

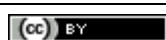
Development of Physics Learning Material Based on Problem Based Learning by Integrating Local Wisdom West Sumatra to Improve Critical Thinking Ability of Students

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Abstract –Teachers are not applying the learning material (lesson plans, handout, LKPD, and critical thinking skills tests) are based on problem based learning, causing poor critical thinking skills of learners. In addition, teachers just take the examples of learning that is still out of reach learners. One example that is close to the lives of learners and can be integrated in learning is local knowledge of West Sumatra. Therefore, it is necessary to develop physics learning material based on problem based learning by integrating local wisdom of West Sumatra. The purpose of this research to develop physics learning material based on problem based learning by integrating local wisdom of West Sumatra with valid criteria, practical, and effective. This type of research is the Research and Development. Model development in research is ADDIE model composed of analysis, design, development, implementation and Evaluate. The results showed that physics learning material based on problem based learning by integrating local wisdom of West Sumatra have valid criteria (0.895), practical (89.60) and effective (80.00).

Keywords – Critical Thinking Skills, Local Wisdom, Learning Material, Problem Based Learning

I. INTRODUCTION

Natural Sciences (IPA) is the study of phenomena in the universe and get to the truth of the facts and phenomena of nature through activities empirically obtained by laboratory experiment or wild nature. One of the subjects is a very important science of physics. Physics as a branch of science is very had a dominant contribution in the advancement of science and technology. Physics is the science that studies the phenomenon and its objects and circumstances.

The learning objectives of physics, that learners are able to solve problems found in life. Learners are expected to have a broad view of the physics. That is, students should realize that physics is close to their everyday surroundings. In addition, the teacher is expected to create a learning process to develop the thinking process for learners. Teachers are required to have the ability to make learning fun, centered on the learner and the learning activities associated with everyday life. It allows learners to be more

active in the learning process so that students feel the learning meaningful.

Various attempts have been made by the government to improve the quality of education. Several attempts have been made to optimize the government among other things in the classroom; providing educational support facilities such as teaching materials; improve the quality of teachers through courses, improvement of the learning device; facilities and infrastructure and so on. In addition, the government also has sought to enhance the education curriculum. Completion of the curriculum starting from the 1994 curriculum, CBC, Education Unit Level Curriculum (SBC) as well as the curriculum in 2013 (K13), which demands that humans Indonesia that has the ability to live as individuals and citizens who believe, productive, creative, innovative, and affective and able to contribute on her life. In addition, the curriculum in 2013 also demanded that the students can think critically and creatively.

In reality, learning in school is not optimal. Inadequate learning facilities. Participation of students in the learning process is still lacking that would impact on the ability to think critically. Have been carried out *pretest* of critical thinking skills in class X Audio Vidio C (AV-C) and Bisnis Konstruksi Bangunan A (BKP-A) SMK 1 Padang TA 2017/2018 based indicators of critical thinking skills by

Ennis (1996) which includes giving a basic explanation, argues, provide the logic to think, make decisions, and conduct the evaluation. Classical, value of *pre-test* critical thinking skills class X AV-C do not meet the predetermined KKM, which is 80 like what is shown in Table 1.

Table 1. Test results for Critical Thinking Ability of Students of class X Audio Video C (AV-C) and Bisnis Konstruksi Bangunan A (BKP-A)

Class	Number of Students	Average Value	<KKM		KKM≥		KKM
			Number of Students	Tot %	Number of Students	Tot %	
X AV-C	31	23.23	31	100 %	0	0%	80
X BKP-A	25	34.80	25	100 %	0	0%	80

Based on the data in Table 1, 100% of the total of students of class X AV-C and BKP-A has not reached the KKM. This value is significant enough to conclude the critical thinking skills of learners are still low.

Based on the reality on the ground, the need for learning material in meeting the demands of the curriculum in 2013 to address the problem of learning. Learning material can be used by teachers and learners. The learning device is expected to make teachers and learners do various activities in the learning process. The device in question can be a learning lesson plans, teaching materials (modules, *handout*, LKPD and others), as well as the assessment of learning. The facilities were estimated practical for teachers to learn learners are *handouts* and LKPD, meaning with their *handouts* and LKPD learners can learn from a variety of sources such as the environment, relevant textbooks, the Internet and other media.

