

Students' Scientific Literacy Profile in Karanganyar

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Abstract. This research is aimed to find out students' scientific literacy ability. This research was conducted in class XI MIPA at two different schools in Karanganyar. The sample used in this study was 65 students. The method used in this research is quantitative method. The technique used in this study is a quantitative technique to analyze the data obtained. The instrument used is a question instrument containing 13 different level questions, adapted from scientific literacy question from PISA 2015. The instrument consists of four competencies of science literacy. The four competences of scientific literacy are interpreting data and scientific evidence, explaining scientific phenomenon, applying simple scientific knowledge, and evaluate and designing scientific inquiry. Data collected were analysed by scoring on each item, then grouped based on the competence of each item. Based on the results, obtained varying results for each of the competence measured. The achievement gained for each competence are relatively low, only small number of students are able to fulfill each competencies. The highest achievement of competencies is on explaining scientific phenomenon and the lowest achievement is on evaluate and designing scientific inquiry. It can be seen that the ability of scientific literacy students in Karanganyar is relatively low.

Keywords: instrument, profiles, scientific literacy, test

INTRODUCTION

Nowadays, along with the development of scientific and technology, required a capability that can help learners to face the problems in the 21st century. Science education is needed to help students prepare for the challenges of the globalization era. The general purpose of science education is creating talent and ability to obtain new scientific literacy. Furthermore, science education causes humans in their personal and social lives as citizens to play better roles [1]. Scientific literacy is the ability to use scientific knowledge to identify questions, and to draw evidence-based conclusions to understand and help make decisions about the natural world and the changes caused by man-made activities [2,3]. Scientific literacy is important for the learners in order to understand the environment and solve the problem. One of the most important objectives of Science Education is the development of scientific literacy [4].

PISA (*Programme for International Student Assessment*) defines scientific literacy as the ability to use scientific knowledge and ability, identify questions, and draw conclusions based on evidence and data in order to understand and help make decisions about the natural world and human interaction with nature [5]. The ability of scientific literacy is defined as the ability of a person to distinguish the facts of science from a variety of information, to know and analyze the use of scientific inquiry methods and the ability to organize, analyze, interpret quantitative data and scientific information [6].

In general definition, science literacy is a combination of skill, attitude value, understanding and knowledge about science necessary for individuals to develop their research-investigation, problem solving and decision-making skills, to become life-long learning individuals, to maintain their worry about the world around them [7,8]. The individuals with science and technology literacy are the ones who are more efficient in attaining and using the

knowledge, solving problems, making decisions by taking the potential resks, benefits, alternatives about the problems concerning science and technology into consideration, producing new knowledge [9].

According PISA’s data about measures the scientific literacy’s aspect of learners, Indonesia's achievements are always below international standards with results that are still far from satisfactory. Based on the data obtained, the rank of Indonesian scientific literacy since 2000-2012 has decreased [10]. The data can be seen in table 1.

Table 1. Rank of Indonesian Scientific Literacy

Year	Indonesia’s Average Scores	Maximum Scores	Indonesia Ratings	Number of Participan Countries
2000	393	500	38	41
2003	395	500	38	40
2006	393	500	50	57
2009	383	500	60	65
2012	375	500	64	65

Scientific literacy is an indispensable ability in the 21st century, which need to be acquired by future generation in order to meet the challenges of globalization due to the advancement of information and technology [11]. Scientific literacy is defined here as using applied content knowledge, while practicing safe and ethical approaches to inquiry during the practice of constructivism, or invention literacy [12]. Scientific literacy means knowledge and understanding of the scientific concepts and prosesses required for personal decision-making, participation in civic and cultural affairs, and economic productivity [13]. There are a number of reasons why scientific literacy is considered important. The society we live in depends to an ever-increasing extent on technology and the scientific knowledge that makes it possible. In live, decisions we make every day have the capacity to effect energy consumption, our personal health, natural resources, and the environment ultimately the well being of ourselves, our community, and the world [11].

