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BAIF CHARACTERISTICS WAVE AND OPTICS TO TRAIN SCIENCE LITERACY ABILITY BY RVGM OF JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

This article describes BAIF characteristics (physics textbook) to train science literacy ability through VGM representation of junior high school students. The aim of research is how BAIF characteristics to train science literacy ability through VGM representation of junior high school students. The aim of research can be described into two problems. First, is BAIF consist of the example of application refer to science literacy ability? Second, how is the BAIF writing pattern for junior high school students? Type of this research is R & D (Research and Development). The research is started by collecting qualitative data, and then arranging draft of BAIF until to be BAIF which ready to validation. The subject of research is BAIF to train science literacy ability through VGM representation of junior high school students. The respondents of research are students of 8th grade junior high school in even semester. The technique of collecting data is observation, questionnaire, test, and document. The result of research shows that BAIF characteristics has been consists the example of application to train science literacy ability through VGM, and has a pattern of writing order such as title, title of sub topic, material feature, example of exercise item, exercise item as competence test, and references.

INTRODUCTION

Education is believed as agent of renewal which existence must able to prepare future generation who can compete in global society life (Siburian, 2013). Education can be held as well as learning activity. Learning activity is not good caused by: (1) curriculum or components are not good (Sudjana, 1991, Fattah, 2000); (2) Teacher competence (professional); and (3) students ability to study physics is low (Dahar, 1989).

Science literacy ability of Indonesian students is still low until now. It is proved by the result of research who done by PISA and held by OECD (Organisation for Economic Co-operation and Development), in 2006 science literacy ability of students is 50th rank of 57 countries (OECD, 2009), and then in 2009, Indonesia is 60th rank from 65 countries (Balitbang, 2011), in 2012 Indonesian students is 64th rank from 65 countries. And recent result of PISA in 2015, Indonesian students is 69th rank from 79 countries. PISA is literacy study which purpose to research about reading ability (reading, literacy) of students who have age 15 years old, mathematics (mathematics literacy) and science (scientific literacy) which consist of question identification, get new knowledge, describing scientific phenomenon, and writing the prove based on conclusion (OECD, 2016).

The role of teaching material in education process is important and also decide the aim of education can be reached, Hayati (Mahardika, 2011). Alwasilah (2005) said that teaching book has important role in education system. the process quality and education result are affected by teaching material used. The physics books now show physics concept in verbal and mathematics. Presentation through picture or chart still few or nothing in every topic. It causes many students difficult to draw and graph the physics phenomena. And many students difficult to explain a picture or chart of physics phenomena. This problem is caused by teaching material used as learning source consist of a few exercise questions which related with picture of physics phenomena.

The physics concepts by multiple representation is combine verbal concept, picture concept, and mathematics concept are needed by students to apply in physics learning. By RVGM ability, students have comprehended physics concept. It means they can present physics concept by verbal, mathematics, and also draw physics

concept. If students' RVGM ability increase, so automatically their ability to comprehend physics concept also increase, and it means that they can explain physics concept to another people. Because of that, it is needed teaching book of natural science – physics (BAIF) which can increase representation ability of verbal, picture, mathematics to exercise science literacy ability.

Characteristics of teaching book which can increase RVGM ability to exercise science literacy ability is teaching book which has writing pattern based on writing procedure: 1) analysis, 2) design, 3) develop, 4) evaluation, and 5) revision. Another that, the teaching book writer also sees division every chapter, example is every chapter divided into 3 (three) parts namely introduction, presentation and conclusion.

Finally, it needs to do research with books or students worksheet, "Developing Teaching Book of Natural Science – Physics (BAIF) wave and optics to exercise students' science literacy ability through RVGM" need applied.

