

## Validity of Student Worksheets Based on Socioscientific Issues Towards improve Students' Literacy Skills

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**Abstract:** This study aims to determine the validity of students' worksheets based on socioscientific issues (SSI). The method in this research used the Research and Development (R&D) method which is carried out until the initial product design development stage. The research and data collection stage includes literature studies and field studies. The field study was carried out on one hundred students and thirty science teachers in ten public and private junior high schools in Bandar Lampung and Metro City using a questionnaire needs analysis and an initial test of PISA science literacy skills. The initial product design development stage is carried out the process of preparing a draft of the learning kit, then proceed with designing the student worksheet as a product model that is developed and validated the product by three experts and two teachers using a validation questionnaire. The results of the validation test by experts (87.5%) and teachers (90.6%) on content, validation by experts (80%) and teachers (94%) on construction, as well as validation by experts (100%) and teacher (100%) towards language states that students' worksheets based on SSI was stated valid toward improve students' science literacy skills.

**Key Word:** validity, student worksheets, socioscientific issues, scientific literacy skills

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### I. Introduction

The development of the 21st century is marked by increasingly interlocking science and technology. The rapid development of science and technology, both directly and indirectly, can affect various fields of life, one of which is the field of education. Science education is specifically directed at preparing students to be successful in the 21st century. One of the skills needed in the 21st century is scientific literacy<sup>1</sup>. Science literacy is the ability to apply science in understanding and solving scientific and social problems in life<sup>2</sup>. Science literacy according to the Organisation for Economic Co-operation and Development (OECD) contains several domains namely context, knowledge, competence, and attitude. The competency domain contains three main aspects that can represent other domains those are explaining phenomena scientifically, evaluating and designing scientific enquiry, interpreting data and evidence scientifically<sup>3</sup>.

Science literacy is quite the main concern of educators in guiding teaching science, because literacy is a skill to live in an era where scientific knowledge is the foundation of daily life<sup>4</sup> and becomes a demand to be mastered by every individual both in daily life and in the world of work<sup>5</sup>. But in fact, the results of research that have been done stated that the results of learning science in various countries are still low<sup>6,7,8</sup>. This is evident from the results of the Program for International Student Assessment (PISA) study published by the OECD 2016, the last scientific literacy measurement conducted in 2015 showed that the average scientific literacy value of Indonesian students was 403 in the aspect of knowledge about science so placing Indonesia ranked 62 out of 70 countries. Measurement of scientific literacy has increased but in general is still below the average OECD<sup>3</sup>.

The quality of teachers and teaching methods is one of the causes of the success of the scientific literacy capabilities of countries that are able to achieve high scores in PISA<sup>9,10</sup>. Another factor is the lack of science learning that is associated with the context of problems in daily life so students find it difficult to deal with simple problems because they are unable to link the concepts of knowledge they have at school with problems that exist in everyday life<sup>11</sup>. Sunyono also revealed that in learning science it is necessary to present real problems<sup>12</sup>. Learning should be designed and implemented through strategies that are able to meet contextual needs so that students are not only able to understand scientific concepts but can also apply them in decision making on social problems that require scientific solutions<sup>11,13</sup>.

Based on the results of research in a preliminary study conducted on 30 teachers and 100 junior high school students from public and private schools in Bandar Lampung and Metro City, there are only a few teachers who practice their literacy skills. Than, the student's worksheets used in learning contains questions

that are asked to return the concepts that have been learned. The knowledge delivered is only limited to theories in the book. Reasons that cause teachers to consider the limitations of ability and time in making their own student worksheets that will be used. There is no teacher who has creativity and innovates in making teaching materials. Depending on the teacher relying on student textbooks. In addition, the results of the initial tests of the ability of the literacy of the PISA conducted on the students of the results of the initial research are still below the target score of science literacy. Therefore, it is necessary toward improve the learning process through a teaching material in the form of student worksheets based on socioscientific issues (SSI) toward improve students' scientific literacy skills. Lee revealed that instructional written materials play an important role as a means to assist teachers in effective teaching practices. Student worksheets are one of the most frequently used materials in the learning process at school<sup>14</sup>.

SSI-based learning is learning that presents social issues in the community that are conceptually related to science<sup>15</sup> related to the conceptual, procedural, or technological context<sup>16,17</sup>. Based on the results of previous studies, SSI is very potential if used as a basis for learning science in schools in increasing students' scientific literacy<sup>18, 19, 20, 21, 15</sup>. The use of SSI can be used as a bridge to real problems that exist in the community and the foundation by students in exploring science content. Environmental pollution material is one of the scientific content that is very close to the context in everyday life so that it can be used to practice scientific literacy skills<sup>22</sup>. Environmental pollution material contains various problems or contextual issues that are evident in the daily lives of students. Therefore, it is necessary to develop teaching materials that support learning activities namely student's worksheets that uses science issues in it that are based on SSI.

