



CHARACTERISTICS OF THE ABILITY OF PHYSICS CONCEPT IN ENRICHMENT TEACHING MATERIALS OF NATURAL AND MINERAL RESOURCES (NMRs) LITERACY

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ABSTRACT

This study is aimed at describing the characteristics of basic physics concepts in materials of science literacy enrichment of natural and mineral resources (NMRs) prepared by students of Physics Education Department, Universitas Islam Negeri Sunan Gunung Djati Bandung. The method of data collection for scientific literacy ability of NMRs is obtained from the description of NMRs, results of describing the enrichment materials of NMRs process, the basic concepts of physics, and context as well as attitudes of students towards NMRs through paper enrichment materials. This study was conducted to 15 documents of enrichment materials made by students. The study concluded that: (1) characteristics of students' ability to describe the physics concepts in literacy enrichment materials NMRs show variation; (2) the ability of describing concept of fundamental physics in five NMRs groups being investigated shows a low gains. The study recommends that the application of material needs developing and teaching media literacy enrichment and physical sciences should have more contextual NMRs for secondary, high school and undergraduate students.

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Keywords: characteristics of basic physics; enrichment materials; literacy of natural and mineral resources

INTRODUCTION

Republic of Indonesia has abundant natural and mineral resources (NMRs). This potency also becomes a set of asset, which may be explored, developed and used for the purpose of Indonesian citizens' prosperity. As matter of fact, the potential NMRs, which are in the form of water, land and air resources, are all available in all Indonesia's region. These NMRs, in fact, is part of human's integrated environment. Therefore, the bigger potential of NMRs is to explore the greater benefit that Indonesian citizens may obtain.

The reality shows that Indonesian citizens do not fully get the benefit of the availability of po-

tential NMRs in their regions yet. They still have limited access in using those potential NMRs. Greater than that, they also provide insufficient involvement in managing the NMRs. Specifically, only artisans and unskilled labors who actively get involved in such activity. Yet, citizens also lack of comprehension or literacy upon their surrounding NMRs. Such limitation towards NMRs is not shown by half of students living within the NMRs location, but also by college students from regions with potential NMRs. They do not have enough literacy, especially in the concepts of science or physics found in NMRs management.

Literacy towards NMRs is included in scientific literacy. Students or college students who know the scientific concepts will also have sufficient literacy in NMRs. Recently, there are students with low ability of scientific literacy, which can be seen in their low concern in NMRs

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management (such as water resources) (Hidayati, 2016; Arief & Utari, 2015). In fact, the amount of such potential NMRs is not balanced with citizens' awareness in involving themselves upon the use of mineral resources. Nowadays, citizens do not have sufficient literacy in the value of the abundant NMRs yet (Eheazu, 2014; Allman & Daoutidis, 2016; Kusmana & Hikmat, 2015). In order to have sufficient literacy on NMRs they need to obtain enough information through the implementation of briefing and provision of NMRs enrichment teaching materials (Rusli, 2016; Hobson, 2003; Purwanto et al., 2014; Rochman, 2015). Moreover, there are numerous researches on the effort of the improvement in such ability with various strategies (Khaeronytyas, et al., 2016; Fakhriyah, et al., 2017; Setiawan, et al., 2017; Setiawati & Rusilowati, 2013). The presentation of literacy enrichment teaching materials may also be used as scientific materials which are based on research result (Parmin & Peniati, 2012).

According to the abovementioned conditions, therefore the researchers decided to review the Characteristics of students' ability, especially in college, towards the NMRs. The last but not least, the researchers also aimed to figure out the way the information of enrichment teaching materials of NMRs involves the basic physics concepts (Zakiyyah et al., 2016; Yuliati, 2013).

METHODS

This descriptive and collaborative research was based on the identification of a series of activities and products performed and produced by a group of respondents (college students) on NMRs. Such activities started with the planning of NMRs to be learnt. Collection of initial information relating to NMRs was followed by NMRs location survey and collection of information and products submission. At the end of the activity, the researchers conduct the data analysis and interpretation.

This research was applied to college students living in 15 location in West Java, which consisted of 5 water resource locations, 2 forest resource locations, 1 waste resources location, 1 geo-park location, and 3 natural sand resources. All data were collected in a paper document containing four open questions to guide the college students in compiling the enrichment teaching materials of NMRs. The researchers then sco-

red the answers and descriptions proposed by the college students on the four literacy questions to the range of 0-5 (adapted from Holden, 2010; Peranginangin, 2014). The score range shows that 0=non-filled; 1=inadequate expressions and some are false; 2=inadequate true expressions; 3=most of the expressions are true but less comprehensive; 4=all the expressions are true but less comprehensive; and 5=all the expressions are true and comprehensive.

