The profile of students’ scientific literacy in competence aspect in junior high school of Yogyakarta city

A Widowati*, L Widyastuti and E Widodo
Science Education Department, Yogyakarta State University, Indonesia

*Corresponding author: asri_widowati@uny.ac.id

Abstract. This research was conducted to describe the students' scientific literacy profile for the competence aspect in general, and each sub-aspect of scientific literacy competence for the students of grade VIII in junior high school of Yogyakarta city and how the sequence of scientific literacy acquisition for student competence aspect based on the favorite ranking of the school. This research is a descriptive quantitative design research with research is survey method. This research was conducted in six public junior high schools located in Yogyakarta with different favorite ranking. The sample of this research is 200 students. The sample is determined by purposive sampling technique based on favorite ratings and research permit. The results of the research indicate that the literacy profile of science on competency aspect, in general, is still lacking. In detail, for the sub-aspect of scientific literacy ability other aspects of competence that is evaluating and designing scientific questions and interpreting scientific evidence and data is still lacking, even for sub aspect ability to explain the phenomenon in a scientific way which still very less. Ranking aspects of the competence of scientific literacy sequentially from top to bottom linearity according to the school's favorite rating.

1. Introduction

Education is required to be able to prepare students to live in a digital era, encourage students to use knowledge and skills to utilize technology in the discovery of new things in the future, be able to make decisions, develop skills, and continue lifelong learning. This is because the need for multifaceted capabilities, multitasking, technology-driven world that must be owned by students to deal with 21st-century life. Powell & Snellman state that the vital function of education is to train students to prepare themselves for a successful life in the 21st century as the digital century and the knowledge-driven economic era [1]. In addition, the digital era makes information an important part of contemporary people's lives and has an impact on various fields of life [2]. Of course, this requires good quality education. Educational reform is vital to make the quality of education better than before.

One of the vital educational reform efforts carried out by various countries is in the form of developing scientific literacy and becoming the main goal of science education [3]. Education must be able to make an understanding of science learning that leads to the formation of scientific literacy [4]. Scientific literacy is crucial to solving problems because of rapid changes in science and technology, both with regard to ethics, morals and global issues. Scientific literacy affects students in making decisions about problems personal and
social [5]. Literacy assessment is not solely on the measurement of the level of scientific understanding, but also the understanding of scientific processes and the ability to apply knowledge and the process of science in real situations [4]. PISA (Programme for International Student Achievement) explained that competence in scientific literacy is not only the ability to know natural science concepts and theories but also knowledge about practical procedures and matters related to scientific inquiry and how to make science more advanced as described [6]. As stated by Widowati, Widodo, Anjarsari & Setuju state that if students have scientific literacy then they have the ability to deal with and respond to the problems of society that develops, think critically, solves problems, and has the deep understanding to apply scientific concepts in solving problems [7].

The results of the PISA study program linked to the scientific literacy of 15-year-old school students in 2015 suggest that the average science score of Indonesian students is 382, of which Indonesia is the lowest of all participating PISA countries. The data in question is a relatively low level of literacy skill ability of 15-year-old school students in Indonesia. According to [8], the cause of the low ability of students' scientific literacy is because the introduction of science-oriented / test-oriented questions such as PISA and TIMMS (The Third International Mathematics and Science Study) has not been applied to the learning process which is a scientific problem, and a scientific question.

Previous studies have not provided a specific description of what scientific literacy skills still need to be developed, so it is still important to conduct an investigation to find out in detail which aspects of scientific literacy skills still need to be developed. In addition, no one has linked the level of school favourite. So it is important to do research that describes student scientific literacy clearly and is associated with the student's favourite level, which in this case is closely related to the quality of the school.

This study focused on the subject of the students of class VIII in junior high school in Yogyakarta city based on the favorable ratings of schools. Junior high school is selected as a population of similar research and standards. Yogyakarta was chosen because this region is one of the provinces in Indonesia which is famous as a city of students with high-quality education, especially in the city of Yogyakarta. The school favorite level is chosen because it will affect the learners' learning outcomes.

This study aims to describe the profile of scientific literacy for the aspect of competence in general and each subs aspect competence of scientific literacy. In addition, this study also aims to investigate the rank of scientific literacy aspects for grade VIII students at the junior high school in Yogyakarta city based on the school's favorite rating. Based on the data obtained will give specific information related to the weak point of scientific literacy of Indonesian students, it can be used as input for the improvement of science learning in junior high school, especially in Yogyakarta city to be more optimal in developing scientific literacy.

2. Methods

Type of research method used in this research is survey method with the descriptive quantitative approach. It makes a systematic description about students' scientific literacy in competence aspect according to the reality. This research was conducted in September - November 2017. This research took place in public junior high school of Yogyakarta. The school used as a sampling site consists of six public junior high schools in Yogyakarta city based on the school's favorite rating.

