

Development of Evaluation Tool Based on Science Literacy on Topics of Water Recycling

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Abstract

The aims of this research were to develop evaluation instrument based on science literacy which was appropriate to be applied, comprehend and easily to be learnt by the students, and functional to identify the capability of scientific literacy among students. The research methods used ADDIE design (Analysis, Design, Develop, Implement and Evaluate). The subjects of the research was the fifth degree students in Gisikdrono 02 Primary School Semarang. Validity test results indicated that the instrument has been valid. The reliability test result gained 0.83 with excellent criteria. The characteristics of evaluation instruments which had developed indicate that the instrument had a proportion of difficulty level in number of 20% easy questions, 55% about moderate, and 25% difficult questions. The results of the differentiation power analysis then combined with the level of difficulty and obtained 30 question items with good quality that can be used. The scientific literacy capability profile tested by the developed instrument showed that the mastery of science literacy in moderate criteria.

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INTRODUCTION

Focus of Science education based on (AAAS) *American Association for the Advancement of Science* is science Literacy (Ridwan, et al. 2013). OECD (*Organization for Economic Co-operation and Development*) defined science literacy as the ability to conclude and solve problems about nature and the interaction between nature and society (Rusilowati, 2015). PISA (*Programme for International Students Assessment*) stated that science literacy as a capacity to use scientific knowledge and ability, identify questions and draw conclusions based on books and data in order to make decisions about human interaction with nature (Toharudin, 2011). Chiapetta (1991) revealed that there are four aspects of science literacy that is science as a body of knowledge, science as a way of investigating, science as a way of thinking and interaction between science, technology, and society.

Science literacy of Indonesian students is under average and commonly on the low international benchmark (Toharudin, 2011). This is in accordance with the TIMSS (*Trends in International Mathematics and Science Study*) results that Indonesia's scientific ranking in 2015 dropped to 45th rank from 48 countries. Competence of students' science becomes low because students are not trained to express opinions or ideas, so when they were given the problem related to the meaning and relevance of the material with the surrounding environment, students are unable to solve it (Mardhiyyah, 2016).

This is apparent at the time when the research was conducted for initial test to students of grade five Gisikdrono 02 elementary school of 50 students. Initial tests were adapted the TIMSS problem for primary school with an average score of 61.5. The results did not match the expectations. Based on the observation results, the learning process was already included the ability of science literacy. The problem shown that the results were not in accordance with the expectations in the Curriculum 2013 which is better education system shown by low student initial test result.

Facts of the low ability of students in doing science problems that contain the components of science literacy which usually in essay type, so it is necessary that in order to increase the science literacy for students, the tests are presented the form of multiple choice questions. Hartati (2015) stated that science literacy was important to be mastered by students in relation to the way students were able to understand the environment, health, economics, and other problems faced by modern societies that rely heavily on technology and progress, as well as the development of science.

In line with the research results, Fu'adah (2017) found that the students literacy profile was still low which was indicated by the percentage of mastery of science literacy under 60% for each category. They suggested that the development instruments based on science literacy to evaluate students' science literacy skills should be improve so that students are familiar with science-based literacy matters. Mardhiyyah (2016) in her research indicates that the ability of science literacy of fourth grade students in all aspects of science literacy is still at low level. Sinaga (2015) stated that for the improvement of assessment instruments on student teachers can develop a model of the PISA model for integrated scientific learning. Based on the results of the research, assessment instruments need to be developed with an emphasis on the ability of science literacy aspects.

Based on the background of the problem, it is necessary to develop a evaluation instrument based on science literacy to measure students' literacy skills. But in the research the topic arrised is water cycle materials, due to its commonsense to the students daily life activity.

METHODS

The research method is R&D method. It is used to produce a specific product and test the activity of a particular product (Sugiyono, 2012) and to develop new products or refine products that already existed and could be accounted for (Sukmadinata, 2012).

This research developed evaluation tools based on science literacy of water science materials. The instruments were given to a team of validators consisting of experts in the field of materials and evaluation experts. Both validators provide achievement feasibility about evaluation to be used on research subject. Development model in this research use model according to Branch (2010) which was consist of analyze, design, develop, implement, and evaluate.

The test subjects used in this study were 124 students of grade five Gisikdrono 02 primary school Semarang. Technique of data collecting in research of development of evaluation tool based on science literacy of water cycle topic. There were 4 kinds of data collection method. They were observation, test, questionnaire, and document. The instrument test analysis was used to test on 40 questions in the water cycle matter in grade 6 students of Gisikdrono 02 primary school. Analysis of the instrument test were used the validity, normality, difficulty index, and different problem.

RESULTS AND DISCUSSION

Feasibility of Evaluation Instrument Based Science Literacy

Characteristics of evaluation instruments based science literacy developed includes validity, reliability, difficulty and distinguishing power.

1. Validity

Table 1 shows the result of validation of evaluation tool based science literacy by the expert shows that the assessment covered 2 aspects of content component and content presentation components included in the criterion is very valid. Expert validation results on evaluation tools based science literacy in line with research Widiyanti (2017) which gained very high level of validity with 3.35 score.

Table 1. Recapitulation of Validation Results of Evaluation Tools Based Science Literacy

Validator	Score	Percentage (%)	Criteria
Matter	9	90	Very valid
Evaluation	9	90	Very valid

This is in line with the research of Charmila (2016) which shown that the results of the study and discussion concluded that the mathematical problems of the PISA model using the Jambi context developed have been valid and practical.

2. Reliability

Table 2 shows the results of reliability test analysis which obtained value of r_{11} of 0.83 greater than the r_{tabel} of 0.279. So, it can be concluded that the problem is said to be reliable because the value of $r_{11} > r_{tabel}$ and has a very high reliability criteria.

