The Development Of Collision Module Based On Process Image For Physics Learning In Senior High School

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ABSTRACT

This action research explored the development of instructional material in module form based on process image which valid, practice, and effective at physics learning in senior high school. Physics contained the concepts with the fundamental categorising something into presenting on verbal so the physics concepts are usually abstract so that mental image needed. The development of this module is one of instructional material which can help the student thinking systematic about the physics concepts so that it can learn by students independently. The module must be describing the basic competencies and it will be achieved by students and served with a good language, interesting, and completed by illustration clearly. Process Image interpreted by a series of images (objects, events, phenomenon), which every image of that series always look a different combination overall describing phase stages comprehensive. The development of module in this research is using Thiagarajan design research and development 4D (Define, Design, Develop and Disseminate) and it still at the phase Develops which the result through expert validation and action research that is a plan, action, observe, and reflection during the research. Finally, the collision module based on process image can be used in physics learning.

INTRODUCTION

Physics are about process and product. The Process have the meaning the procedural to discover physics product (the fact, the concepts, the principle, the theory, or the law)
which through the scientific methods (Indrawati, 2011). Physics also need understanding than memorizing, but it has deep meaning focused on forming process through the discovery, mathematical data presentation, or based on some rules. Learning physics are always related with the principle, the laws, and formulas. Physics consists of the concepts. The concepts basically categorizing something into presenting non-verbal, so the concepts usually abstract so that the mental image needed. Physics concepts has a character appropriate with physical and mathematical logic so that both of them have an individual character. The character of that knowledge was not easy for student so that the students must have basic knowledge. Basic knowledge can formed by new experience to the environment daily based on Siregar (Sutarto, 1999). Physics was one of subjects at school which have low result study among the other subjects of science. Based on PUSPENDIK 2015/2016 we know that the result study there is national exam for physics subject in Indonesia still low, with the average value 7.3 lower than chemistry 7.9 and biology 8.2. Learning physics in Indonesia was separated, theoretical, still teacher center learning, the student was passive on learning. Based on the questionnair and limited observation in jember senior high school that was presenting the material at the instructional material still not packaged yet at some topics eventhough have a label. According to that background needed of development instructional material on module form to support physics learning on senior high school. For students, physics module can be assumption that help their process on learning physics systematically about physics concepts, so that it can be learned by self. For teacher, module.

METHODS

Research on model development (process image-module) is implemented in 4D model format developed by S. Thiagarajan et.al (1974: 6-9) consisting of 4 main stages; 1) Define (Limitation), 2) Design (Design), 3) Develop (Development) and 4) Disseminate (Spreading). In general, the four stages can be described as follows. The first was Define, at this define stage, the activities carried out include: Analysis Media model implemented in KBM; Conducting an analysis of the learning models that have been implemented in High School; Learning Model Analysis needed for the implementation of SCL-based and product-based school learning; Perform characteristic analysis of teaching materials model based on SCL and students able to produce the product. The second was Design. Review the theories of the experts relevant to the model to be developed (expert against the model); Validate initial pattern design (prototype) to perfect the design so it is ready to apply; Preliminary study to define the developed model; Undertake studies related to the model to be developed and preliminary studies to identify material characteristics; Design the initial pattern of the image process module (prototype) to perfect the design so it is ready to apply; Gather theories that support the design of the developed model; Prepare a design to review the model (module-process image); Assess the model (process-image module) based on conformity with the designed design. The third was Develop. Creating an planning of learning (RPP) with a model design (module-process image); Constructing a customized RPP with the model (process image module); Implementation test on physics subjects; Testing (process-image module) through the action research cycle includes: plan, action, observe, and reflection to see
the design consistency (prototype); Teaching Materials Products; Prepare the teaching materials so that the model guidebook (process module-image). The fourth was Disseminate. Testing module-image process that aims to see the consistency of products produced through action research cycles include: plan, action, observe, and reflection through deployment to school. The overall design as follows. Validity is a reference to declare an instrument can measure what should be measured. Validation of image-based module process on collision material is a module that has been through the validation phase by several experts and has been declared categorized as valid.

Validity of logic or validation of experts is a validation performed after the instrument concerned has been designed and prepared properly. Logical validation can be achieved if the instrument is compiled in accordance with existing provisions. Thus logical validation is obtained after the completed instrument is completed. According Thiagarajan et. Al (1974: 28) expert validation is still divided into two namely instructional validation and technical validation. Here are some aspects that are in each of the instructional validation and technical validation.

