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H B Atta[1], Vlorensius[1], Irianto Aras[2] and Ikhsanudin[3]

[1]Biology Education Department, Faculty of Teacher Training and Education, Borneo University of Tarakan
Jl. Amal Lama 1, Tarakan, Kalimantan Utara, Indonesia
[2]Mathematics Education Department, Faculty of Teacher Training and Education, Borneo University of Tarakan
Jl. Amal Lama 1, Tarakan, Kalimantan Utara, Indonesia
[3]Doctoral Student, Graduate School, Yogyakarta State University
Jl. Colombo 1, Karangmalang, Depok, Sleman, Yogyakarta, Indonesia

kayyiez92@gmail.com, vlodit72@gmail.com, arasirianto1990@gmail.com, ikhsanudin.2019@student.uny.ac.id

Abstract. Scientific literacy is the ability to read, write, and assist in acquiring competencies that are interrelated to learning science effectively. This research aimed to know the construction, characteristics of items, and quality of developed scientific literacy instrument and to measure the ability of scientific literacy of junior high school students in Tarakan city. This research uses the procedure of test development. The research samples for developing the instrument and measuring ability were 733 students obtained from six junior high schools, which determined by purposive sampling. The data were collected by administering the test and documentation. The data analysis use Winsteps and SPSS computer programs. The results demonstrate the instrument which meets scientific literacy was in the form of 40 items of multiple-choice questions and 6 items of essay questions. The content validity of the test instrument was 0.77, and the Cronbach reliability was 0.85. Both of these criteria were in the high category. The ability of scientific literacy of students in Tarakan city in the knowledge and process dimensions were relatively low. In this case, it should be considered that the development of scientific literacy skills needs to be optimized, especially at the samples.

1. Introduction

Education has an important role in developing the life of the nation by developing the potential of each individual. One important potential is the knowledge and skills that describe the individual's ability to solve problems. Education is the basis for spurring individuals to have scientific and technological competencies to support the success of developing the intended potential. Scientific literacy can help individuals solve problems in various situations. Scientific literacy is important to be mastered by students so that they can understand the problems in society that are very dependent on technological progress and the development of science [1].

Science literacy prepares individuals to become citizens who are responsible and sensitive to around problems. Research on Special Issue on Scientific Literacy explains that scientific literacy is an integral component in the development of human resources [2]. Scientific literacy is a very important thing to be mastered by each individual because it is closely related to how one can understand the environment

and the problems faced by modern society [3]. Science is one aspect of education that is used as a tool to achieve educational goals, to raise individuals who are literate in science [4].

In the context of the PISA (Program for International Student Assessment), scientific literacy is defined as the ability to use scientific knowledge, identify questions and draw conclusions based on evidence, in order to understand and make a decision regarding nature and changes made to nature through human activities [5]. PISA 2000 and 2003 define three major dimensions of scientific literacy in their measurement, namely science processes, science content, and science applications. In PISA 2006, the dimensions of scientific literacy were developed into four dimensions with additional aspects of science attitude [6]. Each dimension of scientific literacy has its own assessment indicators.

Based on the PISA 2015 research, Indonesian students' literacy skills still need to be improved. Indonesia ranks at 62 of 70 countries in the Country Note-Result of PISA 2015. About the score of the test, the increase in Indonesia's achievements in 2015 provided optimism, although it was still low compared to the OECD average [7]. Based on the average value, there is an increase in the value of Indonesian PISA in the three competencies tested. The highest increase was seen in science competencies, from a score of 382 in 2012 to a score of 403 in 2015. Improvements, changes, and renewal in various matters are needed to improve the students' scientific literacy. Educators can use appropriate learning instruments to help and facilitate the students in developing their potential.

The effectiveness and efficiency of educational instruction cannot be separated from the learning instruments used. Therefore, learning instruments have an important role in the teaching and learning process. In line with the explanation above, the development of instruments, namely syllabus, lesson plan, worksheets, and students' book must be scientific literacy-oriented with certain learning models stated to improve learning outcomes based on comprehensive criteria in terms of cognitive, affective and psychomotor through the quantitative analysis [8]. Thus, further research is needed regarding the development of scientific literacy at different levels of the class to enrich the concept of good learning instruments. As a response to this situation, it is very interesting to conduct research related to scientific literacy assessment at the secondary school level.

