Analysis of student’s scientific literacy skills through socio-scientific issue’s test on biodiversity topics

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Abstract. The aim of this study was to describe student’s scientific literacy skills on biodiversity topics at grade X of senior high school. Dimension of scientific literacy that was assessed is science’s competence and attitude towards science. The science competency tests and attitude rating scale based on biodiversity’s socio-scientific issue is used to measure scientific literacy skills. The result of study showed that student’s scientific literacy skills for science competence dimension are low (15.84% for class A and 19.50% for class B) and also for attitude toward science dimension (31.15% for class A and 37.05%). We concluded that student’s scientific literacy skills are low (23.49% and 28.55%).

1. Introduction
Science education at 21st century should be required student to have innovative thinking and idea, to involve student as a scientist and do scientific research based on [1]. Science education is expected for confronted challenge globally to aim a society that literate the science and technology, and any problems which can appear involve in. It is should be a background to changing paradigm of national education in Peraturan Menteri Pendidikan dan kebudayaan (Regulation of Minister of Education and culture) no 96 year 2013. In 2013 curriculum, science education at school is expected to forming students who have high scientific literacy [2]. Scientific literacy prepares responsible citizens and sensitivities to the issues around their lives [1]. Also, scientific literacy is a key of competence in preparing a generation that is able to use knowledge and information science to interact with the challenge of life [3]. It is corresponding to aims of science education in 2013 curriculum.

Scientific literacy defined as the capacity to use scientific, to identify questions and to draw evidence based conclusions in order to understand and help make decisions about the natural world and the changes made to through human activity [3,4]. Scientific literacy has been focused on construction of student’s knowledge to use appropriate and meaningful concepts, critical think, and make balanced, well-informed decision relevant to their life [5]. As an institution of education, school especially learning process at class is expected to giving scientific literacy for students.

There are four dimensions of scientific literacy [3,6], there are: a) Science contexts, b) Science contents, c) Science competences, and d) Attitude towards science. In the scientific literacy assessment, PISA determined three sub-categories of science competences [7,8], there are: a) Identifying scientific issue, b) Explaining phenomena scientifically, and c) Using scientific evidence. Since 2006 [3], Program for International Science Assessment (PISA) has assessed the attitude toward science in the
test, which has four sub-categories are: a) Interest in science, b) Support for scientific inquiry, c) Self-belief as science learners and, d) responsibility towards resources and environments.

Scientific literacy is one of domain that assessing on PISA. Indonesia’s rating in PISA showed that Indonesian student’s scientific literacy skills are low. Any factors like schools infrastructure, curriculum, books, learning methods, learning models, and human resources influence on student’s scientific literacy [9,10]. The result of scientific literacy study is expected to be a foundation for formulating efforts which are able to increase scientific literacy skills [11].

In this study, scientific literacy skills are analyzing through a test based on socio-scientific issue (SSI), as contents and contexts of science. In recent years, science education started to highlight the use of socio-scientific issue in the teaching and learning process [5]. Socio-scientific issue is an issue that emerging based on concept and problem of science, controversial, and is subject to public discussion [12,13]. Learning socio-scientific based is widely used to developing science skills [14]. Using a controversial and dilemmatic issue on SSI can giving influence to developing intellectual individuals as individual and as a member of society, so it is expected to promote student’s scientific literacy [1,10].

Using socio-scientific issue based on biodiversity topics is one of goal of environment education at education institution according to UNESCO [15]. Mainly, Indonesia is one of countries that have a rich biodiversity. However, the condition of biodiversity is decreasing currently. It caused by many factors like human activities and environment changing [16]. Currently the hot issues in Indonesia’s biodiversity condition are illegal logging, illegal fishing, a forest fires, lost biodiversity, over forest function. Many issues can arise from the topics involve in, which able to be socio-scientific issue for learning process at class, especially for biology. Integrating biodiversity socio-scientific issue is also expected to increasing a caring attitude to environment.

2. Methods
This study is using descriptive method to describe a situation or characteristic of sample without any treatment [17]. We use a descriptive method to describe student’s scientific literacy skills on the competence of science and attitude science dimension. The study was conducted at a senior high school in Bandung Barat and using a purposive sampling as a sampling method [18]. We choose two classes as a sample. The subject was 71 student science programs at X grades.

Data was collected by instruments of with multiple choice scientific literacy tests and attitude rating scales that involving biodiversity’s socio-scientific issues. The test of scientific literacy and attitude rating scale are adapted and developed from PISA 2009 and 2012. Those socio-scientific issues on the test are current condition of biodiversity in Indonesia. In addition, additional data were taken by interview, to knowing student knowledge about these issues.

