

Development of Problem-Based Learning Oriented Teaching Learning Materials to Facilitate Students' Mastery of Concept and Critical Thinking Skill

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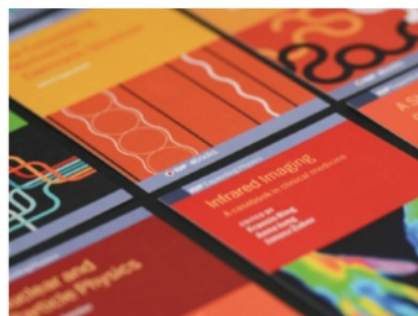
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Development of Problem-Based Learning Oriented Teaching Learning Materials to Facilitate Students' Mastery of Concept and Critical Thinking Skill

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Abstract. This research aims to develop problem-based learning oriented teaching materials to improve students' mastery of concept and critical thinking skill. Its procedure was divided into two phases; developmental phase and experimental phase. This developmental research used *Four-D Model*. However, within this research, the process of development would not involve the last stages, which is disseminate. The teaching learning materials which were developed consist of lesson plan, student handbook, student worksheet, achievement test and critical thinking skill test. The experimental phase employs a research design called *one group pretest-posttest design*. Results show that the validity of the teaching materials which were developed was good and revealed the enhancement of students' activities with positive response to the teaching learning process. Furthermore, the learning materials improve the students' mastery of concept and critical thinking skill.

1. Introduction

As one of educational aspects, learning science plays a vital role in upgrading education quality, particularly in forming qualified human resources, who are able to think critically and creatively to overcome problems and apply the knowledge in daily life. The fundamental dilemmatic problem often faced by the primary school teachers is the fact that mostly the students cannot correlate between what they have learned and how to use it in real life [1]. This happens on account of their comprehension of the material, which is merely in abstract forms, i.e. unlike things they need in the society. The conceptual understanding is important for every student because by extensively and profoundly knowing it, they would be able to apply it for various purposes [2]. One of mental processes in understanding concept is critical thinking skill which is defined as cognitive process of gaining knowledge.

According to Kirmizi [3], critical thinking is briefly a mental process for perceiving the world using our existing knowledge. Akyuz [4] stated that critical thinking is a thinking skill which consists of mental processes of discernment, analysis and evaluation. Critical thinking comprises of such processes as featuring intelligence about a matter, deciding and judging accurately [5]. In detail, critical thinking



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is a way of approaching and solving problems based on persuasive, logical and rational arguments, which involve verifying, evaluating and choosing the right answer to a given task and reasoned rejection of other alternatives solutions [6].

To create and escalate students' mastery of concept and critical thinking skill, the researcher uses Problem-Based Learning (PBL). This model is one of an instructional model in which a problem is designed as the center of the learning [7]. The problem is designed such that the students can solve in small groups and reflect on their experiences [8]. The model may improve the teaching and learning process because it focuses more on the developing students as self-directed learners compared to traditional models that encourage students to be spoonfed by teachers [9]. Thus, this model can be considered as a student-centered method of teaching that involves learning through solving unclear but genuine problems. In detail, students analyse the problem and context and apply deductive and inductive processes to understand the problem in order to find a possible solution or solutions [10]. This model turns the students from passive information recipients to active ones, free self-learners and problem solvers, and slides the emphasis of educational programs from teaching to learning [11].

In order to manifest a significant learning pattern, the teacher should maintain the teaching in such a way, so that the students can get many experiences. Teachers as the learning management at educational units are expected to prepare and develop qualified learning media, including lesson plans, student worksheet, assessment sheet, and student teaching materials to reach the learning goals. Therefore, it is necessary to conduct developmental research to evolve the science learning oriented to the learning model based on the problem to train the students.

2. Method

This research is a developmental research, as, within it, the science teaching learning material oriented to problem-based learning model is developed. The program is designed to help the students' mastery of concept and critical thinking skill. The teaching and learning material comprise lesson plans, student teaching materials, student worksheet, and assessment sheet which were tested in the classroom. The developed learning materials implemented in a class with 25 pupils of the fourth grade. The research procedure is divided into two phases, i.e. developmental phase and experimental phase.

2.1 Developmental phase

The developmental phase aims to produce better learning through revision and validation from experts. This developmental research refers to 4D (*Four-D Model*) by Thiagarajan [12]. The procedure of the development consists of four stages namely, define, design, develop, and disseminate. However, within this research, the process would not involve the last stage, i.e. disseminate. The researcher chooses the model because it is detailed in its stages, systematical, and suitable for the development of learning oriented to PBL model.

2.2 Experimental phase

This phase employs a research design called "*One group pretest-posttest design*". The observed variable consists of 7 elements. They are validation of learning media, implementation of the lesson plans, students' activities, students' responses, concept comprehension, critical thinking skill, and obstacles in learning. Therefore, to determine the quality of the developed teaching and learning material, it is required to obtain three kinds of data, i.e. validity, practicality and effectiveness.

3. Results and Discussion

The results of developing the science teaching and learning material oriented to problem-based learning model to train the students' mastery of concept and critical thinking skill are described as follows:

3.1 Validation of Learning Media

The result of the validation of learning media showed in table 1.

