



DEVELOPING OF SCIENCE TEXTBOOK BASED ON SCIENTIFIC LITERACY FOR SEVENTH GRADE OF SECONDARY SCHOOL

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ABSTRACT

The aims of this study are to produce of science textbook based on scientific literacy; to kind of the characteristics of science textbook, knowing feasibility and readability of the science textbook. The study start with product development and then continued by feasibility test and readability test. Feasibility test was done with the respondent are lecturer and science teacher of VII grade at SMP Negeri 1 at Magelang, Purwokerta, and Cilacap. Readability test uses cloze test that filled by VII grade students. The cloze test was done at SMP Negeri 1 Magelang, SMP Negeri 1 Purwokerto, and SMP Negeri 1 Sidareja Cilacap. The study results in feasibility test show that the literacy science textbook that developed has average score >81,25% of percentage from validators. It means the literacy science textbook is suitable. Based on the readability test result, science literacy textbook is easy to learn. The score of cloze test that science literacy textbook is >57% from each respondents.

Key Word: Science Textbook, Scientific Literacy

INTRODUCTION

Science development influences technology. Education that close with technology is science education. Understanding and using science concepts in daily life problems and simple technology is the goal of science education. Based on that goal, education must focus on scientific literacy as stated by National Research Council (1996). Scientific literacy defined by OECD (Organization for Economic Co-operation and Development) as an ability to conclude and to solve problem about nature and interaction between nature and society (Nbina dan Obomanu, 2010).

Science education has been applied in Indonesia for years, but the result in international level Indonesian is on bottom rank especially for scientific literacy focus. Based on Badan Penelitian dan Pengembangan or Balitbang data (2011) the PISA (Programme for International Student Assesment) in 2000, 2003, 2006, and 2009 Indonesian students got 393, 395, 393, and 383 in a row for scientific literacy score in focus. Those score got rank 38 from 41 countries (2000), 38 from 40 countries (2003), 50 from 57 countries (2006) and 60 from 65 countries (2009). All the results were on the under international mean score that is 500. The newest result of PISA in 2012 based on OECD data, Indonesia got 383 score and rank 64 from 65 countries. One of the factors that influence student's scientific literacy result is

the textbook selection. This statement appropriate with the Irawan's study result (2013) that is one of the cause's factors the lowness of student's scientific literacy result is textbook. Textbook is the learning source that connected directly to the students and close to them.

A science textbook that based on scientific literacy must has some basics categories (Chiapetta, et al, 1991). Those basics categories are science as the body of knowledge, science as the investigative nature, science as a way of thinking, and Interaction of science, environment, technology and society.

Science as the body of knowledge. This category typifies most textbook and presents information to be learned by the reader. Textbook materials in this category are presents facts, concepts, principles, laws, hypotheses, theories, models and asks student to recall knowledge or information.

Science as the investigative nature. This category reflects the active aspects of inquiry and learning, which involves the student in the methods and processes of science such as observing, measuring, classifying, inferring, recording data, making calculations, experimenting, etc.

Science as a way of thinking. This aspects of the nature of science represent thinking, reasoning, and reflection, where the student is told about how the scientific enterprise operates.

Interaction of science, environment, technology, and society. This aspects of scientific literacy pertains to the application of science and how technology helps or hinders humankind.

Scientific literacy on the textbook that used in common schools especially for VII grade has not balanced, it's appropriate to the Hastiti's study result (2014), Rusilowati (2014), Rusilowati & Yuliyanti (2015) that the contains of the scientific literacy aspects have been include in textbook, but the proportion of each aspects have not balanced. The available textbook in only concentrate in science as a body of knowledge aspect. This aspect present facts, concepts, principles, laws, hypothesis, theory, model and questions and has biggest percentage, 58, 24%. Student's scientific literacy can be raised by presenting the science material which interrelated with technology and society issues. One of the present issue which connect with science in society is pollution (Subiantoro, et al, 2013). As the solution of those problems, it needs to develop a science textbook that based on scientific literacy.

METHODS

This study was used Research and Development (R&D) procedure that has been modified as potential and problem, data collecting, product design, product validation, product revision, initial product try-out, product revision, product try-out, and product revision to becoming a final product. The product of this study is science textbook based on scientific literacy seventh grade secondary schools. Product try-out conducted in SMP Negeri 1 Magelang, SMP Negeri 1 Purwokerto, and SMP Negeri 1 Sidareja Cilacap, Central of Java.

The potential and problem of the research are the lowness of student scientific literacy in international level and the lack of science textbook that developed based on scientific literacy aspects at school. Data of curriculum and scientific literacy aspects are needed, so before making design of the product, data collecting was done first. Product design was validated by validator.

The assessment of validity done by lecturer and science teacher of VII grade at SMP Negeri 1 at Magelang, Purwokerta, and Cilacap. Feasibility test uses questioner based on Badan Standar Nasional Pendidikan (BSNP) feasibility textbook aspects. The readability level of the textbook was measured by Cloze Test.

RESULTS

Results of this study are characteristics, feasibility, and readability of science textbook based on scientific literacy.

Characteristics of Science Textbook

The developed science textbook contains scientific literacy aspects completely. Product of the studies are three science textbooks especially with theme Knowing of Heat (A), Motion (B), and Matter Changes in Environment (C). The balance proportion of the scientific literacy aspects are showed by the indicators for each aspect in every material in textbook. The aspect of science as the body of knowledge has 40% of indicators from all indicators in one material, and the others aspects have 20% of indicators for each.