In accordance with the characteristics of physics, basically starting from the physical phenomena that are often found in the lives of learners. Learning physics is not only focused to solve the problems alone, but the important thing is that learners can understand the concept of the material so that it will facilitate the learners in work on the problems. Therefore, teachers need to provide learning tools such as lesson plans, *handout*, and LKPD.

Based on the needs analysis that has been done in SMK 1 Padang obtained data, that competency standards (SKL) 52.94% on a pretty good criteria, Performance of 61.25% on both criteria, learning difficulties learners 57,50% in pretty good criteria , facilities and infrastructure 64% in both criteria, as well as learning resources 40% on unfavorable criteria.

Based on the analysis of these needs, it can be concluded that there are weaknesses in terms of SKL, Performance of teachers, learning difficulties learners, facilities and infrastructure, and learning resources. These weaknesses affect the characteristics of learners. Data analysis of learners is drawn is the motivation, interests, intellectual abilities, learning styles, and the opinions and expectations of educators learning material used for this. The results of the analysis of the data obtained learners motivation 43.39% in the criteria fairly well, 46.45% interest in the category is quite good, the intellectual component values obtained 42.90% with a category quite well, learning styles showed that 58.06% of learners show visual learning style, 32.26% auditory, and kinesthetic 0.97%, and the opinion of learners towards learning tools that have been used educators get the average value of 32.58% with unfavorable criteria.

To strong then the analytical results and the needs of learners, conducted interviews. Based on the interviews, a physics teacher at SMK 1 Padang has used learning tools

such as lesson plans. Teacher lesson plans yet to develop independently so that learning activities done in class is still running in one direction that makes the learners do not understand what the teacher in the classroom. To that end, the RPP should be developed so that the interaction between teachers and learners so that they can understand what the teacher in the classroom. In addition, the RPP also not contain local wisdom. One example is the local wisdom of West Sumatra. Generally, teachers use the environment as a potential apperception, not until the discussion of physics at the local knowledge of West Sumatra deeper. Supposedly, in the RPP contains local wisdom of West Sumatra so that learners can recognize local wisdom in the area and able to stay awake and not going to disappear over time. In addition, the students also learned that local knowledge in their area can also be integrated in the learning of physics that will increase knowledge and interest in the matter physics. Learners Class X Engineering at SMK 1 Padang also do not use *handout* and LKPD in the learning process. To that end, *handout* and LKPD need to be developed to support learning.

Another thing that also affects the quality of the learning process is the use of strategies, models, and methods of learning. Upon observing strategies, models, and methods of learning, it was concluded that the use of strategies, models, and methods less than optimal. Learners less participate in the learning process. Learners only receive learning material presented by the teacher and rarely ask when things are not understood. In addition, critical thinking ability of students is also low. Critical thinking skills of students can be seen in Table 1 earlier.

Based on the above phenomenon, the need for strategies, models, and methods that make the critical thinking skills of students increased during the learning process. The problem posed in this problem-based learning is an open issue that the right answer may be not just one. PBL model is proven to improve students' academic achievement. Besides, learners need to develop social skills in order to be active in group discussions and self-study exercises in order to further increase confidence among learners. This will lead learners to develop the ability to think to find any answers. In addition, the ability to communicate or express opinions can also be improved through learning is done because it is generally more demanding problem-based learning activities of learners by involving small groups. Thus, the problem-based learning in line with the teaching of physics because it provides a stage for learners to be able to solve physics

problems that exist in everyday life based on the concept of physics.

In accordance with the issues described above, has been studied development of physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra. The purpose of this study to develop physics learning to improve the critical thinking skills of learners.

The problems developed in this study is how to develop physics learning material based on *Problem Based Learning* by integrating local knowledge of West Sumatra valid, practical, and effective?

II. REVIEW OF LITERATURE

A. PHYSICH LEARNING MATERIAL

Nazaruddin (2007) states that the learning material is a set of tools that prepared teachers for the implementation and evaluation of learning can be done systematically and obtain results in line with expectations. Learning material is also interpreted as a number of materials, tools, media, instructions and guidelines to be used in the learning process (Susilo, 2007). Rustini (2014) suggest that the learning material is a set of learning resources that allow teachers and learners perform the learning activities.

