



The Development of Earth Layer Material Booklet Based on Science Literacy for Junior High School Students

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Abstract

Science literacy skills are needed by students in the face of the challenges of the XXI century. Based on data from PISA study results, students' science literacy skills in Indonesia in 2015-2018 did not increase significantly. In 2018, Indonesian students' science literacy was ranked 36th out of 40 participating countries with a score of 396. The score is still well below the PISA International average score of 489. Teaching materials are one of the factors that can affect the level of science literacy skills of students. Existing teaching materials do not meet the balanced comparison of science literacy category content. Therefore, a textbook in the form of a science literacy-based textbook is compiled that has a balanced comparison of science literacy category content. The purpose of this study is to know the characteristics, validity and estimation of the practicality of the teaching materials developed. The research method used is R&D with ADDIE model. But in this study, only four stages were conducted, namely Analysis, Design, Development, and Evaluation. Implementation stage is not done because during the Covid-19 pandemic, students do WFH learning so that researchers can not implement Booklet Layer Earth in the learning process in the classroom. The booklet developed meets the comparison of science literacy category content in teaching materials, namely 47.06% : 17.65% : 17.65% : 17.65%. Validity test results showed that science literacy-based booklets were eligible to be used as teaching materials with media expert percentages of 85.00% and 99.00% and material experts of 86.90% and 95.00%. Teachers' responses to the materials developed obtained the Excellent criteria with percentages of 91.25% and 90.00%. Students also gave positive responses to teaching materials with Excellent criteria and obtained an average percentage of 84.96%.

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INTRODUCTION

The current globalization and issues related to environmental issues, advances in information technology, the rise of creative and cultural industries, and the development of education at the international level are challenges that are being faced by Indonesia (Kemendikbud, 2013). Understanding science must be built during educational times so that students are able to act on reasonable scientific knowledge when dealing with various issues and problems that occur such as treatment of a disease, climate change, and so on (Jones et al, 2015). Thus, in the face of the challenges of the XXI century, science learning needs to be based on adequate science literacy.

Science literacy is the ability to scientifically explain phenomena, evaluate and design scientific investigations, and interpret data and evidence scientifically (OECD, 2017; 2019). Science literacy requires not only knowledge of science concepts and theories, but also knowledge of procedures and practices. Science literacy covers a broader dimension, covering aspects of the context of science applications and aspects of scientific competence/scientific processes (OECD, 2019).

Students' science literacy ability in Indonesia is still relatively low, this can be proven from the Programme for International Students Assessment (PISA) data which states that the average improvement in science literacy ability in 2015-2018 has not changed or improved significantly. In 2018, Indonesian students' science literacy was at the level of 36 out of 40 participating countries with a score of 396. The score is still well below the INTERNATIONAL PISA average score of 489 (OECD, 2019). In addition, evidenced from several research results conducted by Ariyanti et al. (2016) using Nature of Science Literacy Test (NOSLiT), Rachmatullah et al. (2016) using Scientific Literacy Assessment (SLA), and Rusilowati et al. (2016) using Scientific Literacy Evaluation Instruments. Although the evaluation tools used are different, the results of student science literacy in Indonesia shown remain low. One of the reasons for the low ability of science literacy in Indonesia is the selection of teaching materials (learning resources) used during the learning process (Kurnia et al., 2014)

Biology is part of Sciences which has a science with a higher level of complexity and has certain characteristics so that it takes teaching materials that can motivate and help students to master certain aspects of ability in biological materials. Biology learning using visual-based teaching materials, can complement the basic experiences of students when they read, discuss, practice, and others. However, teaching materials using textbook resources today are more textbooks, although there are already variations in illustration additions but have not had enough influence on increasing students' reading interest so that reading interest becomes low. Low reading interest leads to lack of students' activeness, low students' motivation and learning outcomes (Nursalina and Budiningsih, 2014; Nurlatipah et al, 2015).