RESULTS AND DISCUSSION

Characteristics of the college students' ability of concept revelation, process, contexts and attitude

Characteristics of the college students' ability of concept revelation, process, context and attitude to the enrichment teaching materials of NMRs literacy can be described in the Table 1. Based on Table 1, 15 documents of enrichment materials of natural and mineral resources come from 15 places in West Java. The materials are described based on components of concepts, process, context, and attitude. The students ability in describing the concepts are varied. The variation takes place from the highest to the lowest i.e. describing positive attitude (2.53), describing process (2.31), describing context (2.28), and describing concepts (2.26). The result shows that despite the low ability of describing concepts, the students have high positive attitude. The positive attitude can be in the form of caring dealing with the use and risk of using natural and mineral resources. Generally, the students' ability in describing the materials is still low (2.35–below the average score on 0.5 scale).

The ability of describing the conceptual components only scores 2.26. The students' ability in describing and identifying concepts of Physics in the materials of natural and mineral resources is also still low. The low ability results in the decreasing supports of environmental resources (Goldman et al., 2014). The next low score occurs in the ability of describing context (2.28).

For instance, in the aspect of concept, their most prominent literacy were in water and natural sand resources. Meanwhile, they had insufficient comprehension on concept related to forest and waste resources. In fact, forest resources has economic function, which exceeds the management cost (Purbawiyatna et al., 2011).

Table 1. The Average Scores of Describing Ability in The Teaching Materials of Natural and Mineral Resources

| Natural and Mineral Resources | Concept | Process | Context | Attitude | Average |
|--------------------------------|---------|---------|---------|----------|---------|
| Waterfall of Tasikmalaya | 2.7 | 2.3 | 2.1 | 2.7 | 2.45 |
| Reservoir Water of Sukabumi | 2.5 | 2.3 | 2.1 | 2.6 | 2.38 |
| Tanjung Water of Tasikmalaya | 2.6 | 1.9 | 2.2 | 2.5 | 2.30 |
| Katulampa Dam of Bogor | 2.2 | 2.5 | 2.2 | 2.8 | 2.43 |
| Water Resource of Sukabumi | 2.6 | 2.5 | 2.2 | 2.5 | 2.45 |
| Palm Sugar of Sukabumi Regency | 1.8 | 2.2 | 2.3 | 2.5 | 2.20 |
| Eucalyptus of Indramayu | 1.9 | 2.3 | 2.5 | 2.3 | 2.25 |
| Cow dunk of Bandung City | 1.8 | 2.2 | 2.2 | 2.4 | 2.15 |
| Geopark of Sukabumi Regency | 2.1 | 2.4 | 2.5 | 2.3 | 2.33 |
| Unused river of Bandung | 1.9 | 1.9 | 1.8 | 2.3 | 1.98 |
| Rubber Waste of Tasikmalaya | 1.9 | 2.1 | 2.1 | 2.2 | 2.08 |
| Rice Husk of Tasikmalaya | 2.1 | 2.2 | 2.3 | 2.6 | 2.30 |
| Galunggung sand Tasikmlaya | 2.6 | 2.7 | 2.5 | 2.9 | 2.68 |
| Sand Majalengka | 2.7 | 2.6 | 2.6 | 2.6 | 2.63 |
| Sand Bandung | 2.5 | 2.5 | 2.6 | 2.8 | 2.60 |
| Average | 2.26 | 2.31 | 2.28 | 2.53 | 2.35 |

Characteristics of the average ability in revealing the Physics concept literacy

Characteristics of the college students' average ability in revealing physics concept literacy in enrichment teaching materials of NMRs may be described in the Table 2. According to Table 2, the Characteristics of college students' ability in revealing the physics concept, which was described through the enrichment teaching materials of NMRs, showed particular variation, with the range of 1.9 to 2.68 and at the scale of 0-5. By the range of 1.9 to 2.68. The average score amounted to 2.35 was still below 2.5. Such higher point showed that other than the variation, their ability in revealing the physics concept of each NMR in many regions in West Java remained low. Similar with the other researches, the researchers also figured out that students need to obtain appropriate training to access numerous literatures. Besides, college students should be trained to explore higher thought ability, such as when they observe the potential natural resource in their surroundings (Fakhriyah et al., 2017).

Among the fifteen places of natural and mineral resources, there are only five students achieving scores which is higher than 2.5 in describing the concepts of physics. They are the ones describing the waterfall of Tasikmalaya (2.7), Tanjungwater of Tasikmalaya (2.6). Water Resource of Suiabumi (2.6), Galunggung Sand of Tasikmalaya (2.6), and Sand of Majalengka (2.7). The five students come from the places close to the natural and mineral resources. Moreover, the

mining and distributing activities are easily observed by people. It shows that the close distance between the people and the natural and mineral resources influences the people's understanding and care of natural and mineral resources (Peraningin, 2014). Another finding shows that the students are more concerned with the development of sand materials. The students have good understanding and attitude upon the impact of sand mining in Majalengka and Galunggung Tasikmalaya (Suhermana, et al., 2015).

