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The Development of Students Worksheet Based on Science Literacy in Environmental Pollution Material

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Abstract

The aim of this study is to describe the characteristics, analyze the validity and readability of student's worksheet (LKPD) on environmental pollution material for junior high school. This type of research was a Research and Development (R&D). Development research using the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). This development was limited to the development stage. The practically instrument was a questionnaire of teacher and students. The validator consists of media expert and material expert. The data obtained is qualitative data converted to quantitative data. The result showed that the validity by media expert obtained high validity criteria with an average score of 94.7 and an average score by material expert of 84.5 obtained a high valid criterion. The readability test of student's worksheet was tested on limited students with 10 students of class VIII SMP Negeri 1 Ngrampal and 1 science teacher. The result of the response of student obtained 92.5 with very good criteria. The result of teacher response obtained 91.98 with very good criteria. It can be concluded that the student's worksheet develops feasible and practically used in the learning process.

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INTRODUCTION

The 21st century is a century of globalization marked by advances in science and technology. In the 21st century, individuals are required to have the ability to access, read, and understand the global world with scientific and technological knowledge (Rohaeti, 2015). One of the important abilities in the 21st century is literacy (Hatami et al., 2017). 21st century learning is learning that focuses on literacy, skills and attitudes, knowledge skills, and proficiency in technology. To improve the competitiveness of 21st century learning, it is required to have 6 kinds of basic literacy, including: (1) language literacy, (2) numeracy literacy, (3) science literacy, (4) digital literacy, (5) financial literacy, (6) cultural and civic literacy (Pangesti, 2018).

Science literacy is the ability to use scientific knowledge to explain scientific phenomena, identify problems and draw conclusions based on evidence related to science issues (OECD, 2019). The existence of science literacy is very important because it can contribute to life, especially when individuals make decisions (Muhajir, 2015). Science literacy is an ability related to the application of science values in everyday life (Mahmud & Pratiwi, 2019). The description explains that science literacy is important for students to understand the environment, health, social, modern, and technology so that students have the skills and competencies to make science a scientific attitude (Aberšek et al., 2015).

Learning that is contextual to students' lives is believed to train students' science literacy skills (Sukmawati, 2017). The contextual aspect is needed in environmental learning, considering that the scope of environmental issues is closely related to daily life which not only involves knowledge but requires attitudes and skills to address and solve existing environmental problems. The topic of environmental pollution is contextual material if it is related to the surrounding environment.

The importance of science literacy is not proportional to the reality that occurs in the field. The science literacy of students in Indonesia is still relatively low, based on the results of the Program for International Student Assessment (PISA) held by the Organization for Economic Coorporation (OECD) in 2018 Indonesia occupied the 74th position out of 79 countries participating in the assessment conducted by PISA (Hewi & Shaleh, 2020). The low level of science literacy in Indonesia is caused by several factors. One of them is the low ability to read and write scientific papers. Another factor is the selection of learning resources (Fuadi et al., 2020). Aqil 2018 states that textbooks are used by 90% of science teachers and 90% of the learning time allocation. knowledge and application of science literacy that only uses textbooks have not fully touched the souls of students which results in learning becoming boring and students lack understanding of subject matter in the context of life. The conventional learning process and the use of teaching materials that have not been oriented towards science literacy are also factors in low science literacy (Macharia & Macharia, 2018).

One of the factors that can support the science learning process is by providing quality teaching materials and in accordance with the context of science learning (Handoko et al., 2016). The teaching material that will be used is in the form is students worksheet based on science literature. Students worksheet is a form of teaching material that functions as a guide that facilitates teaching and learning activities. Students worksheet is a teaching material that allows students to build their own knowledge (Taslidere, 2013). Students worksheet is a sheet that contains tasks that must be done by students, students worksheet usually contains instructions, steps to complete a task given by the teacher. Students worksheet must clearly state the basic competencies and objectives to be achieved (Yildirim et al., 2011). The use of students worksheet will also provide opportunities for students to actively participate in learning.

METHODS

This type of research was a research and development (R&D). This research utilizes the *ADDIE* model (Analysis, Design, Development, Implementation, and Evaluation) adopted from (Aldobobie, 2015; Sugiyono, 2019). In this study was limited to the development stage. This study produces teaching material products is students worksheet based on science literacy on environmental pollution material. The data collection technique uses an instrument in the form of a questionnaire. Questionnaire instruments needed in this study include media expert validation

sheets, material expert validation sheets and student worksheet readability sheets. Students worksheet validity data analyzed by descriptive percentage analysis, with with the formula.

$$p = \frac{n}{N} x\ 100\ \% \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Description:
p = Percentage of the score obtained
f = Number of scores obtained
n = Maximum number of scores

Determination of validity by referring to the percentage score criteria obtained based on the following table 1:

Table 1. Product Validation Criteria

Score Percentage (%)	Criteria
76 < X ≤ 100 %	Very Valid
51 < X ≤ 75 %	Valid
26 < X ≤ 50 %	Not Valid
X ≤ 25	Strongly Invalid