1. Lesson Plan

Majid (2014) states that the lesson plan is a plan that describes the procedures and organization of learning to achieve the basic competencies specified in the standard content and has been translated dala syllabus. Trianto (2009) also states that the lesson plan is a guide to the steps that will be undertaken by teachers in learning activities that are arranged in a scenario of activities. In line with previous statements, Mulyasa (2007) reveals that the lesson plan is a plan that describes procedures and learning management to achieve one or more of the basic competencies that are applied in the content standard and is described in the syllabus. Then amplified by Muslich (2008) states that the RPP is learning design subjects per unit which will be applied in the classroom teacher.

2. Handout

According to Salim (2000) *handout* is one form of print media that is easily developed and can be used in learning. Ministry of National Education Instructional Materials Development Guide explains *handout* is written material prepared by the teacher to enrich the knowledge of students. Usually taken from the literature that has some relevance to the material being taught/basic competencies and subject

matter of material that must be mastered learners. From some of the above it can be concluded that the *handout* is one of the print media used in learning. Aim the use of *handouts* is to enrich the knowledge of students. Depdiknas (2008) a *handout* shall contain such things as lead speaker on a regular basis and clear, based on solid knowledge of the results and statements, and graphs and tables are hard drawn by the listener can easily be obtained.

3. Student Worksheets

One of the learning materials used is student worksheets (LKPD). Khawarizmy and Wiyatmo (2016) states that LKPD has a function to measure the abilities of learners. At the basic education level, the charge should be emphasized that one of them is the ability to take a decision that involves understanding the problem, planning, analysis, and problem solving (Depdiknas, 2006).

LKPD a sheet containing a collection of activities that allow learners perform real activity with the object and issues studied. LKPD serves as a guide to learners and also allows learners and teachers to conduct classes. LKPD also can be defined as the print instructional materials in the form of sheets of paper containing the material, summary and instructions execution of tasks to be done by the students, which refers to the basic competence achieved (Prastowo, 2011). The tasks given to learners can be either theory or practice.

B. PROBLEM BASED LEARNING

One model of learning is *Problem Based Learning*. The purpose of using problem based learning is the learners by having the ability to think critically, analytical, systematic and logical to determine alternative solutions to problems through the exploration of empirical data in order to foster a scientific attitude (Sanjaya, 2011). Excess PBL by Selcuk (2010) states that PBL in addition to equip learners with the knowledge, can also be used to improve problem-solving skills, Ability to think critically and creatively learning. Lifelong Similarly, Sahyarl (2017) states that PBL can make learners have a high level thinking skills such as critical thinking, PSA, and creative thinking. Argaw (2016) also found models PBL are more effective than conventional teaching method for learning physics.

C. LOCAL WISDOM

Mungmachon (2012) states that local wisdom is the basic knowledge gained from living in balance with nature. Meanwhile, Khusniati (2017) states that local wisdom is man's attempt to use moral cognition and act and behave on

issues or phenomena in a certain scope. In line with this, the Dewi (2017) states that one event or phenomenon or object of the most famous in every region and even across countries and regions is the local wisdom, especially with regard to the peculiarities of the local culture.

D. CRITICAL THINKING ABILITY

Bahr (2010) states that critical thinking is an important goal of the education sector. Duron (2006) also states that critical thinking is the ability to analyze and evaluate information. Correspondingly, Kulekci (2015) states that critical thinking encourages individuals to analyze evaluate and explain through interpreting the ideas from a broader perspective. According to Adeyemi (2012), critical thinking has two components, namely the skills to produce and process information and beliefs as well as the habit of using their skills to guide behavior based on intellectual commitment.

III. METHODS

This type of research is the *research and development* with the development model of ADDIE (*Analysis, Design, Development, Implementation, and Evaluate*). Subject product trials are learners class X Audio Video SMK 1 Padang. The development process starts from the analysis phase that includes needs analysis, curriculum analysis, material analysis, and analysis of learners. After the stage of designing a learning device. The next stage of development of learning material in accordance with their designs, perform validity, as well as the practicalities of testing for learners to see the effectiveness of the learning material.

Data collection instrument in this study consisted of sheets of assessment instruments validation learning material (lesson plans, *handout*, LKPD, and test critical thinking skills), sheet validation of learning material, sheet assessment instruments practicalities of learning material, sheet practicalities of learning, and test critical thinking skills.

The validity of the learning material is analyzed using Cohen's Kappa formula. Developed learning material considered valid if it has reached the interval ≥ 0.61 (Anthony). Practicality learning material carried by the data calculating final grades instrument results were analyzed in scale (0-100). The effectiveness of the learning material judged by the increase in critical thinking skills. To assess the critical thinking skills enhancement is done by giving *pre-test* and *post-test*. This increase is represented by the

value of *Gain Score* (Hake, 1999: 1). Declared effective learning device if 85% of learners have reached KKM set.

