

Analysis of Science Literacy Skills of Banda Aceh SMP Students in Solving PISA Physics Problems

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Abstract

The Program for International Student Assessment (PISA) is an institution that has examined the scientific literacy abilities of students aged 13-15 years old. From this program, it was found that the scientific literacy skill of Indonesian students is still below the international average. This study aimed to analyze the scientific literacy skills of students of SMP Kota Banda Aceh in solving PISA questions with physics content. The subjects of this study were 90 grade VII and VIII grade students aged 13-15 years. These students are randomly selected to represent high, medium and low abilities. The instrument used in this study was the PISA standard scientific literacy questions with physics content. The results showed that the level of scientific literacy skills of students of SMP Kota Banda Aceh in solving PISA questions with physics content is categorized as medium. The results of the analysis also show that the main weakness is found in the aspect of using scientific knowledge in analyzing texts or articles.

Keywords: Science literacy, PISA, physics content

1. Introduction

The quality of the human resource is one indicator of a nation's development. In this era of globalization, Indonesian education is still experiencing serious problems. The low quality of education in Indonesia is shown in the report of the Program for International Student Assessment (PISA). In this report, the scientific literacy skills of Indonesian students aged 15 in 2012, 2015, and 2018 are listed. In 2012, Indonesia was ranked 64th out of 65 participating countries with a score of 382. Whilst, in 2015, it was ranked 70 out of 72 countries with a score of 403. And lastly, in 2018 it was ranked 63 out of 71 countries with a score of 396. The achievement of this score shows that Indonesian students have low scientific literacy skills because the scores obtained are still below the international average of 500 (OECD - Organization for Economic Co-operation and Development, 2019).

The PISA study was first conducted in 2000 and is continuously hold every three years. In each study, students aged 15 or in the final year of their compulsory school level are randomly selected to take a battery of tests which consists of three basic competencies; reading, mathematics, and science. In this study, PISA measures what students know, understand, their ability to communicate, apply their knowledge, and their ability to analyse their knowledge with critical thinking skills (Organization for Economic Co-operation and Development, 2017).

Scientific literacy is expressed as a person's ability to understand science, communicate science (oral and written), and apply scientific knowledge to solve problems so that they have a high attitude and sensitivity to themselves and their environment in making decisions based on scientific considerations (Permatasari & Fitriza, 2019). Furthermore Ridwan & Rusilowati (2015) state that scientific literacy is the ability to use scientific knowledge to draw conclusions based on scientific facts that can be described in a classroom assessment.

Rusilowati, Kurniawati, Nugroho & Widiyatmoko (2016) state that the measurement of scientific literacy is very important to determine the extent to which students are scientifically literate. Research on Indonesian students' scientific literacy has been conducted by Diana, Rachmatulloh & Rahmawati (2015). The study reported that Indonesian students' scientific literacy skills are indeed still low. The results of another study (Sinaga, 2015) show that students are not used to working on science questions with the physics content of the PISA model. Physics is seen as a science to study natural phenomena. The ability of students in the field of physics is one of the keys to success in adapting to changing times and entering the world of technology. Therefore, scientific literacy in the field of physics is required.

Based on the description above, PISA study data provides a lot of valuable information about world educational problems, especially scientific literacy. Therefore, it is unfortunate if the data is not analyzed and used for introspection and correction of the education system in Indonesia (Hadi, 2009). This can be done nationally, or locally.

Locally, the PISA study encourages researchers to map and analyze the scientific literacy abilities of SMP Kota Banda Aceh students. The results of this mapping and analysis can be used as an initial description of students' scientific literacy skills and the quality of science learning at SMP Kota Banda Aceh. The results of this analysis can also be used as a reference, reflection and consideration for the relevant policy making. This study was specifically aimed at analyzing the scientific literacy skills of Banda Aceh City Junior High School students in solving PISA questions with physics content.

2. Method

This research is a quantitative study using descriptive methods (descriptive-quantitative), namely descriptive research using size, quantity or frequency. This research was conducted not by giving treatment, manipulation or altering the independent variables, but describing a condition as it is (Sukmadinata, 2012). The research subjects were 90 grade VII and VIII grade students aged 13-15 years. These students were randomly selected to represent high, medium and low abilities.

The instrument used in the study was PISA standard scientific literacy questions with physics content. The questions emphasized the count on physics material or content. The items led students to certain quantities which then asked for other unknown quantities. Questions that did not require the use of counting were given in the form of multiple choices. Several descriptive questions required recall of knowledge that had been taught, as well as phenomena and technology in everyday life. The results of students' answers were assessed, then grouped into intervals and frequency. Percentages were calculated and categorized to see the level of scientific literacy skills.

