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To: PUJIANTO

Dear Sir/ Madam,

The organizing committee of 2014 International Postgraduate Conference on Science & Mathematics 2014 (IPCSM'14) proudly announced that your abstract with the title:

Effects of Disaster Risk Reduction Through Science Instruction for  
Elementary School On Volcano Disaster Preparedness Behavior

is accepted to be presented in IPCSM'14 that will be held on 18<sup>th</sup> to 19<sup>th</sup> of October 2014. The full paper is expected to be received by the committee on 18<sup>th</sup> September 2014. Further information is available on our website: <http://ipcsml.upsi.edu.my>

Thank you.

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## EFFECTS OF DISASTER RISK REDUCTION THROUGH SCIENCE INSTRUCTION FOR ELEMENTARY SCHOOL ON VOLCANO DISASTER PREPAREDNESS BEHAVIOR

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### Abstract

It has been done a research in order to achieve volcano disaster preparedness behavior especially Mt. Merapi (Java, Indonesia) for students of Elementary School. It examines whether science instruction influences volcano disaster preparedness, and whether disaster education and resources mediate between anxiety and disaster preparedness behavior.

Research is conducted by qualitative design. About 14 students of SDN Kiyaran 2 grade 4 are involved as respondents. Data were collected through observation on teaching-learning process, focus group discussion and in-depth interview with all respondents (teacher and student of elementary school).

Results showed that there was a lack comprehension of volcano eruption, disaster risk of it and disaster preparedness in students of Elementary School grade 4. Further, it was found that science instruction (disaster education) and resources are partial mediators between anxiety and volcano eruption preparedness. Implications of the findings are discussed within socioeconomic and cultural context of Special District of Yogyakarta, Indonesia.

Key words: volcano, disaster preparedness, science instruction, elementary school

### Introduction

Geographically, Indonesia has a thousand of islands (big and small islands) which are located on plates meeting of Euro-Asia and Indo-Australia tectonic plates. This condition makes Indonesia being more potential of some natural disasters happened such as earthquake, tsunami, flood, landslides and volcanic eruption in some areas of Indonesia. Moreover, it can inhibit of the national development program. The government through the Disaster Management Regulation and Act No. 24/2007 states that geographically, geologically, hydrogeological and demographically of Indonesia is more potential for disaster happened which are caused of natural and human being factors. It can be a source of inhibited factors of national development program. Then, as far as natural disasters are concerned, government's interest is shifting from disaster prevention to disaster mitigation in the hope of reducing disasters as much as possible.

Indonesia is a rich of active volcanoes. Because of its situation, most of the islands in Indonesia have an active volcano. Moreover, it follows of positive and negative benefits. Not only the soil becomes more fertile, but it is also more potential of volcano eruption happened. Directly, volcano eruption threatened people's life with its dangerous materials. Many activities are inhibited. Students cannot study in their classroom because of the materials of volcano eruption destroy the school buildings and some public transportations. In most cases of volcano

eruption, the increases of victims are caused of the lack of understanding about what volcano is and what should people do if the eruption happened. Mostly, people who live surroundings the volcano have no detail information about disaster risk reduction or mitigation system. Indonesia is the 5<sup>th</sup> country in the amount of the population but this condition is not supported by a big of population in behavior of disaster preparedness (Deny Hidayati, 2012). Severely, people more believe in myth and local culture than scientific information from the government or Center for Volcanology and Geological Hazard Mitigation. This situation is less favorable for disaster mitigation system. Then, it initiates to develop an integrated mitigation system which combines of local culture including myth and scientific knowledge to reduce the risk of disaster (D. Cadag, J. & Gaillard, JC., 2012).

Amount of natural disasters since 1975 to 2011 is increased in typical and a kind of risk of disaster (UNICEF & UNESCO, 2012). The Disaster Management Regulation and Act No 24/2007 changed the paradigm of mitigation system. It is shifting from “disaster prevention” to “disaster mitigation”. In the development country, most of the budget of the financial year is allocated for evacuation program ( Kenny, C., 2012). If the disaster mitigation system can be developed, this budget can be reduced. Then, it can be allocated for others such as education development program, healthcare program, public service and public transportation. Indirectly, the disaster of volcano eruption makes the student gets a limited teaching learning process services. While the volcano eruption happened, most people focus on how to evacuate the victims. Then, students have no activities because their school building broken.