This study uses public Junior High School in Yogyakarta city as population and the schools as sampling research was chosen because of the school facilities in those. A total of 16 junior high schools in Yogyakarta city located in the city of Yogyakarta is divided into three categories of favorite schools high, middle, and low. The favorite categorization of the school is determined based on the number of registered school interest, the value of the input in the form of the average value of New Student Admission in 2016/2017 and the value of output (National Examination value conducted class IX in the period of academic year 2016/2017). Based on the rankings by the researchers, there are five junior high schools with the highest ranked favorite school category, six public junior high schools with favorite high school and five public junior high schools with low ranking favorite schools. Researchers then choose two public junior high schools of Yogyakarta each category favorite level of school. Preferred high school preference is level 1 and 2. The middle preference level taken is school level 6 and 8. The grade school does not allow for samples taken because it is not
allowed (limited permit) from school. While the low level taken is a school with rank 12 and 13. The technique used in this research is purposive sampling technique. The purposive sampling technique is the method of sampling based on certain objectives or considerations that have been set before. This study intends to consider schools with various levels of favorite ranking schools and licensing in conducting this research.

This research’s data collection is using scientific literacy test. This test technique as part of the assessment of a series of activities to obtain, analyze, and interpret data about the process and learning outcomes learners are done systematically so as to obtain meaningful information in decision making the description. The indicators of sub aspects competence scientific literacy as Table 1.

| No | Sub Aspect of Competence Scientific Literacy | Indicator                                                                 | Number of Items |
|----|--------------------------------------------|---------------------------------------------------------------------------|-----------------|
| 1  | Explaining the scientific phenomenon       | Remembering and applying scientific knowledge that appropriates with a certain condition. | 1a              |
|    |                                            | Identifying, using, making the model and the simple description for explaining the scientific phenomenon that ever sees in daily life. | 1b              |
|    |                                            | Making appropriate prediction                                             | 1c              |
|    |                                            | Offering explanatory hypotheses                                           | 2               |
|    |                                            | Explaining the potential involvement of scientific knowledge for the community | 3               |
| 2  | Evaluating and to design scientific inquiry | Identifying the questions investigated in certain scientific studies       | 4a              |
|    |                                            | Distinguishing questions that allow scientific investigation              | 4b              |
|    |                                            | Proposing a way to investigate scientific questions (problem formulation) | 5               |
|    |                                            | Evaluating a method of scientific inquiry                                 | 6a              |
|    |                                            | Describing and evaluate the methods used by scientists to ensure data reliability and objectivity of an explanation | 6b              |
| 3  | Interpreting scientific evidence and data  | Changing data from one form to another (diagrams, graphs, etc.)           | 7               |
|    |                                            | Analyzing and interpreting data to draw conclusions                      | 8               |
|    |                                            | Identifying assumptions, evidence, and reasons in the text relating to IPA | 9               |
|    |                                            | Giving reasons that support or reject a conclusion formula               | 10              |
|    |                                            | **Total item**                                                           | 14              |

This research procedure uses two steps. The first step is the empirical test and the second step collects the actual data. Empirical tests are applied in school research. Researchers chose the highest ranked favorite school for empirical tests. Empirical tests are applied to 31 students. The empirical test aims to generalize students to samples in research so that empirical tests can describe almost similar characteristics. Empirical test results can describe the student's response to the next can be applied to the subject of collecting the data really. Furthermore, after the instrument is tested its feasibility is used to collect scientific literacy data from
junior high school students. Analysis of validity and reliability of the scientific literacy with Quest program. The test results of validity as Table 2

| No | Compatibility with the Rasch Model | Mean | Standard Deviation | Note |
|----|-----------------------------------|------|--------------------|------|
| 1  | Infit mean square                 | 1.00 | 0.16               | Fit  |
| 2  | Outfit t                          | 0.9  | 0.6                | Fit  |

Table 2 shows that the results of empirical validity of 14 item of scientific literacy test are declared valid because Infinite mean square and outfit t values meet the criteria in the Rasch model. The results of the scientific literacy test reliability test show the internal consistency value of 0.64 with a very high category. Scientific literacy data obtained through tests were analyzed using descriptive analysis techniques.

3. Result and Discussion

3.1. Profile of scientific literacy competence aspect

Literacy of science aspects of competence greatly affects a person's ability in doing research [9]. Aspects of competence in scientific literacy teach students how to use their knowledge in terms of identifying scientific problems, explaining scientific phenomena, and the use of scientific evidence.

The mean understanding of aspects of scientific literacy competencies of eighth-grade students of public junior high school in Yogyakarta City in terms of school favorite level as in Table 3.

Table 3 shows that the average score of understanding of the competency aspect of scientific literacy of grade VIII students at public junior high school of Yogyakarta based on the favorite rating of the school is a high school level high school with an average score of comprehension aspect of competence. from 65.39. The average scores make schools with low preference levels to have a profile of literacy competency competencies that fall into the "very less" category. The above results also show that the overall average score obtained is 49.58 for understanding the competency aspects of scientific literacy of all schools in grade VIII students with the predicate "very less".