Table 2. Recapitulation of Reliability Test Result

n	r_{value}	r_{tabel}	Conclusion	Criteria
40	0.83	0.279	Reliable	Very high

Distinguishing power

Table 3 shows the results of the distinguishing power of 40 test questions. There are 6 questions including excellent criteria, 8 questions including good criteria, 17 questions included in intermediate criteria and 9 questions including poor criteria. So there are 30 questions that are used for evaluation tools.

Table 3. Recapitulation of The Distinguishing Power

Criteria	Number of question item	Amount of question
Poor	9, 18, 19, 21, 26, 27, 34, 35, 38	9
Intermediate	2, 3, 4, 5, 6, 12, 13, 15, 16, 17, 22, 25, 29, 30, 32, 33, 36	17
Good	7, 23, 24, 28, 31, 37, 39, 40	8
Excellent	1, 8, 10, 11, 14, 20	6

3. Difficulty Index

Analysis of validity, reliability, distinguishing power and difficulty index questions used in this study is a valid and reliable question. As for the level of difficulty and different points of the matter, it is seen that the composition is between difficult, medium and easy. The composition of the problem that has distinguishing power is very good, good,

intermediate and poor. The result of the calculation show that the worthy items to use were 30 problem while the less worth item were 10 problem.

Tabel 4. Recapitulation of Difficulty Index

Criteria	Result	
	Number of question	Amount of questions
Difficult	8, 10, 33	3
Moderate	6, 7, 9, 11, 12, 13, 14, 15, 17, 18, 22, 25, 28, 29, 30, 34, 36	17
Simple	1, 2, 3, 4, 5, 16, 19, 20, 21, 23, 24, 26, 27, 31, 32, 35, 37, 38, 39, 40	20

The Practical of Evaluation Tool Based on Science Literacy

1. Questionnaire of Student’s Feedback

Questionnaire of student’s feedback was given to students who have been working on evaluation tools based on literacy of water science matter. Any student who has worked on evaluation tools based science literacy is provided with a student response questionnaire to be filled in accordance with the student's response to evaluation tool based science literacy.

The results of a large-scale student response of grade five in Gisikdrono 02 primary school on evaluation tools based science literacy of 100 students. There is one aspect that got 97% that is on aspect 1. In addition there is one aspect that 98% that is on aspect 10. There are 2 aspects that got 99% on the aspects of 5 and 6 and there are 6 aspects that 100%.

2. The Questionnaire of Teacher’s Feedback

Questionnaire of teacher’s feedback is a questionnaire given to teachers to analyze the practicalities of evaluation tools based science literacy on science learning water cycle matter.

Teacher's responses questionnaire on large-scale trials to 4 teachers of grade five in Gisikdrono 02 primary school to evaluation tools based science literacy from 10 aspects that asked 3 aspects that got score 15 or 93.75% that is on aspect 2, 3 and 8. In addition there are 7 aspects that got the number of 16 or 100% score that is aspect 1, 4, 5, 6, 7, 9 and 10.

3. Student Cognitive Learning Outcomes

The students' cognitive learning outcomes in working on evaluation tools based science literacy consist of small-scale, small-scale and large-scale test scores. The evaluation tool based science literacy consists of 30 questions consisting of 16 aspects of knowledge, 8 aspects of the process, 3 aspects of thinking and 3 aspects of the relationship of science, technology and society.

Small-scale trials were conducted with the subject of 8 students of grade five in Gisikdrono 02 primary school. The limited trial subjects consisted of 28 class Five D students and a large-scale trial consisting of 100 five A, five B and five C class in Gisikdrono 02 primary school students. The students' cognitive learning outcomes in doing evaluation tool based science literacy presented in Table 5.

Table 5. Cognitive Learning Outcomes of The Science Literacy-Based Evaluation Tool

Trial	Average
Small scale	65.83
Limited scale	71.52
Large scale	80

Table 5 shows that the value of small, limited-scale, and large-scale pilot trials are increasing. The empirical study supporting this research is Astuti's research (2012) which developed the literacy-based assessment of science matter of development stage secretion began with validation by showing that the assessment instrument is very suitable to be used. The results of small-scale trials also show that effective assessment instruments improved student learning outcomes and are practically used based on student and teacher response outcomes.

Sudiatmika (2010) stated that junior high school teachers in Bali still make assessment or assessment that only emphasizes the cognitive aspect. Saad (2012) explained the relationship between knowledge and practice of teaching in the classroom. This could be anticipated by the socialization of the making and use of instruments, so that teachers become accustomed to using assessment instruments.

The students' science literacy profile is seen from the range of score scores obtained by the students. The results obtained by the students in the large-scale trial are listed in Table 6.

Tabel 6. The Result of Assesment that Obtained by Students

Range of score	Student's score average	Literal level
$0 \leq x \leq 40$	16	Nominal
$40 < x \leq 98$	65	Funcional
$98 < x \leq 154$	15	Conceptual
$154 < x \leq 160$	4	Multidimensional

Based on the data presented in Table 6, it can be concluded that the students' science literacy profile obtained by students is in functional level. At this functional level students have the ability to understand the concepts of science but students have not been able to apply science in society and technology and students can recognize problems that can be scientifically investigated.

The importance of students' understanding of the concept of the water cycle to scientific literacy abilities, so students are wiser to use water in their daily lives. Haristy, et al (2013: 3) stated that students have difficulty in getting meaning and using science to solve various problems that occur in everyday life that actually requires a good understanding of science in his lives.

CONCLUSION

Evaluation tools based on the literature of water cycle science matter are considered feasible and practical to use based on the assessment of experts who meet criteria very valid on the material, construction and language aspects used. Evaluation tools based science literacy can measure the science literacy level of grade V elementary school students. The scientific literacy ability profiles obtained by students are at a functional level.

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