Science materials in grade VII presents as integrated subject, and in this product the integration type of the materials uses Connected model. This model relates one main topic to the next topic, one concept to the other concept, one skill to the other skill and today's work to the tomorrow's work in the study (Fogarty, 1991). Materials of science textbook are construct of some indicators. The indicators are construct of four scientific literacy aspect. Table 1 is show the sample of indicators for construct of the material textbook theme Matter Changes in Environment (Puspaningtyas, et al., 2015).

Table 1. Indicators to Construct Material Textbook by Scientific Literacy Theme Matter Changes in Environment.

Number	Scientific Literacy	Indicators
1	Science as the body of knowledge	<ol style="list-style-type: none"> 1. Mention the characteristics of material in student's environment. 2. Define and differentiate physics changes and chemistry changes from phenomenon in the environment. 3. Mention the signs of chemistry changes. 4. Differentiate mixture and non-mixture.
2	Science as the investigative nature	<ol style="list-style-type: none"> 5. Mention the signs of chemical reaction in simple experiment. 6. Doing mixture separation based on physics and chemistry characteristics.
3	Science as a way of thinking	<ol style="list-style-type: none"> 7. Describe the idea development of dynamite making. 8. Describe cause and effect from physics changes and

4	Interaction of science, environment, technology and society	chemistry change in rain phenomenon.
		9. Describe the work steps and benefit of water distillation technology.
		10. Describe the use of science as problems solution for humankind (artificial rain technology).

Textbook characteristics are contain all of four scientific literacy aspects and has a balance proportion of scientific literacy aspects. Four scientific literacy aspects presented on main part in textbook, they are Ayo Belajar (representation of Science as the body of knowledge), Mencoba Yuk (representation of Science as the investigative nature), Ayo Berpikir Ilmiah (representation of Science as a way of thinking), and Sains dalam Kehidupan (representation of Interaction of Science, Technology and Society). Main parts of this textbook presented at Figure 1.



Figure 1. Feature of Science Textbook Based on Scientific Literacy

Feasibility of Science Textbook

Feasibility test was used questioner based on Badan Standar Nasional Pendidikan (BSNP) feasibility textbook aspects. There aspect feasibility are content, language, graphic, and one aspect development is science literacy content. Results of score feasibility textbook by validator presented at Table 2.

Table 2. Result of Score Feasibility of Science Textbook

Theme	Validator	Content Feasibility (%)	Presentation Feasibility (%)	Language Feasibility (%)	Graphic Feasibility (%)	Science Literacy Content (%)	Average (%)	Category
A	1	87,50	86,30	88,50	89,60	88,00	89,22	Very
	2	87,50	93,80	86,50	93,80	89,80		Feasible
B	3	95,31	98,75	94,23	97,73	96,30	90,42	Very
	4	95,31	92,50	98,08	100,00	98,15		Feasible
C	5	89,71	80,00	92,31	88,46	90,74	87,34	Very
	6	85,29	85,00	84,62	86,54	90,74		Feasible

Readability Textbook

Data of the readability textbook were collected by test cloze. The data were shown in Table 3.

Table 3. Average of Readability Textbook

Number	Theme	Readbility Index (%)	Category
1	A	72,43	Easy to read
2	B	71,80	Easy to read
3	C	80,05	Easy to read
Average		74,76	Easy to read

DISCUSSION

The balance proportion showed on the percentage indicators for each aspects. The first aspects

(*Science as a way of thinking*) has 40% number of all indicators, and the other aspects has 20% for each. The balance proportion of scientific literacy aspects for science textbook is 2:1:1:1. This design conducted with Wilkinson (1999) statement.

Feasibility test result was shown on Table 2. From the data, the average feasibility result got percentage >81,25%, it means the developed science textbook classified as a very feasible learning source. The result showed that the textbook as the product was well developed. The developing process was pointed from Panduan Pengembangan Bahan Ajar that published by Depdiknas (2008). One of the important point for textbook developing according to Depdiknas (2008) is the material must be derived from competences that will be achieved. Those competences were shown as the indicators or learning objectives.

Readability test result showed positive score that got percentage average > 57% that is 74.76%. Higher percentage is 98.25% and lowest is 61.93%. It means the developed textbook was easy to read and to learn. Some of the result was means some correspondent that having difficulty to learn the developed science textbook. One of those difficulties is their lack of vocabulary. This result is connect with Essem Educational Limited (2007). They said the textbook readability was influenced by text format, ability reader, difficulty of vocabulary, structure text and syntax.

Good readability was easy to read, behind show the good quality of textbook. It's same with Devetak & Vogrinc (2013) statement's. They were said textbook quality looked at word, sentences, and text. The result of them research 90% students make conclusion about Science with sentences.

CONCLUSION AND REMARKS

Based on results and discussion, it can be concluded that the developed science textbook has a complete scientific literacy aspects that presented on main part of the textbook. They are Ayo Belajar (*Science as the body of knowledge*), Mencoba Yuk (*Science as the investigative nature*), Ayo Berpikir Ilmiah (*Science as a way of thinking*), and Sains dalam Kehidupan (*Interaction of Science, Technology and Society*). Developed science textbook also has a balance proportion of scientific literacy aspects that showed at the percentage of indicators for each aspects. The first aspects (*Science as a way of thinking*) has 40% number of all indicators, and the other aspects has 20% for each.

The feasibility test result of developed science textbook is > 81, 25%. It is mean science textbook is very feasibility. The readability science textbook is 74,76%. It means the developed textbook was easy to read and to learn. Both of them show that the developed science textbook is feasible and readable.

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