3. Results and Discussions

The results of the students' science literacy abilities in solving PISA questions of physics content are presented and categorized as in table 1 below.

Table 1. Percentage and Categories of students' Science Literacy Skills

Interval level	Frequency	Percentage (%)	Category
81-100	0	0	Very high
61-80	8	8,9	High
41-60	52	57,8	Medium
21-40	27	30	Low
0-20	3	3,3	Very low
Total	90	100	
Average		44,5	Medium

The percentage data of students' science literacy abilities in solving PISA questions of physics content is illustrated by the following bar chart.

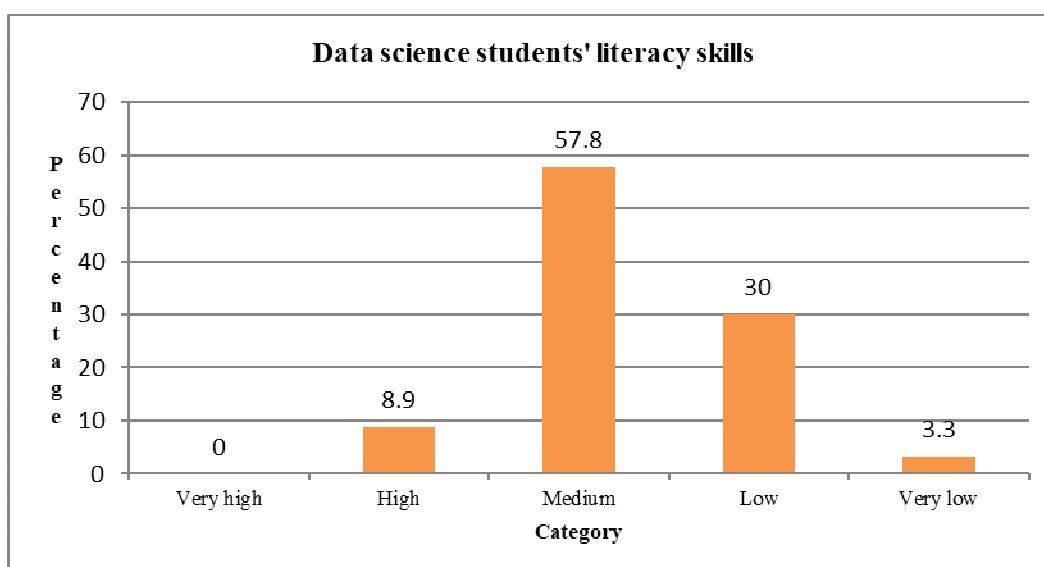


Figure 1. percentage bar chart students' science literacy skills category

Based on Table 1 and the research findings, it is shown that the science literacy skills of the SMP Kota Banda Aceh students in solving PISA questions related to physics content are medium in the category. The results of this study are different from the results of PISA research in 2012, 2015 and 2018 which show that the scientific literacy of Indonesian students aged 15 years is relatively low. The difference between the results in this study and the PISA results is possible because, in this study, the PISA questions included only those related to physics content, while the other content, like mathematical and reading literacy tests, were not included.

Based on the results of the present study, generally, students in Indonesia tend to be very good at memorizing but are less skilled in applying their knowledge (Pantiwati & Husamah, 2016). Furthermore, Pertiwi, Atanti & Ismawati (2018) revealed that the low scientific literacy of students was caused by the tendency to use memorization as a vehicle to master science, not the ability to think.

When a deeper analysis is applied, it is found that generally, students are only able to answer PISA questions for physics content related to aspects of conceptual knowledge as a result of memorization. In terms of the ability to use scientific knowledge to analyze texts or articles, students' abilities are still relatively low. Students of Kota Banda Aceh Junior High Schools consider science subject matter learned in school as a set of facts that must be memorized, thus memorization is thought will help them in answering the exam questions. The low ability of junior high school students in Banda Aceh in analysing texts or articles illustrates students' low critical thinking skills.

According to Osborne (2014), critical thinking is an organizing process that allows students to evaluate evidence, assumptions, logic, and the language that underlies other people's statements. The ability to think critically and creatively is important in learning science, as it enables students to solve problems of everyday life.

4. Conclusions

Based on the results and discussion, it can be concluded that the science literacy skills of Banda Aceh City Junior High School students in solving PISA questions of physics content are medium in the category. The further analysis of the students' aspects of scientific conceptual

knowledge resulted in memorization skill as the highest. The skill of using scientific knowledge in analysing texts or articles is low. This shows that students' ability to think about science critically and creatively is poorly developed. Based on these findings, teachers must implement more effective science learning methods to improve students' scientific literacy.

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