

The Validity of Assessment's Instrument in Science Subject Based on Science Literacy for Junior High School

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Abstract - The study aimed to determine the validity of science-based science literacy subject evaluation tool for first semester junior high school students in grade IX had been conducted. This type of research is development research using the Plump model development. The validity of science-based science literacy subject evaluation tools is carried out with 2 types of validity namely logical validity and empirical validity. Logical validity is carried out by 5 experts who assess the validity of the questions developed. Based on logical validity it is known that science questions based on science literacy that has been developed have met valid criteria with an average validity of 88.98%. Empirical validity is determined by calculating the value of the validity of each item by using the product moment formula. As many as 60 scientific literacy-based items developed for each question have different values of item validity according to the type of problem. From the results of the validity of the items as a whole obtained a value of 67.67% and included in the valid criteria. Based on the second value of this validity (logical and empirical validity) it can be concluded that the questions developed are included in the valid criteria with a validity value of 78.33%.

Keywords - Validity, Evaluation's Tool, Science Literacy, Science Subject.

I. INTRODUCTION

Education is the main thing for the development of the nation especially in science-based learning. Science literacy is an appreciation of science by increasing the components of learning within oneself to contribute to the environment (Holbrook, 2009, Anderman, 2012, Dillon, 2016). De Boer (2000) states that the first person to use the term scientific literacy is Paul de Hart Hurt from Stanford University who states that Science Literacy means understanding science and applying it to people's needs. Literacy of science by the Organization for Economic Cooperation and Development (OECD) is defined as the ability to use scientific knowledge to draw conclusions and solve problems about nature and the interaction of nature with humans (Nbina and Obomanu, 2010).

Science coverage was evaluated through The Program for International Student Assessment (PISA) conducted by the Organization for Economic Cooperation and Development (OECD) in 1997 and only implemented in 2000 (Sellar, 2014). PISA is an international study of literacy achievement in reading, mathematics and science for 15-year-old school students (OECD, 2009).

Education in Indonesia today still faces many problems. One of the problems in Indonesia is the low quality of education especially in scientific literacy (Murti, 2018). The low quality of education in the field of scientific literacy is evidenced from the results of the PISA study on 15-year-old school students. PISA scientific literacy data in 2000 ranked Indonesia 38th out of 41 countries (OECD, 2002), in 2003 Indonesia

occupied 38 of 40 countries (OECD, 2004), in 2006 ranked 50th out of 57 countries (OECD, 2006), 2009 ranked 60th out of 65 countries (OECD, 2009), in 2012 it was ranked 64th out of 65 countries (OECD, 2012), and 2015 was ranked 62nd out of 72 countries (OECD, 2015). The results of Zulyusri's study, et al. (2017) on science Olympiad participants at the junior and senior high school levels using the components of the 2006 PISA questions found that scientific literacy results from students in the Olympics were in the low category.

Low scientific literacy ability is the underlying reason for the government to revise the 2006 to 2013 curriculum which emphasizes the science approach. Ministry of Education and Culture (2013) stated that the 2013 curriculum was considered as the key to boost Indonesia's lagging value in the PISA study.

Some of the factors that cause low scientific literacy of students in Indonesia are first, the introduction of questions oriented to science skills such as the PISA problem (Odja, 2014, Dragos, 2015). Second, science learning habits that are still conventional, lack of interest in reading and writing science that must be owned by students (Norris and Philips, 2003). Third, the lack of ability of students to interpret graphs / tables in the problem (Glazer, 2011, Rahayu, 2015). Fourth, students are not accustomed to working on critical thinking questions that exist in science literacy questions (Sariati, 2013, Pamungkas, 2018). In learning, students are used to working on existing questions in printed books (Rockinson, 2013) and examples of questions given by the teacher, and very rarely are the questions made applied to cases related to the environment and technology.

Based on the observations and interviews of the authors with several science teachers and students at the Sutera 1 Junior High School, Sutera Sub district, Pesisir Selatan District, West Sumatra Province there were still some problems regarding scientific literacy in the PISA study. First, some science teachers do not yet know information about scientific literacy and some do not even know the term, so the teacher's limited knowledge and understanding in linking learning activities are carried out with the demands of

scientific literacy. Second, mastery of student science literacy is caused by a lack of books and exam questions that demand scientific literacy. This obstacle makes the teacher not aware of science literacy competencies. Third, the level of difficulty of the exam questions in the school is only at levels C1 to C3 and only a small degree of difficulty is found in stage C4, while the scientific literacy questions in PISA meet the criteria until C6 which demands high reasoning (Hahn, 2013, OECD 2015). This can be seen from the analysis of the first semester exam questions carried out by the authors in Table 1.

