

Development of Teaching Material Based on Problem Based Learning Integrated Critical Thinking Skills (A Preliminary Study)

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Abstract – This article discusses a preliminary study of needs analysis in learning physics. The preliminary study was conducted at several schools in the city of Padang. The sample of this study was taken with a purposive sample technique so that it was obtained namely SMAN 2 Padang, SMAN 3 Padang, and SMAN 8 Padang. This preliminary study was carried out aimed at developing Physics teaching materials using a contextual teaching and learning approach integrated thinking skills for high school physics learning. This research uses descriptive statistical methods. The stages in this research are prepared in the form of design and development of instruments, implementation in the form of data collection, and completion in the form of data analysis. The results of the analysis in this study indicate that the needs analysis including learning activities, graduation standards, and critical thinking skills have been implemented well, but the application still needs to be improved, especially in critical skills. Contextual learning is able to guide students to practice problem solving, linking material with real problems, so students are able to think critically. Therefore, it needs to be improved by developing physics teaching materials based on problem-based learning models using the Contextual teaching and learning approach integrated critical thinking skills for high school physics learning class XI.

Keywords – Contextual teaching and learning, Critical Thinking Skills, Learning activities, Problem Based learning, Physics learning, Problem solving, Teaching Material

I. INTRODUCTION

The fourth industrial revolution era, or so-called industrial 4.0 is an era of the rapid development of technology. The term Industrial 4.0 appeared since 2011 in Germany [1]. This era was marked by the use of machines and technology that integrated with the Internet network to aid humans. Technological developments in industrial 4.0 are affecting

education. Thus, this revolution is known as education 4.0. Education 4.0 is an education that applies the use of technology in the learning process that takes place continuously without limited by space and time. This Education 4.0 exists in helping to solve the problem, obtaining a solution, and allows the finding of innovations. The revolution 4.0 allows competitive competition among

humans. In this era, Qualified Human Resources are needed to well face the competition to balance the Education 4.0 era.

Today, Education 4.0 is needed to address the challenges which occur in industrial 4.0. In the 4.0 industry, the role of education is very important in producing qualified and competent human resources. The government has tried to answer these challenges by improving the quality of education to be able to compensate for the 4.0 level. One of the government's efforts is to improve and develop the education system in Indonesia. Currently, education in Indonesia has been implementing the Curriculum of 2013. The learning process is applied to the curriculum of 2013 is marked by the approach, strategies, methods, techniques, and tactics, as well as learning models. The purpose of this curriculum is to prepare educators and learners to be active, creative, innovative and characterized as expected.

For today's education, there should be an increase in the learning process to achieve competence that must be owned by learners. The competence is known as the 4C competence which consists of the ability to think critically; communicatively; creatively; and collaboratively [2]. The education curriculum must also be revised by adding the five competencies to prepare and assist educators in guiding learners entering the era of revolution 4.0, which is an Internet-based learning competency; competence to bring learners to have an entrepreneurial attitude with technology; global competence; competence to face the future planning strategy; competence to assist students facing difficulties and solve problems [3]. So, it can be concluded that it is needed to improve the quality of human resources in facing the challenges of Revolution 4.0.

One effort that can be done to address the challenges of the revolution 4.0 is to apply the use of teaching materials (Student worksheets) in the learning process. The application of teaching materials can help offset the challenges in education 4.0. One of the supporting teaching materials to improve 4C skills is a student worksheet. The application of student worksheets is able to help achieve the expected skill competence in education 4.0.

Teaching material is a device that contains subject matter to help learning activities [4]. Teaching material is material that is arranged systematically and can be used by teachers and students in learning activities [5]. Besides that, teaching materials also make learning more effective [6]. The characteristics of teaching materials are self-instructional; self-contained; stand-alone; adaptive; user-friendly [7]. The teaching material used must be following the learning objectives and contextual so that students easily understand

the learning material. [8]. The benefits of teaching materials are to direct learning activities following learning objectives, evaluation tools for student learning outcomes. Teaching materials must at least have the following structure 1) learning instructions; 2) competencies to be achieved; 3) Learning material; 4) supporting information; 5) exercise; 6) worksheets; 7) evaluation [9]. Teaching materials can help students to understand learning materials, train students to be able to find and develop learning concepts so that students can be active and improve competence following the demands of the revolution era 4.0 [10]. Teaching materials are able to influence or encourage students to gain knowledge and skills competencies. Thus, teaching materials become one of the important tools or materials to help teachers in the learning process to improve student competencies [11]. Teaching Materials are said to be of high quality if they meet the stipulated requirements, to increase the activeness and competence of students. Based on the structure of these teaching materials, teaching materials can help make it easier to carry out learning activities, so students need to be trained and guided to be able to use 4C skills. The role of teaching materials is very important in improving the competency of students. This is following the demands of education 4.0, which can train students to be able to think critically, creatively, collaboratively, and communicatively.