Improving scientific literacy skills, students in learning can use a variety of strategies, as well as learning tools, that do not only contain the concepts but also include scientific literacy [9]. Indonesian students' literacy skills are influenced by many things, including curriculum, education system, selection of teaching methods and models, learning facilities, learning resources, teaching materials, and so forth [10]. Therefore, to improve and improve students' literacy skills, there needs to be improvement and renewal in teaching and learning activities in the center of country to the outermost regions of the country.

The condition of the outer regions of Indonesia is different from the condition of advanced urban areas with adequate facilities and environmental conditions. Communities in the outermost areas certainly need an increase in human resources, including in Tarakan city, North Kalimantan Province. This is aimed at developing the capability of the communities to facing the high competitiveness of neighboring countries. On the other hand, North Kalimantan is the 34th Province, as well as the youngest province in Indonesia. One of the cities in this province is Tarakan. In this case, learning outcomes in the cognitive domains of students in Tarakan city were still considered low [11]. Critical thinking skills of junior high school students in Tarakan city still in the low category and need to be improved [12]. These conditions indicate low scientific literacy ability. The low level of scientific literacy of students will have a negative impact on people's ability to survive in the current globalization era. This is due to the lack of information obtained in solving the daily problems so that it affects the individual's ability to encounter life problems.

The explanation above is an asset that must be maintained and improved in order to advance Tarakan city and prospering the lives of the people. Various potentials that can turn out to be a big profit for Tarakan city including the location of the strategic geographical location as an international shipping channel. This will be directly proportional if the people of Tarakan city have academic competencies that can be highly competitive. The importance of scientific literacy assessment aims to increase intellectual capacity so that it has sufficient tools of thought to carry out its role. Although in the local

scope at Tarakan city and the junior high school level, scientific literacy instruments can measure the characteristics of students who have low to high abilities. Based on the issues described before, it is necessary to conduct research on the assessment of scientific literacy of junior high school students in Tarakan city, especially regarding the development of instruments that can be used in evaluating and improving students' scientific literacy skills.

2. Research Method

This research is development research with the test instruments that refer to the Mardapi model [13]. Steps to develop test instruments starting from compiling test specifications, writing test questions, examining test questions, conducting test trials, analyzing test items, improving tests, assembling tests, administered the tests, and interpreting test results. The sample was the number of 733 students from six schools was determined by considering the national examination scores of low, medium, and high on science subjects. The instruments developed in the form of scientific literacy assessment instruments that consist of 40 items with 7 items anchor and student worksheet material for the human respiratory system. The sample used for the trial was 303 students and for the measurement of the domain of knowledge as many as 260 students and for the measurement of the process domain as many as 170 students. The research was assisted by six observers. The data was analyzed in both classical test and item response theory using Winsteps and SPSS computer programs.

3. Results and Discussion

3.1. Validity and Reliability of the Science Literacy Assessment Instrument

The instrument that can be used for measurement is the instrument that has met the valid and reliable criteria. The developed instrument in this study is a test along with a scientific literacy answer sheet, which is the main product of this research. The content validity analysis obtained the Aiken index of 0.77 so that the contents of the instrument proved valid. Furthermore, construct validity was analyzed using explanatory factor analysis by using the SPSS program. Based on the output of total variance which explains the eigenvalues in each component and variance explained in the scree-plot, it shows that the assumption of the dimensional measurement of the model has been fulfilled. This is indicated by the eigenvalues found in the scree-plot image. Before the factor analysis is carried out, it is necessary to test the adequacy of the sample used for analysis. The following are the results of KMO and Bartlett's Test.

Tabel 1. The result of KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.719
Bartlett's Test of Sphericity	Approx. Chi-Square	4.301E3
	Df	780
	Sig.	.000

Based on the results, it is known that the KMO value is 0.719 or greater than 0.50. Thus, the sample size used in this trial is sufficient for factor analysis. In addition, the chi-square value of the Bartlett test is 4300.976, with 780 degrees of freedom and p-values smaller than 0.05. This is in line with the opinion that the KMO MSA test equipment is used to measure intercorrelations between variables. The matrix can be analyzed for factor analysis if it has KMO> 0.5 [14]. Then, the test dimensionality is fulfilled if the test is proved to only measure one dominant dimension, the same ability [15]. Based on the output of analysis, the number of factors formed can be seen from more than one eigenvalue, which means it is a factor used as an indicator [16]. The results of the analysis show that there are thirteen factors formed and can explain about 66.48% of the total variance. This eigenvalue is presented in the scree plot (Figure 1). The results of the analysis show that factor 1 is the dominant factor because it has an eigenvalue of 6.617 where the value is the largest than the other or dominant. The cumulative percentage of 66.48%

mention above has met the criteria of minimum cumulative value (>50%). It means that taking a number of factors has been declared appropriate [16].

