

CREATIVE PROBLEM SOLVING LEARNING MODEL THROUGH LEARNING MODULE TO IMPROVE THE STUDENTS' CRITICAL THINKING ABILITY

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Abstract

Critical thinking is one becomes the objective in education because it can help develop the students' potency development. However, Newton's laws is considered difficult for the students because they need to think critically to solve the problems through Newton's laws. It can be also seen from the students' low score of that topic. Moreover, the students also lack of critical thinking ability in Physics learning especially in the topic of Newton's laws. Therefore, because there is no teaching material which can specifically improve students' critical thinking ability, this study aims to develop learning material in form of module to improve students' critical thinking ability in learning Newton's Laws topic. This study employed Research and Development design. The participants of this study were 10th grade students of 48 students SMAN 1 Metro. This study developed Creative Problem Solving (CPS) learning model to improve the students' critical thinking ability in learning Newton's Laws topic. The result shows that the modul can enhance students' critical thinking skills since the students can achieve the knowledge and train their critical thinking abilities. In addition, the use of creative problem solving learning model can also improve the students' critical thinking skill through the stages in the model of creative problem solving and the stages in critical thinking. This study concluded that the module development through CPS learning model can improve the students' critical thinking ability, as shown in the step of CPS model and the step of critical thinking which related to and strengthened one another.

Key Words: Creative Problem Solving, Module, Critical Thinking.

INTRODUCTION

Education has strategic position in improving human resources quality in this developing era. High-quality human resources can only be achieved by developing Indonesia education quality. According to Kartimi & Liliarsari (2012), by improving the quality of Indonesian human resources, it can produce the next generations who are ready to face the challenges in the globalization era and also produce good thinking ability through education. As an example, one of thinking abilities, critical thinking ability, becomes the objective in education because it can help develop the students' potency development, (Puspita & Jatmiko, 2013). In education, critical thinking is proven to prepare the students to think in various branches of knowledge toward self-fulfillment of intellectual need and develop the students' to be a potential individual.

Additionally, critical thinking also enables students to identify the problems systematically, encounter various challenges in organized ways, formulate innovative questions, and design the solutions. According to Kartimi & liliarsari (2012), critical

thinking is a directed and clear process used in mental activities, such as problem solving, decision making, persuasion, assumption analysis, and scientific research.

Nowadays, the students lack of critical thinking ability because there is no Physics teaching material which can specifically improve the students' critical thinking ability and appropriate learning model as well. Therefore, it is important to develop teaching material in form of module to improve the students' critical thinking ability in learning Newton's Laws topic.

This study would answer the following questions, *how can the teaching material development through module improve the students' critical thinking ability in learning Newton's Laws topic?*

THEORETICAL FRAMEWORKS

Critical Thinking

According to Duron et al., (2006), critical thinking is, very simply stated, the ability to analyze and evaluate information. It can be concluded that a critical thinker can produce important questions and problems, formulate clearly, and judge relevant information using abstract ideas, think widely, and communicate effectively.

In learning process, the students are trained to develop critical thinking ability in order to solve their problems both individually and in group. Meanwhile, the teacher's role in developing critical thinking is only as the facilitator and motivator. According to Kartimi & Liliyasi (2012), the teacher's role in developing the students' critical thinking ability is as the booster, facilitator, and motivator.

To train the students' critical thinking ability, direct practice is necessarily needed. According to Snyder, L. G., & Snyder, M. J. (2008), critical thinking is a learned skill that requires instruction and practice. Business education instructors at both the secondary and post-secondary levels can enhance students' critical thinking skills by (1) using instructional strategies that actively engage students in the learning process rather than relying on lecture and rote memorization, (2) focusing instruction on the process of learning rather than solely on the content, and (3) using assessment techniques that provide students with an intellectual challenge rather than memory recall. According to Snyder, L. G., & Snyder, M. J. (2008), several barriers can impede critical thinking instruction. Lack of training, limited resources, biased preconceptions, and time constraints conspire to negate learning environments that promote critical thinking.