IV. RESULT

The development process starts from the analysis phase that includes a needs analysis (SKL, Prominent, learning difficulties learners, facilities and infrastructure, as well as learning resources), curriculum analysis, material analysis, and analysis of learners. Needs analysis can be seen in Figure 1.

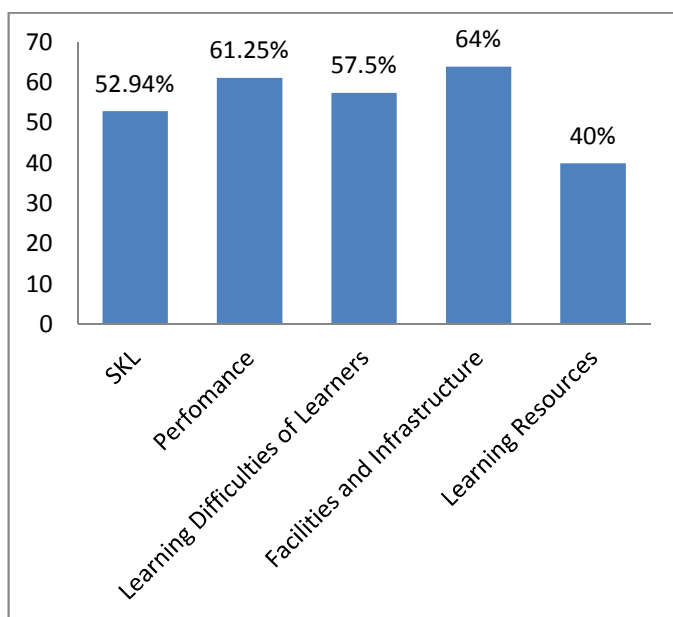


Figure 1. Needs Analysis

Based on Figure 1 it can be concluded that there are weaknesses in terms of SKL, Prominent, learning difficulties learners, facilities and infrastructure, as well as learning resources. These weaknesses affect the characteristics of learners. Data analysis of learners is drawn is the motivation, interests, intellectual abilities, learning styles, and the opinions and expectations of educators learning tools used for this. The results of the analysis of learners of aspects of motivation, interest and intellectual abilities can be seen in Figure 2.

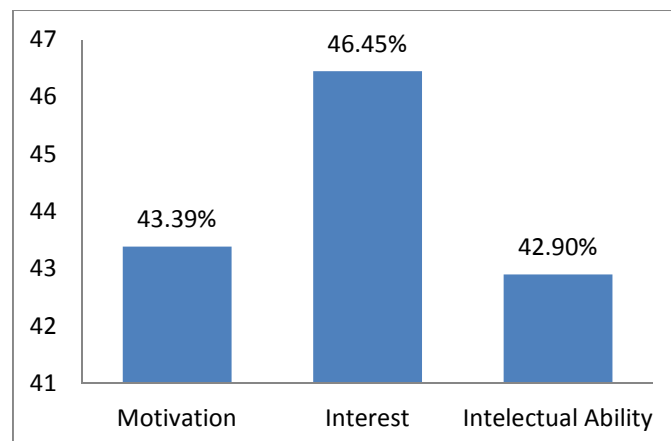


Figure 2. Analysis of Motivation, Interest, and Ability Intellectual Students

Learning style analysis results of students can be seen in Figure 3.

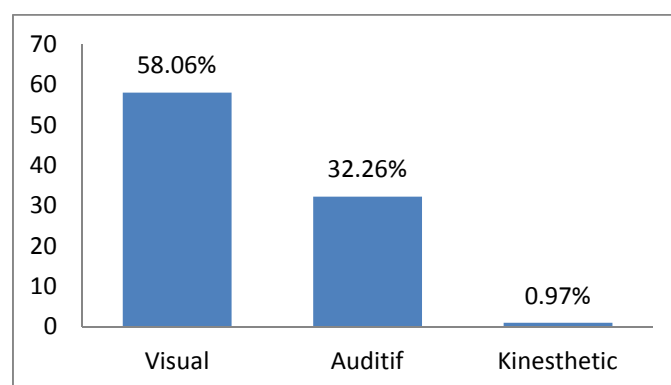


Figure 3. Analysis of Learning Styles Students

Learning material results of analysis of existing devices by learners can be seen in Figure 4.

