Analysis of image representation capability in physics learning through the textbook based process image

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Abstract. Physics is closely related to verbal concepts, pictures, graphics, and mathematics. The results of learning physics can not only be seen through the ability of students to represent physical concepts verbally and mathematically, but can also be seen through the ability to represent in the form of images and graphics. This study aims to analyze the abilities of students in interpreting process images in physics learning in the subject of direct current electricity. This study uses quantitative descriptive research by involving high school/MA grade XII students as research subjects. The analysis in this study was carried out with the analysis of several related journals. The results showed that the level of students' ability to interpret images in textbooks based on physics learning through physics based textbooks in the process included in the sufficient category.

1. Introduction

Physics is a part of science that studies nature and its symptoms which consist of processes and products [12]. Physics does not only contain knowledge to memorize, but in physics it emphasizes the process of forming knowledge and mastery of concepts in the minds of students in the learning process. Thus, in learning physics students are required to be able to build knowledge in themselves with an active role in the teaching and learning process [11].

One of the most important components in learning is the Learning Implementation Design (RPP), one of the elements of the lesson plan is a learning resource. Learning activities can run effectively and efficiently if learning resources are available, and one example of learning resources is teaching materials in the form of textbooks [2][15]. Textbooks have an important position and function in learning activities [8]. With the existence of textbooks, students can learn coherently so that they master a complete competency.

In physics lessons are closely related to verbal concepts, pictures, graphics, and mathematics [9]. Multirepresentation ability is the ability of students to present the information they get in the form of verbal, mathematical, pictures and graphics [5]. Physics learning outcomes can not only be seen through the ability of students to represent physics concepts verbally and mathematically, but can also be seen through the ability to represent in the form of pictures and graphics. Students who can represent them in verbal form are not necessarily able to represent physics concepts in mathematics, pictures, and graphics [9]. In this study focused on how students can represent images.

Based on the above problems, a solution is needed to solve these problems. Given the importance of textbooks in a physics learning process, an alternative solution to solving the problem of students' low image representation ability is to develop a textbook that is effective and efficient for use in physics learning that provides facilities for students to be able to learn maximally. Textbooks that have been used so far have not been able to properly facilitate the learning process [16]. This is supported by the results of observations in several physics textbooks used by high school students. These textbooks generally only contain material by displaying a lot of writing and lack of supporting pictures, so that it makes students less interested and has difficulty in learning and remembering existing material. The pictures in the textbook cannot facilitate students in understanding the concepts of physics.

Based on this, researchers will develop a textbook in which it presents a picture that explains a
process of physical events. This textbook is called a textbook based process image. Process image is a series of modeling images of objects, events or phenomena, in which there are relative differences between one image and another in terms of circumstances, positions, forms, and their combinations, which as a whole describe a coherent stage and constitute a complete unity [14]. Process image will greatly assist students in analyzing and reasoning about an event more coherently without having to present the real event.

2. Method
This research tend as research survey, with an emphasis on study: 1) book source of reference beginning; 2) description of subjects; 3) learning model commonly used beforehand; 4) research results before relating to the effectiveness of physics learning with textbook; 5) research results before relating to the effectiveness of process image in physics learning; 6) research results before relating to the analyze image capability in physics learning.

Technique data collection used in this analysis is interview, observation, documentation, scientific journal, prosiding, and the reference books. The data is analyzed and described qualitatively. The subject of study this is a Jember high school student. Focus on this research is to analyze the image representation capability in physics learning through the textbook based process image.

3. Results and Discussion
3.1. Research results before relating to the effectiveness of physics learning with textbook
The results of the study related to the effectiveness of physics learning with textbook obtained from scientific journal, article, and reports research shows that using the textbook effective in learning. Some research results can be seen in table 1 below.

| Year | Result                                                                 | Author                       |
|------|------------------------------------------------------------------------|------------------------------|
| 2019 | The content of 21st century skills in the book raises more critical thinking skills, problem solving, and decision making with an appearance percentage of 61.86%, communication skill with the percentage of 14.81%, creativity and innovation skills emerge with a percentage of 14.88%, while collaboration skills become skills with the least emergence with a percentage of 7.44%. | Wakid Rima Oktafianto, Hartono, Sulhadi |
| 2014 | Textbook are a means of the success of the teaching and learning process. | Greene and Patty             |
| 2015 |                                                                        | Hanifa                      |

3.2. Research results before relating to the effectiveness of process image in physics learning
The results of the study related to the effectiveness of process image in physics learning obtained from scientific journal, article, and reports research shows that using process image effective in learning. Some research results can be seen in table 2 below.

| Year | Result                                                                 | Author |
|------|------------------------------------------------------------------------|--------|
| 2017 | 51 out of 60 students find it easier to understand a concept when explaining with a process image. | Harianto |
| 2017 | process images can make students more interested and active in solving problems in learning | Yusmar |
| 2005 | Images can also focus attention on a particular problem, and this helps individuals remember more concepts relevant to the problem | Sutarto |
3.3. Research results before relating to the analyze image capability in physics learning

The results of the study related to the analyze image capability in physics learning obtained from scientific journal, article, and reports research shows that analyze image capability in physics learning. Some research results can be seen in table 3 below.

Table 3. Research results before relating to the effectiveness of process image in physics learning

| Year | Result                                                                 | Author                                    |
|------|------------------------------------------------------------------------|-------------------------------------------|
| 2019 | Verbal explanation through the text will become easier to understand if the text is completed with pictures or graphics that correspond to the material. | Anis Yulia Amanati, Wasis, dan Muslimin Ibrahim |
| 2003 | Stating that multiple representation can support the construction of deeper conceptual understanding. | Mayer                                     |
| 1994 | Stating that the processing of information in the formation of the concept will be easily called when stored in long-term memory, especially in the form of images. | Maltin                                    |
| 2006 | Stating that multiple representations can be used so that one representation constrains interpretations of another one. Often learners can find a new form of representation complex and can misinterpret it. In this case one might use a second, more familiar or easy to interpret, representation to support learners’ understanding of new complicated representation. | Ainsworth                                 |

4. Conclusion

Physics learning outcomes can not only be seen through the ability of students to represent physics concepts verbally and mathematically, but can also be seen through the ability to represent in the form of pictures and graphics. Learning physics using physics textbooks based process image has several advantages, including students can develop their thinking power by digging and finding information themselves, active teaching and learning processes, students dare to express their opinions, are critical in analyzing and identifying a problem, students can apply knowledge that is owned to solve a problem, students more easily understand the concept of physics, student learning will be more meaningful so that the knowledge gained is easier to remember. Learning using physics textbooks based process image is expected to strengthen the image representation image capability to the maximum.

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