## **II. Material And Methods**

The method in this study refers to the procedure of developing Research and Development (R&D)<sup>23</sup>. In general there are 10 steps in conducting research and development. But in this study only carried out up to three initial stages namely research and data collection, planning, and development of the first draft product. The research and data collection consists of literature studies and field studies. Literature study is carried out with the aim to explore information on needs related to the concepts and theoretical foundations underlying the products to be developed, review the curriculum and the results of previous research that have been published as a reference for developing students' worksheets based on SSI.

The field study was carried out on one hundred students and thirty science teachers in ten public and private junior high schools in Bandar Lampung and Metro City using a questionnaire needs analysis and an initial test of PISA science literacy skills. After analyzing the results of the data obtained, planning and product development are carried out. Then in the initial product design development stage, the learning device draft is drafted, after the learning device draft is successfully compiled, then the student worksheet design is compiled as the product developed (draft product I) which is then validated by the expert. Expert validation was carried out by three experts and two practitioners to produce product validity in terms of content, constructs and language which then produced a draft of product II that was developed according to input from experts and practitioners.

The data analysis technique of the questionnaire data needs assessment of teachers and students was done by calculating the percentage of respondents' answers on each item using the following formula:

$$\%J_{in} = \frac{\sum J_i}{N} \times 100 \%$$

Where %  $J_{in}$  is the percentage of answer choices  $i$ ,  $\sum J_i$  is the number of respondents who answered answer  $i$ , and  $N$  is the total number of respondents.

The data analysis technique of expert and teacher validation was calculated from the results of the response scores given based on the Likert scale using the following formula:

$$\% X_{in} = \frac{\sum s}{S_{maks}} \times 100\%$$

Where%  $X_{in}$  is the percentage of respondents' answers on the questionnaire,  $\sum S$  is the total score of the answers, and  $S_{maks}$  is the maximum expected score. Then the results of the analysis of the percentage of response scores are interpreted using Arikunto's interpretation.

The data analysis technique for calculating the average percentage of response scores is done using the following formula.

$$\overline{\%X_i} = \frac{\sum \% X_{in}}{n}$$

Where  $\overline{\%X_i}$  is the average percentage of answers,  $\sum \% X_{in}$  is the percentage of each item on the questionnaire, and  $n$  is the number of questions. Then presents the answers interpreted as a whole into the criteria.

The data analysis technique of analyzing students PISA science literacy test data was done by calculating the students' answers on each item of science literacy indicator test using the following formula:

$$\% X_{in} = \frac{\sum s}{S_{maks}} \times 100\%$$

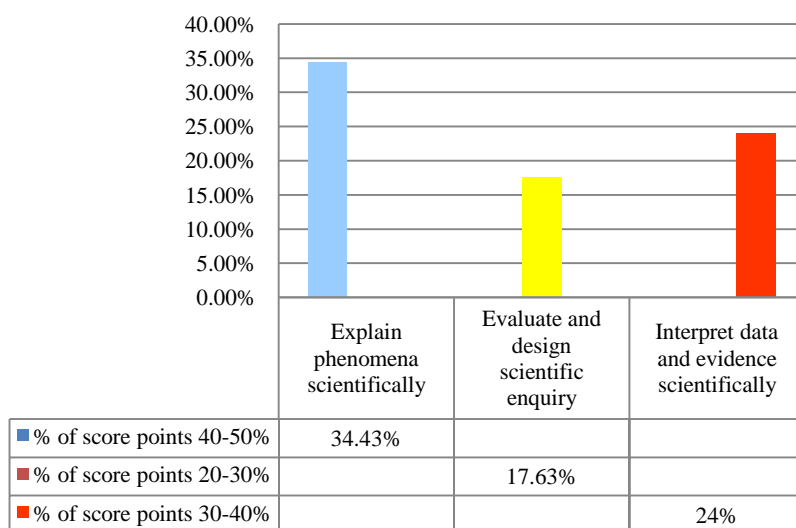
Where  $\% X_{in}$  is the percentage of answers to PISA literacy questions,  $\sum S$  is the total answer score, and  $S_{maks}$  is the maximum expected score [24]. Then the results of the analysis of the percentage of answer scores are interpreted based on the item scoring at PISA 2015<sup>3</sup>.