Table 1. Analysis of First Semester (Biology) Exam Questions for Middle School in the South Coast District of 2017/2018 Academic Year.

No.	Cognitive Levels	Total	Percentage (%)
1.	C1	10	45.5
2.	C2	8	36,4
3.	C3	3	13.6
4.	C4	1	4.5
5.	C5	0	0
6.	C6	0	0
Total		22	100

In connection with the results of the analysis that the author did on the exam question, Dharma Setiawan (class IX student of SMPN 1 Sutera) said that, in the questions that had been tested on the mid semester and semester exams there were still many memorizing questions. Questions relating to the surrounding environment and using a high level of thinking are few.

Another problem faced by teachers is the unavailability of science-based questions that require reasoning in answering them. The habit of the learning process as indicated this will result in students' scientific literacy abilities not being optimal. Arikunto (2012) revealed that educational benchmarks can be identified by evaluation. This means that if students are expected to think critically, then the types of questions given must also train critical thinking. The questions given to students are still lacking in directing and training students to think critically.

Given the importance of scientific literacy as a measuring tool for evaluating and improving students' thinking skills and the many problems raised above, researchers have developed science-based science literacy evaluation tools for Grade IX students of Middle Semester I.

II. RESEARCH METHODS

This research was conducted in the even semester of the academic year 2017/2018. The subjects of this study were the IX grade students of 1 Sutera Public Middle School, South Coastal District. This type of research is development research using the Plomp model. Development research is an effort to develop and produce a product in the form of science questions, especially in the field of Biology based on scientific literacy. The evaluation tools developed were 60 questions consisting of 43 multiple choice questions, 4 description questions, 7 compound questions, 6 attitude questions.

The development of this scientific literacy-based evaluation tool uses the Plomp model which consists of three phases, namely the initial investigation phase (preliminary research phase), the phase of developing and making prototypes (development or prototype phase), and the assessment phase (Plomp, 2013).

In the initial investigation phase, problems and needs analysis were carried out, curriculum analysis, and analysis of science problems in the school to get an overview of the development of the products to be developed. In the phase of development and manufacture of prototypes several stages were carried out, namely: prototype I, prototype II, prototype III, prototype IV, prototype V. In the assessment phase a trial was conducted on the actual class. This research is limited to validity testing logically and empirically.

Validity is logically validated by experts who include construct conditions, content requirements, language requirements, and technical requirements. The validator involved in this validation process is Dr. Dwi Hilda Puteri, M.Biomed, Ms. Moralita Chatri, M.P, and Mr. Ali Adaus, M.Pd as material experts, Dr. Abdurrahman, M.Pd as linguists, and Mr. Dr.

Darmansyah, ST, M.Pd as a Technology / Media expert.

Empirical validity is determined by calculating the value of the validity of each item by using the product moment formula. The test results are then used for revision so that this scientific literacy-based evaluation tool really meets the needs of the user and can be applied to the actual class, resulting in science-based science literacy subject evaluation tools.

Validity analysis is obtained from the data collection instrument filled by experts or experts (Adam, 2011). Data analysis begins by providing scoring for each item. Scoring based on a Likert scale with conditions such as the following.

Table 2. Categories and scores for validity of scientific literacy-based evaluation tools

Score	Category
4	Strongly agree
3	Agree
2	Disagree
1	Strongly Disagree

Source: Arikunto (2012)

The results of the scores obtained are tabulated and the percentage is searched using the following formula.

$$\text{Validity} = \frac{\text{Score obtained}}{\text{Maximum Score}} \times 100\%$$

Based on the value of the validity obtained, the assessment criteria for the validity of a scientific literacy-based evaluation tool are determined with the provisions in Table 2.

Table 3. Categories of Validity Evaluation Tools Based on Science Literacy

Value of Validity	Category
81 – 100	Very Valid
61 – 80	Valid
41 – 60	Valid enough
21 – 40	Less Valid
00 – 20	Invalid

Source: Riduwan (2009)

Based on empirical validation carried out by assessing the item / item by determining student scores on item items that are calculated for validity, determine the total score of students, then the data is entered into the product moment formula with a rough number using the following formula.