Empiric validity or development test is the validation obtained after tested. Empirical validity can not be obtained simply by the preparation of instruments under the provisions only, but must be proven through experience in the form of field trials. An instrument is said to have empirical validation when it has been tested from experience (Arikunto, 2011:66).

The population of this study is a sample of students of class XI in Senior High School 2 Jember. The sampling technique used is random sampling. The sample is analyzed needs using the consideration that the resource person is the one who knows best about the information that the researcher expects. Activities undertaken to analyze the resource is to make observations about the needs, characteristics of students, academic value and provide tests to measure the ability of students' procedural knowledge skills. Based on the observation result, the sample used for valid image-processing test of SCL learning and the effect of the process-image module implementation on the students' skills is class XI in Senior High School.

The instruments used in this study are: 1) Tool Learning Validation Sheet and Module-image process. This validation sheet aims to get advice and feedback on learning tools and especially on the process-image module. The device validation sheet and Module-process images are used by validators to assess the feasibility of the device and the process-image module from various aspects including material, graphics, language and the display of the process-image module. 2) Observation sheet of student activity. This observation sheet is used to observe student activities during the lesson. In this study the student activity sheet refers to an existing instrument with little modification. This observation was conducted in the experimental class for 5 meetings. 3) Questionnaire Response Students. Questionnaire is used to determine students' responses after SCL learning is done, either with school books or by using the process-image module. 4) Test student ability. To determine whether there is an increase in the skills of procedural knowledge skills resulting from different treatments, students are given a skill test of procedural knowledge skills, which contain the material of the collision and contain the components of the skill component of procedural knowledge. These results are at once used to measure classical completeness of the class to determine the effectiveness of the image-module process.

The data collection techniques in this study is to use: 1) Validation Sheet The
process image module To get a proper assessment of the device and the process-image module and to get input for revision, the questionnaire is provided simultaneously with the device and the image module of the process that has been created. Validator gives a sign (√) on each rating category on a scale of 1-4. The result will be average to get the result of whether the learning device is feasible to use (LD), feasible to use with repair (LDP), and Inappropriate Use (TLD). In addition the validator also provides input in writing on the validation sheet. 2) Observation sheet of student activities This observation sheet is used to observe student activities during the lesson. During the lesson, teachers observe student activities such as understanding problems, solving problems, discussing among friends, presenting results, evaluating problem solving results on modules, making conclusions, and behaviors that are not relevant to KBM. Assessment is done on the group but still done the personal assessment of students, making it easier for teachers to observe.

3) Student Response Questionnaire. To obtain student response data on learning using image-oriented process module SCL then used questionnaire. With this questionnaire can be known how much student response to learning. Responses measured in this questionnaire include student responses as learning progresses, problems presented, learning tools used, and skills skills skills provided. 4) Test the ability of students' procedural knowledge skills. After the collision material is complete, the teacher provides posttest of procedural knowledge skills to determine whether or not there is an increase in problem solving skills in the students. The results of this test are also used as a reference of classical completeness. Students are said to be complete if the value is more than or equal to KKM that is ≥76 If the total students are completed in one class ≥85% then the class is declared thoroughly.

Practical Module The image-based collision process is analyzed based on the observed data of the implementation of learning by two observers and the mean value is analyzed to determine the result of the assessment with equation (Arikunto : 2012).

\[ p = \frac{\sum A}{\sum N} \times 100\% \]

Description: \( p \) = Percentage of learning activity
\( \sum A \) = Number of aspect scores performed
\( \sum N \) = Total score of all aspects observed

Implementation of learning using a process-based collision module is determined by comparing the results obtained and the following criteria:

<table>
<thead>
<tr>
<th>No</th>
<th>Interval Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0,80 ≤ D ≤ 1,00</td>
<td>Very good</td>
</tr>
<tr>
<td>2</td>
<td>0,60 ≤ D ≤ 0,80</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>0,40 ≤ D ≤ 0,60</td>
<td>Good enough</td>
</tr>
<tr>
<td>4</td>
<td>0,20 ≤ D ≤ 0,40</td>
<td>Not too good</td>
</tr>
<tr>
<td>5</td>
<td>0,00 ≤ D ≤ 0,20</td>
<td>Bad</td>
</tr>
</tbody>
</table>

The practicality of the process based image impact module is also analyzed based on the product users, both by teachers and students. Assessment of the project-based collision module of the process by the user with indicators: (1) writing approach, (2) language, (3) clarity of
sentence, (4) implementation, and (5) physical appearance (picture / graph). Scoring uses numbers with a likert scale of 4 choices, ie 4 = very good, 3 = good, 2 = enough, and 1 = less. Instruments that have been filled then sought the average score according to the following equations and criteria: amount of score for specific aspect per maximal score for assessment.

