Physics concept on flood mitigation in West Java

C Rochman*, R N Yulianti, D Nasrudin and A Malik

Physics Education Studies Program, UIN Sunan Gunung Djati Bandung, Jl. A.H Nasution 105, Bandung, Indonesia

*chaerulrochman99@uinsgd.ac.id

Abstract. Flood mitigation is not just a disaster but a dense phenomenon of the physics concept. Understanding of the phenomenon and flood process helps human safety. This study aims to analyze the concepts of physics in the event of flood disaster so as to obtain the best educational material about flood disaster mitigation. The method used is pre-experiment with one shoot test. The research population used is high school students in 5 (five) cities in West Java or as many as 300 people. The instrument used is a test with 4 (four) open questions about the process, concepts, context and attitudes of learners to the flood. This research shows that the low ability of students' literacy toward the physics concepts contained in the phenomenon of flood disaster. Based on the results of this study, it is necessary development and application of physics enrichment materials about flooding at various levels of education.

1. Introduction

The trends of hydrological disasters such as drought, land, landslides, tornadoes, tidal waves, and floods are the dominant and increasing types of disasters in different parts of the world. In Indonesia, flooding is a disaster that often occurs in most of the regions in the country. Various disadvantages of material possessions as well as psychological suffering are experienced by exposed communities [1]. Not only that, the victim's life was often experienced by some people.

The occurrence of floods is an interaction between human and natural aspects arising from the process by which humans try to use nature useful and avoiding harmful nature [2]. Experience of flood disaster not only once, but there are in some areas that make flood as an annual disaster. They understand the phenomenon of the flood, but very few are looking for a solution. The public understanding of the flood has not reached the point of how to avoid and stay away from the exposed areas. As a result, people in certain areas always suffer all the time.

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Community efforts to avoid flood exposure are linked to their understanding or literacy towards flooding. Community control over floods, flood-related concepts, flooding impacts and best avoidance, and prevent flooding is still low. Low understanding of the flood process often results in a large number of casualties [3]. Unintelligible flood concepts create behavior that causes flooding. Fewer calculations on the impact of floods resulted in greater losses (suffering) of communities after the flood disaster [4].
To reduce the impact of flooding and find a permanent solution it requires the ability of community literacy on adequate flooding [5]. Increased literacy on flooding needs to be started from school-age communities such as learners in high schools in areas exposed to flooding. In this regard, learners on a curricular basis have been or are obtaining scientific concepts [6]. Especially the physics concepts that form the basis for understanding the phenomenon of the flood from the point of view of physics. Therefore, the effort to explore and study in depth the physics concepts that exist in the phenomenon of flooding, for example, becomes very important [7].

The participant's understanding of this flood phenomenon needs to be given in the form of enrichment material [2]. Because if this material is given on a curricular basis in the classroom it is feared will increase the number of hours of lesson. It is, therefore, necessary to develop enrichment materials on flood accompanied by a description of relevant physic concepts [2] [8]. To ensure that flood mitigation information and enrichment materials are important, a survey of literacy skills profiles of learners in exposed areas of flood and surrounding areas is required.

Physics materials as part of the teaching materials are important in literacy and strengthen the understanding of physics concepts of learners at the secondary school level. Enrichment materials needed to understand flood disasters must be in accordance with curriculum and flood mitigation literacy movements for all Indonesian citizens. The mitigation literature addresses the flood for Indonesian citizens concerning the prevention and prevention of disaster exposure, and so on. In some areas, the flood disaster got resistance caused by the low literacy happened in the community, especially the students. In order for students' literacy to be stronger, enrichment is needed [6].

In the study of physics, learners are important to know the application of physics concepts in various flood mitigation. Meanwhile, physics teacher candidate students at the secondary level still low their understanding of flood disaster mitigation. Besides the flood mitigation material is not available in the course specifically. Also, this learning material is not supported by the secondary school curriculum. Whereas the literacy of learners and physician candidates is absolutely necessary. Because the understanding of flood mitigation is a necessity to fulfill current needs [3]. Therefore, this study and study is directed to find out how the literacy profile of middle-level learners. In addition to the learners, also studied the ability of physics education students in preparing and concerning the enrichment materials (supporting materials). Some research indicates that still need to be enhanced by student and student awareness toward science literacy which come from nature and environmental phenomenon.

2. Research methods

Based on the fact that the low literacy ability of the students and the lack of enrichment materials on flood disaster mitigation in the school environment, this research was designed by survey method in 4 locations of flood disaster. Research subjects involved physics education students and 4 groups of learners who totaled as many as 300 people learners. Students prepare the literacy test instrument consists of 4 (four) open questions. The data of literacy capability of flood mitigation was analyzed in accordance with rubric score 0-4. Whereas students assigning tests at 4 locations observed and compiled the supporting materials of the flood disaster. The process of enrichment analysis which is composed by the students and the students' answers using rubrics so as to produce an overview of the physics concepts involved in the mitigation of flood disaster.

3. Result and discussion

Based on the characteristics of data obtained from the literacy and evaluation tests of physics concepts on the test results, it will be presented literacy profile of flood mitigation, comparison of literacy between near and far from mitigation location of flood, comparison of student flood mitigation literacy (based on location school), and the following physic concepts profile.

3.1. Literacy profile of flood mitigation

Based on the results of data analysis of the learners' answers about the literacy of flood mitigation, then obtained the profile of their ability as shown in figure 1 below.
Figure 1 above shows that the literacy ability profile of learners at 4 locations exposed to varied flood disasters. For the literacy ability of students who are exposed to the highest flood disaster until the lowest consecutive owned by such students in the area of Bandung, Garut, Sumedang, and Sukabumi. As for learners from schools that are far from the location exposed to flood disasters in successive learners from Bandung, Sukabumi, Garut, and Sumedang. It is interesting to learners in the Sukabumi area, the average literacy ability of learners far from the flood disaster is greater (2.72) than the students exposed to flood (2.58).