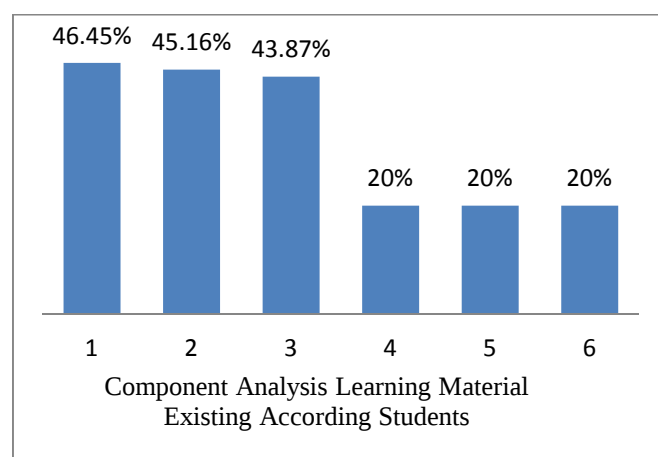


Figure 4. Analysis of Existing Learning Material According Learners

Description:

1. Material used educator learning interesting for learners.
2. Learning material used educators make learners more aware of the concepts and principles of physics.
3. Learning material used educators make learners motivated and active in learning.
4. Learning material stimulates learners to think critically.
5. Learning material integrate local wisdom of West Sumatra.
6. Devices material learning *Problem Based Learning*.

The results of the analysis of expectations of learners towards learning device used educators can be seen in Figure 5.

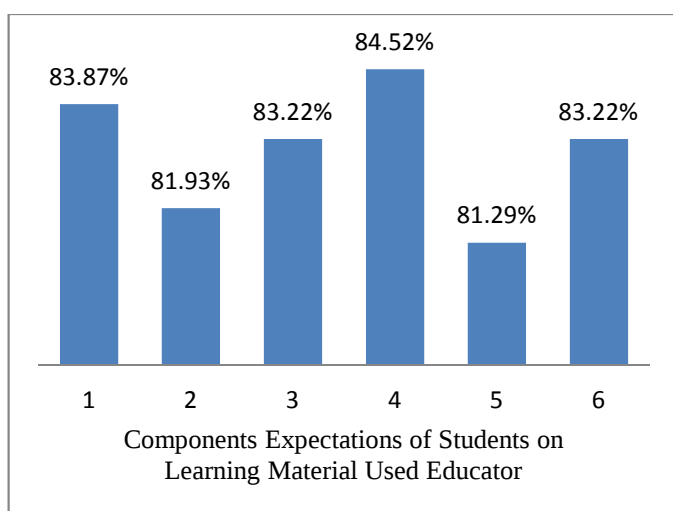


Figure 5. Expectations of Students on Learning Material Used Educators

Description:

1. Learners prefer that educators use a variety of learning tools.
2. Learners expect in every lesson educators provide exciting learning tools that make them more active and concentration in learning.
3. Learners expect in a learning device used educators, there is a structured guidance that keeps them focused in finding the concept.
4. Learners expect learning tools are used to improve critical thinking skills.
5. Learners expect learning device that is used to integrate local wisdom of West Sumatra.
6. Learners expect based learning tools used *Problem Based Learning*.

After the analysis phase, followed by the design and development phase learning material, then the learning device is validated by three experts / lecturers graduate UNP and two practitioners / physics teacher at SMK 1 Padang.

Before performing device validation prior learning assessment instrument validation by experts and practitioners using the formula *Cohen's Kappa*. After the validation sheet is valid, an assessment of the validity of the learning material and the results obtained are described in Table 2.

Table 2. Validity Value Learning Material

Learning Material Developed	Aspect Validated			Average	Category
	Content	Constructs	Language		
RPP	0,86	0,91	0,87	0,88	Valid
Handout	0,84	0,95	0,89	0,89	Valid
LKPD	0,85	0,91	0,88	0,88	Valid
Critical Thinking Ability Test	1,00	0,92	0,93	0,93	Valid

Based on Table 3, it can be concluded that the learning material (lesson plans, *handout*, LKPD, and test critical thinking skills) has been on the invalid category.

The next test against the practicalities of learning material is developed. Test practicalities obtained from the assessment of the enforceability of the RPP for each meeting, the assessment of the *handout*, LKPD, and critical thinking skills test (questionnaire responses of teachers and learners). The observation of enforceability of the RPP can be seen Table 3.

