Student's Level of Understanding on Mobile Learning based Volcano Eruption

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Abstract. This study aims to analyze student's level of understanding on mobile learning based volcano eruption. This research is quantitative descriptive. The sample were 200 students who lives in the area that affected by the eruption of Merapi Volcano (Magelang Regency, Sleman Regency, and Yogyakarta City), recruited using a simple random sampling. The instruments were online survey questionnaire of Student's Level of Understanding on Mobile Learning based Volcano Eruption. The distribution of the data is normal, reliable and homogen based the analysis used IBM SPSS Statistics 22 software. The results of this study indicate that students who lives in Merapi Volcano prone area have a good understanding about mobile learning based volcano eruption. Level of student's understanding on mobile learning meet a good criteria with percentage 72,80%, level of student's understanding on volcano eruption meet a good criteria with percentage 73,40%, and student's understanding on disaster mitigation meet a good criteria with higher percentage 76,40%.

Keywords: disaster mitigation, mobile learning, volcano eruption.

1. Introduction

The number of crisis events caused by natural disaster such as volcano outbreaks, earthquakes, flood, and hurricane has dramatically increased over the past decades. Given its location in the Pacific Ring of Fire, volcanic eruptions pose a significant threat. 13% from the world's volcanoes are in Indonesia, which is 129 volcanoes are active. Merapi is a part of the most volcano in Indonesia. In October 2010, the biggest Merapi Volcano eruption ranked third in the world in terms of impact [8] and it claimed at least 386 people were killed and more than 300.000 people evacuated [15]. The loss of life was partly due to basalt landslides which generated pyroclastic flows that cascaded 16 km from the Merapi Volcano [6]. The ashes covered nearby towns completely, destroying infrastructure, houses, economic activities, and education activities.

Merapi eruptions has destroyed most of education facilities. Disaster looses data shows that damage occurred to physical facilities such as classroom, teacher’s room, libraries, and teaching-learning equipments [3]. The main damage is in school activities that experiencing a short-time vacuum because the building made into a refuge within 40 days. The disaster somehow tells us a value about the importance relations between education and the disaster itself.

Disaster related with education to ensure student has a good mental preparedness when disaster and after disaster events, having right attitude to face crucial moments and critical, minimize panic, reduce victims, and know the next danger in the environment [10]. One of the efforts made by the government...
especially in Central Java is to strengthen the disaster education and disaster mitigation in every aspects of life. The research by Sadewo shows that Central Java has a high level rank on efforts to anticipate / mitigate disasters based on aspects of early warning systems, safety equipment and evacuation routes.

A disaster is usually understood as a critical, widely shared, devastating event following unusual procedures. It makes the planning process for communities under continuous threat particularly challenging [14]. Ideally, those who are aware of the hazards and concerned should feel motivated to become better prepared; however, research repeatedly shows that an accurate risk perception often fails to generate adequate preparedness.

How these individuals respond to the threats posed by volcanic hazards influences the effectiveness of official hazard mitigation, response, and recovery efforts. Ideally, those who are aware of the hazards and concerned should feel motivated to become better prepared [5]. One way to increase student response to disasters is to strengthen preparedness behaviour and disaster understanding.

Preparedness is a crucial behaviour for people who live in disaster prone areas. Preparedness is an individual concept that perceived as part of adjustment behaviors in others [12]. Appraisals of the preparedness behavior and one's ability to enact the behavior, including both cognitive and social factors, were also found to influence preparedness for several behavioral theories and hazard types examined.

The factors that influence individual and household preparedness intentions and behaviours are complex and multifaceted [11]. As we know, the integration of disaster education and curriculum at school is one way to shape the preparedness behavior and strengthen the disaster understanding to students. Based on research that has been done by Tyas about student perception toward their preparedness for volcanic eruption disaster, the student from SMP Negeri 2 Cangkringan have good knowledge towards their preparedness for volcanic eruption disaster and their preparedness to face disasters is instinctively formed.

To save our generations of natural disaster requires two priorities; education on disaster risk and safety in the schools. Disaster education is very important for building an understanding of the teachers and students about the causes, nature, and effects of disaster. It also fosters the knowledge and behavior to contribute proactively for the prevention and mitigation of disasters. Based on research by Pamungkasih, student's knowledge and attitude facing disaster preparedness volcanic eruptions. The research result shows that the knowledge and attitude facing disaster preparedness volcano eruption of student class VIII SMP around Merapi Volcano had a good knowledge about knowing the danger sign of eruption with percentage 29% and had a ready for disaster preparedness with percentage 59%.