### III. Result

Based on the results of a preliminary study conducted to teachers shows that as many as 90% of teachers use student worksheets in the learning process but the student worksheets used is not made by the teacher themselves. The student's worksheets available contains questions that are reminiscent of the concepts that have been learned. The scientific context presented is only limited to the theories in the book. The reason given by the teacher was due to the limited ability and time in making their own student worksheets to be used. This acquisition illustrates that there are still many teachers who have not been creative and innovative in making teaching materials.

The results of the questionnaire showed that teachers already knew the importance of practicing science literacy skills of students in science learning but only 30% of teachers practiced science literacy in the classroom. Then as many as 80% of students have the habit of memorizing in learning science material. Furthermore, 92% of student's worksheets used were less attractive because student worksheets prints only used opaque paper, designs and colorless drawings making them less attractive. Material selection is based on preliminary study data results that 80% of teachers stated that the student's worksheets used in learning on environmental pollution material has not fully displayed the phenomena that occur in the surrounding environment and has not yet trained students' science literacy skills.

It is also in line with the results of the questionnaire, the need for student's worksheets which increases scientific literacy shows that there are 100% needs to be reviewed from teachers and students. Then, based on the results of preliminary tests of science literacy ability using PISA questions conducted on one hundred students shows that the science literacy ability of students is still below the average PISA assessment score target of 2015. The results of these tests can be seen in Graph 1 below.



**Figure 1.** Score percentage of student's initial science literacy

Validation activities are carried out after product development. Product validation includes content, construction and language validation carried out by three expert tests and two teachers using a validation questionnaire. The results of the validation of experts and teachers are in the following Table 1..

**Table 1.** Results of expert validation and teacher

No	Aspect	Percentage		Criteria
		Expert	Teacher	
1	Content	87.5%	90.6%	Valid
2	Construction	80%	94%	Valid
3	Language	100%	100%	Valid

#### IV. Discussion

The initial test results of the pisa science literacy skills above indicate that the test results of students are still below the target score science literacy skills achievement of PISA . Based on the results of the initial tests of scientific literacy skills and the results of the analysis of needs questionnaires, teaching materials were developed in the form of SSI-based learners student's worksheets toward improve science literacy skills. These instructional materials are arranged based on the characteristics of SSI as follows: (1) SSI-based teaching materials are prepared by raising issues or issues that are controversial and become debates in the community <sup>13</sup>; (2) SSI-based teaching materials are general problems that have not been resolved and are issues or problems in the community with relatively or uncertain answers to solutions <sup>25</sup>; (3) SSI-based teaching materials in it contain ethical and moral elements <sup>13</sup>; (4) SSI-based teaching materials have a relationship between science and social and affect life in society <sup>15</sup>. The components contained in the students' worksheets consist of competencies to be achieved, instructions for using the students' worksheets scientific issues presented, drawings that are relevant to the topic of the topic, discussion question columns, experimental activities, evaluating issues based on evidence, columns reviewing the impact occur as well as a column of conclusions and actions. The development product is in the form of students' worksheets based on SSI with the topic of environmental pollution.

Based on the results of the validation of experts (87.5%) and teachers (90.6%) of the contents stated that the phenomena presented in the student worksheets based on SSI are in accordance with the context of the material and are relevant to daily life based on existing issues. The phenomena presented can help students in identifying problems and formulating problems. The examples presented reflect events, events or conditions that are relevant to real life. Questions and stages of activities compiled in student's worksheets can help students to develop the ability of science literacy.

Based on the results of the validation of experts (80%) and teachers (94%) to the construction stated that the student's worksheets based on SSI was in suitable with the components of the students' worksheets with the indicators set. The picture presented is in match with the context of the material presented. There is a suggestion from the validator that pictures should be taken directly based on the condition of the surrounding environment so that it looks more contextual.

Based on the results of the validation of experts (100%) and teachers (100%) to the language stated that student's worksheets based on SSI is communicative and easily understood by students. The use of punctuation and grammar is appropriate. The sentences used are effective and do not cause plural or ambiguous notions. Based on the elaboration of the results of the validation stage above, the results of the validation of the contents, constructs, and language of student's worksheets based on socioscientific issues accordance with the characteristics of SSI.

#### V. Conclusion

Based on the results of the study, the validation results obtained from three experts and two teachers on the content, construct and language. Results by experts (87.5%) and teachers (90.6%) on content, validation by experts (80%) and teachers (94%) on construction, as well as validation by experts (100%) and teacher responses (100%) to stated languages of students' worksheets based on socioscientific issues was stated valid toward for improving students' science literacy skills.

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