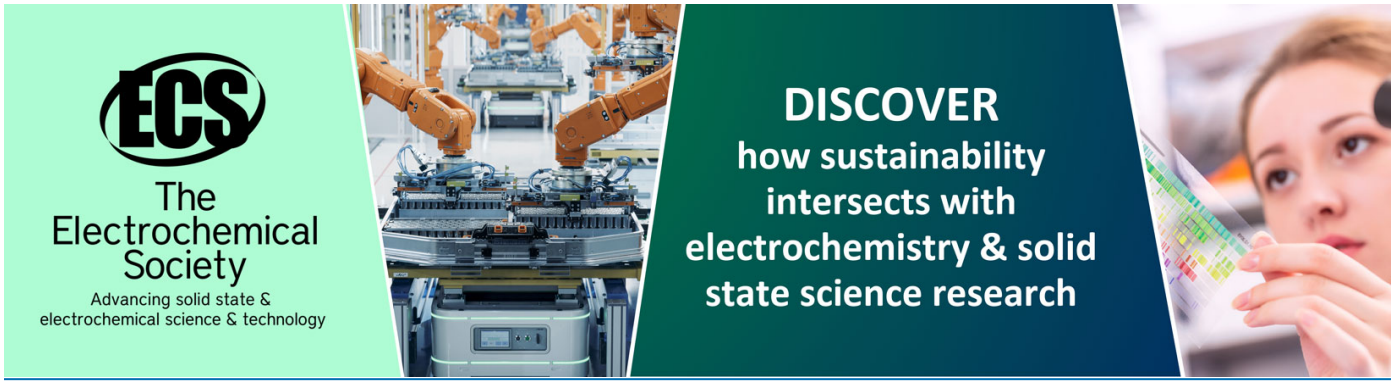
Scientific literacy profile of X grade students in Gunungkidul on Biology reviewed based on gender



Scientific literacy profile of X grade students in Gunungkidul on Biology reviewed based on gender

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Abstract. This study aims to determine the ability of scientific literacy of students in biology subjects that are reviewed by gender. This research is a descriptive study with survey method to find out the difference in scientific literacy scores of male and female students. The population in this study were all X grade students in Senior High School in Gunungkidul Regency. The research sample used was 351 students from six schools taken by cluster random sampling with a total sample of 229 female students and 122 students of male students. The scientific literacy test instrument was prepared based on the 2015 PISA indicators by only taking biological content. The research data were analyse with Test of U Mann Whitney which had previously been subjected to a prerequisite test. The results showed that the average score of scientific literacy ability of female students was higher with a value of 59.45 compared to the average score of male students with a value of 55.33. Based on the results of the Test of U Mann Whitney showed a significance value of 0.16 which can be concluded that there is a significant difference between the average scientific literacy scores of female students with male.

Keywords: *scientific literacy, gender, female, male, PISA 2015*

1. Introduction

Science is a knowledge that can be obtained through the collection of data using experimental methods, observation, or deduction in order to produce an explanation of the symptoms observed [1]. In learning science means studying oneself and the environment. To master the concept of science is not separated from the ability in the application of the concept to daily life. The ability in the concept of science in daily life is called the ability of scientific literacy [2]. The Program for International Student Assessment (PISA) defines the scientific literacy of its knowledge and used in identifying questions, acquiring new knowledge, explaining scientific phenomena and making conclusions of various evidences. Scientific literacy was first measured by PISA in 2000 and continued every three years periodically. The measurement results in 2012 showed that Indonesia is a country with low student scientific literacy skills.

Students who have knowledge of science are students who can apply concepts or facts obtained in schools to understand and solve various natural phenomena in their daily lives. Scientific literacy is one of the essential skills for students to face of the 21st century. This relates to the students who are required to be able to understand the environment, health, economics and other problems faced by communities in the 21st century where the society is very concerned with the advancement of science and technology.

Scientific literacy is a key in the face of various challenges in the 21st century. The 21st century citizens will have to acquire the basics of scientific and technological literacy. The students have to understand how basic scientific principles are applied in finding solutions to problem in the field of agriculture, weather, energy, health and nutrition, industry, defense, processing of information and other areas of human concern. It would help them to discover the relationship between science and technology. Science and technology in these areas besides acquiring problem solving and decision making skills [3]. Scientific literacy means that a person can ask, find, or determine the answer of the questions derived from curiosity about daily experiences. A literate citizens should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it [4].

There are many factors lead to the low of scientific literacy in Indonesia, namely gender, economic and social, and immigration. Low knowledge of Indonesian scientific literacy is indicate in many ways. The lack of the attention of socio-cultural environment as a source of learning is suspected caused the low of students scientific literacy skills in Indonesia [5]. Tjalla [6] stated that the average scientific literacy capability of Indonesian male students is higher than the average scientific literacy skills of Indonesian female. According to the results of the Afriana study [7] the competency aspect of the indicator explains the scientific phenomena of the female class higher than the male class. This difference may be because female spend more time studying science and learning to learn science so that scientific exploitation or explaining scientific phenomena is better.

According to the results of PISA 2012, male are better to female in mathematical performance. Female feel less motivated to learn math and less confident in its abilities compared to male. For the field of technology and engineering, Hango [8] mentioned that the STEM (Science, Technology, Engineering, and Mathematics) field was dominated by male. Female mostly choose fields of biology or science, so fewer are choosing the fields of engineering, computer science, and mathematic.