In addition, there are several steps in critical thinking learning activities. According to Duron et al., (2006), 5-steps model to move students toward critical thinking: Step 1. Determine learning objectives. Considering the importance of a course, its placement in a program of study, and its role in providing a base of knowledge to be built upon by other courses, a teacher should first identify the key learning objectives that define what behaviors students should exhibit when they exit the class. Step 2: Teach through questioning. Questioning is a vital part of the teaching and learning process. Step 3:

Practice before you assess. In the past decade, a major shift has taken place in education; that shift is toward active learning. Step 4: Review, refine, and improve. Teachers should strive to continually refine their courses to ensure that their instructional techniques are in fact helping students develop critical thinking skills. Step 5: Provide feedback and assessment of learning. Teacher feedback, like assessment, compares criteria and standards to student performance in an effort to evaluate the quality of work.

The students lack critical thinking ability because mostly teachers still use conventional teaching model which does not stimulate the students to think critically. To support the development of the students' critical thinking ability, Physics learning is conducted based on problems. According to Friedel et al., (2008), he claimed that in order to teach using the problem-solving approach, the problem-solving process must serve as the foundation of the lesson.

Furthermore, there are 7 strategies of problem solving in Physics learning. According to Gaigher et al., (2007), the seven steps of the strategy can be summarized as follows: (1) Draw a simple diagram to represent the system, (2) Indicate the data on the diagram, (3) Identify the unknown variable, (4) Analyze the problem in terms of physics principles, (5) Write down the relevant equation(s), (6) Substitute and solve, and (7) Interpret the numerical answer.

Creative Problem Solving (CPS)

According to Pepkin (2000) Creative Problem Solving (CPS) is "representing process dimensions in a natural, rather than in a contrived way. Undergoing a transformation from a prescriptive to a descriptive approach. Becoming more flexible and responsive to task, contextual, personal, methodological and meta-cognitive consideration." Learning model that can be implemented to improve the students' critical thinking ability is Creative Problem Solving (CPS) which is a variation of Problem Solving learning, since through that learning model, the students can solve their problems. According to Susilo (2012), through problem-based learning model, the students can solve the problems structurally and orderly, so effective problem solving can be achieved. Besides, through problem-base learning model, the students are trained to identify, analyze, and evaluate the problems accurately, so they can develop their reasoning critically to solve their problems.

Moreover, there are several reasons choosing CPS learning model. According to Totiana & Redjeki (2012), Creative Problem Solving learning model has advantages, such as training the students to comprehend the concept by solving a problem, training the students to be more active in learning activity, developing the students' thinking ability, and training the students to implement their knowledge in daily life.

Additionally, according to Friedel et al., (2008), the literature provided evidence that problem-solving style, problem-solving level, and critical-thinking disposition each contributed to the employment of critical-thinking skill level during the problem-solving process. Meanwhile, according to Gaigher et al., (2007), it was found that students who

had been exposed to the structured problem-solving strategy demonstrated better conceptual understanding of physics and tended to adopt a conceptual approach to problem solving.

Furthermore, Creative Problem Solving (CPS) is better implemented in learning than conventional teaching method. It is in line with Totiana & Redjeki (2012), implementing Creative Problem Solving provides more effective learning activities than the students who are taught by conventional method. Those learning activities include question-answer activity. The students who have passion in particular subject will always ask about many things they do not understand. Thus, affective aspect can succeed in cognitive learning aspect.

Besides, CPS is one of Problem Solving learning models which have similar characteristics to Problem Solving model. According to Maftukhin, M., & Dwijanto, D (2014), CPS learning model has characteristics, such as the learning activity is started with problems which reflect real-life condition. Then the students in group actively discuss the formulation of problems and identify their weaknesses, analyze and find the relevant materials related to the problems by themselves and report the solution of the problems. Meanwhile, the teacher's role is as the facilitator.