In this research, there has been aimed to find out the senior high school students’ scientific literacy ability, which is one of the important capabilities that must be possessed in the 21st century.

METHODS

This research was conducted to find out the profile of students' scientific literacy ability in Karanganyar. The method used in this research is quantitative method. Quantitative method is a research method based on the philosophy of positivism, used to examine the population of a particular sample, sampling techniques are generally random, data collection using research instruments, quantitative or statistical data analysis with the aim to test the hypothesis that has been established [14].

The sample used in this research is the students of class XI MIPA at two different schools in Karanganyar such as SMA Negeri Colomadu and SMA Negeri Gondangrejo in academic year of 2017/2018. The sample used in this study was 65 students. The research variable in this study is the ability of students' scientific literacy, measured by using an assessment instrument. The research instrument was used in this research is scientific literacy test that adapted from PISA 2015. The instrument consists of 13 questions test with different level, that consist from level 1 to level 5. The competencies of scientific literacy used in this instrument consisting of interpretation of data and scientific evidence, explaining scientific phenomenon, applying simple scientific knowledge, and evaluation and scientific design.

The data obtained analyzed quantitatively by scoring on each item. Data processing technique done by calculating the percentage of students who are able to answer each question correctly, after previously done grouping questions based on the level of questions and competencies of scientific literacy. The questions with the same level grouped, then calculated percentage of students who are able to answer questions at those levels correctly. It also applies to issues that shared the same competencies. This grouping aims to know the level of achievement and competencies of scientific literacy to be measured.

Several stages committed to the data obtained are as follow:

1. Collect data.
They collaboratively learn to collect and generate multiple types of quantitative and qualitative data, supported by the coach. In the first step, they collect data to ascertain the scope of the problem, and to determine goals [15].
2. Assessment on any questions successfully answered correctly.
3. Group of data
Grouping questions based competencies and level of scientific literacy.
4. Converting score into value
Converting score to get percentage of competencies and levels. Written in equation 1 [16].

$$Value = \frac{scores\ obtained}{mainum\ scores} \times 100 \quad \dots\dots (1)$$

5. Analyze data
In the first step, they check the quality of the data collected regarding the problem, and then analyze these data, to formulate evidence-based goals, determine the quality of the data collected aabout the underlying cause of the problem [15].
6. Interpret data and describe the data.
Calculated the percentage based of competencies and level of scientific literacy measured.. Collaboratively learn to transform data into information, by reading and interpreting tables and graphs, and interpreting information from diverse analyzed qualitative data, in order to draw a conclusion. They interpret the data regarding the problem, by interpreting the mean of student achievement data, and use this information to formulate their specific data-based goals [15].
7. Explaining the data results.

RESULTS AND DISCUSSION

Scientific Literacy Achievement

The results obtained from research on students' scientific literacy profile categorized based on the level of questions and scientific literacy competencies.

1. Analysis Students' Profile Based on Level of Scientific Literacy

Recapitulation results from scientific literacy data based on the level of questions as listed in table 2.

Table 2. Result of Scientific Literacy Level

Level of scientific literacy	Percentage
Level 1	47,68 %
Level 2	59,99 %
Level 3	59,61 %
Level 4	26,66 %
Level 5	3,07 %

2. Analysis Students' Profile Based on Scientific Literacy Competencies

The results obtained based on the achievement of each competencies of scientific literacy measured can be seen in table 3.