Bybee in [9] conveys that on the average between OECD countries, male's scores are significantly higher than female at a scale of interest in science topic learning. Finland and the Czech Republic are the two countries with an average science score above the OECD average in which female score is higher than male. Topics such as "crude oil were transformed into other materials" and "famous scientists and their lives" had little interest for both male and female. Female are giving the highest ratings to topics related to themselves especially more to health, thought and happiness. While male have more interest in the destruction of technology and events. In addition, male are also more interested in the issue of automobile technology than female. Therefore, the research needs to be done to see the profile of scientific literacy skills of X grade students in Gunungkidul Regency on biology which is reviewed by gender.

2. Research method

This research is a descriptive study with the survey methods to know the profile about the ability of scientific literacy in X grade students on biological subjects that reviewed by gender. The instrument used to retrieve the research data is the instrument of scientific literacy test, based on the indicators of the competence of PISA 2015, namely explaining scientific phenomena, evaluating and designing scientific investigations, and interpret the data and evidence scientifically. This research has been done in 2017-2018. The population in this research is all students of X grade students in Gunungkidul regency. The research samples used as many as 351 students from six schools were taken with a random cluster by class with a sample number of female learners as much as 229 and males as much as 122. The data that collected is a result of student's scientific literacy test with multiple choice tests and essays to determine scientific literacy skills that are categorized as low, medium or high. The hypothesis test used was the test of U Mann Whitney which had been through the normality test and the homogeneity of variance.

3. Results and Discussion

3.1. Description of Measuring Students Scientific Literacy Based on Gender

Scientific literacy measurement data differentiated based on the students gender, female and male measured using the instrument of assessment of scientific literacy aspects of PISA 2015 with 20 questions consisting of 10 multiple choice questions and 10 questions essay. The scientific literacy problem is focused on biological content only. Here is table 1 that shows the description of scientific literacy measurement results.

Table 1. The results of description analysis of measurement of scientific literacy

Gender	N	Score of Scientific Literacy				Maximum score	Score category
		Min	Max	Range	$\bar{y} \pm s$		
Male	122	12.5	90	77.50	55.33 ± 15.49	100	Low
Female	229	20	87.5	67.50	59.45 ± 15.03	100	Low

The table above shows the student literacy score of X grade students on biology subjects in Gunungkidul is reviewed from gender. The average score of scientific literacy on the biological subjects of male students is 55.33 or by a low category compared to the maximum test score while the average scientific literacy score on female student on biology subjects is 59.54 or low category compared to the test maximum score.

3.2 Hypothesis Test Results

The hypothesis test starts with the normality test and homogeneity of variance in advance to determine whether the parametric condition has been met or not. The normality test results are shown in table 2 below.

Table 2. The results of normality test

Gender	Value of Significance	
	Scientific literacy	Conclusion
Male	0.00	Abnormal
Female	0.03	Abnormal

Based on the analysis test results normality data is obtained that the scientific literacy score data for both female and male are less than 0.05 that can be concluded that the data is not distributed normally, so it is not resumed in the test stage of the variant so as not to meet the parametric requirements. Because it does not meet parametric requirements, it is continued to test hypothesis using the test of U Mann Whitney. The results of the test of U Mann Whitney analysis are shown in table 3.

Table 3. The result of test of U Mann Whitney

Scientific Literacy based on gender	Value of Significance	Conclusion
	0.16	Significance different

Based on the results of the descriptive analysis test above, the average score of scientific literacy on biological subjects in female students is higher than male students. After the inferential analysis using the nonparametric statistical test of U Mann Whitney showed the value of significance is 0.16. It means that the value is less than 0.05 and it can be concluded that there is a significant difference between the average scores of female and male scientific literacy. However, the highest and lowest score of all research samples is acquired by male. The value inequality of scientific literacy score is also higher male students compared to female. The average score of scientific literacy both female and male on biological subjects belongs to the lower category compared to the value of the total score.

The results of the study differ from the opinion of Tjalla [6] stating that the ability of the average scientific literacy of Indonesian male students is higher than the average scientific literacy skills of

Indonesian female students. The difference is possible because in this research assessment of scientific literacy is only limited in the scope of biological knowledge, while scientific literacy generally includes knowledge of biology, physics, technology and earth and space.

The results showed that the average scientific literacy score on higher biological subjects of female students than male was not detached from the topic used in measuring scientific literacy related to biological content. In addition, Hango [8] reveals that males are more dominating STEM (Science, Technology, Engineering, and Mathematics). While most female have a biological or scientific field. According to Bybee in [9] also reveals the difference of interest between male and female where female rank supreme for interest in topics related to themselves, especially health, thinking, and happiness. While male have more interest in the topic of technological damage and events.

Measuring the ability of scientific literacy on biological subjects in this study refers to three indicators of scientific literacy on the aspect of competency, explaining scientific phenomena, evaluating and designing scientific investigation, and interpret the data and evidence scientifically. According to Mahanal in [10] students ability to complete project tasks such as solving problems, synthesizing information, and conducting studies or research influenced by gender because male and female have characteristics that different. Mahanal in [10] also stated that female are judged to be higher than male in the ability to make conclusions that mean female are better able to identify the elements needed to draw conclusions, construct hypotheses, identifying variables in relationships, considering relevant information, and analyse the data.

4. Conclusion

This paper presents the profile of scientific literacy skills in biology subjects of X grade students which is reviewed by gender. The results showed that the average of female students scientific literacy score was higher than that of male students. The hypothesis test results also show that there is a significant difference between the averages of scientific literacy ability of female learners with male.

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