METHOD

This research tends to be a survey research, with emphasis on: 1) early reference source books; 2) description of subjects; 3) initial condition of textbooks; and 4) previous research results which related to representation and related to develop textbooks. Based on research activity, the research data tends to be qualitative descriptive data. The data obtained by observation technique, questionnaire, document and literature study on various source, such as: book, scientific journal, article, research report and other as secondary data. To obtain the result and conclusion, the data obtained is analyzed by descriptive analysis. Subject of this research is textbooks of Natural science – physics (BAIF) wave and optics that can train science literacy ability based RVGM for junior high school students. While the respondents of research is students of 8th grade of junior high school 1 Jember.

RESULT AND DISCUSSION

Research related to science literacy ability

The results of previous research in some countries which related to science literacy ability obtained from scientific journal, article, and research report show that

science literacy can give effect to student performance and improve student literacy ability.

Table 1. The result of research related to science literacy

Year	Product and researcher
2015	Visual reading ability to improve students learning can be important step in future for implementation and development of junior high school which more successful. Chi-Kim Cheung& Aditi Dubey Jhaveri
2016	Literacy strategy in topic based learning has significant effect to improve reading competence of physics in secondary school, implementing literacy strategy can improve reading and writing competence of physics Indonesian student Selly Feranie, Ridwan Efendi, Saeful Karim and Dedi Sasmita.
2016	By textbook design oriented to science literacy in environment pollution topic can improve student science literacy ability. Nisa Hanifan Fitriani, dkk.
2016	Comprehending profile of letter skill show that scientific literacy is low under 50% for all categories. Evaluation instrument which is developed able to fill content validity, construction, and suitable with criteria valid, more valid and valid. Ani Rusilowati, Lina Kurniawati, Sunyoto E. Nugroho, Arif Widiyatmoko.
2016	Student skill in improving syntax can be a useful instructional device to support developing literacy. Youngmin Park & Mark Warschauer

Research related to physics representation

The results of previous research in some countries which related to verbal representation, picture and mathematic which are obtained from scientific journal, article and research report show that representation can give effect student performance, can improve student representation skill. Some the result of research is shown by table 2.

Table 2. The result of research related to physics representation

Year	Product and Researcher
2006	Learning environment roles to develop modern physics representation. The use of difference representation and chosen representation support representation skill of university students. Patrick B. Kohl &Noah D.F.
2006	Performance of university students depend on complete fundamental physics problem representation and student of university have consistence opinion but lack of correlation with performance Patrick B. Kohl and Noah D. Finkelstein.
2011	Difficulty which is influenced by many imagination mental can be solved through representation

Year	Product and Researcher
	I Ketut Mahardika
2012	Multi-representation approach used in interactive conceptual learning program has high efektivity for giving comprehension the concept of work and energy to student of university. Suhandi dan Wibowo.
2012	Multi-representation is one of approach which enough effective used for giving comprehension physics concept of university students. Suhandi, dan F.C. Wibowo.
2015	Inquiry learning model instrument can train multi-representation physics skill of senior high school students in heat topic in order to make students easy to visual the abstract concepts. Binar Kurnia Prahani, Soegimin W. W., Dan Leny Yuanita

Research related to develop of textbook

The results of previous research related to develop of textbook is informed that research about textbook which focus to develop of textbook for increasing skill to increase verbal representation skill, picture and mathematic is nothing. From the result of research, we find that research to develop textbook as shown by table 3.

Table 3.Research related to develop of textbook

Year	Product and Researcher
2005	Physics textbook with physical phenomena picture analysis assignment in physics learning activity of senior high school can appeal student mental in concept achievement level which tend to high category. Sutarto
2009	Fundamental physics textbook for student of university as a candidate biology teacher consist of physics principles which is required by student of university; reading textbook level of fundamental physics for candidate biology teacher is high category; The use of fundamental physics textbook for candidate biology teacher can improve comprehension physics concept. Toto.
2013	The score of every indicator textbook consist of characteristic value can be decided from average of 5 indicator such as the complete of textbook, content, language, textbook performance and graph textbook. Mila Anggela, Masril, dan Yenni Darvina.
2013	Pocket book which developed in research is scored by assessment guide from BSNP namely assessment instrument step 1 and 2. Validity step 1, pocket book is validity by using validity instrument step 1 from BSNP such as content aspect, performance aspect, and the graph aspect. Nurul Laili Rahmawati , Sudarmin, dan Krispinus Kedati Pukan
2015	The result of research shows that (a) game includes elaboration potential to study physics concept which is measured by concept map and (b) concept map is more suitable than multiple choice item for determining the effect of commercial game in cognitive elaboration. Chuen-Tsai Sun, Shu-Hao Ye, &Yu-Ju Wang
2017	Physics web textbook which is developed consist of content characteristic, visual

