Student’s profile about science literacy in Surakarta

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Abstract. This research was conducted to find out student’s initial profile of science literacy. The method used was descriptive with 46 students as subjects. The instrument used is science literacy question referring to PISA 2015. Data processing technique used are scoring on each question, changing the score values, grouping the level subjects obtain based on the value and conclusion. Competencies measure in this test are explaining scientific phenomena, interpretation of data and evidence scientifically, and evaluate and design scientific inquiry. The results of the three competencies are 30.87%, 40.20%, and 24.90%. Achievement level of science literacy achieved by students in level 1 47.82%, level 2 33.82%, level 3 42.93%, level 4 26.50%, level 5 21.73%. Based on the result of research, it can be concluded that the ability of science literacy students in Surakarta relatively low.

1. Introduction

People’s lives are evolving along science and technology advances. Therefore, need a society that knows and understands the problem in society. In this case, education is becoming the determinant of society’s ability to face the progress. The educational process is expected to form students who are science and technology literate. Science literacy is considered important in development that occurred because science literacy can train critical thinking ability and science process skills [1]. Understanding of science and technology is essential for a person’s readiness to live in a modern society [2].

Definition of science literacy according to PISA is “An individual’s scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues, understanding of the characteristic features of science as a form of human knowledge and enquiry, awareness of how science and technology shape our material, intellectual, and cultural environments, and willingness to engage on science-related issues, and with the ideas of science, as a reflective citizen” [2]. Miller (2008) defines science literacy as the level of understanding of science and technology which is needed in people’s lives [1]. Dani (2009) defines science literacy as an understanding of concept and process of science necessary for decision making [3]. Generally, science literacy is defined as the ability to use scientific knowledge, identify questions, make factual inferences and apply in daily life.

Science literacy is an important an necessary ability, especially to face up the problems in the 21st century. Science literacy make enables one to make conclusions and make informed decisions [3]. In the era of globalisation, a people would need science literacy. Someone who literate science will live well in this era of globalisation [4]. According to Sadler (2009), someone who literate in science is able to make decisions regarding the issues in force, able to face situations where scientific ideas and
process are involved [5] [6]. Thus, it can be concluded that science literacy is an important ability to be possessed by a person. Science literacy helps one to solve problems and make scientific decisions.

PISA (Programme for International Student Assessment) is a literacy study that aims to examine periodically the ability of learners aged 15 years. The research is done every three years. Research by PISA aims to know the readiness of students in facing the challenges of the 21st century [6].

The PISA test result indicates that student’s literacy skills in Indonesia are still low. Indonesia is ranked 64 out of 65 countries. The scores obtained for science literacy are 382 [7]. PISA test results in 2015, Indonesia is ranked 62 out of 70 countries. The scores obtained for science literacy are 402 [8]. The scores obtained by Indonesia on PISA test 2012 and 2015 are at level 1. According to PISA 2015, there are 6 levels used to measure science literacy. The levels are level 1a&b with minimum score 334.9, level 2 with minimum score 409.5, level 3 with minimum score 484.1, level 4 with minimum score 558.7, level 5 with minimum score 633.3, and level 6 with minimum score 707.9 [9].

1st scientific competence measured in science literacy is identifying scientific problems (recognising the issues that are likely to scientifically investigate, identifying keyword to search scientific information, recognising the key features of scientific inquiry). The second competence measured in science literacy is explaining phenomena scientifically (applying knowledge of science in a given situation, describing or interpreting phenomena scientifically and predicting changes, identifying appropriate descriptions, explanation, and predictions). The last competence measured in science literacy is using scientific evidence (interpreting scientific evidence and making and communicating conclusions, identifying the assumptions, evidence and reasoning behind conclusions, reflecting on the societal implications of science and technological development) [10].

2. Method
This study was conducted to find out the initial profile of science literacy students in Surakarta. The method used in this research is a descriptive method. Descriptive method is a research method used to collect information on the subject of research [11].

The subjects in this study are students of class XI MIA, amounting 46 people. Subjects come from two different schools. The instrument used in this research is science literacy test that adapted from PISA 2015. The questions of test amount 13 questions. The competencies assessed in this test are interpreted data and evidence scientifically, evaluate and design scientific inquiry, and explain phenomena scientifically [8]. The competencies are divided into levels 1-5. In the implementation of the test, each student has distributed 1 sets of test questions. The time given to answer the questions is 30 minutes.

Data processing technique performed are:
1. Scoring for each question. The score for the perfect answer is 1. The maximum score if answer the questions perfectly is 13.
2. Converting score into value. Written in equation 1 [12].

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\text{value} = \frac{\text{scores obtained}}{\text{maximum scores}} \times 100 ........ (1)
\]

3. Grouping of research subject based on a value obtained. Subject are grouped into science literacy levels.
4. Calculate the competence achievement science literacy
5. Calculate the average ability of students science literacy
6. Analyse the data obtained and describe the data.
3. Result and Discussion

3.1. Result

Questions of test and categorization of science literacy levels adapted from PISA 2015. The result of science literacy test according to levels of science literacy shows in Table 1.

| Levels of Science Literacy | Percentage | Students Who Can Answered Questions on Level |
|----------------------------|------------|---------------------------------------------|
| Level 1                    | 47.82%     | 22                                          |
| Level 2                    | 33.82%     | 15                                          |
| Level 3                    | 42.93%     | 20                                          |
| Level 4                    | 26.50%     | 13                                          |
| Level 5                    | 21.73%     | 10                                          |
| Level 6                    | -          | -                                           |