Education is needed to increase the understanding of disaster preparedness especially for the children in hope of reducing the victims. Students of the elementary school will tell to their parent about what volcano is, what should they do if volcano eruption happened, how to find the way for evacuation and how to identify the preliminary phenomena of volcano eruption. Mostly, their parents get the information about volcano disaster from their children who have learnt in their school (RCC, 2007). It is more effective to make people being aware of disaster preparedness through the instruction in the classroom.

Science is one of the subject that is taught in all levels of education system in Indonesia. According to this condition, it is better to teach about natural disaster phenomena through science activities. Teaching about volcano disaster can be integrated in the science teaching materials. Actually, teaching learning process can be done while the volcano doing its activity in order to give an enrichment of mitigation system.

### **Characteristics of Science Instruction in The Red Zone of Volcanic Eruption**

Mt. Merapi is a volcano located in Central Java, Indonesia. Actually, it is located in three areas of red zone area. They are Klaten (Central Java), Sleman (Special District of Yogyakarta) and Magelang (Central Java). The volcano has been very active since May 2006. On May 13 of that year an official evacuation alert was issued and on the 15<sup>th</sup> an extensive pyroclastic flow occurred. As a result of massive volcanic eruptions in October and November of 2010, more than 350 people died and over 300.000 were forced to evacuate their homes. The nearby Borobudur temple complex ruins, a World heritage site, was covered in ash, leading to a sharp drop in tourist visitors, which usually number about 2 million annually. For approximately two

years after these volcanic eruptions of 2010, the villages in the Yellow Zone and Red Zone are visited to conduct a survey of disaster prevention awareness including the teaching-learning process in the classroom.

Learning is an activity with the intention that the process of learning a person or group of people can take place. In carrying out the learning process, teachers are at the forefront of creating a system environment or conditions that conducive to the learning activities to achieve goals effectively and efficiently. In the learning activities, there are two activities that mutually affect learning and teaching. Learning is a process of change, which changes the behavior of a person or subject of study. Teaching is providing something by way of guiding and learning activities to help someone (students) in developing intellectual potential, (emotional and spiritual) so that these potentials can develop optimally (Fajar, Arnie, 2005: 12-13). It can be concluded that learning is a process interaction between students and teachers, learning resources, the environment, education means to achieve a goal efficiently and effectively. Thus, it can be said that learning is a process through the ability to master a learning experience.

Learning is needed by all learners, both in the normal situation and in areas prone to natural disasters. Considering learning is one of the human rights of every citizen of Indonesia, then learning remain to be implemented, including in areas prone to natural disasters that have limitations both of the teachers and learning equipment. However, in implementing the learning in areas prone to natural disasters is different from the normal regional learning available of learning tools such as teachers, teaching medias, textbooks and so on. Learning activities in disaster-prone areas need to emphasize several factors such as the variety of learning and simple methods. It needs to be done because of the limited teachers and educational facilities are owned. In addition, the learning activities in areas prone to natural disasters should focus on learners and learning outcomes factors such as motivation of learning, fun and foster of independent learning so that the learning outcomes are meaningful and can eliminate the grief to students. It is as stated in the Government Regulation No. 19/2005 on National Education Standards, which mandates that the learning process should be carried out by way of "fun, challenging, motivation, creativity, and independence". In addition, the provision of learning services in the area of natural disasters can be performed both by teachers and the community to support learning with limited facilities in emergency conditions. Currently there are several models of learning such as cooperative learning, inquiry, discovery, integrated and so on can be implemented for this condition. Overall the model can be applied in disaster-prone areas by modifying it according to local circumstances.