Education is a key mechanism which is student can participated directly in disaster risk reduction. When student are supported and provided with sufficient knowledge and skills, they can protect themselves, save others, and promote significant changes to reduce risk of disaster [2]. Disaster education aims to increase student's resiliency on disaster risks by solidifying knowledge about disasters, developing skills to prepare, adapt, mitigate, and respond to effect of disasters [13]. The importance of disaster education in schools implies disaster mitigation education needs to be introduced at the level of schooling in Indonesia [9]. As one of the efforts to prepare the people of Indonesia disaster preparedness. One of the innovations that can be applied is by integrating disaster education and technology.

Indonesia is currently entering the era of the Industrial Revolution 4.0, where technology, physical, digital and biological space combine into one. The impact is that there is less geographic locations activity because most of all are converting into digital. Mobile learning is an alternative learning media that integrated with technology. Mobile learning is a technology that able to change the way students communicate, interact, and behave with one another and shape their perceptions of learning [1].

4.0 urgently needed in the era of the successor generation of the Indonesian nation has a lot of ability. The positive impact of using mobile learning stated in research by Oyelere, especially for blended learning, social learning, student-centered learning, and project based learning, all of which are supported in mobile learning implementation. The research also indicates that developing mobile learning application through a well-established is expedient because its specific guidelines for evaluation and iteration.
Based on these problems, this study aims to analyze student's level of understanding on mobile learning based volcano eruption. This study focuses on student who lives in Merapi Volcano’s prone areas. The third question raised in this research are: how the understanding of mobile learning? How the understanding of volcano eruptions? And how the disaster mitigation that they already know? To address these questions, this study explores the understanding of student who lives in disaster-prone of Merapi Volcano.

2. Methods

These online survey questionnaire was administered to students who lives in the area that affected by the eruption of Merapi Volcano (Magelang Regency, Sleman Regency, and Yogyakarta City). Survey participants were shown a list of statements that could indicate the understanding about mobile learning based on volcano eruptions. These statements and items divided into three categories: understanding of mobile learning and its technological tools, volcanic eruption disaster, and disaster mitigation.

Respondents were recruited using a simple random sampling method. The simple random sample means that every case of the population has an equal probability of inclusion in sample [19]. The questionnaire was distributed through science teacher around in area that affected by the eruption of Merapi Volcano. Between 4 - 13 August 2020, 200 individuals participated in the survey (Table 1. survey demographic data).

| Table 1. Survey Participant Demographic |
|-----------------------------------------|
| Demographic | Survey participants |
|--------------|---------------------|
| Sex: n = 200 |                      |
| Female       | 72%                 |
| Male         | 28%                 |
| Age: n = 200 |                      |
| 12           | 11%                 |
| 13           | 18%                 |
| 14           | 39%                 |
| 15           | 22.5%               |
| 16           | 7.5%                |
| 17           | 2%                  |
| Origin: n = 200 |                  |
| Magelang Regency | 62.7%             |
| Sleman Regency  | 21.5%               |
| Yogyakarta City | 16%                |
| Parent's Education Qualification: n = 200 |      |
| No formal education | 3%                |
| Primary       | 34%                 |
| Secondary     | 48%                 |
| Diplomas      | 2%                  |
| Bachelor/ Master/ Doctorate | 14%          |

The checklist understanding on the questionnaire included 33 supply items that develop from 3 categories: 12 items of understanding mobile learning (mobile learning definition, learning experience with mobile learning, mobile learning purposes, distance learning platform, science learning with mobile learning, the weakness of mobile learning, and mobile learning features needed in science learning); 13 items of volcano eruption understanding (characteristics of active volcano, the stages of volcano eruption warning, volcanic materials, volcanology information, self eruption experience, volcano eruption in science learning, and type of volcano eruption); and the last is 8 items of disaster mitigation (understanding disaster mitigation, disaster mitigation purposes, disaster risks, disaster-prone areas, volcano eruption sign, evacuation routes, pre-disaster mitigation, disaster mitigation when eruption occurs, and post-disaster mitigation).

