solving (PS strategy) is not designed to explain directly how to solve a problem, but a strategy designed to help the process of solving the problem with the steps it has. This means that by using a PS strategy, students will be guided in accordance with the procedures or steps that exist in that strategy. Therefore learning physics with PS strategy has consequences that go through these learning stages or steps that must be taken to lagkah problems encountered can be solved. Problem solving (problem solving) is seen as a fundamental part of learning physics (Heler, Keith, & Anderson, 1992; Reif, Larkin, and Brackett, 1976). Problem solving is one of the learning strategies that can be used in accordance with the teaching of physics as physics of content (Gok & Silay, 2008). But many physics teachers found that their students do not solve the problem in accordance with the desired level of proficiency (Redish, Scherr, & Tuminaro, 2006; Reif, 1995; Van Heuvelen, 1991).

Newell and Simon (1972) states that a person is faced with a problem when he wants something and does not know immediately that a series of actions he can perform. In the same way, Martinez, 1998 (in Docktor & Heller, 2009) states that problem solving is the process of achieving the goal when the path to that goal into uncertain. The above definition depends on their subjectivity. What is a problem for someone might not be a problem for others. The definition depends on the



acceptance of hardship duty (Hsu et al., 2004). According to Salami (2000) (in Adesoji, 2008) problem solving in science depends on the level of students' cognitive abilities. This statement indicates that students who succeed in solving scientific problems, turns using reasoning strategies that are often higher than students who did not work and use low reasoning. Adesoji (2008) have observed that the problem solving strategy is effective in teaching students with different ability levels. Problem solving not only find the correct answer but also is an act that covers a broad mental abilities (Altun, 2002 in Gok & Silay: 2008). Structure of problem solving (by Maloney, 1994 in Gaigher, Rogan & Braun: 2006) expressed as a way to improve performance and conceptual understanding dig. Research conducted by Gaigher (2004) showed an increase in performance (performance) as well as an increase in conceptual understanding (Gaigher, Rogan & Braun: 2006). Specific strategies for physics has been developed by Reif (1995) in his book Understanding Basic Mechanics, and by Heller & Heller at the University of Minnesota (Heller & Heller, 2000; Redish, 2003). Steps according to Reif taken from the book are: 1) Analyze the Problem, 2) Construction of a Solution, and 3) Checks (and revise if need) (Yousuf & Chaveznava, 2006).

While the steps of problem solving strategies at the University of Minnesota consists of five steps, which are 1) Focusing problem (Focus the Problem), 2) Describe aspects of physics (Describe the Physics), 3) Plan a solution (Plan a Solution), 4) Running solving plan (Execute the Plan), and 5) evaluating the answer (Evaluate the Answer) (Kyurshunov: 2005; Yousuf & Chaveznava, 2006). PS strategy that will be used in this research is to implement the strategy by taking these five steps above. The fifth step is operationalized in the following student learning activities. First, to move focus problems, students develop a qualitative description in the form of pictures or words that help students to find the subject matter (Heller & Heller, 2000; Redish, 2003). Second, the steps outlined aspects of physics students simplify the problem if possible and apply useful relationships. Third, students create a plan solving. In this step, students create a common framework based on relationships that have been proposed in the previous step. Fourth, students carry out the plan that is manipulating the equations, include numbers that are known, and solve algebraic problems. Fifth, in the last step, the students evaluate the answer, namely by examining the mistakes and make sure that the answer is satisfactory.

RESEARCH METHOD

Research Methods

This research method is a form of action research. This study uses a minimum of three cycles.

Action Research Procedures

Implementation of actions performed on three stages, namely (a). Diagnostic phase, and (b) Phase Therapy (c) Post-Treatment Phase

(A) Diagnostic Phase

Lecturers to diagnose the learning process and student learning outcomes at the course Wave TA 2012/2013 based on the achievement of learning outcomes (documentation) as well as interviews with several students. Interviews were conducted at 20 study participants to determine student learning conditions. Information from the interviews necessary to identify and formulate the learning problem and apply the learning problem-solving strategies for successful student learning can be influenced by the way teachers manage learning.

From the results of carefully conducted studies deketahui that (a) is active in the learning partisipasi relatively low, (b) has not occurred on student self-relevant learning, (c) lectures take place

klasikal and verbal, and (d) assessment of learning outcomes are emphasized in cognitive aspects. Study of the literature on quality learning in Higher Education conducted to determine the model of learning that is relevant to the course objectives Physics I and who can support the goals of improving the quality of learning as one of the research objectives Learning Quality Improvement (PPKP) in 2013. Learning models to problem solving strategies implemented in the first half of the lecture because the model has advantages and is quite relevant to the learning objectives Physics I. Advantages of this model can (a) students are actively membelajarkan the intellectual and emotional involvement, the freedom to explore the learning experience and learning resources, and put the lecturer as facilitator, (b) create a constructivist learning aktivitas that set itself in a problem-solving plan, and to interpret in various ways to the situation of the problem, (c) encourage students to learn cooperatively together to reach the goal and sharing knowledge to achieve the answer the problem, and (d) stimulate the students to learn creative and divergent thinking and the confidence to try different ways to solve problem.