The level of understanding of competency aspects of students' scientific literacy is also influenced by the initial knowledge constructed by the students themselves. Bada [10] states that links the initial knowledge of students in learning, students with high initial knowledge are easier to associate new information received with existing knowledge. Students with higher initial knowledge will more easily learn to relate the competence aspects of scientific literacy.

In detail, it can be described the acquisition of categories of understanding aspects of scientific literacy competency at each favourite school level as Table 4.

Table 4 shows that the understanding of aspects of scientific literacy competence most students from schools with high favorite level are quite sufficient while understanding aspects of scientific literacy competencies most students from schools with favorite level are classified as poor and understanding aspects of students' scientific literacy competencies from low favorite schools classified as very lacking.
Table 4. Understanding the aspects of scientific literacy competence for grade VIII students of public junior high school viewed from favourite school levels;

| No. | Category | Understanding Aspects of Scientific Literacy Competence | High fo | High fr (%) | Medium fo | Medium fr (%) | Low fo | Low fr (%) |
|-----|----------|----------------------------------------------------------|--------|-------------|------------|---------------|--------|------------|
| 1   | Very Good| 5                                                        | 8.7    | 0           | 0          | 0             | 0      | 0          |
| 2   | Good     | 5                                                        | 8.7    | 1           | 1.61       | 0             | 0      | 0          |
| 3   | Enough Good| 30                                                       | 48.39  | 1           | 1.61       | 0             | 0      | 0          |
| 4   | Less     | 3                                                        | 4.84   | 58          | 93.50      | 3             | 4.84   |            |
| 5   | Very Less| 19                                                       | 30.64  | 2           | 3.23       | 59            | 95.16  |            |

Note:
fo = objective frequency
fr = relative frequency

3.2. The understanding each aspect of scientific literacy competence aspect

Based on the researcher's result, it can be seen that students from schools with high and low advancement rates have the highest average value on understanding aspects of interpreting evidence and scientific data, whereas schools with the middle level have the highest mean on understanding aspects of evaluating and design scientific inquiry. Students from schools with high, middle and low adventurous rates had the lowest mean for understanding aspects of explaining the phenomena in scientific. This is because the average value of aspect factor indicator explains the phenomenon scientifically get the low value.

Figure 1. Average value each aspect of scientific literacy competence aspect

Proposing a way to investigate scientific questions (problem formulation) is part of the stages of the scientific method that must be implemented in natural science learning to achieve learning objectives. This scientific method is often overlooked by students. They only pay attention to the steps of the scientific method. Based on research conducted by Ratnawati, Rahayu & Prayitno although in some textbooks explained about the scientific method, students rarely read and understand the scientific method [11]. The lack of understanding of evaluating a method of scientific inquiry is because students are less introduced to evaluating scientific methods, they are only introduced to the stages of the scientific method.
3. 3 The rank of scientific literacy competence aspect

Based on the discussion on every aspect of the scientific literacy competence that has been obtained for each favorite grade category of the school, it can be seen overall that the students' rank between the level of understanding of the scientific literacy competence aspect with the favorite school ranking level influences each other. Schools with the highest level of progress have the highest level of understanding of the highest scientific literacy competencies with a rating of 1 while the middle to moderate schools have a level of understanding of the competency aspects of the level of scientific literacy moderate with rank 2 and low school level has the lowest level of understanding about the competence aspects of scientific literacy with a rating of 3. Based on these results, students' scientific literacy correlates with school favorite levels. As Carolina’s research results [12] shows indicating if school favorites are related to school quality.

In general, it can be described that what is described is that Indonesian students are not yet accustomed to learning scientific literacy, proven empirically for Yogyakarta city junior high school students. This is suspected because science learning is still not oriented to the development of scientific literacy as a competence that must be possessed. Second, students are generally poorly trained in solving problems with characteristics such as those that apply scientific literacy.

4. Conclusion

The results show that the literacy literacy literacy profiles sequentially from the highest, middle, and low-grade favorite rankings are sufficient, less and less. Level of competence aspects of scientific literacy in accordance with the favorable ratings of schools. Understanding the literacy aspect of scientific literacy is an aspect to explain the phenomenon scientifically is very lacking, the understanding of the competitive aspect of scientific literacy is the evaluation aspect and the design of the scientific question is lacking, and understanding the competence aspect of scientific literacy is the aspect to interpret the evidence and the scientific data also less. The scientific literacy competence aspect is the highest ranking in all school categorizations (high, middle, and low).

Based on the results of this study, it is recommended that the development of learning that can develop student scientific literacy optimally, especially related to competency scientific literacy aspects. NOS in the approach makes the approach more optimal develop scientific literacy because NOS is very vital component in scientific literacy [13]. It must be done as soon as soon possible so that the problem of scientific literacy is not prolonged.

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