Based on these explanations, scientific literacy instruments are considered unidimensional. The dimensions measured in the data can be proven in the results of the scree-plot, which is a steep number. The number of steeper shows how many dimensions or factors, and the slope of changes in eigenvalues does not indicate the existence of dimensions [17]. Therefore, the dimensions can be seen from the results of the scree-plot formed. Tests are said to be unidimensional when the components 1 and 2 in a scree-plot have a considerable distance. The scree-plot of the construct analysis output can be seen in Figure 1 below.

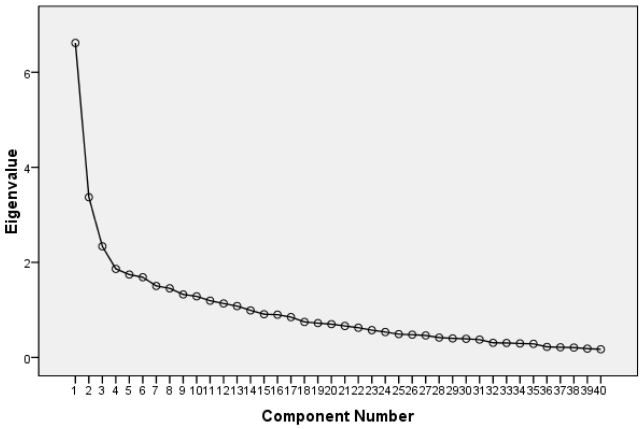

Figure 1. *Scree Plot* of construct validity of science literacy assessment instrument

Figure 1 shows that component one is far away from component two, while component two to component three and so on is close to the eigenvalue, which starts to slope on the third component. It shows that there is one dominant factor, and other factors make a large contribution to the variance that can be explained so that it can support the validity of the instrument that is developed. Validity is evidence and theory support for the interpretation of test scores in accordance with the purpose of using the test [13]. Validity leads to the truth of comparability between theory and the contents of the instrument [18]. Instruments that have the validity of the test instrument 65% of items are very high, and 35% of the items are high category can be said to be good test instruments [19].

Furthermore, the instruments used in the test must be tested for reliability. Based on the results of the analysis, obtained a reliability value of 0.85 so that the reliability of the test is categorized as very high, and the results of student scientific literacy measurements can be trusted. Reliability implies the existence of a provision or consistency,y that is if a stimulus is repeated or repeats under the same conditions, it will produce the same response. The stimulus used can be a question or statement, while the response can be in the form of an answer or a result of physical measurement. The measurement process that is unstable or inconsistent will be said to be unreliable. Based on the results of the analysis, in line with the research conducted by Ridwan [20] about the development of assessment instruments with a contextual approach to measure students' level of scientific literacy, the results of validity showed that the instrument was in a valid category with limited reliability of instruments at 0.77 and extensive trials of 0.81. This value states that the reliability of the test meets the criteria of a good instrument.

3.2. Item Difficulty of Science Literacy Assessment Instrument

The characteristics of the test instruments analyzed in the development of this test instrument are the level of item difficulty. The analysis of the difficulty level of items on the test instrument that has been tested with analysis using Item Response Theory. The level of difficulty of the items can be seen in the following table.

Table 2. The difficulty of items of science literacy assessment instrument

Item Difficulty (b)	Item's Number	Total Items
b>2	1	1
1 < b ≤ 1	11, 14, 2, and 4	4
0 < b ≤ 0	32, 10, 7, 22, 24, 28,31, 26, 18, 20, 13, 23, 19, 15, 40, 21 and 16	17
-1 < b ≤ 0	36, 8, 30, 27, 9, 35, 6, 17, 12 and 5	10
-2 < b ≤ -1	5, 12, 34, 29, 3, 38, 39 and 25	8

The results of the analysis demonstrate that each item has a different level of difficulty. There is only one item that is outside the category (item number 1), the difficulty level of this item is 2.02 in logit scale; it is very difficult. The criteria for receiving items are -2 to +2; the greater level of difficulty is more difficult item than the smaller one. This is in line with the statement of Hableton and Swaminathan [15] that the value close to -2 indicates that the item is getting easier, and the value close to +2 indicates that the item is more difficult than the others.

