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STUDENT'S SCIENCE LITERACY IN THE ASPECT OF CONTENT SCIENCE?

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ABSTRACT

The fundamental issue is the growing use of scientific information possessed by students to solve problems in daily life and produce useful scientific source from scientific literacy. The purpose of the research was to analyze and describe the ability of a student science concepts from the aspect of scientific literacy that includes aspects of scientific knowledge, scientific competence, scientific context as well as the factors that influence the students' science literacy skills. This research was quantitative descriptive analysis. The instrument used was a matter of objective 40 along with the reasons of the physics concept and biology concepts that are used to measure aspects of scientific knowledge, scientific competence, and scientific context, while the students' attitudes towards science and science teaching and learning strategies measured by questionnaire instrument. Instruments used included multiple-choice test questions reasoned and questionnaires (the attitude of science and science teaching and learning strategies). Based on data analysis it was known that the ability of science literacy PGSD UMK students varied, 66.2% of students were at the level of nominal and 33.8% of the students were at the functional level. It showed that 66.2% of students already had a concept for connecting science with other disciplines, could write a scientific term, but students still had misconceptions, while 33.8% of students considered the theory and explained concepts correctly, but they had a limited understanding and were difficult to connect to the concept of his own opinion.

Keywords: science literacy; skill; content aspect

INTRODUCTION

Every individual needs to determine option or decision based on his scientific information to solve daily life problems and produce a beneficial scientific product which has a source from science literacy. Science literacy is one of science education's target (Hoolbrook & Rannikmae, 2009).

Norris & Philips (2003) found that one of the main purposes is to establish society scientific literacy. Scientific literacy consists of knowledge and understanding of scientific concepts and scientific process that is needed by someone in making decision, cultural and economic productivity (Dani, 2009).

Furthermore, scientific literacy can be promoted by problem solving skill in personal and social (Lederman et al., 2013). Therefore, its development on every individual is extremely important.

Every individual is demanded to have scientific literacy covering its scientific knowledge, scientific process skill, and scientific attitude. With this, scientific literacy development is important. Every individual is obligated to have scientific literacy including scientific knowledge, scientific process skill, and scientific attitude.

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Scientific literate society is able to use scientific knowledge, identify questions, and draw a conclusion based on the evidence, in accordance to understand as well as to generate decision related to nature and its changes done to nature through human activities.

Laugsch (2000) suggested that the development of scientific literacy was very important because it could contribute to the social and economic life, as well as to improve making decision skill at the community level and personal. It was strengthened by Poedjiadi's statement (2005) that an individual has scientific literacy skill and technology. It is a person eligible to solve problems by using scientific concepts gained in education based on his level, recognizing product of technology around him, and its positive impact, or the use of the product and its maintenance, creative in creating simplified product technology so his learners are able to decide based on local values and custom.

PISA-OECD (Program for International Student Assessment-Organization for Economic Cooperation and Development) in 2006 had measured scientific literacy that showed the low level in Indonesia, 29% of the content, 34% for the process, 32% for context (Balitbang Kemdikbud, 2011). Its low level was caused by the understanding about science learning which leads students to incomplete science literacy formation of the students understood by the teachers. In the aspect of content, it was caused by science learning process which still focused on memorizing, so the students did not understand what they learned but only memorized (Jufri, 2013). This low scientific literacy on learning process aspect was a focus for teachers (Ekohariadi, 2009). The student's activity is only listening to teacher's explanation; then students learn science as products instead of process, attitudes, and applications. The next aspect is the contextual aspect; teachers are not fully connecting the material with the student's environment (Tjalla, 2009). Whereas, phases of teaching and learning in scientific literacy according to Holbrook (2011) include contact phase, curiosity, ellaboration, decision making and recontextual. In addition, according to Rubini et al.' (2016), The problem about the low scientific literacy abilities of students can not only be solved by applying the model/method/strategy of science learning based on constructivism. The classroom environment and climate are an important component of the students' literacy skills. Likewise, the school infrastructure, human resources, organization, and management bring a very significant influence to students' achievement literacy. Another factor affecting the ability of students' scientific literacy is a teacher. Therefore, scientific literacy measurement is needed to figure out its improvement of human source quality especially the students of the primary educational department as the candidates of elementary teachers.

