



## The Implementation of Learning Device using Problem-Based Learning Model to Optimize Students' Science Problem-Solving Skill

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### Abstract

A research on learning device development using problem-based learning model on junior high students has been conducted. The research aims to describe the implementation result of learning device using a problem-based learning model to optimize high school students' science problem-solving skill. This research is conducted as an effort to improve education quality especially the learning process. It is a Research and Development (R&D) kind of research which is to develop learning device. 4D steps by Thiagarajan are applied in developing learning device. In addition, the learning device is tested for validity and feasibility by the expert. The research process is conducted through some phases, such as device development phase, expert test, limited test, and extended tryout on science subject of Junior High school grade VIII in Bone Bolango district. This research discusses the implementation result on an extended tryout. The findings show that the developed learning device can optimize learning management, students' activities, and students' response in which each is in good and very good category. Meanwhile, individual student learning achievement is 91% accomplished. Problem-based learning model can be applied at high school students of grade VIII especially on science subject, lesson of motion and energy.

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## INTRODUCTION

A change in learning innovation and culture is needed to create quality human resources; therefore it is necessary to design a curriculum that can develop skills, in which students have to be the focus of education system (Gonzalez et al., 2004; Tirado et al., 2007). Learning model shifts from teacher-centered to student-centered (Beccera et al., 2011).

The implementation of learning models in learning process aims to improve learning quality and students learning achievement. In fact, teacher generally does not really understand the learning model like problem-based learning model. Furthermore, the teacher does not really understand how to arrange learning device and the purpose of learning device organization.

Based on the explanation above, it is necessary to develop and implement problem-based learning model. Some of the research results about the implementation of learning device development, among others are; Yusuf (2008, 2009 and 2011); Ntobuo & Yusuf (2012 and 2013); Yusuf & Rahman (2014). The implementation result shows that students learning achievement is optimal; students are active and happy with the learning model applied by the teacher.

### Research Objective

The research aims to describe the implementation result of learning device shown from learning process result which is learning management, students' activities, students learning achievement and students' response to the learning process.

### Learning Device

Learning device that is developed in this research applies steps by Thiagarajan (1974) or is well known as the Four-D Model. The learning device is developed by 4 steps which are establishment, design, development, and dissemination.

### Problem-based Learning Model

The problem-based learning model is a learning model applies in high-level thinking on a problem-oriented situation. This model is also known as project-based teaching, experienced-based education, authentic learning and anchored instruction (Ibrahim & Nur: 2005).

Problem-based learning aims to increase students' self-motivation and problem-solving skill, teamwork and life-long learning (Woolfolk, 2009). The main characteristic of problem-based learning is a set of learning activities in which its learning activities are directed to solve problems. Problem-solving is conducted by scientific thinking approach (Sanjaya, 2008).

According to Ainoglu & Tandoga (2007), problem-based learning is student-centered active learning in which students can develop their problem-solving skill. Ibrahim, et al. (2005). Problem-based learning has the following characteristics: problem posing focused on interdisciplinary linkages, authentic inquiry, generate products and teamwork.

Beccera et al., (2011) develop problem-based learning which is called Teaching and Learning Model (T&L). This T&L model consists of five steps: (1) design the order of learning topic with problem-based structure, (2) explain at the beginning of teaching each part of the problem, (3) raise the issue or set of problem to be discussed so that it can respond to strategies that can be solutions, (4) determine concept to solve problems, and (5) do periodic summary from what has been achieved.

This model aims to create a learning environment which simultaneously promotes emotional and scientific rationality from all involved actors (teacher and student) in problem-solving. Moreover, this model aims to improve students' academic achievement, interest, and motivation.

### Problem Solving

Problem is a difficult and foreign study to the solver, but it can be solved and at least has a clear objective. Meanwhile, an easy assignment in which an individual can easily find out and already know the solution is called exercise (Abdullah,

2006). According to Woolfolk (2009), the problem is a situation that demands an effort to achieve purpose and one has to find out ways to do it. Problem-solving is an implementation of knowledge and ability to achieve a certain target (Slavin, 2006; Solso et al., 2008).

Newell & Simon (in Lynn, 2009) describe the problem solving as a process of decision making which occurs when a solution is offered with the assignment they do not have and a set of particular action that can be used to achieve the solution.

Mateycik (2009) stated that it is important to have skills in problem-solving which is by using a similar approach to the previous problem. Problem-solving as a process of decision making influenced by the experience of self-problem solving, knowledge and assignment interpretation (Lynn, 2009).

Abdullah (2006) found out that interpreting and investigating cannot be performed by every student. Problem-solving can only be seen on the steps of problem reading, followed by design and calculation. It shows that interpreting problem and investigating answer are two steps that need to be strengthened among students to increase their problem-solving skill.

## METHOD

The research method is descriptive which is to describe learning management result, students' activity and learning achievement as an effect to the implementation of learning device using the problem-based learning model.

The research is conducted in all public middle school in Bone Bolango district that implements the 2013 curriculum. The research subject is students of grade VIII in science class.

Data collection is conducted through observation and test. Observation is conducted to view students learning achievement. The collected research data is analyzed using descriptive statistics in form of a table, percentage, and graphics. The result of data processing is then discussed narratively by comparing result and theory.