According to Vidal (2010), he suggested the five steps of the CPS approach, they are:

1. *Fact finding*: Observe carefully and objectively, like a camera, while collecting information about the problematic situation. Explore and identify the facts of the situation. *Action*: Who? What? Where? When? Why? How (is and is not)?
2. *Problem finding*: Clarify the challenge or problematic situation by considering different ways of regarding and reflect on those possibilities. *Action*: In what ways might we...? How do we...?
3. *Idea finding*: Look for more diverse ideas, alternatives, options, paths, ways, and approaches, use various methods and techniques (divergent thinking). *Action*: Make new relationships, associations, connections, magnify, minify, combine, rearrange, change, reverse, turn upside down, and inside out.
4. *Solution finding*: Examine ideas in new and different ways, from even more viewpoints and criteria; become aware of consequences, implications, and reactions to tentative idea/solution. Select or combine ideas to create a plan of action (convergent thinking). *Action*: Effect on whom? Effect on what? How to improve?
5. *Acceptance finding*: Develop a plan of action, considering all audiences that must accept a plan. Seeks ways of making the idea/solution more workable, acceptable, stronger, more effective, and more beneficial. *Action*: What objections will different groups have with the idea/plan? How might be set this plan into action? Who is going to do that?

Module Development

The students lack critical thinking ability because there is no Physics teaching material which can specifically improve the students' critical thinking ability. Therefore, module was suggested to be useful for both the students and the teachers in learning process.

Module is printed-teaching material designed by the teachers to help the students study independently, since it is designed systematically. Module has important role in learning because it can help the teachers in the learning process and the learning process can also run structurally. According to Peniati (2012), module is an important part in learning process and a way of organizing teaching material which considers the education roles, material organization strategy including Sequencing based on the composition of teaching material presentation, and Synthesizing based on the efforts that relate the students to the fact, concept, procedure, and principle, in teaching material.

In teaching through module, the students are given chances to study in their own way to solve the problems. An objective of designing module is to provide relevant teaching material to curriculum by considering the students' needs, to make the students more active in learning process. According to Ditasari et al., (2013), the use of module in learning process is to create an activity which stimulates the students' activeness.

In developing the module, to achieve the target, it is necessary to provide a certain relevant procedure and clear material content which fulfill material development criteria. According to Peniati (2012), module development is a set of procedures which is implemented orderly to develop modul learning system. In developing the module, there are 5 criteria, such as: 1) helping the students study independently, 2) having lesson plans which can be responded effectively, 3) containing complete material contents which provide the students more chance to study, 4) can monitor the students' learning activities, and 5) advising, guiding, and providing the students' improvement progress. Moreover, the theory and lesson plan should consider these 3 main components, such as: 1) learning situation, 2) teaching method, and 3) teaching result.

According to Budiono & Susanto (2006), module should have several components, such as: (1) the students' activities sheet, containing the lessons should be mastered by the students. The material composition should be in line with instructional objective will be achieved, designed step by step, so it will be easy for the students, (2) worksheet, including the students' activities sheet used to answer and work on assignments or problems solving, (3) answer key, to evaluate or correct the students' works by themselves, (4) question sheet, containing questions to see the students' improvement in learning the materials provided in module, (5) answer key for question sheet, to correct the peer-correction done by the students.

Based on Depdiknas (2008), in designing a good and interesting module, to motivate the users, module development should consider these characteristics:

1. *Self Instructional*, module enables the students to study independently.

2. *Self Contained*, module contains the whole lesson materials of 1 competency unit. This concept aims to provide the students more chance to study the teaching materials completely, since the whole teaching materials are composed in the module.
3. *Stand Alone*, module is designed completely. Therefore, the students do not need other supplementary teaching materials to study and work on assignments in the module.
4. *Adaptive*, module should have high adaptive power toward the development of science and technology and be flexibly used in various hardware.
5. *User Friendly*, module should be friendly to the users. Every instruction and available information should be helpful and friendly to the users, including facilitating the users in responding and accessing their needs. Simple language use, easy to understand, and use common terms, are the examples of *user friendly*.

Those characteristics will motivate the students, thus, the learning objective will be achieved, since the students can study independently through module. Therefore, to design learning module which can function effectively, it should be designed and developed by considering the relevant aspects and elements.

In designing module, it is also necessary to consider the steps. According to Prastowo (2012), there are 4 steps in designing a module, such as: curriculum analysis, module titles, module code, and module writing. Besides, Prastowo (2012) also stated that there are 4 steps in developing module, such as: identifying the learning objectives, formulating the material outlines, writing the materials, and determining its format and structure.