Based on the average literacy ability data from the four regions, the students who are exposed directly to the flood disaster in Bandung have the highest literacy ability (2.85). In contrast, the learner in Sukabumi area is the smallest (2.58). It is known that the frequency of disasters in Bandung is much higher than in other areas. This shows that learners who often experience flood disaster, then they are increasingly knowing and recognizing the characteristics of the flood disaster [9] [10].

3.2. Comparison of literacy
Based on the results of data analysis of the students' answers about the literacy of flood mitigation, then obtained the literacy profiles (process, concept, context, and attitudes) based on the location of their flood disaster as shown in figure 2 below.

Figure 2 shows that the literacy capability profile in the process aspect and the learners content at 4 locations exposed to flood disaster varies considerably, i.e. between 2.15 and 3.02. The highest and lowest scores on the content aspect are the learners residing in Bandung and Sumedang (2.62 and 2.15). Similarly, the highest and lowest scores on content aspects are in Bandung and Sumedang (3.02 and 2.35)
Based on the acquisition of literacy score above, it appears that learners in Bandung have the ability to describe the results of observing the process of flooding is higher than the students in the area Sumedang. The ability to describe an event including a flood of phenomena can be affected by the direct experience and frequency of flood events in an area [8] [11].

In the context and attitude, aspects can be presented in figure 3 below.

Figure 3. Comparison of literacy (context and attitude).

Figure 3 shows that the literacy capability profile in the aspects of the context and the attitudes of students in the 4 locations exposed to the flood disaster varied considerably between 2.70 and 3.15. The highest and lowest scores on the context aspect are learners residing in Bandung and Sukabumi (2.85 and 2.70). Similarly, the highest and lowest scores on attitude aspects were in Bandung and Sukamubi (3.15 and 2.75).

Based on the acquisition of literacy score above, it appears that learners in Bandung have the ability to describe the impact caused by the flood disaster higher than the students in Sukabumi area. The ability to describe the impacts or occurrences of an event including floods can be affected by the direct experience and frequency of flood events in an area. In addition, it appears that learners’ attitudes toward flood disasters in each region are greater than in other aspects [7] [12] [13]. This shows that the level of awareness of students to the flood is very high. Positive attitudes toward the effort to initiate floods, responding to floods and post-flood attitudes [14].

3.3. Profile of physics concept on flood mitigation

Based on the results of the analysis of the concepts of flood physics, then the percentage of profile obtained. The following presents the percentage profiles for the four flooded areas as shown below.

Figure 4. Profile physics concept of flood mitigation (N=300).

Figure 4 shows the average percentage of the number of learners who write physical concepts on the phenomenon of a flood disaster. Consecutive highest to lowest percentages, the concept of gravity...
(81.0%), the concept of water discharge (71.5%), the concept of kinetic energy (67.5%), the concept of static fluid (65.5%), the concept of fluid dynamics (61.0%), concept of momentum (38.5%), concept of collision (34.5%), friction concept (29.0%), and concept of viscosity (11.0%). The concept chosen with the highest percentage is water discharge by learners in Bandung (88%). As for learners in Sukabumi is the concept of gravity (83%). The concept chosen by the lowest students either is the concept of good viscosity by learners in Bandung (18%) and in Sukabumi (14%).

The concept of water discharge (water discharge) is the concept of the most written by learners in the event of a flood disaster. In plain view, flood disaster is dominated by the capacity of water that exceeds the volume of reasonableness. So that the amount of water capacities is not able to be accommodated to cause flooding. Visually, the flow of water in the event of flood becomes an easy and simple object seen by anyone including by students who experience a flood disaster. While viscosity concept is visually difficult to observe [15] because this phenomenon is intrinsic. The viscosity will convey the flowing water material [16]. So to understand the viscosity, learners must understand that the flowing water carries materials such as soil or other objects. The amount of soil or other objects causes the greater the viscosity to be greater [17] [18]. This will cause learners' understanding of the concept of viscosity more difficult than with other concepts [19].

3.4. Comparison of physics concept between Bandung and Sukabumi student

Based on the results of data analysis of the learners' answers about the literacy of flood mitigation, then obtained a profile percentage of concept-physics concepts written by learners in each area in the process of a flood disaster. The following presented two areas: Bandung and Sukabumi which showed the highest average data (57.2%) and the lowest (48.8%). These two areas were chosen because they have a significant percentage-averaging difference as shown in figure 4 below.

Figure 5 shows that the concepts selected by learners in Bandung and Sukabumi are static fluid, dynamic fluid, water discharge, gravitation, collision, viscosity, momentum, friction, and kinetic energy. The concept chosen with the highest percentage is water discharge by learners in Bandung (88%). As for learners in Sukabumi is the concept of gravity (83%). The concept chosen by the lowest students either is the concept of good viscosity by learners in Bandung (18%) and in Sukabumi (14%).

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convey flowing water material. The greater the viscosity of the flood waters the greater the momentum occurs [1].

4. Conclusions
Understanding learners exposed to flood disasters to physics concepts are varied and still low in both learners in areas exposed to direct or distant ones. The more physics concept described by learners is a concept that is directly visible visually (water discharge) compared to the invisible concept (viscosity) [15] [19].

The research recommends that a literacy model of physics concepts should be developed for each type of flood disaster. Based on local potential or local wisdom in the form of enrichment materials both written and digital [4] [20].

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