The use of models and approaches in learning activities also provide an important role in achieving learning objectives. One of the innovative learning models recommended in the 2013 Curriculum is the problem-based learning (PBL) model. This model is problem-based. Students are guided and trained to be able to solve real problems to improve competence and critical thinking in solving these problems. The application of this PBL model can help students to understand and interpret the learning material obtained. The approach that can be used is contextual teaching and learning. CTL approach is an approach that emphasizes students to be fully involved to find learning material that is learned with real-life situations or problems [12]. The use of the PBL model and the CTL approach can guide students to learn independently, think critically, innovatively, and contextually so that students can understand knowledge and skills.

Critical thinking is an ability to analyze ideas or more specific ideas and develop them towards better [13]. This capability is needed to analyze a problem so that it can solve the problem. The ability to think critically encourages students to come up with ideas or new thoughts about problems about the real world. This supports the development of teaching materials based on problem-based learning using

a contextual teaching and learning approach to improve student competency.

The efforts made by the government to deal with the challenges of the 4.0 revolution are one of the ways to do it is to improve and develop the curriculum. Therefore, the 2013 curriculum expects teachers to be able to guide students to be able to balance the 4.0 revolution with a variety of skills. Skill competence is very important for students to achieve the expected learning goals [14]. One of the 4C skills that are suitable for use in this teaching material is critical thinking skills. The application of this skill in Physics learning is in accordance with the 2013 Curriculum if it has been implemented well in schools, it will have a good impact on education in Indonesia [15].

One solution in overcoming this problem is developing teaching materials based on problem-based learning models using the CTL approach integrated critical thinking skills for high school physics learning. This article focuses on analyzing the needs in physics learning for the development of teaching materials based on problem-based learning models using an integrated CTL approach of critical thinking skills. This research is the initial stage in fulfilling the development of physics teaching materials. This research uses the Plomp development model. Preliminary studies aim to find out the existing problems, so that support in improving and developing learning tools [16]. Analysis of needs in learning physics is carried out at high schools in the city of Padang. The samples in this study were SMAN 2 Padang, SMAN 3 Padang, SMAN 8 Padang. The questionnaire used is to collect and analyze data in learning activities. The indicators in this analysis are first, regarding initial, core, closing activities; second, regarding graduation standards in the form of student competencies, namely attitudes, knowledge, and skills; third, regarding critical thinking skills. the graduation standard in the form of students' competencies, namely attitudes, knowledge, and skills; third, regarding critical thinking skills.

II. METHODS

The descriptive qualitative method was used in this study. Descriptive research is a study describing the object being researched [17]. The object of research can be in the form of characteristics, events or activities, relationships, and differences between one situation with another situation. The aim of this study was to obtain information on the problems at the time of the research [18]. The research process consists of three stages: preparation in the form of design and development tools, implementation such as data collection, and completion in the form of data analysis. The population

of this study is a high school in the city of Padang. Sampling used a purposeful sample technique in this study. Aimed sample is a sampling methodology based on a number of considerations [17]. Samples from this study were SMAN 2 Padang, SMAN 3 Padang and SMAN 8 Padang.

The method used to collect data is the questionnaire method. The questionnaire is a tool used to provide the respondent with some of the statements or questions and to ask them to provide clarification on those statements or questions [16]. The questionnaire used for this analysis is a closing questionnaire. The closed questionnaire is a questionnaire that offers alternate responses that have been identified by the researchers to be chosen by the respondent. The data collection methods used in this study use the Likert scale. Likert scale is a scale designed to measure and determine the level of attitudes and opinions of one or more people about a phenomenon [19].

The used data analysis technique is descriptive statistics. The results of the questionnaire analysis were obtained by calculating the acquisition of scores given by respondents in each indicator. The calculation of the value on the questionnaire can use the following formula:

$$P = \frac{f}{N} \times 100\% \quad (1)$$

Where:

P is the total score,

f is the acquisition of scores and

N is the maximum number of scores.

To determine the type of category obtained from each indicator, the data analysis is carried out using the provisions provided in Table 1.