Table 2. Students' Ability in Describing Literacy concepts of Physics in The Enrichment Materials of NMRs

| Natural and Mineral Resources | Concept |
|--------------------------------|---------|
| Waterfall of Tasikmalaya | 2.7 |
| Reservoir Water of Sukabumi | 2.5 |
| Tanjung Water of Tasikmalaya | 2.6 |
| Katulampa Dam of Bogor | 2.2 |
| Water Resource of Sukabumi | 2.6 |
| Palm Sugar of Sukabumi Regency | 1.8 |
| Eucalyptus of Indramayu | 1.9 |
| Cow dunk of Bandung City | 1.8 |
| Geopark of Sukabumi Regency | 2.1 |
| Unused river of Bandung | 1.9 |
| Rubber Waste of Tasikmalaya | 1.9 |
| Rice Husk of Tasikmalaya | 2.1 |
| Galunggung sand Tasikmlaya | 2.6 |
| Sand Majalengka | 2.7 |
| Sand Bandung | 2.5 |
| Average | 2.26 |

The Characteristics of Students' Ability in Describing the Enrichment Materials based on the Grouping of NMRs

NMRs may be categorized into 5 types: water, forest, waste, geopark and sand/mineral. The Characteristics of the average ability upon revelation which was based on NMR groups may be explained in the following Figure 1.

According to Figure 1, the Characteristics of the NMR groups' average ability upon revelation, which was described through the enrichment teaching materials of NRMs, remained in low scores (scale of 0-5). The highest score upon the ability in revealing the physics concept of NMR groups by college students was 2.63, which was concerning sand/mineral NMR and respectively

followed by water (2.41). Furthermore, geopark reached the score amounted to 2.33, while forest was 2.63. Unfortunately, they were included in low score. The last score was for waste resource, which were only 2,19. The researchers also figured out that the most revealed physics concept composed several things, they were: material, mechanics, basic plane, transportation, physical change, force and energy, collision, physics of earth, types of rock and gravitation. Meanwhile, in case of waste resource revelation, college students indicated their lack of physics concept revelation. This possibly happens since waste does not have many correlations with physics concept. The prominent revelation of physics concepts included fluid, evaporation and heat.

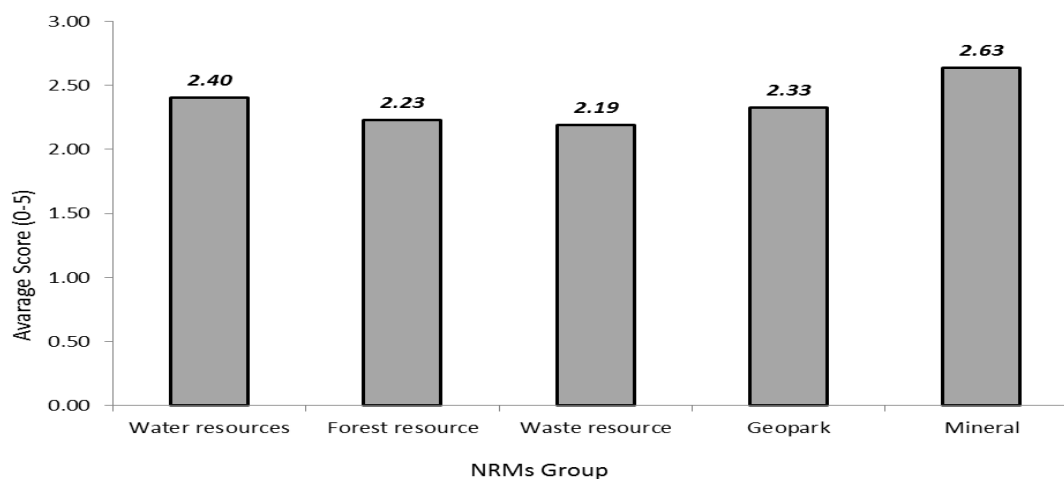


Figure 1. Characteristic of The Student Ability in NRM Enrichment Material Description

In case of sand and mineral resources, the most revealed physics concept was related with the exploitation process of rocks turning into sand, which is well known as gravitation. Such concept was revealed during rock scraping by using numerous mechanical tools such as crowbar (traditional) or beco and sand truck. Moreover, there was the revelation of types of mineral materials such as sand, gravels, rocks, clay/soil and limestone. Sand mining is always connected with its impact towards the condition of the land and water in related area. The quality of land and water surely will be decreased, which results in negative effect for citizens in such area (Suhermana et al., 2015). This revelation is in line with the other researches, which state that science teachers should encourage their students to be able to implement science in maintaining and preserving the environment wisely (Parmin et al., 2015).

CONCLUSION

The researchers conclude that: (1) the Characteristics of the college students' ability in describing the physics concept in enrichment teaching materials of NMRs shows the differences based on the characteristics, location, and phenomena; (2) their ability in revealing the physics concepts are low, since the revelation remains in general or macro concepts. Therefore, in accordance with the result and discussion, the researchers suggest that the development and implementation of enrichment of more comprehensive teaching materials as well as contextual learning media of physics literacy upon the NRMs should be conducted, especially to elementary, high school and college students.

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