DEVELOPMENT OF PROCESS IMAGE-BASED STATIC ELECTRICITY RESOURCE PACKAGE IN TEACHING HIGH-LEVEL THINKING OF JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

The innovation of textbooks in science learning is needed for improving the science process skill and student's attitude. Process image-based learning package is textbook innovation that displays the material concept of science in three types of representations that are a microscopic representation, symbolic, and submicroscopic. Image-based learning resource package is expected can improve learning outcomes of learners in the form of concept mastery through high-level thinking process and becomes solution for the limitations of IT-based learning media facilities because of the innovation of static electricity learning resource package illustrates science materials that are abstract and are presented in a sequence of systematic drawings and are designed to be attractive so they can provide strong retention because concepts are built on discovery and high thinking process. The model of this research was adopted from the Four-D development model, including stages of defining, designing, developing and disseminating. The purpose of this research is to test the validity of the development of process image-based static electricity learning package to teach high-level thinking to junior high school students. The determination for validation was conducted by two science education experts (expert judgment) and one junior high school science teacher. The results of the validation of process image-based static electricity learning resource package show that the criteria are very valid with successive scores; 90,74(expert validator 1), 93,74 (expert validators 2), and 93,98 (science teacher validators of junior high school).

Keyword: - *Learning Resource Package, Process Image, High-Level Thinking Skills*

1. INTRODUCTION

The changes in the system of values and patterns of life as a result of the advancement of science and technology and the process of globalization indirectly demand prerequisites of the human ability to get opportunities for participating in it. Education has an important role in preparing human beings with quality that can survive in the global era by improving performance through the learning process followed by system supports, materials, and human resources (Semiawan,1998). Learning in the context of preparing human resources in the future must refer more to the concept of learning planned by the commission of UNESCO in the form of "*the four pillars of education*" that are "*learning to know*", "*learning to do*", Learning to life together to participating and cooperating with others in all human life activities ("*learning to life together*"), and "*learning to be"*. Efforts to improve the quality of human resources can be done through science education (Liliasari,2012). The science learning must be guided by the nature of science as a process, *(a way of investigating*), Science as a product (*a body of knowledge*), and Science as attitude *(a way of thinking*) (Jaya et al.,2014). Science learning in displaying a phenomenon can be presented in the form of three representations, that are macroscopic, submicroscopic, and symbolic, for example in the learning of chemical and electrical concept (Yuliati,2013).

Learning resource is all resources (in the form of data, people, object or environment) that can be used for giving facility (simplicity) for students, (Jalinus, 2016). Jeong *et al.* (2009) mentioned that learning resources help students to build understanding towards problems and help students to give an idea for problem solutions. The more effective students take advantage of various learning resources the higher the level of success of student achievement. Presently, textbooks are still considered important and can facilitate the delivery of information in science learning, even though nowadays is advanced technology era but not all schools can implement the use of digital media in the learning process, besides that, high funding requirements, different parents economic abilities or because considering the effects or negative impacts produced, therefore one solution to the limitations of IT-based teaching media is to use process-based textbooks that can visualize the process of events (object, circumstance, phenomenon), in displaying three representations that are able to overcome problems in learning and abstract material information (Arsyad,2011)

To overcome this problem, then innovation is needed in learning especially development of special textbooks or instructional media that called process image-based static electricity learning resource package that is compatible with curriculum demand by considering learners needs that adjusted to material characteristic and students characters. Learning resource packages have been introduced previously in the research of Sutarto *et al.* (2000) and the result is obtained that "Learning resource packages with photo analysis of physics events can improve student learning outcomes in the form of concept mastery". Besides that, Sutarto *et al.* (2018) stated that image can function as visual-based media to facilitate science learning and according to data analysis conducted using process image media has a significant effect on student activities, skill in analyzing an image and graphic representation.

According to the elaboration above, the author is interested in developing teaching materials in the form of process image-based learning resource packages. This learning resource package is a prototype textbook that is the development of new learning resources but is referring to the renewal or improvement of existing teaching material research. Process image-based learning resource packages will teach high-level thinking skills based on the 21st-century learning framework. This process image-based static electricity learning resource package is expected to be a solution for problems and help students understand the concepts of learning, improve the process of critical thinking, and provide space for students to explore information independently so that the dominance of teachers can be reduced, so that learning is meaningful, interesting and fun, with visualization of images and in the form of continuous images that are systematically expected to make it easier for students to understand abstract concepts and can teach high level thinking skill.