Table 1. Types Of Categories

Interval	Category
<75	Less
≥75-83	Enough
>83-92	Well
>92-100	Very Good

III. RESULT AND DISCUSSION

The data obtained in this study are data that contain educators' responses to learning physics in the form of percentages. This research data is a response by a physics teacher in class XI at the school used as a sample in this study. This data consists of three indicators which include learning activities, competencies, and students' thinking skills in learning. This data is part of the need's analysis, but this study only determines three indicators. These indicators complete

the analysis of performance or learning activities, students' graduation standards or competencies, and critical thinking skills.

The results of the analysis on the first indicator are learning activities including introduction, core, and closing. The results of the questionnaire analysis announced that learning physics at the school that was sampled had been well implemented, but it was still not optimal. Based on the results of a questionnaire that has been provided by educators. The results of the analysis for the first indicator of physics learning activities can be seen in Figure 1.

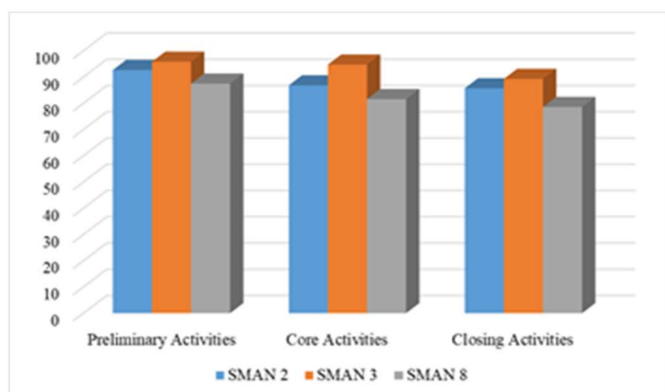


Fig. 1. Graph analysis of physics learning activities

Based on these graphs, it presents an analysis of physics learning activities that are included in both categories. The average preliminary activities in learning activities have been categorized as good at 92%. The hope the educator has carried out preliminary activities as expected. This preliminary activity gives an important meaning to the next activity. If this preliminary activity is not carried out properly, further learning activities will produce results. In this learning activity, educators are expected to bring students physically and psychologically so that they can support learning activities.

The average core activity in this learning activity has been categorized as good at 87.81%. Related educators related learning activities in accordance with the curriculum of the 2013 Curriculum. This core activity increases the competence of students. In this activity, educators are expected to be able to manage learning activities by using a variety of models, approaches, and learning strategies and methods, so that students are not easily bored with this learning, so learning becomes more interesting.

The average closing activity in this learning activity has been categorized as good at 84.52%. Hope educators have the skills to close learning. This activity is often overlooked.

While this activity is one of the most important activities in learning activities. This closing activity does not cover routine activities carried out by students, such as providing physical and psychological, provided activities that provide an assessment of learning learned and the level of student achievement. The higher the success rate of students, the higher the success of educators. This activity reviews the summary of lessons learned, evaluations, and students' assignments. The purpose of the preliminary analysis research in this learning activity is to assist teachers in improving learning activities to better achieve the expected Learning objectives [15]. Based on the results of graph analysis as shown in physics learning activities, it has been implemented well in accordance with the expected indicators in the 2013 Curriculum.

The results of the analysis on the second indicator namely graduation standards, including attitudes, knowledge, and skills. The results of the questionnaire analysis are the educators' responses to the graduation standards or students' competencies in learning. Based on the results of a questionnaire that has been filled out by educators. The results of the analysis for the second indicator on passing standards can be seen in Figure 2.

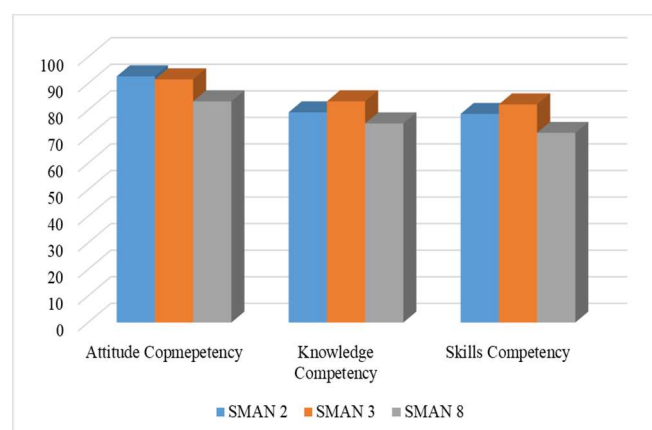


Fig. 2. Graph analysis of graduation standard

Based on the graph shows that each competency has a different response. Learning activities influence student competencies. The competencies include competency attitudes, knowledge, and skills. Attitude competency obtains the highest data, then knowledge and finally skills. The average competency of students' attitudes is categorized as good, that is 89.2%. The average competency of students' knowledge is quite sufficient at 79.15%. The average competency of the students' skills was considered sufficient at 77.38%. The results of the analysis of physics learning

activities also provide a role in the competence of students [16]. Graduation standards regarding the competencies of these students have been done well but are still not optimal. This graduation standard still needs to be improved so that the competence of students increases. Standard graduation is not yet optimal in applying problem-based learning following real conditions or better known as contextual to be able to help students to be active, think critically according to the demands of the 2013 Curriculum [12]. Problem-based learning with contextual can help students to understand learning well.