## RESULT AND DISCUSSION

The implementation of learning device is performed to measure the effectiveness, efficiency, and practicality of developed learning device.

### Learning Management

Observation on learning management is performed by two observers who are the science teachers. Based on the observation result of learning management, it is obtained the average of observer assessment result is between 3,31 to 3,87 or in a good and very good category. The result of data reliability analysis is from 94,59% to 100%. As stated by Borich (1994), an observation instrument is categorized good if it has a reliability of  $\geq 75\%$ . It shows that the developed lesson plan can be applied by a science teacher on the lesson of motion and energy.

### Activity of Students Characterized Behavior

Observation of students' activity during the learning process is performed to perceive characterized behavior of every student. The aspects of students' characterized behavior which is observed in the learning process are (1) honesty, (2) responsibility, (3) helpful to every needy friend, (4) creative, (5) careful or thorough, and (6) punctual. The average of observation result during the learning process is as in Figure 1.

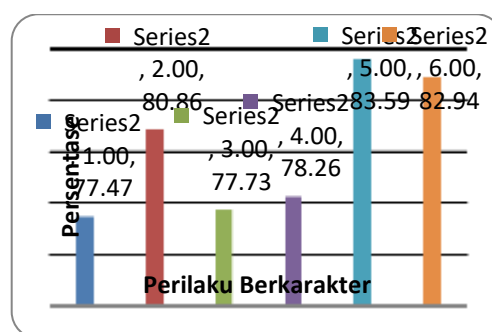


Figure 1. Diagram of Students Characterized Behavior

The analysis result of students' characterized behavior assessment shows that on average students are thorough, punctual, and responsible during the implementation of learning device using problem-based learning model. This finding is in line with Nur (2011) that stated:

problem-based learning creates a classroom environment in which open and honest ideas exchanges occur.

### Students Social Skill

The aspects of students' social skill which observed in the learning process are (1) asking, (2) contributing idea or opinion, (3) collaborating or communicating, and (4) appreciating other's idea or opinion. The analysis result of observation assessment on student social skill is viewed in Figure 2.

The research result shows that student activity often occurs on inquiring and appreciating each other's idea and opinion. The average reliability is 98,05% or in a good category.

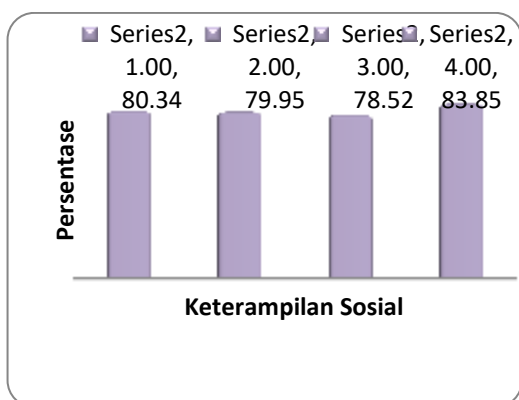


Figure 2. Diagram of Student Social Skill

It is seen from figure 2 that students' social skill occurs a lot in appreciating friend's idea/opinion, inquiring, and contributing an idea. This describes that in learning process occurs discussion among students or groups in accomplishing given assignment by asking each other question, collaborating, and paying respect. This is in line with Akinoglu & Tandoga (2007) that stated that problem-based learning enables students to develop problem-solving skill and do teamwork.

### Students Learning Achievement

The effectiveness of learning device can be measured by students learning achievement test. From students learning achievement, it is viewed the completeness of learning objective and completeness of students learning individually and classically.

Based on the result analysis of students learning achievement in the first year, it is obtained 90,5% of students have met the learning criteria individually, therefore it is classically completed. In the second year, it is obtained 91% of students have met the learning criteria individually, therefore it is classically completed. This shows that the implementation of problem-based learning model can optimize problem-solving on students of Junior High School in Bone Bolango district in the science subject. This is in accordance with the idea of Beccera et al. (2011) that teaching and learning model aims to create a learning environment which simultaneously promotes students emotional involvement and scientific rationality in problem-solving and increases students academic achievement. Furthermore, Woolfolk (2009) and Akinoglu & Tandoga (2007) stated that problem-based learning aims to increase problem-solving and collaboration skill.

### Students Response

Questionnaire distribution to the students intends to find out students' response to the given learning process. Students' response consists of students' interest and motivation in the learning process using the problem-based learning model.

The analysis result of students' response either from interest or motivation on the applied learning model in the first year is averagely in a good and very good category and so as in the second year. It shows that the implementation of problem-based learning model can generate students' interest and motivation in studying. According to Beccera et al. (2011), a teaching and learning model is aimed to increase students' interest and motivation. Likewise, Woolfolk (2009) stated that the purpose of problem-based learning is to increase intrinsic motivation and life-long learning which is self-directed.

### CONCLUSION

On the implementation of learning device using the problem-based learning model, it is found that teacher can utilize the learning device well. The implementation of learning device can

also help students meet the learning achievement criteria either individually or in a cluster, as well as can train students' problem-solving skill.

Based on the findings, it can be concluded that learning device using problem-based learning model is effective, efficient and practical for high school students of grade VIII in science subject of motion and energy lesson.

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