Data Analysis of the readability of students worksheet is obtained from the analysis of readability questionnaire data. There are two readability questionnaires, namely the readability questionnaire for students and the readability questionnaire for teachers. Students worksheet readability assessment is measured using the following formula:

$$p = \frac{f}{n} x\ 100\ \% \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Description:
p = Percentage of the score obtained
f = Number of scores obtained
n = Maximum number of scores

Table 2. Percentage Criteria

No	Score Percentage	Criteria
1	81.25 < P ≤ 100	Very Good
2	62.50 < P ≤ 81.25	Good
3	43.75 < P ≤ 62.50	Not Good enough
4	25.00 < P ≤43.75	Not Good

RESULT AND DISCUSSION

The results of this science literacy-based on students worksheet development research include 1). The process of developing science literacy-based on students worksheet , 2). The results of the students worksheet validation assessment, and 3). The results of the readability assessment.

1). Students Worksheet (LKPD) Based On Science Literacy Procces

The process of developing students worksheet has an initial stage, namely analysis. The results of the analysis stage are known that the teaching materials used are in the form of package books, the package books used in schools mostly only contain aspects of knowledge without directing students' thinking processes. The students worksheet used is students worksheet which only contains practice questions and is still in the form of black text paper and there are no pictures relevant to the surrounding environment. The students worksheet used in schools is still less relevant to the surrounding conditions in the environment and the learning process has not involved many activities that are integrated with science literacy. Based on that background, students worksheet based on science literacy was developed.

The development stage, namely the design stage, carried out activities to design student worksheet based on science literacy using the Canva application. The design of students worksheet development includes a cover, preface, table of contents, how to explore students worksheet (LKPD), and there are features that contain aspects of science literacy including: 1). science as a body of knowledge 2). Science as a way of investigation 3). Science as a way of thinking 4). Interaction of science, technology and society, selection of fonts and font sizes and selection of appropriate sentences that will be used in students worksheet.

The third stage is the development stage, this stage is carried out after making the design of students worksheet based on science literacy. The draft of students worksheet is used as a guideline in developing students worksheet. This development research produces products in the form of students worksheet based on science literacy. the display of students worksheet based on science literacy shown on Table 4.

Table 4. Display of students worksheet based on science literacy

No	Science Literacy Aspect	Features	Description
1	Science As A Body Of Knowladge	Lets Learning	The let's learning feature contains material reviews about environmental pollution.
		It's a Fact	The it's a fac't feature is a section that contains facts about environmental pollution (water, air and soil).
2	Science As A Of Investigation	Lets Investigate	In the let's investigate section there are activities in the form of observations about environmental pollution (water, air and soil). The parts in this features displayed are about practicum tools and materials, observation tables and conclusion columns.
3	Science As A Way Of Thinking	Let's Thinking 1	This section talk about the environmental problems contained in article and data about environmental pollution.
		Let's Thinking 2	This section talk about the environmental problems contained in the article and data about environmental pollution.
4	Interaction of science, technology and society	FYI (For Your Information)	The FYI (For Your Information) section contains the latest information on waste management. FYI view that contains information about the location of waste banks
		Cheking Your Habbit	This section contains a table with statements about caring for the environment.

The profile display of students worksheet development based on Table 4 can be seen on some Figure 1 below:

Figure a. Lets Learning Page Display

Figure b. It's a Fact Page Display

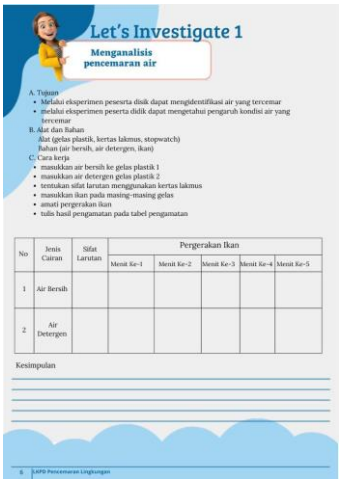

Figure c. Let's Investigate Page Display

Figure d. Let's Thinking 1 Page Display

Figure e. Let's Thinking Page Display

Figure f. FYI (For Your Information) Page Display

Figure g. Website And Application Page Display

Figure h. Garbage Type Page Display

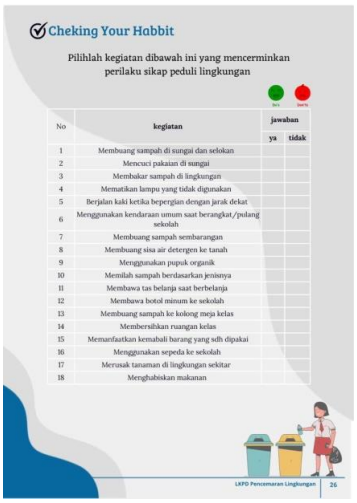

Figure i. Display of the Environmental Awareness Statement Page

Figure 1. The profile display of students worksheet development

2) Validation Assessment Results

The validity of students worksheet consists of material validity and media validity. This validity is done to determine the level of validity of the developed of a students worksheet. The Product validity test is was tested by media experts and material experts. The assessment result was shown on Table 5.

Table 5. Assesment Result.