According to Fatonah (2016) the student handbooks are too thick and less interesting so that it reduces students' reading interest, one of which is biology books. Students tend to be interested in reading books that contain short explanations and display color images rather than textbooks that contain more explanations. In addition, students still do not know and understand the meaning of scientific terms related to the concept of science, especially the concept of biology. Scientific terms are very important for students to understand because they are important aspects of understanding and mastering the concept of science. Mastery and understanding of science concepts is important in building student science literacy (Adams et al, 2006; Marhana, 2018). From this comes the idea to provide the appeal of the development of teaching materials in the form of booklets based on science literacy. Teaching materials in the form of booklets are one of the printed media that can convey information in a concise and interesting image, so that it is used as a tool to understand biological materials, as well as provide interest in learning Biology (Fauziyah, 2017).

Based on the observations made in grade VII of SMP Negeri 13 Semarang, the teaching materials used during the learning process are student handbooks and Power Point Slides that present some understanding of the facts/concepts/theories that form the basis in science learning. However, the things that need to be considered and developed are teaching materials that can present an overview of issues or phenomena that occur in the surrounding environment/daily life scientifically so that it can be a support in the learning process. Students not only understand the content of the material, but can recognize and analyze the occurrence of a natural phenomenon by interpreting the data or evidence scientifically through investigation. In addition, the lack of enthusiasm of students towards the teaching materials. To answer the problem, a teaching material in the form of a booklet is prepared. The purpose of this research is to know the characteristics, validity and estimation of practicality of teaching materials developed.

RESEARCH METHODS

This research conducted at SMP N 13 Semarang in the odd semester of the 2020/2021 academic year. The population in this study was all of students in the VIII which consist of nine classes and samples used is students in VIII H class with a total of 32 students with the condition that they had received the learning of earth-layer material in the VII grade. The research method in this study is Research and Development (R&D) with ADDIE model adapted from Hidayat et al. research (2019). But in this study, only using four stages, namely Analysis, Design, Development, and Evaluation. Implementation stage is not used because during the Covid-19 pandemic, students conduct WFH (Work from Home) learning so that researchers cannot implement the Earth Layer Booklet in the learning process in the classroom directly. Data is collected by observation methods, questionnaires, and documentation. The results of the study were analyzed descriptively quantitatively.

RESULT AND DISCUSSION

The Characteristics of Science Literacy-Based Earth Layer Booklet

In the teaching materials developed there are four categories of science literacy presented by Chiappeta et al., (1991). Science as part of knowledge is in the material review section, science as a way of thinking is represented by the "Let's Think!" section, science as an investigation process is represented by the "Let's Do" section, and the interaction between science, technology, and society is represented by the "Science in Life" section. Images of each category of earth-layer material science literacy are presented in Figure 1.



Figure 1. Sections representing each category of science literacy in teaching materials

The results of the analysis of the content of each category of science literacy in the Earth Layer Booklet showed a percentage of 47.06% for the science category as part of knowledge, 17.65% for the science category as a way of thinking, 17.65% for the science category as a process of investigation, and 17.65% for the category of interaction between science, technology, and society or sequentially obtained a comparison of 2:1:1:1.

Table 1. Results of analysis of the composition of science literacy category in The Earth Layer Booklet

No.	Sub Material	Science Literacy Categories			
		Science is a part of knowledge	Science is a way of thinking	Science as an investigation process	Interaction between science technology, and society
1	Structure of the earth	1			
2	Atmospheric layer	1	1		
3	Lithosphere layer	1		1	
4	Hydrosphere layer	1	1		
5	Earthquake	1			1
6	Tsunami	1			1
7	Volcano	1	1	1	
8	Landslide	1		1	1
	Total	8	3	3	3
	Percentage (%)	47.06%	17.65%	17.65%	17.65%
	Ratio	2	1	1	1

Earth Layer Booklet Validation

The results of validation of media experts toward the Earth Layer Booklet by Validator 1 obtained a percentage result of 100.00% for aspects of the size and type of booklets, 80.77% for the cover booklet design aspect, and 87.50% for the design aspect of the booklet content, while the media validation results by Validator 2 obtained a percentage result of 100.00% for the size and type aspects of the booklet, 98.08% for the cover booklet design aspect, and 100.00% for the booklet content design aspect. Overall, the average percentage obtained is 85.00% (Validator 1) and 99.00% (Validator 2) with Very Valid criteria and does not need to be revised.