The results of the analysis on the third indicator are critical thinking skills. This analysis aims to determine the application of these skills in learning. Critical thinking skills not only involve students, but educators also play a role in training students to possess these skills. The 2013 curriculum has directed schools to apply several skills namely 4C [15]. One of the skills to be reviewed is critical thinking skills. The results of the questionnaire analysis are the educators' responses to the work that will involve students in learning. The results of the analysis for the third indicator of critical thinking skills can be seen in Figure 3.

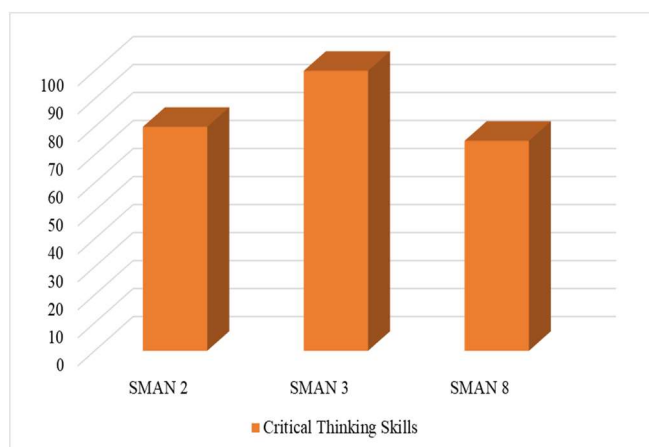


Fig. 3. Graph analysis of critical thinking skills

Based on the graph shows that each school has tried to train students to apply these critical thinking skills. The average critical thinking skills show the efforts of educators to guide students to have critical thinking skills categorized as good at 85%. Efforts made by educators to guide students to have the ability to think critically have already been implemented but are still not optimal. The use of innovative models in the 2013 Curriculum will help educators and students to conduct learning optimally. One of the demands of Curriculum 2103 is to apply a learning model that is problem-based variation following real conditions so that students can become more active, critical, and better

understand the learning material. Problem-based learning with real conditions helps students to develop and interpret learning through experience and circumstances [12]. This contextual learning helps students to be able to have high or critical thinking skills.

This needs analysis is interrelated with one another. Requirement Analysis which consists of learning activities, graduation standards, and students' critical thinking skills. This analysis was obtained based on the educator's response to the learning undertaken. Therefore, it is necessary to improve planning in learning to be carried out by educators. The application of physics teaching materials will help in implementing the plan, to support students in understanding Physics material to be able to increase the competency of students. One solution to this problem is to develop Physics teaching materials based on problem based learning models using the CTL approach integrated critical thinking skills for high school physics learning. This learning can help to improve students' understanding and competency skills [2].

IV. CONCLUSION

Based on the results of the study of the needs of physics learning presented, the need analysis is still graded as strong. Physics learning exercises have been carried out in accordance with the criteria of the 2013 Curriculum. Learning activities also have an influence on students' competency and critical thinking skills. Optimal learning activities will have a good impact on student skills. Average review of learning activities provided 92 per cent of preliminary activities, core activities 87.81 per cent, closing activities 84.52 per cent. In the second measure, i.e. graduation or skill level, attitudes were 89.2 per cent, awareness was 79.15 per cent and skills were 77.38 per cent. In the third measure, the attempts of educators to develop critical thinking skills are 85%. The study of the needs of studying physics is well categorized. The findings of this study suggest that physics learning activities have been carried out in compliance with the criteria of Curriculum 2103, but that critical thinking skills have not yet been optimally implemented. Since critical thinking skills are one of the skills that students must have in Revolution 4.0. The rapid progress in science and technology in the 4.0 technological period has led to a desire for education to be able to follow the growth of curriculum 4.0. Training that embraces the goal of the 4.0 Revolution is to adapt problem-based learning to real-world conditions so that students can more easily understand and perceive training through experience and life around them. One solution that can be found to solve these issues is the development of material

teaching based problem-based learning model that incorporates the CTL approach to applied critical thinking skills for high school physics learning. The material teaching is intended to help high school physics understand.

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