Table 1.The result of learning media validation

No	Learning Media	Average Score	Assessment Category
1.	Lesson plans	3.83	Good/Valid
2.	Student teaching materials	3.76	Good/Valid
3.	Student worksheet	3.73	Good/Valid
4.	Concept comprehension test	3.75	Good/Valid
5.	Critical thinking skill test	3.65	Good/Valid

3.2 Readability of Student Teaching Materials and Student Worksheet

The percentage of students' reading material readability and student worksheet for the content aspects got the interesting response percentage of 84% which means 84% of the students were very interested in the teaching material and the student worksheet, while 16% of the students were not. For the aspect of performance for teaching materials and the student worksheet, the researcher obtained percentage of students who were interested in the performance of students teaching materials which was 92% and 88% for student worksheet, while 8% for those who were not interested in the performance of students learning materials and 12% for student worksheet.

In terms of difficulty aspect of the explanation of activities in the teaching materials and worksheet, 20% of the students argued that it was difficult, while 80% of them argued that it was not difficult. Meanwhile, for the image aspect, 88% of students thought that the drawings on the teaching materials and 84% for the worksheet were easy to understand. 12% of them thought that the drawings on the student teaching materials and 16% of them for the student worksheet were difficult to understand. Hereinafter, on the aspect of the question, 88% of students said that the questions in student teaching materials were understandable, and 84% of them said so for the student worksheet. On the other hand, 12% and 16% of the students argued that the questions on the teaching materials and worksheet were hard to be understood.

3.3 Lesson Plan Implementation

All learning activities in Lesson Plan were implemented, with the average value obtained by each aspect in the amount of 3.75 was a good category. This indicates that the lesson plan using the overall problem-based learning model has been implemented in the classroom learning process.

3.4 Student Activity

During the learning, the researcher conducted an observation of the student activities. The observation results can be presented as in Table 2.

Table 2. The result of student activities observation

No	Students' Activity	Meeting I (%)	Meeting II (%)	Average Percentage of Students' Activity (%)
1	Listening/paying attention to the teacher	12	9	10.5
2	Taking note and discussing with student/teacher	13	8	10.5
3	Reading and doing the student worksheet and teaching materials	14	14	14
4	Preparing the equipment and materials for the experiment/observation	13	13	13
5	Working in group	12	13	12.5
6	Presenting the group work	6	8	7
7	Discussing with the other student and the teacher and getting any response from the teacher concerning about the presentation	10	13	11.5
8	Asking/responding the question from the other student or group, or even the teacher in class discussion	9	11	10
9	Giving conclusion related to the learning	7	9	8
10	Behaving irrelevantly	4	2	3
	Total	100	100	100

3.5 Students' response

To elicit the students' response towards the learning, a questionnaire is given to the subjects. The analysis in the percentage of subjects' response is described as follows: for the material/content, teaching materials (learning media), student worksheet, learning atmosphere and the way teachers teach, 80% of students were very interested and the rest were interested enough. For the learning materials/content components, teaching materials (learning media), student worksheet, learning environment and how teachers teach, 83.2% of the students stated that it was very new and 16.8% of others stated that those aspects were clear enough. Regarding the students' responses to the language component of learning media, material/content of teaching materials, examples of problems, worksheet, experiment/observation in the student worksheet, 80.8% of students stated that it was very easy, 14.4% students stated that it was quite easy and 4.8% of students stated that it was quite difficult. For the response to the component of the teacher's explanation and guidance during the learning of concepts and the completion of the worksheet, 84% of students stated that it was very clear, while the other 16% stated quite clear.

Regarding the components of the teacher's way of using the problem-based learning model, which are orienting problem, organizing students, guiding investigation, developing and presenting the work, analyzing and completing it, 82.4% of the students said it was very good, 11.2% stated it was good enough, 4% stated it was less good. The students responded to the learning component using the problem-based learning model, which are orienting problem, organizing students, guiding the investigation, developing and presenting the work, analyzing and evaluating, 80% of them stated it was

very easy, 16% of them stated that it was quite easy, and 4% of them stated it was quite difficult. The students' response to the critical thinking skill component, using a credible source, writing reasons based on existing data or arguments, accepting or rejecting arguments, ideas, or decisions accompanied by clear and logical reasons, developing and maintaining an opinion, logical reasoning, planning experiments and planning, defining terms using their own words, being able to think openly, giving information well, and making conclusions was 81.2% of students stated it was very easy, 13.6% of them stated it was easy enough, and 5.2% of them stated it was quite difficult. As the response to critical thinking test items and concept comprehension test, 84% of the students stated it was very easy, 16% of the students stated it was quite easy, 86% stated it was very new and 14% of them stated it was quite new. Thus, in general, the students give a very positive response to learning science with PBL.

3.6 Concept comprehension test

The test consisted of 10 items of multiple choice questions and was given twice, i.e. pretest and final test (post-test). The average value of the students' concept comprehension test at the pretest time was in the amount of 5.20 and 8.52 for the posttest. In the pretest, the number of students was six, while in post-test, all students got the complete value on the mastery criterion (value ≥ 7). The average sensitivity of concept comprehension test was 0.33 (item of sensitivity to learning process). The average score of gain-score in concept comprehension test was 0.67 with a g-moderate category.

3.7 Critical thinking skill test

The test was measured using the form of a description test. It consisted of ten items that have been adapted to the indicators of critical thinking skill. In the pretest, all students did not gain the average score of 4.08, while at the post test there was only one student who did not gain the average score of 7.49. Average sensitivity was about 0.34 with category "sensitive". Then, the average gain-score value of critical thinking skill was 0.58 with the g-moderate category.

4. Conclusion

Based on the results of media experiment, analysis, discussions, and findings in the learning process, it can generally be concluded that the media of science learning model based on developed problems have been valid, practical, and effective to improve the understanding of concepts and train the critical thinking skill of students.

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GENERAL COMMENTS

Instructor

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