Designing learning module is based on competency in the objectives. Therefore, the steps in writing the module based on Depdiknas (2008) are as follow: (1) Analyzing the module needs; (2) Designing module draft; (3) Try-out; (4) Validation; and (5) Revision.

METHODS

This study employs Research and Development (R&D) design, a research design conducted to create certain product and test its effectiveness. The product developed in this study was a Physics module through Creative Problem Solving (CPS) learning model to improve the students' critical thinking ability. This study was conducted at SMAN 1 Metro and The participants were 10th grade students of 48 students. The procedures of this study are formulation of problems critical thinking, data collecting, designing and creating prototype module. In this early stage, the instruments used were questionnaire and interview.

The development steps in this study are explained in the diagram below (see figure 1):

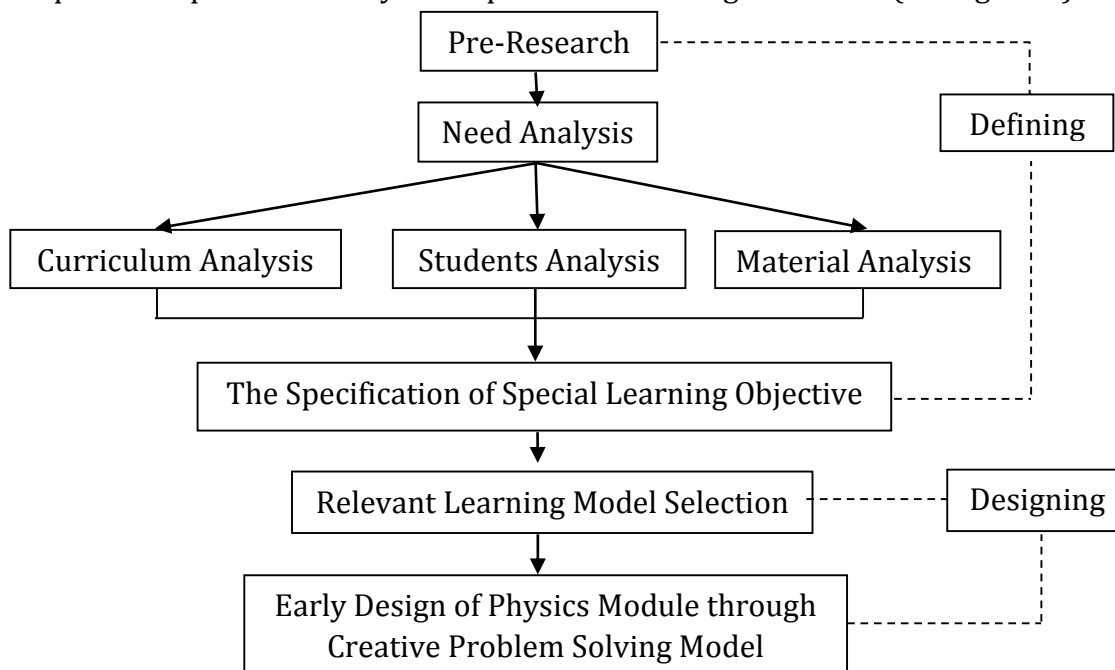


Figure 1: The development steps in the early stage of module design.

RESULTS AND DISCUSSION

Based on the survey of need analysis administered to the students and teachers, the results are as follow:

1. Results of Questionnaire and Teachers' Interview

According to the teachers' perceptions, they strongly agreed with the learning through in senior high school level because the students can study independently, be more active and creative, and think critically without teacher's explanation.

Based on result of teachers' interview, it can be concluded that the module should be (a) easy to understand, (b) in line with curriculum 2013, (c) complete for both students and teachers, (d) leading the students to be active and creative, (e) in communicative language.