Education mitigation or disaster preparedness prevention is defined as behavior that is conducted by an individual. Mitigation education and preparedness is the mediation between the public anxiety to a natural disaster (Mishra, S. & Suar, D., 2011). *Education for Sustainable Development* (EFSD) is the foundation in the framework of disaster mitigation education. There are five priority/disaster rescue five dimensions, namely:

- a. Dimension 1: Understanding the science and mechanisms of natural disasters
- b. Dimension 2: Learning and practicing safety measures and procedures
- c. Dimension 3: Understanding risk drivers and how hazards can become disasters

- d. Dimension 4: Building community risk reduction capacity
- e. Dimension 5: Building and institutional culture of safety and resilience  
(UNICEF & UNESCO, 2012)

Attempts to add the charge of disaster risk reduction into the curriculum is a potential means to understand the disaster risk reduction indirectly. One example is to add it to the subjects of Natural Science (IPA) and Social Sciences (IPS), geography. In science, it can be achieved by learning the mechanisms of natural geo-seismic phenomena. The subjects of geography shaped the activity of natural disasters and their impact on society ( Selby, D. & Kagawa, F., 2012). Illustrations of natural disaster phenomena can be realized in the form of a simulation or animation. The results of the distribution of a questionnaire to a number of elementary school students, junior high school and senior high school shows that the use of simulated natural disaster evacuation further facilitate students in understanding disaster mitigation (Goto, Y. et al., 2012).

Therefore, disaster risk reduction strategy is based on a vulnerability assessment and risk continue to be done, so many actors who need to be involved, which comes from the government, technical and educational institutions, various professions, the business world, and the local community. Their activities will need to be integrated into strategies and development plans that enable as well as encourage the exchange of information widely. Multi-disciplinary relationship that is just the very basic things in order to be thorough disaster risk reduction and sustainable.

### Distribution of Volcanoes in Indonesia and Characteristics of Mt. Merapi

Indonesia is a country with the largest number of volcanoes in the world. Most of the active volcanoes in Indonesia and tend to perform activities which take place periodically. Here is a map of the distribution of volcanoes in Indonesia:

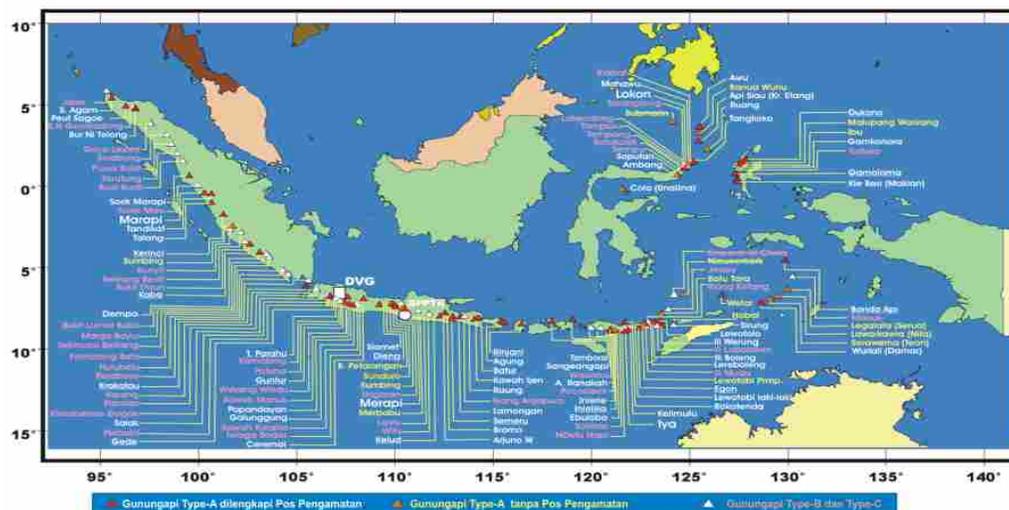


Figure 1: A map of the distribution of volcanoes in Indonesia (Source: PVMBG, 2010)

Generally, volcanoes in Indonesia can be classified into three types, namely volcanic type A, type B and type C (Muhamad Hendrasto et al, 2012). The description of each type can be described as follows:

**Type-A:** Volcano eruption magmatic who had experienced at least one time after the year 1600.

**Type-B:** Volcano that after the year of 1600 not to mention having a magmatic eruption, but still showed symptoms such activities solfatara activities.

**Type-C:** Volcano eruption is unknown in human history, but there are signs of past activities in the form of solfatara/fumarole fields at weak levels.