3.3. The Students' Ability in Science Literacy

The results of the knowledge domain of science literacy assessment on 260 subjects in Tarakan city, can be seen in Table 3 below.

Table 3. The ability science literacy of students in knowledge dimension in Tarakan City

Ability (θ)	Number of Student(s)			Total Student(s)
	School A	School B	School C	
0 < θ ≤ 1	7	0	2	9
-1 < θ ≤ 0	40	28	50	118
-2 < θ ≤ -1	46	42	26	114
-3 < θ ≤ -2	3	5	3	11

Based on Table 3, it can be concluded that students' literacy skills tend to be at the ability scale of -1 < θ ≤ 0 and -2 <θ ≤ -1, the number of students in the first category is 118 and the second is 114. Then, the results of this study are scientific process aspect for students to test the hypothesis. Assessment of student science processes is carried out by using Student Worksheet. Some aspects of science process assessment begin from observing, classifying, communicating, interpreting data, measuring, using tools, conducting experiments to concluding something they found. Average scores of students' science processes can be seen in Table 4 below.

Tabel 4. The Students' ability of science literacy of in knowledge dimension in Tarakan City

School	School A	School B	School C	Total
Mean Score	67,89	55,03	48,96	57,29

Assessment of science literacy is not only part of knowledge, but also science processes are included in the scientific literacy section. Science process skills are physical and mental skills related to fundamental abilities that are possessed, mastered, and applied in scientific activity. The students' scientific literacy skills can be seen in the tables. The ability of the scientific literacy of students in the knowledge dimension is relatively low. This low level of scientific literacy abilities of students may be influenced by several factors, including the curriculum and education system, the selection of learning

methods and models, learning facilities, and learning resources. The independent variables that assumed consistently influence the scientific literacy of students are the reading ability, mathematical ability, and facilities that supporting learning. The results of these studies indicate that students' scientific literacy abilities can not be separated from the variables that influence it. Therefore, in further learning it is necessary to pay more attention to several variables related to the development of scientific literacy so the learning can be more optimal.

Achieving scientific literacy skills can be improved through the learning process. Learning experiences that are able to improve scientific literacy are explained by Toharudin [21], including using science concepts, applying process skills, and science values when making decisions and being responsible in daily life. In the context of literacy, there are possibilities for using science to leverage reading comprehension and reading to leverage science understandings in classrooms [22]. Teachers were recommended to focus their pedagogical attention on the method of obtaining knowledge and understanding problem-solving in the wider context to improve the science literacy skills [23]. The teachers have to understand that science literacy skills is important aspect of teacher professionalism and self-directed professional learning [24]. Prepare environmentally literate citizens; the conceptual framework is needed [25]. In this case, the teacher needs to create the learning processes in such a way to stimulate the science literacy of students. Besides that, the teachers need to pay attention to the bias factor in science literacy improvement such as the gender aspect of students [26]. In addition, learning processes can be improved to knowing how people influence science and technology and how science and technology affect society, knowing the sources of information from trusted science and technology and use these resources in decision making. Achievement of students' scientific literacy skills carried out by scientific literacy assessment. In further learning, especially in Tarakan city, the scientific literacy assessment instrument that has been developed in this study can be used to improve students' scientific literacy skills through the learning process in classroom. Moreover, the teacher can develop the new instrument by referring to the blue-print of the instrument.

4. Conclusion

Based on the results of this research, the instruments produced are the test instrument and student worksheet. The test instrument consists of 40 items with 7 anchor items. The quality of the instrument is evidenced by the value of validity and reliability indexes obtained, namely Aiken validity, on average 0.77, and reliability of 0.85. The dimensional assumptions have met the criteria with a cumulative percentage of variance explained at 66.48%. In the test instrument, the difficulty level of 39 items in acceptance criteria. Furthermore, the results of scientific literacy skills that have been measured on the dimensions of knowledge of junior high school students in Tarakan city are in a low category. This indicates that the development of students' literacy skills is not optimal enough and needs to be improved. The product of this research can be used to improve the quality of the teaching and learning process and assess the students' skills as an evaluation to improve it.

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