(B) Phase Therapy

At this stage, learning straegi repairs done three cycles and each cycle is implemented in accordance with the changes to be achieved on the basis of the factors that would like investigated. Implementation of the actions described below will dilaksanakan for each cycle and made changes according to their achievement.

RESULTS AND DISCUSSION

The problem solving method can increase the understanding of wave concept to the student of physics education study program University of Bengkulu. This research using three cycle as an action research. In the first cycle, the average value of the wave of students in a course using problem-solving method is 52.22 with absorption values of 52, 22% and 28.57% learning completeness In the second cycle, the average value of the wave of students in a course using problem-solving method is 54,57 with absorption values of 54, 57% and 31,42% learning completeness In the third cycle, the average value of the wave of students in a course using problem-solving method is 58 with absorption values of 57, 62% and 37,14% learning completeness

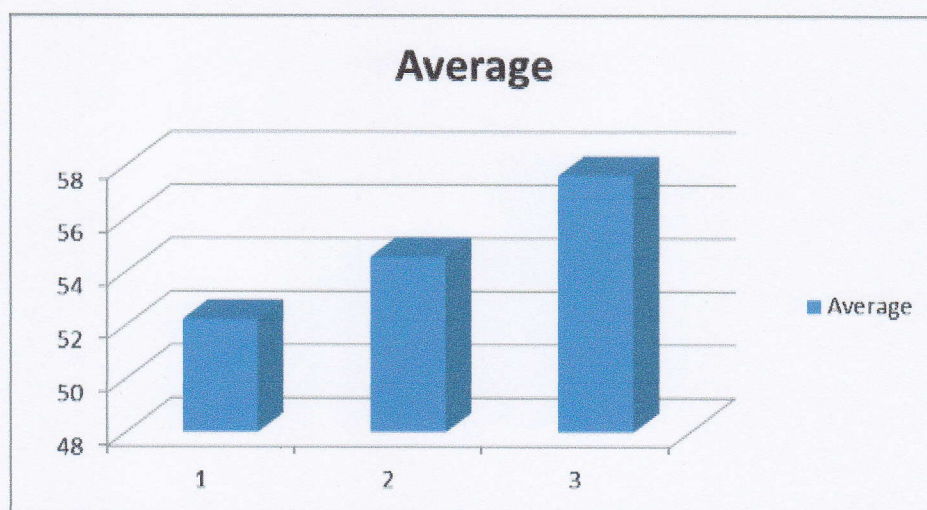


Figure 1. Average Score of every cycle Using Problem Solving

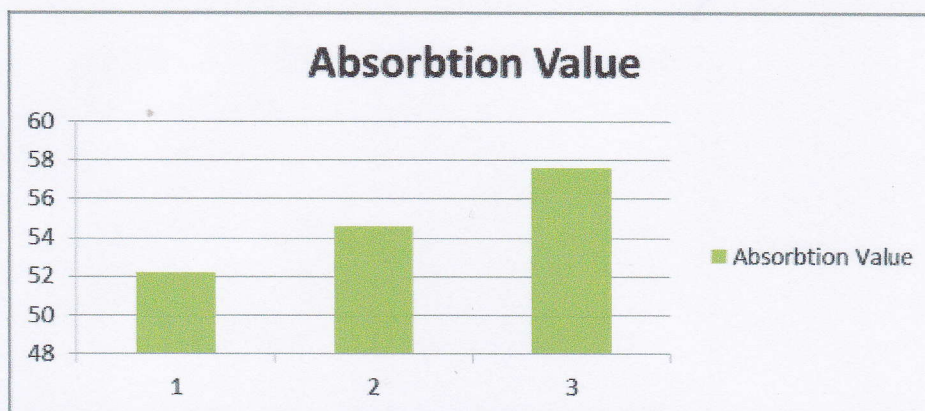


Figure 2. Score of Absorbtion Value every Cycle

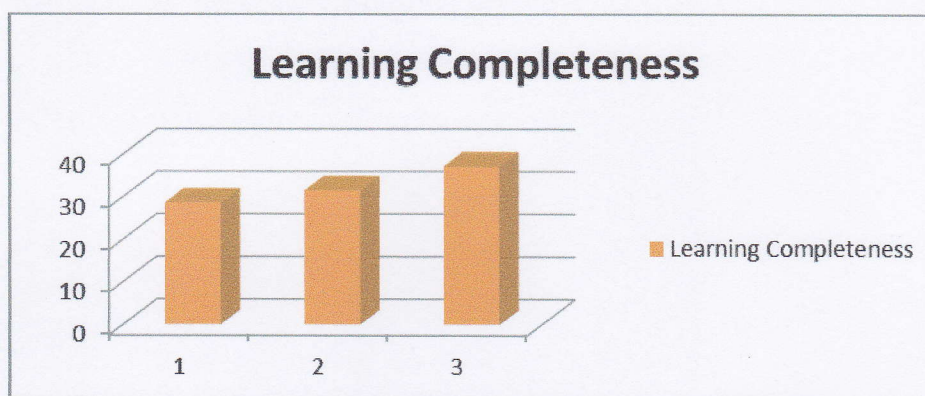


Figure 3. Learning Completeness every cicle

CONCLUSION AND REMARK

1. In the first cycle, the average value of the wave of students in a course using problem-solving method is 52.22 with absorption values of 52, 22% and 28.57% learning completeness
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