Media Expert test Result		
Assesment Aspect	Percentage Score (%)	Criteria
Display Performance	96.4	Very Valid
Language Performance	87.5	Very Valid
Grafic Performance	100	Very vaid
Average	94.7	Very valid
Material Expert Test Result		
Assesment Aspect	Percentage Score (%)	Criteria
Material Suitability	87.5	Very valid
Material accuracy	87.5	Very valid
Learning Support material	91.7	Very valid
Suitability with the level of students understanding	84.5	Very Valid
Communicative	81.3	Very Valid
Suitability with the correct Indonesian	81.3	Very Valid
The use of term	78.3	Very Valid
Aspect of science literacy	84.5	Very Valid

Based on the results presented in table 4, the average result of the validation assessment by media experts is 94.7 with very valid criteria. Assesment result by material expert obtained of 84.5 wih very valid criteria. Based on the assessment results obtained from media experts and material experts, it can be concluded that the students worksheet based on science literacy is declared very valid and can be used in learning.

3) Results of Student Worksheet Readability Assessment

This readability aims to determine the responses of students and teachers which can be used as a measure of the quality of the students

worksheet that has been developed. The readability test is carried out after conducting a validity test and the product is declared valid or feasible to use. The readability value of students worksheet is obtained by distributing and checking the questionnaire for the readability of students worksheet to science teachers and class VIII students as many as 10 people. The result of readability was shown on Table 6.

Table 6. Readability Test Result

No	Assesment Aspect	Average	Criteria
1	Display Performance	79.2	Good
2	Language Performance	100	Very good
3	Material Performance	95	Very Good
4	Learning Evaluation	93.75	Very Good
Total		367.95	Very Good
Average Readability Score		91.98	

Table 6 shows that the average value of readability of students worksheet based on science literacy by teachers is 91.98 with very good criteria. This shows that the students worksheet can be read very well by teachers.

The result of readability test by students was shown on Table 7.

Table 7. Readability Test Result By Students.

No	Assesment Aspect	Average	Criteria
1	Display Performance	96.67	Very Good
2	Material Performance	88.33	Very Good
Total		185	Very Good
Average Readablity Score		92.5	

Based on table 6, it can be seen that the average value of readability of students worksheet based on science literacy by students is 92.5 with very good criteria. This shows that the developed of students worksheet can be read very well by students.

The development of students worksheet based on science literacy gets the results of product validation with valid criteria because the students worksheet includes aspects of science literacy, namely: 1). science as a body of knowledge 2). Science as a way of investigation 3). Science as a way of thinking 4). Interaction of science, technology and society. In the students worksheet developed there are various activities that can train students' science literacy skills. This is in accordance with the explanation (Dragoş & Mih, 2015) that activities that integrate aspects of science literacy can prepare and produce someone who is able to understand science and phenomena in everyday life. In addition, the developed students worksheet also has an attractive design and the images contained in the students worksheet are images that are mostly images of environmental pollution in Central Java. The use of images of environmental pollution around students is a factor that attracts students' interest in studying environmental pollution material in the students worksheet. This is because learning that is directly related to students can attract student interest and motivation (Roziyah & Haryani, 2017).

Teaching materials that can support learning are teaching materials that do not only emphasize aspects of knowledge, but include balanced science literacy categories (Maturradiyah & Rusilowati, 2015). The aspect of science as a body of knowaldge displayed on students worksheets is expected to be able to understand the concepts, laws and principles in integrated science subjects, based on cognitive learning theory which states that students' learning abilities are influenced by the touch of the educational process that can improve students' cognitive functions (Fuadah et al., 2017). The aspect of science as a way of thinking is also displayed on the students worksheets, in this aspect students are expected to have critical thinking skills. critical thinking skills mean that students can think deductively-inductively, can interpret data and can relate concepts to one another (Salamah et al., 2017). In students worksheets there are other aspects, namely the aspect of science as a way of investigation, in this aspect students are expected to be able to develop process skills that can help students in forming scientific attitudes and thinking processes. The Interaction of science, technology and society aspect in the students worksheets is

expected to be able to understand the application of science and technology in everyday life. Based on (Tobin, 2015) which states that technological speed is an inseparable part of scientific literacy, meaning that a person must follow technological developments to apply scientific knowledge, recognize problems and draw conclusions based on evidence.

The results of the readability test in table 7 have very good readability. These results were obtained through a readability questionnaire in which most students stated that the developed of students worksheet had clear writing, easy-to-understand and the students worksheet displayed pictures and cases of environmental pollution in Central Java. All aspects in the students worksheet can attract interest and motivate students to read or learn using the students worksheet that has been developed. This statement is in accordance with previous studies that the development of students worksheet based on science literacy can motivate students to learn (Pernandes et al., 2022).

CONCLUSION

Based on the research that has been done, teaching materials in the form of students worksheet (LKPD) based on science literacy produced. Obtained an average validity value by media and material expert 94,7 with very valid criteria and 84,5 with very valid criteria.The result of readability test by teachers of 91.98 with very good criteria, and the average readability value by students of 92.5 with very good criteria. From this study it can be concluded that the students worksheet based on science literacy developed obtained very valid results and read very well.

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