2. METHODOLOGY

This research is a type of development research. The research model was adopted from *the Four-D* development model developed by Thiagarajan, Semmel, and Semmel (1974). The three stages in the 4-D development model including (1) *define*, (2) *design*, (3) *develope*, (4) *disseminate*. The purpose of this research was to test the validity of process image-based static electricity learning resource package to teach high-level thinking. The determination of product validation was conducted by two education experts (*expert judgment*) and one junior high school science teacher. The scoring criteria were referring to the validation scoring criteria (Sujarwo,2006).

$$score = \frac{\text{Total scores from validator in each aspect}}{\text{Maximum total score}} \text{ x } 100\ \%$$

Table 2. Validation Scoring Criteria

No	Average Interval	Criteria
1.	$25{,}00 \leq$ skor $\leq 43{,}75$	Invalid
2.	$43{,}76 \leq$ skor $\leq 62{,}50$	Less Valid
3.	$62{,}51 \leq$ skor $\leq 81{,}25$	Valid
4.	$81{,}26 \leq$ skor ≤ 100	Very Valid

The validity of the picture-based learning resource package process is viewed from four aspects, namely the feasibility of content, construction, graphics, and language. Content feasibility indicators include product suitability indicators with 21st-century education needs, 2013 curriculum, learning objectives, renewability, contextual, material and product functions in forming student character. Suggestions and inputs are concluded and narrated as a

basis for the revision and improvement of products to be developed. Process image-based static electricity learning package to teach high-level thinking is considered valid if at least in the "valid" criteria

3. DISCUSSION

The product developed in this study is in the form of printed media in the form of processing image-based static electricity learning packages that contain contextual material that refers to the 2013 curriculum. Based on the research result of process image-based static electricity learning resource package to teach high-level thinking, the data is obtained as follows:

Result of needs analysis to 20 teachers of state and private Junior High Schools in Jember Regency, all teachers (n=20) stated that they had never used textbooks in the form of image-based learning resource packages. The teacher uses teaching materials in the form of electronic school books (BSE) which contain extensive learning material, worksheets containing summaries of the material and many practice questions, both of which present process images in a small amount of conceptual discovery. This causes learning to be centered on the teacher (teacher center). 14 teachers stated that they had never made homemade textbooks because of the limitations of time, cost and lack of knowledge and experience in the process of making textbooks and 75% of respondents in teaching and learning activities had not facilitated students to learn independently. Result of needs analysis to 9 students from 3 different schools. All respondents were junior high school students aged 12-16 years with the level of intellectual development according to Piaget (Dahar, 2011) at the formal operational stage.all students (n=9) stated that static electricity material is abstract material that is quite difficult to understand. Students are more enthusiastic and active in practicum-based learning, therefore there is a need for learning innovations in place of practical activities and all students agree if this material is visualized in the form of interesting images. All students agree that textbooks in the form of drawing process-based static electricity learning packages will make it easier for students to understand material concepts so science needs to be applied. Based on the table of the results of the needs analysis, it can be concluded that the development of a process image-based static electricity learning package to teach high-level thinking of junior high school students is needed as an effort to improve the quality of results and processes in science learning.

The analysis results show that static electricity material refers to core competencies and basic competencies 2013 curriculum. In this curriculum, science subjects at junior high school are packaged in an integrated manner in science with character formation following core competencies 1. Specifications of learning objectives and concept analysis are the basis for developing process-based learning resource package packages that provide guidance or description of thought processes that can improve the ability to think analytically. In the learning objectives stated after using a static electricity drawing process based on process images, students can analyze the concept of static electricity, analyze the process of loading objects, analyze the interaction of electric forces, analyze factors that influence the electric field, analyze induction events. From the statement above the analysis activity (C4) conducted by students will improve high-level thinking skills and students' independent learning abilities. So the analysis activities in learning by using process image-based learning resource packages are expected to create a supportive learning atmosphere to teach high-level thinking, in the learning process (Kemdikbud, 2018).

The design phase in this study is to compile learning resource packages based on images of static electricity processes and research instruments. The drafting of a learning resource package or initial draft is adjusted to the results of the needs analysis that has been done to the teacher and students. In accordance with learning instruments, namely syllabus that contains of basic competence and Lesson plan . In addition, the process of designing process-based static electricity learning source packages is adapted to the characteristics of process images, namely the existence of a series of sequential images and it appears there are relative differences in terms of shape, condition, position which can overall describe a sequential stage and become a unified whole. The product design process begins with the selection of media following the needs analysis, following the initial design of the development of a process image-based static electricity learning package in teaching high-level thinking to junior high school students, interest, contextually relevant, following learning objectives, student needs and characteristics. The selection of image-based learning resource package media process is also chosen as the most appropriate media because it considers the funding factor, the limitations of android-based learning facilities, and the negative impacts that are caused and to reduce the dominance of verbalistic subject matter delivery systems. The following is the initial design of the development of a picture-based static electricity learning resource package to teach students high-level thinking.