3. Results and Discussion

3.1. Result of student’s competences science
The early step of this study was selected a biodiversity socio-scientific issue in Indonesia and arrange a scientific literacy multiple choice tests. The result of the test describes student’s scientific literacy at two classes of subject research. The result of competence science dimension can be seen at Table 1.

| No | Class     | Sub-categories of competence (%) | Average (%) |
|----|-----------|----------------------------------|-------------|
|    |           | *a  | *b   | *c   |             |
| 1  | Class A   | 14.67 | 20.62 | 12.23 | 15.84       |
| 2  | Class B   | 15.56 | 25.34 | 17.58 | 19.50       |

Note: *Sub-categories of competence:

a = Explaining phenomena scientifically
b = Identifying scientific issue
c = Using a scientific evidence
3.2. Result of Student’s attitude towards science
The second dimension on this study is attitude towards science dimension. Data was collected by using attitude rating scale that developing based on three sub-categories according to PISA. Data showed in Table 2.

| No | Class   | Sub-categories of attitude science (%) | Average (%) |
|----|---------|----------------------------------------|-------------|
|    |         | *1 | *2 | *3                     |             |
| 1  | Class A | 35.78 | 32.34 | 25.34 | 31.15 |
| 2  | Class B | 45.50 | 37.25 | 28.45 | 37.06 |

*Sub-categories of attitude science:
1 = Interest in science
2 = Responsibility toward environment and resources
3 = Support for scientific inquiry

Based on Table 1 and Table 2, the student’s scientific literacy at two classes can be seen in Table 3.

| No | Class | Scientific Literacy (%) | Average |
|----|-------|--------------------------|---------|
|    |       | Competence | Attitude |         |
| 1  | A     | 15.84       | 31.15    | 23.49   |
| 2  | B     | 19.50       | 37.06    | 28.55   |

3.3. Student’s Knowledge About Socio-scientific Issue
Based on interview result, we know that generally students know about biodiversity issues. Students know the issue from many sources such as internet and television. But, students have never done any further investigation about these issues. Other than that, more student are aware of the issue about condition biodiversity in Indonesia, than others issue. Also, student stated that they are very interest to learn more about these issues. We also know that partly students are getting lazy to reading the article of issue. So, they are desn’t understand about the questions.

Student’s scientific literacy skills showed from the average of percentage result from competence and attitude science after tested. Based on Table 1, we know that average of student’s result competence science on class A is 15.84% and class B 17.85%. Those results come from three sub-categories of competence science, explaining phenomena scientifically, identifying issue scientifically and using scientific evidence. Based on those results, the student’s scientific literacy on competence science category is low. Student’s scientific literacy skills on attitude towards science also low. Data in Table 2 showed that three sub-categories of attitude towards science class A is 31.35% and class B is 37.06%. That was interesting in science, responsibility toward environment and resources and support for science inquiry. Data also showed that result of average attitude towards science is higher than competence science (Table 1 and 2). We assumed that student’s knowledge about those issues was influencing the results. From the interview we know that student has known about these issues, so that student having more interest in biodiversity socio-scientific issue. It showed by high percentage of sub-categories interest in science (Table 2). According to [19] relevance of socio-scientific issue is influencing for scientific literacy. Such relevance from the student’s perspective is related to level of student’s interest in science.

The result of competence science is getting low caused by any factors reading. From the interview, students declared that they are lazy to read the issue on the test. We assumed it can be influence to the result. Using socio scientific issue as a context of the test should be a way to enhancing student’s scientific literacy skills on biology [20]. These contexts is given information to students about issue,
so students can improving their skill to explaining and identifying scientific issue. It’s a part of science competence.

4. Conclusion
Based on the result of studies, we concluded that student’s scientific literacy skills are low on competence and attitude toward science dimension. It caused by several factors. Students are not familiar to learn more about socio scientific issue. Student also didn’t understand about the issue, because of low level of reading. Nevertheless, student had high interest in socio-scientific issue.

5. References
[1] Fibonacci A and Sudarmin 2012 Int. J. Sci. Research 3 11 708-713
[2] BSNP Standar Nasional Pendidikan 2010 Paradigma Pendidikan Nasional di abad 21 Jakarta
[3] OECD 2013 PISA 2012 result OECD
[4] Toharudin U, Hendrawati S & Rustaman A 2011 Membangun literasi sains peserta didik (Bandung: Humaniora)
[5] Guiteres SB 2014 International education studies 8 1 142-151
[6] Sadler T and Zielder D 2009 Journal of research in science teaching 1-13
[7] De Moraes J V and Castellar S M 2010. Problems of education in 21th century 19 119-126
[8] Holbrook J and Rannikma M 2009 Int. J. of. Environ. Sci. Edu. 4 3 275-288
[9] De Moraes J V and Castellar S M 2010. Problems of education in 21th century 19 119-126
[10] Rahayu S 2015 Prosiding seminar nasional pendidikan kimia
[11] Odja A H 2014 Prosiding seminar nasional kimia Unesa 40-45
[12] Zeidler D L, Sadler T D, Simmons M L and Howes EV 2005 Beyond STS: A research-based framework for socioscientific issues education. Science education 89 3 357-377
[13] Zeidler D and Nichols B 2009 Journal of elementary science education 21 2 49-58
[14] Eilks I, Stolz M, Witteck T, and Marks R 2013 Eurasia. J. Math. Sci. Technol. Edu. 9 4 361-370
[15] Charalambides A.G and Nisiforou O 2012. Int. J. of Science education 34 7 1027-1051
[16] Lembaga Ilmu Pengetahuan Indonesia 2014 Kekinian keanekaragaman Hayati Indonesia (Jakarta: LIPI)
[17] Creswell J W 2014. Research Design (Yogyakarta: Pustaka Pelajar)
[18] A Arikunto S2010 Prosedur Penelitian Bandung Rineka Cipta
[19] Soobard R and Rannikmae M 2011 Science education international 22 2 133-144
[20] Troy D. Sadler 2011 Socio-scientific Issues in the Classroom (New York: Springer)