Table 3. Observations Implementation of RPP

N o	Meeting	Score	Category
1	First	100	Already Done
2	Second	100	Already Done
3	Third	100	Already Done
Average		100	already Done

Based on Table 3, the results of adherence to the RPP for each meeting are in the category of very practical, in terms of the preliminary stage, the core activity, as well as cover.

Results practicalities teacher questionnaire responses can be seen in Table 4.

Table 4. Results of Questionnaire Responses practicalities of Teachers

No	Teacher Questionnaire Response	Rate Observer Average		Average	Category
		DM	GA		
1	RPP	100	100	100	Very Practical
2	Handout	93.75	96.88	95.32	Very Practical
3	LKPD	100	100	100	Very Practical
4	Critical Thinking Ability Test	95.00	90.00	92.50	Very Practical
Average				96.96	Very Practical

Based on Table 4 it can be concluded that the learning device based on questionnaire responses of teachers that are in the category of very practical.

The results of questionnaire responses practicalities of learners can be seen in Table 5.

Table 5. Results of Questionnaire Responses practicalities of Students

No	Response Questionnaire of Students	Average Value	Category
1	Handout	80.625	Very Practical
2	LKPD	77.35	Practical
3	Critical Thinking Ability Test	88.75	Very practical
Average		82.34	Very practical

Based on Table 5 it can be concluded that the results of responses of learners to *handout*, LKPD, and test critical thinking skills that have been developed are in the category of very practical.

To determine the effectiveness of learning material are developed, the test results obtained from the increase in critical thinking skills of learners based on five indicators of critical thinking as in Figure 6.

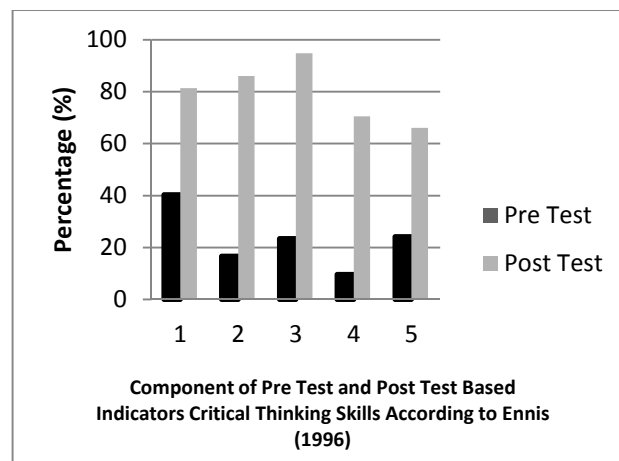


Figure 6. Results of Pre Test and Post Test Based Indicators Critical Thinking Ability According to Ennis

Description:

1. Giving a basic explanation on the *pre-test* scored 40.32% in *post-test* increased to 81.29%.
2. Giving arguments on *pre-test* scored 16.67% in *post-test* increased to 86.02%.
3. Providing logical thinking on the *pre-test* scored 23.39% in *post-test* increased to 94.76%.
4. Take a decision on the *pre-test* gained 9.68% while the value of the *posttest* increased to 70.51%.
5. To evaluate the *pre-test* scored 24.19% in *post-test* increased to 66.12%.

Based on Figure 6 it can be concluded that an increase in critical thinking skills of learners. After testing on Class X Audio Video, only 3 people who are not reached KKM of 31 learners. It shows that 90% of learners have reached KKM set so that it can be concluded that the developed learning material have been effective.

V. DISCUSSION

A. VALIDITY OF PHYSICS LEARNING MATERIAL BASED ON PROBLEM BASED LEARNING BY INTEGRATING LOCAL WISDOM OF WEST SUMATRA

Learning material must be valid so that used in learning. In this study, the validation is done emphasis on validation of the contents, construction, and so the language learning material used in accordance with the criteria that should and arrangement of learning material created in compliance and meet the terms of the preparation of the learning material. This is in line with the Depdiknas (2008) which states that the validity can be evaluated from the content component, linguistic components, presentation components, and components channel. The validity of the physics learning

based on *Problem Based Learning* by integrating local wisdom of West Sumatra created a valid category.