Year	Product and Researcher
	design and navigation with "good" qualified. Angga Bagja Nugraha, Taufik Ramlan Ramalis, dan Purwanto.

The result of syllabus analyze and relation between natural science – physics concept with verbal representation, picture and mathematic (RVGM) from used previous textbook as main standard can be shown by table 4.

Table 4.Relationship between wave and optic concept with RVGM

Concept	Representation		
	Verbal	Picture	Matematics
Wave			
Vibration at Pendulum and Spring	√	√	√
Period and Frequency	√	√	√
Pendulum swing speed	√	√	√
Transverse waves	√	√	√
longitudinal wave	√	√	√
sound waves	√	√	√
Implementation concept	√	√	√
Optics			
Mirror	√	√	√
Lens	√	√	√
Eye	√	-	√
Optical devices	√	√	-

Information:

√ = There is a representation

– = No representation

From table 4 above shows that all wave concept present verbal, picture, and mathematic and optic concept is just several natural science – physics concepts of 8th grade junior high school present picture. Because of that, it needs to give different characteristic or something for making textbook. It is needed to design character textbook of Natural science – physics which able to improve RVGM skill through the correct science literacy based on analysis and research, so it is already to use by junior high school as main guide textbook from government.

Natural science – physics textbook (BAIF) can train science literacy ability through RVGM has characteristics such as: topic title; sub topic title; material feature present concept by verbal and mathematic; exercise item; and competence test item; and

references. An example of research to verbal representation, picture, and mathematic can shown by exercise item below.

The time needed by transverse wave to spread from A to B is 3 second. What is the wave velocity?

Solution:

First step we draw explanation of verbal problem, so it obtained figure 1. It shows that wave A-B spread direction is perpendicular to vibration direction. Transverse wave forms wave crest and wave trough spread

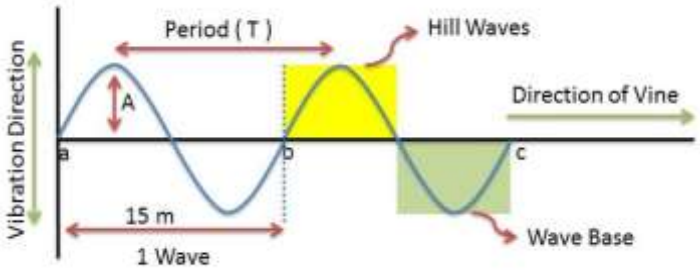

Figure 1.

The wave velocity written by (v) means the distance travelled in each second, "the wave velocity is multiplication between wavelength λ (read: lambda) with frequency"

$$v = \lambda . f \qquad \text{..... 1.1}$$

From formula 1.1, we can produce several formula:

$$\lambda = \frac{v}{f} \qquad \text{..... 1.2}$$

Because frequency is inversely proportional to period f = 1 / T, so:

$$\lambda = \frac{v}{1/T} \qquad \text{..... 1.3}$$

$$\lambda = v . t \qquad \text{..... 1.4}$$

To find wave velocity based on 1.4 obtained:

$$v = \frac{\lambda}{t} \qquad \text{..... 1.5}$$

So the wave velocity from A to B for 3 second is:

$$v = \frac{15\ m}{3\ s} = 5\ m/s$$

CONCLUSION

The result of research shows that natural science – physics textbook (BAIF) wave and optic consist of the example of application with contextual figure about physics phenomena; and it has writing pattern such as title of topic, title of sub topic, material feature, example of exercise item, competence test item, and references.

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