The measurement is important to figure out its improvement on human source quality of the students as a teacher candidate. Students are expected to create an innovative learning and support scientific literacy, so the next generation (primary educational students) will have higher competitive performance. It is based on the field reality and becomes a demand to promote learning process activity. The initial learning which focuses on knowledge needs to move on holistic learning based on skills, attitudes, and literacy to solve various problems. Through this, the students must be capable of dealing with the way of teaching science appropriately. This is in accordance with the opinion of Putra et al.' (2016) which revealed that learning science should equip teachers with professional knowledge.

The focused problem in this research is How the scientific literacy skill distribution of the students is seen from nominal, conceptual, functional and multidimensional levels and what factors affect students' scientific literacy skills? The purpose of the research is to find out the distribution of the students seen from nominal, functional, conceptual and multidimensional levels as well as to investigate and describe factors affecting the primary educational students' scientific literacy skills.

METHODS

The study was conducted on even semester. The subjects were the 4th semester of primary educational students of Universitas Muria Kudus. The samples were taken through Slovin calculation formula and gained 77 students in Applied Science course. Samples were taken to represent all the students who had studied Science Concept course (in the previous semester) with a sampling distribution in Table 1.

In the research, the researcher uses the descriptive quantitative method. It was quantitative since the approach used in the proposal, process, hypothesis, action field, data analysis and data conclusion until its report used measurement, calculation, formula, and numerical data aspects (Ginting, 2008). On this research, the researcher did not do any special treatment toward sample without a control group or experimental

group.

Table 1. The distribution and the Number of the Research Sample

Number	Criteria	Number of the students
1.	The A – score gaining students	17 students
2.	The AB – score gaining students	25 students
3.	The B – score gaining students	25 students
4.	The ≤ BC – score gaining students.	10 studnets
Total		77 students

The instruments used to gain the data were; questionnaire and test to measure the student's attitude toward science and to find out its learning strategy appropriately in a science course. The questionnaire hd three options, such as agree (A), doubt (D) and disagree (DA) then were converted into Likert scale. whereas test hconsisted of 40 multiple choices and attached with reasons relating to scientific content, scientific competency, and scientific context aspects.

After the data had been taken, the test toward the data was conducted. The data were quantitative in the form of a score of scientific literacy mastery, students' attitudes and the expected teaching and learning in science to support scientific literacy. The quantitative and qualitative data would be analyzed descriptively to find out the data intention, or the result would be used to draw a conclusion. And this test was used to find out the correlation between scientific literacy with response questionnaire answered by the students. To calculate, the writer used correlative product formula from Karl Pearson.

RESULTS AND DISCUSSION

Analysis Capabilities Literacy Science Students

Students' scientific literacy skill from Primary Educational Teacher Department was measured by the test and non-test instruments. The test instrument consisted of 40 questions objectively with reasons about science and biology concepts that were used to measure aspects of scientific knowledge, competence, and context. The result scores for students' scientific literacy skill was shown in Table 2.

Table 2. Recapitulation of scientific literacy of the students

High Score	54
Low Score	21
Average score	36
Scientific Literacy Level	66.2% students are in nominal level
	33.8% students are in functional level

Table 3. Recapitulation the measurement results based on indicators of science competence

Indicators	Number of question	Average
Identifying scientific issues	1.4. 7. 9.13.17.21. 23.24.30. 33.37.38	39.8
Explaining phenomena scientifically	2.5.10.14.16.19.20. 22.25.27. 34.35.39.40	34.4
Utilizing scientific evidence	3.6.8.11.12.15.18. 26.28.29.31. 32. 36	35.5

Table 4. Measurement recapitulation based on scientific context indicators

Indicators	Number of question	Average
Health	1. 9. 12. 13.18.22. 30.32.37	38.4
Natural resources	4.7.19. 24. 25. 27. 36	32.3
Environment	2.8.5.11.23.31.33.34	28.2
Disasters	10.14. 16. 20. 28. 35. 38.39	42. 0
Science and technology	3.6.15.17.21.26.29.40	38.3

It resulted that 66.2% students were in nominal level while 33.8% of them were in functional level. Based on this data, the students basically had obtained concept to relate science with another discipline; they coould write a scientific term, but they still had misconceptions or mistake on the concept. Meanwhile, 33.8% of the students remembered the theory and explained the concept correctly, but they had limited understanding and difficulties to relate the concept into their personal answers.

This lack of literacy level was caused by various factors, internal and external. One of the most affective factors is students' educational background before enrolling the university. Not all students of Primary Educational Department were from science course major background.