If viewed from the achievement of science literacy competence from PISA, the result of science literacy test can be seen in Table 2.

| Competencies                              | Percentage |
|-------------------------------------------|------------|
| explain phenomena scientifically           | 30.87 %    |
| interpret data and evidence scientifically | 40.42 %    |
| evaluate and design scientific inquiry     | 24.90 %    |

3.2. Discussion

Based on the results of the science literacy tests shown in Table 1, Know that as many as 47.82% or 22 students can answer test questions that are at level 1. That's mean, as much as 52.18% student cannot answer questions level 1 and considered unable to perform the competencies contained at level 1. There are 33.82% or 15 students can answer the test questions that are at level 2. That's mean, as much as 66.18% can’t answer questions level 2 and considered unable to perform competencies contained at level 2. There are 42.93% of students or 20 students can answer the test questions that are at level 3. That's mean, as much as 57.07% can’t answer questions level 3 and considered unable to perform competencies contained at level 3. There are 26.5% or 13 students can answer the question at level 4. That's mean, as much as 73.5% students can’t answer questions level 4 and considered unable to perform competencies contained at level 4. 21.73% or 10 students can answer the questions that are at level 5. That's mean, as much as 78.27% students can’t answer questions level 5 and considered unable to perform competencies contained at level 5. The competencies levels are shown in Table 3 [2].
Table 3. Science Literacy Levels

| Levels of science literacy | Lower score limit | What students can typically do at each level |
|----------------------------|-------------------|----------------------------------------------|
| Level 6                    | 707,9             | At Level 6, students can consistently identify, explain and apply scientific knowledge and knowledge about science in a variety of complex life situations. They can link different information sources and explanations and use evidence from those sources to justify decisions. They clearly and consistently demonstrate advanced scientific thinking and reasoning, and they use their scientific understanding in support of solutions to unfamiliar scientific and technological situations. Students at this level can use scientific knowledge and develop arguments in support of recommendations and decisions that centre on personal, social or global situations. |
| Level 5                    | 633,3             | At Level 5, students can identify the scientific components of many complex life situations, apply both scientific concepts and knowledge about science to these situations, and can compare, select and evaluate appropriate scientific evidence for responding to life situations. Students at this level can use well-developed inquiry abilities, link knowledge appropriately and bring critical insights to situations. They can construct explanations based on evidence and arguments based on their critical analysis. |
| Level 4                    | 558,7             | At Level 4, students can work effectively with situations and issues that may involve explicit phenomena requiring them to make inferences about the role of science or technology. They can select and integrate explanations from different disciplines of science or technology and link those explanations directly to aspects of life situations. Students at this level can reflect on their actions and they can communicate decisions using scientific knowledge and evidence. |
| Level 3                    | 484,1             | At Level 3, students can identify clearly described scientific issues in a range of contexts. They can select facts and knowledge to explain phenomena and apply simple models or inquiry strategies. Students at this level can interpret and use scientific concepts from different disciplines and can apply them directly. They can develop short statements using facts and make decisions based on scientific knowledge. |
| Level 2                    | 409,5             | At Level 2, students have the adequate scientific knowledge to provide possible explanations in familiar contexts or draw conclusions based on simple investigations. They are capable of direct reasoning and making literal interpretations of the results of scientific inquiry or technological problem-solving. |
| Level 1                    |                   | At Level 1, students have such a limited scientific knowledge that it can only be applied to a few, familiar situations. They can present scientific explanations that are obvious and follow explicitly from given evidence. |

Based on table 2, the achievement of science literacy for each competency is still low. A total of 30.87% of students can meet the competence of explaining scientific phenomena. In this competence, students can remember the knowledge appropriate to a particular situation. Students can use
knowledge to interpret and provide explanations related to phenomena. Such knowledge can also be used to generate hypotheses when there is a lack of data.

A total of 40.42% of students can meet the competence of data interpretation and scientific evidence. In this competence, students can interpret and understand the basic forms of scientific data and evidence used to make claims and make conclusions. Students can identify assumptions, points and reasoning, students can different arguments based on scientific evidence and theories based on considerations, And evaluate scientific arguments and scientific evidence from different sources (internet, newspapers, journals, etc).

A total of 24.90% of students can meet the competence of evaluating scientific design and inquiry. In this competence, students can identify the questions explored in a given scientific study. Students can distinguish possible questions to investigate scientifically. Students can evaluate how to explore the questions given scientifically. Students can explain and evaluate the various ways that scientists use to ensure data's truth and objectivity.

From the data that has been presented, can be described the ability of science literacy students in Surakarta. Based on the result of the test, the ability of science literacy in Surakarta is still quite low. This is seen by a number of students who have not been able to answer the test question, even a matter of tests at levels 1 and 2 are easily classified. If viewed from the achievement of competence, students' literacy skills are also low, This can be seen from the achievement of the three competencies that are below 50%, That is, students still can not dominate the competencies tested by PISA 2015.

4. Conclusions

Based on the result of research and data analysis, obtained the following conclusions the result of science literacy test according to levels of science literacy is 47.82% students can answer the level 1 questions, 33.80% students can answer level 2 question, 42.90% students can answer the level 3 questions, 26.50% can answer the level 4 questions, and 21.73% can answer the level 4 questions. The result of science literacy test according to competencies science literacy measured are 30.87% students achieving competence explain scientific phenomena, 40.20% students achieving competence interpret data and evidence scientifically, and 24.90% students achieving competence evaluate and design scientific inquiry. The ability of science literacy students in Surakarta relatively low. This can be seen from the achievement of low competence, and low-level science literacy achievement.

5. References

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