Table 3. Result of Scientific Literacy Competencies

Competencies	Percentage
Interpreting data and scientific inquiry	48,61 %
Explaining scientific phenomenon	53,76 %
Applying simple scientific knowledge	30,76 %
Evaluate and designing scientific inquiry	28,61 %

Discussion

The data in table 2 which shows the achievement of scientific literacy based on the level of questions, shows that 47.68% students are able to answer correctly questions at level 1. It shows that as 52.32% of students are unable to correctly answer the questions at that level. At this level, students have limited scientific knowledge, they can present scientific explanation that are obvious. At level 2 shown achievement of 59.99%, which indicates that there are 40.01% of students who can not answer the question at that level correctly. At this level, they have adequate scientific knowledge to provide a direct reason and making literal interpretations. At level 3 as many as 59.61% of students answered correctly, while 40.39% of students did not answer the question correctly. At this level, students can interpret and use scientific concepts to explain phenomena and develop short statements. At level 4, students can select and integrate explanations from different disciplines. The results shown that only 26.66% of students who answered the question correctly, it means there are about 73.34% of students did not answer the question correctly. At level 5 the results are very different from previous levels, only 3.07% of students are able to correctly answer questions at level 5, while 96.93% of students are not able to answer the questions at those levels correctly. At this level, students are required to construct explanations based on evidence and arguments based on their critical analysis.

Based data on Table 3 described the attainment of competencies of measured scientific literacy. In competence about the ability of interpreting data and scientific inquiry, 48,61% students fulfill the competence. It indicates that there are more than half of the students, that is 51.39% of students who have not fulfilled the competence. The explaining scientific phenomenon competence there are about 53,76% students who meet the competence, while 46,24% have not fulfilled competence. Furthermore, the competence of applying simple scientific knowledge is only about 30.76% of students who are able to fulfilled the competence, 69.24% of students not fulfills the competence. The competence of evaluate and designing scientific inquiry of competency achievement is only 28,61%, while 71,39% not fulfilled the competence.

Based on the data that has been obtained, it can be seen the students' science literacy profile in Karanganyar, especially the students of the XI MIPA SMA Negeri Colomadu and SMA Negeri Gondangrejo. Based on the results of research that has been done, it can be seen that the ability of scientific literacy students in Karanganyar is relatively low. This can be seen from the percentage of students who can not answer the test questions correctly, both when viewed from the percentage of research results are calculated based on the level of questions and achievement of scientific literacy competence. Besides the results of this investigation also highlight the important role social studies can play as a context for implementing authentic, interdisciplinary simulations that ground learning an applied setting [17].

The lack of the results of the achievement of the test was conducted due to the students are not used to think as scientist and students not have good qualified of scientific literacy ability. It is very contrast with the demands of the ability to be owned by students to challenge the rapid changes in science and technology in the 21st century. Such science literacies involve much more than just content knowledge, but also require an understanding of the representations and interpretation of scientific data, scientific explanations, projections, and the process of science [17].

CONCLUSION

This research aimed to find out the senior high school students' scientific literacy ability in Karanganyar. Based on the result of research and data analysis that has been done in both schools, it can be seen that the percentage of achievement in each level as well as the competence vary greatly. Based on the level of scientific literacy, at level 1 there are 47.68% students can answer questions correctly, 59.99% students can answer question correctly at level 2, 59.61% students can answer question correctly at level 3, 26.66% students can answer question correctly at level 4, and 3.07% students can answer question correctly at level 5.

The result of the achievement test of competencies of scientific literacy, it is found that 48.61% of students fulfill the competence of interpreting data and scientific inquiry, the achievement of explain scientific phenomenon is

53,76%, applying simple scientific knowledge 30,76%, and evaluate and designing scientific inquiry amounted to 28.61%.

Based on the results obtained, known the achievement of scientific literacy level and the competencies of scientific literacy is still relatively low, it can be concluded that the ability of scientific literacy students in Karanganyar still relatively low. The low percentage earned by students due to the low ability of students' scientific literacy. In order to provide students develop in terms of scientific literacy, it is necessary to help them improve their causal mental processes. Accordingly, increasing the performance of the students to the highest level on "data collection" to improve problem solving, critical thinking, doing research, and making decisions; namely, to be a science literate [18].

This data can be used to facilitate teachers to know the students' scientific literacy ability based on their profiles. We believe that still have much to learn and do a lot of similar research or more about scientific literacy useful to determine the cause of the results of achievement obtained were unsatisfactory.

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