2. Data Analysis Result of Questionnaire and Students' Interview

The students' answers were:

a. Teaching Material the Students Wanted

Based on result of interview, teaching material the students wanted was module because they can study the materials independently without time limit and they can also work in group to study the materials in the module. They wanted the module which provides materials, summaries, exercises, and tests.

b. Conventional Teaching Material

The students' perceptions of conventional teaching material were collected through questionnaire. They stated that: (1) the teaching material did not lead the students precisely to the target, (2) the materials used were difficult and boring, (3) the teaching material did not include various kinds of stimulating materials in developing the students' competency through all various activities

and assignments, (4) unclear directions, (5) uninteresting cover color, (6) incomplete, (7) uninteresting pictures, (8) difficult words and sentences use.

c. Learning Model the Students Wanted

The students' answers about learning model they wanted were also collected through questionnaire. It can be concluded that they wanted a learning model that makes them more active and creative and an interesting learning model that can develop their critical thinking ability and lead them to implement the knowledge they have possessed.

3. Material Analysis

Based on result of students' interview, it can be concluded that Newton's Laws topic is difficult. It can also be seen from 10th grade students of SMAN 1 Metro score achievement as in the figure 2 below:

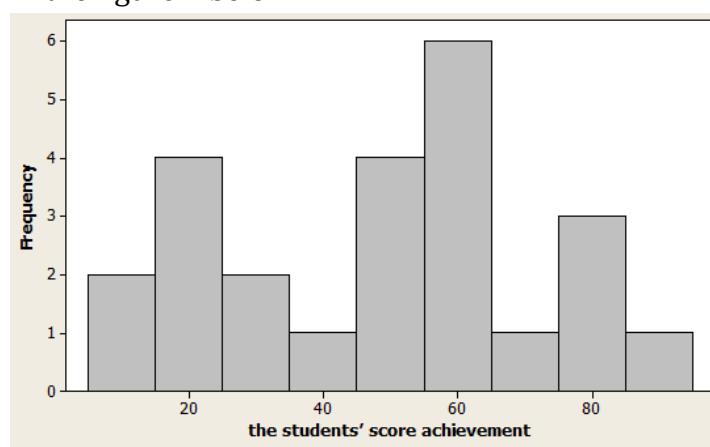


Figure 2: The histogram of the students' score achievement in learning Newton's Laws topic.

With passing grade minimum (KKM) 75, it can be seen in the picture above that the students' scores mostly could not reach KKM. Therefore, the learning model and teaching material in Newton's Laws topic should be evaluated.

Based on need analysis result through questionnaire and teachers' interview, questionnaire and students' interview, and the students' score achievement in learning Newton's Laws topic, it is found that the learning model and teaching material should be evaluated. Based on the data above, however, module is very beneficial to both teachers and students. Therefore, module will be developed to improve the students' critical thinking ability in learning Newton's Laws topic.

Furthermore, based on need analysis result, the approach which is often implemented is conventional learning approach. In learning, based on curriculum 2013, an approach ideally implemented is contextual approach.

In further study, Creative Problem Solving (CPS) learning model will be used to make the students understand the concept of Newton's Laws through problem solving and lead the students to be active in learning activity, develop the students' thinking ability, and lead the students to implement the knowledge they have possessed.

Table 1: The Relationship between Creative Problem Solving Learning Model and Critical Thinking Ability.

| Steps of the CPS | Steps Model to Lead the Students toward Critical | Critical Thinking Ability Indicators |
|--------------------|--|--------------------------------------|
| Fact finding | Determine learning objectives. | Elementary clarification. |
| Problem finding | Teach through questioning. | Basic support. |
| Idea finding | Practice before you assess. | Inference. |
| Solution finding | Review, refine, and improve. | Advanced clarification. |
| Acceptance finding | Provide feedback and assessment of learning. | Strategies and tactics. |

The product development will further be designed is composing learning module through Creative Problem Solving (CPS) learning model which arranges Newton's Laws topic systematically to improve the students' critical thinking ability through learning steps provided in the module which is based on Creative Problem Solving and critical thinking steps.

CONCLUSIONS

Based on data analysis result and discussion, therefore, teaching material and learning model developments can be designed based on need analysis and theoretical discussion. Need analysis is collected through questionnaire and the students' and teachers' interviews. Meanwhile, theoretical discussions are based on design development, module, and learning model and critical thinking.

Based on this study, it can be concluded that developing module through Creative Problem Solving (CPS) can improve the students' critical thinking as shown from the steps in CPS model and critical thinking which relates to and strengthens one another.

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