They were from various majors, such as sociology, science, language, technique, economy, accountant and clothing, so their ability to master the concept of science might vary. It was relevant to the research done by Ekohariadi (2009) who stated that one of the factors affecting scientific literacy was educational background. Educational background, experiences and parents guidance would motivate their children well. In addition, one of the natural factors reflecting opinion, perception, affection and action – was intelligence (Baron & Byrne, 1991). Therefore, the students from science major background clearly had better scientific skills than the non-science majored students. But this could not be ignored in a sustainable manner. According to Jufri et al.' (2016) in his study, if the reason for students' low ability was a teacher, then, of course, it would be closely linked to their patterns of teaching if one day becomes a teacher. Therefore, in order to develop students' ability to become prospective teachers, teaching and learning process in the faculty should be directed to provide students to have scientific skill reasoning to support scientific literacy.

The scientific literacy score results could be analyzed on every aspect to analyze their skills in detail. From the recapitulation of scientific competence aspect (table 3), it was known that the highest average score was on identifying the scientific issue. Meanwhile, its lowest score was in explaining phenomena scientifically. Based on the result, it was known that basically, the students had enough theoretical ability or scientific concept, could identify or determine a problem but still had difficulties to explain the phenomena or problems well. Based on the nominal and functional level, it was said that the students basically knew the theory but still had a misconception and could not explain the concept with their answers (Bybee, 2009). It could be seen during the learning process. When they were given a problem, basically they could mention and identify its root, but they still faced difficulty in analyzing complexly by relating various concepts or seen from other disciplines.

Other affective factors were students' lack access, and literacy, one of them is learning source. The students did not have science concept book. They only had a *handout* from the lecturer although the lecturer had asked them to have books related to the materials for University level. However, some of them admitted having difficulties while learning the books because most science concept literacy provided in the library were translation and some of them were still in English.

The recapitulation of students' scientific literacy skills based on science aspects showed that the indicators of health, natural resources, and technology science had nearly equal average scores, but there was a gap on indicators of environment and disaster. The highest average score in the disaster was 42%, whereas its lowest average score is 28.2%. This low indicator of analyzing of the environment and social issues caused the low level of students' scientific literacy. Marks & Ingo (2009) said that the factor that could improve scientific literacy skills was socio critical-oriented issues to identify, analyze and relate the issue tp environment. Moreover, scientific literacy skill could be improved by making a decision of science technology and environment issues (Yuenyong&Pattawan, 2009). Therefore, the students did not have the ability to solve the problems of the environment, so the results of scientific literacy's score were not good.

The indicator of the disaster had the highest score because students could identify the issue and explain various disaster including scientific concept which related to the disaster, its cause, and its impacts. However, the students could analyze and relate the issue of the environment to various concepts and other disciplines. It was because of the issue of environment involvedvery complex concept and theory. Students could understand environments issues if the students were interested in reading any literature. But, they were not interested in reading many literature except the books from the lecture. Students had homework to summerize and analyze some problem, and their summary had to be related from any literature. 68% students did not understand the content that they wrote. Moreover, the literature was in Eglish. Therefore, Jurecki & Matthew (2012) said that to improve the scientific literacy, students must have the ability to review any literature critically and scientifically.

Basically, the lecturers had applied cross theme learning that related to science, environment, technology and society. But, the students could not have integrated thought, but they were still fragmented in a problem. It was caused by many factors, one of them was intelligence. The students from science background averagely could answer well since they had the concept of science, whereas the students from other educational background found difficulties to explain the concept since they admitted they had difficulties to keep up with the course in detail and the last time they learned was in Senior High School grade X. Based on Treacy & Melissa (2011), the scientific communication improvement gained

from reading, writing, and reviewing journal could improve scientific literacy. In another hand, its initial level of scientific literacy was affected by many factors, such as individual knowledge, speaking askill, social level, educational level and family background (Heath *et al.,* 2014). Scientifically and technically, the factor causing individual literacy was intellectual capacity, including the level of reasoning, attitude, social nature and ability to connect many diciplines (Holbrook & Rannikmae, 2009).

The Analysis of Students' Attitude Questionnaire

The questionnaire and its learning strategy upon 67 questions represent 4 indicators on attitude aspect and 4 indicators on teaching and learning strategy aspect. The questionnaire consisted of the positive and negative statement. Then the scores taken from the students were correlated into scientific literacy skill to find out its relationship between scientific literacy with the students' attitude toward science and its teaching and learning strategy. Its recapitulation and scientific literacy with the questionnaire score was shown in Table 5.