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N \sum X^2 - (\sum X)^2)(N \sum Y^2 - (\sum Y)^2)}}$$

After the results are obtained, then the value of validity is determined by the evaluation criteria for scientific literacy-based evaluation tools with the provisions as in table 3.

Table 4 .Empirical Validity Criteria Problem

Value Range %	Criteria
0,81 – 1,00	Very Valid
0,61 – 0,80	Valid
0,41 – 0,60	Valid Enough
0,21 – 0,40	Less Valid
0,00 – 0,20	Invalid

Source: Arikunto (2012)

III. RESULT AND DISCUSSION

The results of the development of science-based science literacy subject evaluation tools were as many as 60 validated questions.

The results of the validation of scientific literacy-based science subject evaluation tools are as follows.

Table 5. Results of Validation Analysis of Science Subject Evaluation Tools Based on Science Literacy

No	Indicator	Score %	Criteria
1	Construction Terms	94,44	Very Valid
2	Content Terms	93,75	Very Valid
3	Language Terms	79,17	Valid Enough
4	Technical Requirements	88,54	Very Valid

Based on construct conditions, science literacy-based science questions have a value of 94.44% with

very valid criteria. This means that the questions developed are in accordance with the indicators that refer to the question of scientific literacy and are in accordance with the objectives to be achieved. The material in the question is in accordance with the demands of the school curriculum because the researcher designed the problem by analyzing the curriculum first. Rustaman (2013) says that construct validity is a validity that disputes how far test items are able to measure what is really intended to be measured in accordance with a specific concept or conceptual definition that has been set. In this case the researcher makes a question by referring to the question of scientific literacy without ignoring the demands of the curriculum. So one of the goals of developing this question is also the purpose of learning.

Based on content requirements, science literacy-based science questions have a value of 93.75% with very valid criteria. This means that the problem has a component of scientific literacy, namely competence, knowledge, context and attitude. This component is a component of scientific literacy in the PISA study. According to Widoyoko (2009) content validity shows the extent to which questions, assignments or items in a test or instrument are able to represent the overall and proportional behavior of the sample subject to the test. This shows that the questions developed have reflected the overall content or material being tested and that should be mastered proportionally. The valid content requirements mean that the questions that have been developed have summarized the components and important indicators of scientific literacy in the PISA study (Suwono, 2017).

Based on language requirements, science literacy-based science questions have a value of 79.17% with sufficiently valid criteria, this means that the language used in science literacy-based science questions is still in accordance with the rules of good and correct language. The language used is communicative, easy to understand, and in accordance with the use of EYD (Enhanced Spelling). Besides that, the issue of science-based science has correct punctuation. This is supported by Wisnu (2012) who states that good

questions are questions that each item must use language that is in accordance with the rules of good and correct Indonesian.

Based on the technical requirements, science literacy-based science questions are stated with very valid criteria with a validity value of 88.54%. This means that the assessment aspects in the questions developed are related to visual communication such as the selection of colors, appearance, size and type of letters that are clear and readable. Each picture and graph already has its own description and the information is in accordance with the context in the picture or graph displayed (Patrick, 2011). According to Zuriyani (2012) images that are clearly presented with varied colors can help students understand the concepts learned.

Based on the description of logical validity data by experts, it can be seen that science-based science questions developed have met very valid criteria with an average validity of 88.98%.

As many as 60 scientific literacy-based items developed for each question have different values of item validity according to the type of questions such as Table 4 below.

Table 6. The results of empirical validity are evaluation tools based on scientific literacy

Type of Problem	Value of Validity
Multiple choice	0.52
Description and Compound	0.67
Attitude	0.84
Average	0.68
Criteria	Valid

From the results of the validity of the items as a whole obtained a value of 0.68 (68%) and included in the criteria valid. Based on the second value of this validity (logical and empirical validity) it can be concluded that the questions developed are included in the valid criteria with a validity value of 78.49%.

Rustaman (2013) states that tests that have good validity are tests that truly measure the mastery of the material that should be mastered in accordance with the teaching content listed in the Outline of the Teaching Program (GBPP). Valid assessment of science-based literacy questions indicates that the question can be used as an evaluation instrument in science learning at school.

IV. CONCLUSION

Based on the results of the research and discussion it can be concluded that the scientific literacy-based science subject evaluation tool has been successfully developed. The scientific literacy-based science subject evaluation tool developed has validity with valid criteria in terms of logical validity and empirical validity. This evaluation tool can be used as a guideline in making analysis questions in order to help students improve the analytical process of high-level thinking.

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