The result of validation of material experts toward the Earth Layer Booklet by Validator 1 obtained a percentage result of 89.06% for the aspect of content presentation, 85.71% for aspects of material content, and 85.42% for linguistic aspects, while the results of material validation by Validator 2 obtained a percentage result of 93.75% for the aspect of content presentation, 94.64% for aspects of the content of the material, and 95.83% for the aspects of language. Overall, the average percentage obtained is 86.90% (Validator 1) and 95.00% (Validator 2) with Very Valid criteria and does not need to be revised.

Table 2. Earth Layer Booklet validation results

No.	Validator	Presentage		Criteria
		Validator 1	Validator 2	
1	Media	85.00%	99.00%	Very Valid and does not need to be revised
2	Material	86.90%	95.00%	Very Valid and does not need to be revised

Practicality of the Earth Layer Booklet

The practicality of the booklet is done by filling out a questionnaire of teacher responses and student responses. The teacher response questionnaire was filled by biology teachers (IPA), while the student response questionnaire was filled by VIII grade students that is VIII H class which consisted of 32 students.

Both teachers gave positive responses to the Earth Layer Booklet, this can be seen from 20 aspects of the statement obtained an average percentage result of 91.25% by Teachers 1 and 90.00% by teacher 2 with Excellent criteria and does not need to be revised.

Table 3. The results of biology teacher's response to The Earth Layer Booklet

No.	Teacher's Responses	Percentage	Criteria
1	Teacher 1	91.25%	Excellent
2	Teacher 2	90.00%	Excellent

Grade VIII H students also gave positive responses to the practicality of the Earth Layer Booklet, this is evident from 8 aspects of the statement with the lowest percentage result of 80.47% and the highest percentage of 90.63%. Student response questionnaire results obtained an average percentage of 84.96% with Excellent criteria.

Table 4. The student responses to The Earth Layer Booklet

No.	Statement	Score	Percentage
1.	The presentation of earth layer material is arranged systematically.	107	83.59%
2.	Illustration/image makes it easy for me to understand the material of the earth layer.	116	90.63%
3.	Booklet is equipped with real events so that it can add insight / knowledge to me.	109	85.16%
4.	The presentation of earth layer material in the booklet encourages me to always learn and increase curiosity	103	80.47%
5.	This booklet uses communicative languages	106	82.81%
6.	The color selection in this booklet is interesting	115	89.84%
7.	Easy-to-read size and typeface selection	103	80.47%
8.	Booklets are easy to carry around (practical)	111	86.72%
The Average			84.96%
Criteria			Very good

Note: Maximal score is 128 (4 x 32 students)

Booklet Layer of the Earth developed refers to four basic categories in making teaching materials based on science literacy according to Chiappeta et al., (1991), namely science as a body of knowledge, science as a way of thinking, science as a way of investigating, and interaction between science , technology, and society. In addition, the developed booklet has fulfilled the content (composition) of the ideal science literacy category based on research conducted by Wilkinson (1999) with a ratio of 2:1:1:1.

Overall, the booklet developed has met the standards of eligibility of teaching materials according to BSNP 2014 and has advantages including a booklet has a small size so that it can be used practically, has an attractive cover and content design so as to motivate students to learn the material in the booklet thoroughly, the presentation of content is equipped with images and contains information in the form of brief explanations, as well as language that is easy to understand. This is in line with research conducted by Jannah et al. (2018), where teaching materials equipped with images in the discussion will make it easier for students to understand the material presented.

Teachers and students' responses to the practicality estimation of the booklet are very well developed. The percentage value of teachers is 91.25% and 90.00% and the average percentage of students is 84.96%. This indicates that the developed Earth Layer Booklet is practically used as a teaching material.

CONCLUSION

Based on the results of the research, it can be concluded that the Booklet of The Layer of Earth developed has met the comparison of the content of the category of science literacy, namely 47.06% of science as part of knowledge, 17.65% of science as a way of thinking, 17.65% of science as an investigation process, and 17.65% of interactions between science, technology, and society. In addition, the Earth Layer Booklet developed is suitable for use as teaching materials in grade VII junior high school with a percentage of media experts of 85.00% and 99.00% and material experts of 86.90% and 95.00%. The booklet also received a positive response (Excellent) with a percentage of teachers of 91.25% and 90.00% and an average percentage of students of 84.96%.

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