Table 1: Design of Image-based Learning Process Source Package

No	Components of The Book	Design
1	Introduction	a. *Cover of a learning source package* b. Cover page c. Preface d. Table of contents e. Directions using the learning source package e. The Main Competence and The Basic Competence f. Motivational Words g. The Conceptual Map h. The Learning Purpose and Keywords
2	Content Presentation with Process Picture Based	a. Topics: • History of Electric Charge • Atom as the composer of the material basis • Electrical Charge Interaction • Coulomb Law • Electric Potential • Electric Charge Induction • Electroscope • Lightning Natural Phenomenon b. Components of supporting materials: • Apperception • Let's find it • Science horizon • Character Education • Students' Test • Mini Laboratory • Honesty Checklist • Evaluation
3.	Closing	a. References b. Index c. Glossary

Based on Table 1 shows that the design of the development of a process image-based learning resource package consisting of 3 parts, namely the introduction, contents, and closing sections. In the Preliminary section consists of a cover, cover page, table of contents containing all components of the book along with the page, instructions for using learning resource packages, core competencies, basic competencies, and learning objectives to be achieved. In the content section contains the delivery of material information in the form of 14 series of process images that guide students to find concepts, equipped with supporting components such as logo images "test students" which are instructions for students to test high-level thinking skills, "apperception" logo containing things or phenomena that are close to everyday life so students can know the relevance of material to the reality of everyday life. The "tick" logo which aims to establish the character of honesty following the strengthening of character education, where students are expected to check the different color columns to determine students' understanding of the material. "Science horizon" contains additional information related to the material. The "mini-lab" logo is practicum-based learning that is equipped with a component of scientific thinking.

The development stage in this study includes validation activities and limited testing of Image Process-based learning resource packages. Validation of the process image-based static electricity learning package in four aspects, that are the feasibility of content, construct, graphic and language (Akker, 2013). Validation was carried out by an expert validator namely the postgraduate lecturer at the University of Jember and the validator of the user of a science junior high school teacher. Validation scoring criteria based on scoring criteria (Sujarwo,2006). The following are some sample images from expert validation process-based static learning source package to teach students high-level thinking of junior high school students.

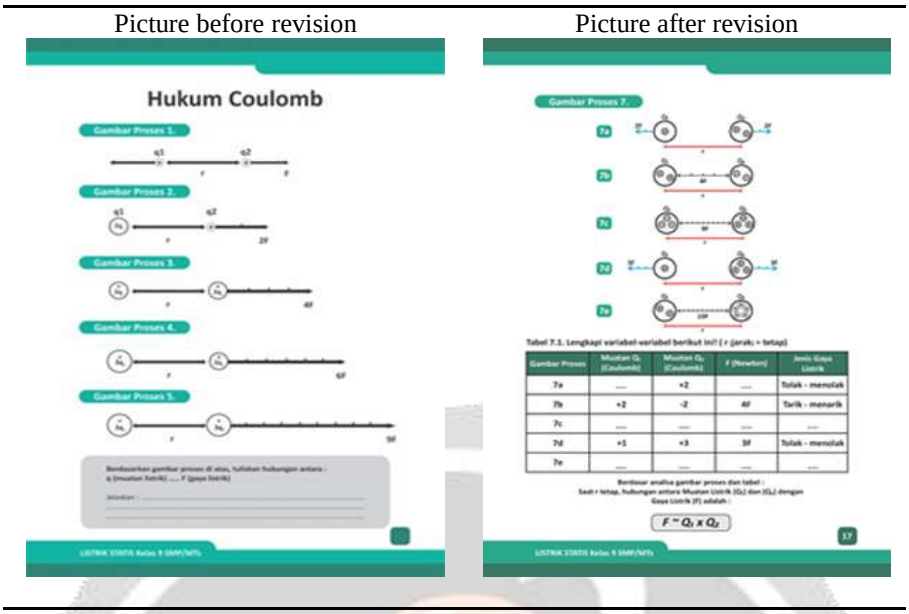

Fig. 1 Process Image of Coulomb's Legal Material

In the image before revision, determine the size of distance (r) is not right, this often happen in commercial textbooks that students use in learning should becomes the initial reference to determine the distance is from the midpoint of objects contains of Q1 to the midpoint of object contains of Q2, beside that, Coulomb Force (F) representation must happen to all objects that are electrically charged, color addition in distance (r); Electric Charge (Q); and Coulomb Force (F) must be consistent. The addition of a table that contains guidance on the discovery of concept and formula contains questions about the level of high thinking.

