The literacy of physics concepts on petroleum exploration: A case in West Java

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Abstract. Since the beginning of the 19th century, petroleum began to be explored in Indonesia which was pioneered by the Dutch which can be further explored by the Indonesian nation. This shows that at that time the nation of Indonesia has started literate. But now most of the Indonesian people are allegedly lacking to understand how the process of petroleum exploration. Based on these assumptions this study aims to obtain exploration literacy data in the area of Bekasi based on physics concepts in learners. Participants of this study are learners from high school are close and far from the location of petroleum exploration. The research method used will be pragmatic explorative. Data collection tools are literation questions consisting of processes, concepts, contexts, and attitudes toward petroleum exploration and interview guidelines. The results showed that the average literacy of the physics concept of students in the low category. This study recommends the need for enrichment materials on petroleum exploration based on local wisdom.

1. Introduction
Petroleum is one of the natural resources that have a very important role [1]. Since 1800, oil exploration has been carried out in Indonesia. Exploration locations are spread across various types and geographical characteristics of Indonesia. Several exploration sites on land such as in Jambi, Subang, Jatibarang, Bekasi, and others are close to residential areas. The existence of exploration activities often causes problems in the surrounding community. Problems that occur arise when the surrounding community does not support exploration activities. One of the causes is the lack of knowledge of the surrounding community towards the objectives, processes, benefits, and impacts of exploration activities [2]. The low knowledge of petroleum exploration is also experienced by high school students around the exploration area [3]. Allegedly, students are not literate and cannot utilize physical knowledge and skills to understand natural resource phenomena such as petroleum exploration.

Literacy of physics concepts in various natural phenomena and natural resources is very useful for students. There are several studies that have been carried out relating to scientific literacy on several natural phenomena and natural resources [2,4]. Students’ understanding of natural phenomena is influenced by educational background. Similarly, research which states that student attitudes influence the level of support for natural resource exploration. In addition, the benefits of natural resources that are felt directly by the community can influence students’ scientific (physics) literacy skills [2]. The study of physics concept literacy in the process of petroleum exploration is still not much done.
Therefore, this study aims to uncover the literacy of the concept of physics in the process of petroleum exploration.

2. Methods
The research method used was pre-experiment. The research was conducted through several stages, namely: conducting an information review on petroleum exploration in the Bekasi area of West Java; reviewing and writing down physical concepts used and discussed in the petroleum exploration process; carry out data collection on physics concept literacy in petroleum exploration; processing literacy data, analysing data processing results; and conclude and make research recommendations.

The instrument used in the form of literacy tests were 4 open questions. The first question related to the petroleum exploration process. The second question is about the physical concepts involved in the petroleum exploration process. The third question about the benefits and impacts of petroleum exploration. The fourth question about the best attitude students should take towards oil exploration activities around them. Each student's answer is scored according to the rubric. The correct and complete answer is given a score of 4. The correct but incomplete answer is given a score of 3. A very simple answer is given a score of 2. The wrong answer is given a score of 1, and no answer is given a score of 0. Participants consist of 11th-grade students in SMK Negeri 1 Tambelang and SMA Negeri 1 Tambelang as many as 71 people.

After processing student literacy data, the next step is the triangulation of several students. Triangulation aims to explore the answers given by students. Triangulation is done by interviewing some of the superior and lower students. The results are described and interpreted so that they can complete the analysis of the research data.

3. Results and Discussion
3.1. Distribution of Student Literacy
Based on the answers to literacy tests on 71 participants, the results were obtained as shown in Figures 1 and 2 below.

![Figure 1. Distribution of Student Literacy Score based on Gender (N=71).](image-url)
Figure 1 shows the students' literacy composition of petroleum exploration. 23 people with an average score of 1.59. The female participants amounted to 48 with an average score of 2.01. The group of male participants was far below the average score in the score range 0 - 4. While the female group was above the average score (2.01). This shows that the ability of all participants is still low. Even so, the score of female group participants is still greater than the average score of the male group.

Figure 2 shows the distribution of literacy abilities of all participants (N = 71). The largest participants were 29 people (40.85%) having an average score in the range of 1.10 - 1.80. Whereas participants who have the highest score only have one (1.41%) or are in the range of scores of 3.25 - 4.00.

The difference in literacy skills of petroleum exploration above is almost the same as the results of previous studies on scientific literacy [5]. There are differences in scientific literacy skills based on gender. The ability of participants to petroleum exploration literacy is still low because most (77, 47%) are in the score range of 1.10 to 2.65 or from fewer criteria to sufficient criteria. This is similar in the case of health literacy in Italy. Health literacy ability is a big problem and the reality is still low [6,7].

3.2. Profile of literacy aspect
Based on the aspects of literacy being tested against 71 participants, the results were obtained as shown in figure 3 below.
Figure 3 shows that the ability of literacy aspects of petroleum exploration varies. On a scale of 0 - 4, the average score of each literacy aspect was the attitude (2.21), concept (1.83), process (1.72), and context (1.72) respectively. So that the average literacy ability of petroleum exploration is 1.87. This average score is still far from the expected average literacy value. The biggest score lies in the aspect of attitude. A positive attitude toward petroleum exploration is greater than the process, concept, and context.

The results above also occur in other studies related to scientific literacy. There is an influence on students’ attitudes toward the scientific phenomena that occur around them [3]. Students have a positive attitude towards what is happening and are seen about the phenomenon of the surrounding science. Students have literacy skills in the lowest aspects of the process and context [8]. This shows that students still do not understand the process of petroleum exploration. In addition, students are less able to understand the benefits and impacts of petroleum exploration activities. This shows that even though they are less able to understand the process and context of petroleum exploration, students still have a positive attitude. It is suspected that the cultural attitude of accepting what happened is still strong among students. The same thing happened in the case of weather changes. Although many Americans do not understand the mechanism of global warming, the attitude towards events is good [9].

3.3 Distribution of Physical Concepts on Petroleum Exploration

Based on the students’ answers to the instrument of literacy on aspects of the concept of physics, the results are obtained as shown in Figure 4.

![Figure 4. Distribution of Physics Concepts on Petroleum Exploration.](image-url)

Figure 4 shows the distribution of physical concepts found in petroleum exploration. There are seven major physics concepts involved in petroleum exploration activities. Consecutive physics concepts that most students choose are heat (30%), energy change (15%), hydrostatic (14%), viscosity (14%), force (8%), density (8%) and Bernoulli (4%). The physics concept that is most widely chosen by students is heat (30%). While the smallest physics concept chosen by students is Bernoulli.

Understanding of physical concepts in the exploration of other natural resources varies greatly. As in the case of palm oil exploration delivered by Offer mans, understanding the concept of science is still low [10]. Environmental education is needed as the right tool to overcome the phenomenon of the energy crisis. Therefore, environmental education based on understanding the concept of science is the right step [11].
4. Conclusion
Based on the results of data analysis, this study concludes that the literacy ability of petroleum exploration in West Java for high school students is still low. Nevertheless, the students' attitude toward petroleum exploration is quite high. This study recommends an in-depth study of the background of the ability of scientific or physical concepts acquired during learning [12,13] and the local wisdom of students' environments [14].

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