Tabel 2. Assessment Criteria The impact-based Collision Module process

<table>
<thead>
<tr>
<th>No</th>
<th>Interval Average</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,00 ≤ D ≤ 4,00</td>
<td>Very good</td>
</tr>
<tr>
<td>2</td>
<td>2,00 ≤ D ≤ 3,00</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>1,00 ≤ D ≤ 2,00</td>
<td>Good enough</td>
</tr>
<tr>
<td>4</td>
<td>0,00 ≤ D ≤ 1,00</td>
<td>Not too good</td>
</tr>
</tbody>
</table>

The effectiveness of process image module is analyzed quantitatively based on the result of cognitive test of collision material at test phase II, while qualitatively based on learning implementation. Data of research result related to second research question by using descriptive qualitative. The research data are as follows: 1) Student activity data. Data on the observation of student activity during the learning activity were analyzed by using percentage. Observation of student activeness done in group with consideration. Indicators of student activeness include student activities in: Taking into account the teacher's explanation, Understanding the problem presented, Group discussion, Problem solving process, Presentation of process and problem solving result, Questioning ability, Ability to answer questions, Irrelevant behavior during KBM Assessment of student activity in Learning is done by checking (√) on the available column based on the assessment rubric that has been made. The assessment corresponds to the observed facts with a scale range of 1-4. To determine the level of student activity in learning, the criteria are as in Table 3.

Tabel 3. Student Activity Criteria In Learning

<table>
<thead>
<tr>
<th>Range activities (%)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 – 100 more active</td>
<td>90 – 100 more active</td>
</tr>
<tr>
<td>80 – 89 Active</td>
<td>80 – 89 Active</td>
</tr>
<tr>
<td>70 – 79 Enough</td>
<td>70 – 79 Enough</td>
</tr>
<tr>
<td>&lt; 70 Not Active</td>
<td>&lt; 70 Not Active</td>
</tr>
</tbody>
</table>

Student Response Data Students' responses to teaching materials in the form of process image modules are grouped into categories of fun, and unhappy. About student interest in interested categories, and not interested. And also about their feelings during the learning process in the categories of likes and dislikes. To determine criteria of effectiveness of student's response to student's component, interest and feeling during the learning, the following analysis is performed

RESULTS AND DISCUSSION

Process Image interpreted by a series of images (objects, events, phenomenon), which every images of that series always look a different combination overall describing phase stages comprehensive. The development of module in this research is
using Thiagarajan design research and development 4D (Define, Design, Develop and Disseminate) and it still at the phase Develop which the result through expert validation and action research that is plan, action, observe, and reflection during the research.

CONCLUSION
For students, physics module can be assumption that help their process on learning physics systematically about physics concepts, so that it can be learned by self. For teacher, module form can make physics learning easily for planning and implementation on learning because at module form there are include indicators, learning goals, material, and evaluation of learning goals. Modules image process was helpful and flexible so that the researchers are trying to develop this module.

ACKNOWLEDGEMENT
Image process research is important and during learning actually physics learning, it use mental image from each students to thinking the physics concepts material collision.

REFERENCES
Press. Jember

Alfabeta. Bandung

Alfabeta. Bandung


Persada. Jakarta

Jakarta

and Bacon Publisher. Boston

Bandung

Jember

Sutarto. (2004). *Keberadaan Buku Paket Fisika (BPF) SMU sebagai Sarana Penunjang
Pembelajaran Fisika di SMU*. Jurnal Pendidikan. ISSN No: 58. Jember: PMIPA FKIP Universitas Jember.

Fisika dengan Paket Analisis Foto Kejadian Fisika*. Jurnal Pendidikan. ISSN


Tim Universitas Jember. (2012). *Pedoman Penulisan Karya Ilmiah Universitas
Jember*. Jember: Jember University Press.

Berbasis Kompetensi*. Jakarta: PT. Elex Media Komputindo.

Mengajar*. Bandung: Remaja Rosdakarya.