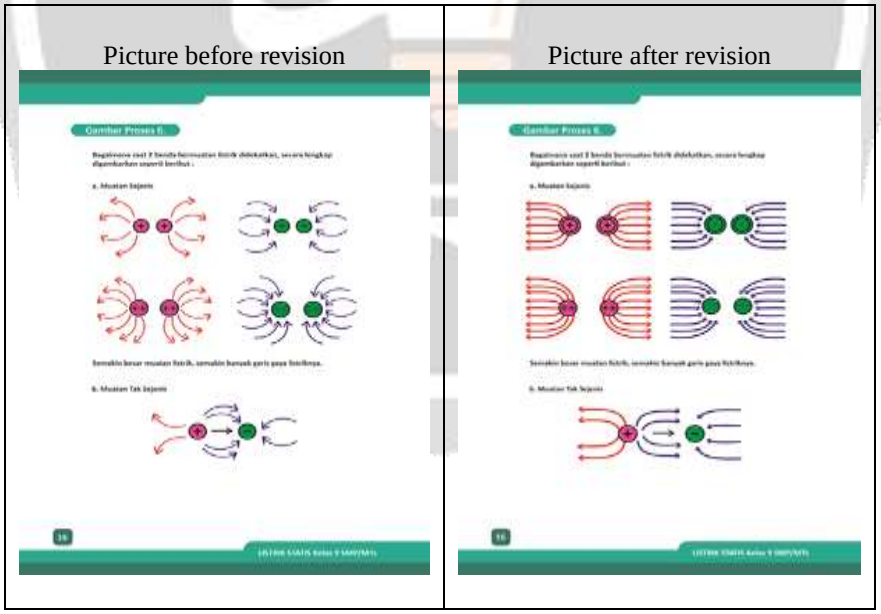

Fig. 2 Process Image of Electric Force Line Material

Force line representation as in the process image before revision from the validator can lead to conceptual errors in students. The existence of an electric field on charged objects is illustrated by imaginary lines that cannot intersect with each other, the results of validity analysis of process image-based static electricity learning resource package by experts are presented in table 3.

Table 3 Validation Result Data

Expert Validator	Obtained Score	Score	Interpretation
Expert Validator 1			
• Content Appropriateness	52	92,85	
• Construct Validation	52	92,85	
• Graphic Appropriateness	45	86,53	
• Language	47	90,38	
Total	**196**	**90,74**	**Very Valid**
Expert Validator 2			
• Content Appropriateness	54	96,42	
• Construct Validation	53	98,07	
• Graphic Appropriateness	51	98,07	
• Language	51	96,75	
Total	**209**	**96,74**	**Very Valid**
The Average		**93,74**	**Very Valid**
Users' Validator			
• Content Appropriateness	53	94,64	
• Construct Validation	49	87,50	
• Graphic Appropriateness	50	96,15	
• Language	51	98,07	
Total	**203**	**93,98**	**Very Valid**

During the validation process, the book is repaired twice because there are some components of the image process that are not right, this can cause material concept errors. Based on the advice on the first revision, the researcher made improvements to the product and then validated it again. Based on the table above, the results of the assessment of process image-based static electricity learning packages from expert validators 1 and 2 are classified as very valid with the acquisition of values 90.74 and 96.74. Likewise, the validation results from user validators that meet very valid criteria with a value of 93.98 Thus, overall the average score of the 3 validators for the process image-based static electricity learning source package is very valid with a mean value of 93.74. This shows the package learning resources for static electricity can be used in junior high school science learning.

4. CONCLUSIONS

Based on validity analysis by expert validators, the average value obtained is 93,74 where that value is in interval $81{,}26 \leq \text{score} \leq 100$ with criteria of very valid. As well as the result of the validation of the user validator, it is obtained a value of 93.98 with very valid criteria. Description of suggestions and input from the three validators are the basis for improvement of each component of the learning resource package, so it is stated that the process image-based static electricity learning package to teach high-level thinking is very valid and feasible to use.

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