Based on the results of the validation physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra can be seen that the device has a valid learning developed with the validity of the lesson plans, *handout*, LKPD, and critical thinking skills tests sequentially was 0.88; 0.89; 0.88; and 0.93. The average results of the validation learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra is 0.895 with a valid category. Validation is done by 3 experts / specialists from Padang State University professor and two teachers from SMK 1 Padang. This is in accordance with Sugiyono (2011) which states that the product validation can be done by experts or experts who are experienced to assess the strengths or weaknesses of the product.

According Sungkowo (2010) the validity of a teaching material is measured by (1) the aspect of material substance consisting of truth, depth, present, and legibility, (2) aspects of learning design that consists of a title, KI, KD, indicators, materials, exercises, composer, and reference, and (3) consists of a display aspect of navigation, typography, media, color, animation, layout and stimulation. The components of the learning device made in accordance with the indicators that have been set on the validity of the questionnaire learning device. In addition, the learning tools are developed in accordance with the measurement aspects of validity (content validity, construct, and language). Thus, it can be concluded that the learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra are made fit for use in learning.

B. PRACTICALITIES OF PHYSICS LEARNING MATERIAL BASED ON PROBLEM BASED LEARNING BY INTEGRATING LOCAL WISDOM OF WEST SUMATRA

Practicalities learning material can be seen from the attractive, efficient and easy to understand the learning material. Based on the analysis of questionnaires implementation of RPP observation that physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra which was developed as very practical. It is seen from the implementation of RPP classified as very practical with the acquisition value of 100.

Practicality learning material can also be seen from the questionnaire responses of teachers and learners' questionnaire responses. The results of questionnaire responses showed practicality teacher learning material are

in the category of very practical value of 96.96. The results of the questionnaire responses of learners also show the practicality of learning material that is in the category of very practical with a value of 82.24. In general the results of data analysis can be concluded that by using a physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra can motivate learners to follow learning in the classroom.

The average value of the practicality of the physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra is 93.07 categorized as very practical. This indicates that the physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra is very practical to use in learning. Teacher experience the ease in carrying out the study. This is similar to Mudjijo (1995:59) states that the practicality demonstrated at the level of ease of use and implementation which includes the cost and time of implementation and the management and interpretation of the results.

C. PRACTICALITIES OF PHYSICS LEARNING MATERIAL BASED ON PROBLEM BASED LEARNING BY INTEGRATING LOCAL WISDOM OF WEST SUMATRA

Developed learning material can be said to be effective if the critical thinking skills of learners has increased and 85% of students have reached KKM set. Based on the results *posttest* of the test critical thinking skills that have been done in class X Audio Video, only 3 out of 31 students who did not reach the KKM. It shows that 90% of learners have reached KKM set so that it can be concluded that the developed learning tools have been effective. This is similar premises Junaidi (2011) which states that one of the criteria for the effectiveness of the views of mastery learning, learning can be said to be complete when at least 75% of the learners have gained the KKM in improving learning outcomes.

It is reinforced by a study of previous studies that have been done Sulardi (2015) which states that the physics learning material with PBL models are valid, practical, and effective way to train the students' critical thinking skills. Susdarwati (2016) in his research indicates that the physics learning material based on *Problem Based Learning (PBL)* on the material and application of Newton's laws fit for use with very good category. Sari (2017) in his research indicates learning device based on Newton's Laws *Problem Based Learning (PBL)* can enhance the problem solving and

cooperative attitude of learners. Oktavia (2016) also states that the development of physics-based learning tools *Problem Based Learning* to improve critical thinking skills and scientific attitudes of high school students.

Development of the physics learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra which in practice is expected to increase the critical thinking skills of students in learning. Activities undertaken in the learning encourages students to be able to apply them in life. This means that the process of resolving the issue is not simply expect the students to understand the material being studied, but how the application of such material can be applied in everyday life. Through the application of learning, learners will feel the importance of learning so that they acquire a deep meaning of what he learned.

Local wisdom of West Sumatra acquired through learning to increase knowledge on self-learners. Learning to use material based on *Problem Based Learning* by integrating local wisdom of West Sumatra is valid, practical and effective can actually help learners improve critical thinking ability even in the form of small scale.

VI. CONCLUSIONS AND RECOMMENDATIONS

Based on the results obtained can be concluded that the learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra has a valid, practical, and effective. Based on the results, the authors suggest that the learning material based on *Problem Based Learning* by integrating local wisdom of West Sumatra can serve as an example for teachers in developing another learning material.

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