Table 5. The Recapitulation of Scientific Literacy and Scientific Attitude Relationship

Indicator	Total	Large correlation value
Questionnaire attitude	15515	0.37%
Students' attitudes towards science	4348	13.3%
Science learning and teaching strategies	9065	-8.2%
Support scientific investigations	682	-0.52%
Confidence	1136	2.95%
Interest in science	1229	22.44%
Responsibility towards natural resources and the environment	1301	14.3%
Submission of materials	3617	-2.22%
Learning model	2428	8.46%
Participation	1816	-6.15%
Evaluation	1204	-13.92%

Based on Table 5, it was known that the students had an interest in science. It was proven from responsive questionnaire stating that its total achievement average score was 86.68 or in the category of very good. Then, responsive questionnaire score was correlated with students' scientific literacy skills.

The analysis showed that the students had interest toward science. It was proven from the responsive questionnaire stating that the total average score of the students was 86.68 or was categorized as very good. The questionnaire was correlated with scientific literacy skills and gained score 0.37. The responsive questionnaire attitude consisted of two variables that were student attitude toward science and its learning and teaching strategy. The average scores of the student's attitude variable towards science iwas 85.56. If the result was correlated with scientific literacy skills, the result was0.1333. It means 13.3% of ability was affected by students' attitudes towards science, whereas 86.7% was affected by other factors and caould be concluded that there was a positive relation between students' attitudes towards science and their skills. The reasonable action theory stated that the attitude affected nature through the process of carefully taking a decision and reasonable (Ajzen & Fishbein, 1980). Attitudes consisted of components such as cognitive, affective and conative (Azwar, 2010). One of the most affective factors of low scientific literacy skills was the students' attitude toward science (Ekohariadi, 2009).

The second variable was teaching and learning strategy. Its average score was 87.23. If the result was correlated with a score of scientific literacy skill achievement, the score was -0.082. The result meant that there was a negative relationship between teaching and learning strategy and their skills. Thus, teaching and learning strategy did not significantly affect students' skill. The learning concept of science was not always done in the class through various learning strategy, but the most important were learning to get skills, both from cognitive, affective or psychomotoric.

The result of science concept score was affected by the learning model used by the lecturers. If the result was correlated with scientific literacy skill score, it was gained 0.0846, so the learning model could affect the skills. Based on the result, 8.46% scientific literacy skills are affected by learning model used. Widiyanti et al.' (2015) stated that scientific literacy-based learning set could make students be more active so they could improve their learning outcomes. And Gormally, et al. (2009) investigated and gained result that showed students centered learning pattern wiould promote students' scientific literacy skills. Based on the questionnaire, the learning model demanded by students were an ex-

perimental model, outdoor learning, cooperative learning, cross theme learning, and any other innovative learning model. Surpless, et al.' research (2014) show that laboratory based learning could increase students' scientific literacy. Moreover, laboratory and inquiry based learning could promote scientific literacy (Gormally, et al., 2009; Forbes & Zint, 2011).

Moreover, the results of data analysis showed that self confidence had a positive correlation with students' scientific literacy (2.95%) and students' interest in science correlate in scientific literacy (22.44%). It caused students with science course had positive confidence in science and had the self-confidence to answer the questions. Holden (2012) said that self-confidence influence dscientific literacy.

CONCLUSION

The result showed that science literacy skills 66.2% of the student of Primary Educational Faculty of Universitas Muria Kudus were in the level of nominal and 33.8% of students were the level of functional. It showed that 66.2% of students already had a concept for connecting science with other disciplines, could write a scientific term, but they still had misconceptions, whereas 33.8% of students understood the theory and explained concepts correctly, but hthey had a limited understanding and found difficulty in explaining the concept with their own opinion. Students' attitude toward science had positive correlation towards scientific literacy skills, whereas teaching and learning strategy negatively correlated toward the skills. 13.3% of the skills were affected by students' attitude, while 86.7% were affected by other factors.

Based on the discussions and findings, the lecturer should provide instructional materials science concepts that could develop students' skill and conduct scientific literacy learning skills in cognitive, affective and psychomotor aspects. Students were able to access various literature and information sources, not only from the lecturer and students had to practice to explore higher thinking skills.

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