The details of the number of volcanoes in the provinces can be seen in the table below:

**Table 1: Distribution and the type of volcanoes in Indonesia**

Type of volcano	Sumatera	Java	Bali & Nusa Tenggara	Sulawesi	Maluku	Total
Type-A	13	19	22	11	12	77
Type-B	11	10	4	3	2	29
Type-C	6	5	5	5	-	21
<b>Sum of Volcano</b>	<b>30</b>	<b>34</b>	<b>31</b>	<b>19</b>	<b>14</b>	<b>127</b>

Source: PVMBG (2010)

Based on Table 1, it can be seen that the chances of a disaster due to a very large volcano. These opportunities are supported by the signs of the activity of each volcano, which until now has always monitored by PVMBG's staff stationed in every province.

Mt. Merapi is one of the most active volcano in Indonesia. This volcano is located 30 kilometers north of the city of Yogyakarta. Based on the history of the eruption, Merapi has experienced more than 61 historical eruptions since the mid 1500s ( B. Voight et al., 2000). Cycle eruption history shows that almost every four years experience eruption. Type of eruption is always subject to change, however, the initial symptoms are always characterized by the eruption frequency volcanic earthquakes are quite high and deadly pyroclastic flow. This is why Merapi has always been a central issue and issues of interest to the geologists in the world (B. Voight, R. Sukhyar, A.D. Wirakusumah, 2000).

### Research Method

Research was conducted by qualitative design. About 14 students of SDN Kiyaran 2 grade 4 are involved as respondents. All of their activities in the science instruction (in door and outdoor) are observed. Data were collected through observation on teaching-learning process, focus group discussion and in-depth interview with all respondents (teacher and student of Elementary School).

### Discussion

Volcanic eruption disaster in mitigation education is integrated into Science for grade 4. Teaching materials are divided into three categories: volcano, the signs of erupting volcanoes

and the dangers of volcanic eruptions. At the volcano material, the teacher tried to introduce how the process of volcanic formation. Students are given an understanding of the advantages and disadvantages of living in a neighborhood close to the volcano. So, students have the awareness and concern about the risk of volcanic eruption. Students are given the knowledge of the names of volcanoes in Indonesia and its eruption events that have occurred related to the volcano. The analysis showed that many students do not understand the dangers and risks stay in the environment close to the volcano. They also less of knowledge of how the formation of volcanoes in the world. The results of student assignment also show that students are not recognize the names of volcanoes in Indonesia.



**Figure 2: Student tried to identify the name of volcano and its location in Indonesia**

Students trying to understand the signs of the volcano that will erupt through serial figure games and creating model of volcano eruption. Each group was given the task of preparing a sequence of figure signs of the volcano will erupt. The observation and analysis of student assignment shows that three of the four groups were formed in the class are still not able to sort

the  
the  
that



signs of  
volcano  
will erupt.

**Figure 3: A group of students showed a sequence of figures a signs of volcano that will erupt**

Attitude preparedness of volcanoes eruptions are also trained in the activities of this serial figure games.



**Figure 4: A group of students demonstrated the model of volcanic eruption**

Students learn to understand how pyroclastic flow spread to residential areas through activities of demonstration models of volcanic eruptions. It is intended to allow them and to realize the dangers of pyroclastic flow occurred when the volcano erupted.

## Conclusion

There was a lack comprehension of volcano eruption, disaster risk of it and disaster preparedness in students of Elementary School grade 4. Further, it was found that science instruction (disaster education) and resources are partial mediators between anxiety and volcano eruption preparedness. Implications of the findings are discussed within socioeconomic and cultural context of Special District of Yogyakarta, Indonesia.

Natural disasters including volcanic eruptions are one of the natural phenomena that can not be avoided. Actions that can be done is to attempt and to reduce the risk of eruption impact through mitigation. Disaster mitigation education through science instruction in Elementary School intended to prepare preparedness attitude as early as possible. This study is only a part of a series. Further research will focus on gathering details about the information of teaching methods especially in Science provided to Elementary School teachers on volcano disaster mitigation, then analyzing the collected data to examine how best to develop support systems for disaster victims in the locality.

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