This research is quantitative descriptive. About the questionnaire consists of 33 items that have been validated by expert lecturers. Data analysis techniques in this research namely (a) the qualitative data.
analysis techniques, with some variations, asked participants to rate their agreement with statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Where necessary, an “I don’t know” (neutral) category was included [5], (b) qualitative data analysis techniques converted into quantitative data with measurements SS: 5, S: 4, N:3, KS: 2, TS: 1. Data from the analysis of the answers to the students and then calculating the average and standard deviation. The analysis result categorized into criteria knowledge and disaster preparedness for volcanic eruptions learners [17]. The category of criteria divided into two items, positive item and negative item. The criteria according to calculations using interval equations. The criteria can be seen in Table 2 and Table 3.

Table 2. Level of understanding for positive items.

| Interval Score (%) | Criteria |
|--------------------|----------|
| 80 – 100           | Very good|
| 60 – 79.99         | Good     |
| 40 – 59.99         | Enough   |
| 20 – 39.99         | Low      |
| 0 – 19.99          | Very low |

Table 3. Level of understanding for negative items.

| Average Interval Score | Criteria |
|------------------------|----------|
| 80 – 100               | Very low |
| 60 – 79.99             | Low      |
| 40 – 59.99             | Enough   |
| 20 – 39.99             | Good     |
| 0 – 19.99              | Very good|

Descriptive statistics recommended for ordinal measurement scale items include a mode or median for central tendency and frequencies for variability [4]. The distribution of the data is normal and homogen based the analysis used IBM SPSS Statistics 22 software. The Cronbach's alpha value is 0.75> 0.7 it means sufficient reliability, the normality value of kolmogorovsmirnov significance equal to 0.128 > 0.05 and the homogenity significance equal to 0.293 > 0.05. Normal and homogeneous data allow these data to be analyzed statistically.

3. Results and Discussion
Disaster learning should be implemented in formal or non-formal education in an innovative way such as integrating with local potential of the volcano eruption. Disaster learning is rising with assumption that the focus of mitigation is not only about disaster management, but rather refers to the understanding and preparedness. Disaster preparedness and readiness refers to the knowledge and capacities of a person to efficiently anticipate and effectively respond to and recover from imminent and present disasters [13].

Hazard-related attributes represent a more detailed measure of perceived response-efficacy that includes efficacy for protecting people, efficacy for protecting property, and utility of the adjustment for other purposes. Respons related attributes measure characteristics of protective actions rather than characteristics of the people responding. People’s responding depend on their understanding about disaster and mitigation.

The best way to educate the disaster and mitigation is through education. Revolution 4.0 encourage education to integrate with technology. Nowadays, smartphone is the most needed device for people. An innovative ideas to support learning disaster integrated with technology is mobile learning. Mobile learning is one of the answers to the demand the revolution 4.0. Mobile learning proven that learning can be more effective, can be done anywhere, and last a long time.
Science learning is one of subject that includes disaster knowledge in its basic competence. Specifically, science learning in junior high school loads disaster material in the structure and dynamics of the earth. To know how student’s understanding about integrating between mobile learning and volcano eruption, then a survey research must be carried out for students who live in prone areas of volcanic disasters. This research divided into three categories; mobile learning understanding, volcano eruption understanding, and disaster mitigation.

3.1. Student’s Understanding on Mobile Learning

Mobile learning understanding of students measured using indicators mobile learning definition, learning experience with mobile learning, mobile learning purposes, distance learning platform, science learning with mobile learning, the weakness of mobile learning, and mobile learning features needed in science learning. The results obtained to know how much student’s understanding about mobile learning. The percentage data of student’s understanding about mobile learning in Merapi Volcano-prone area can be seen in table 4.

| No | Items                                                                 | Percentage (%) | Category |
|----|------------------------------------------------------------------------|----------------|----------|
| 1  | Mobile learning is a technology in education by mobile devices that can only accessed at school.* | 58             | Enough   |
| 2  | I have experienced using mobile learning taught by family or relatives. | 63             | Good     |
| 3  | The aims of mobile learning is to make student easier to engage the instruction in anywhere and anytime, improving communication, interaction and collaboration skills. | 78             | Good     |
| 4  | I have participated online learning by using Google classroom, Edmodo, or whatsapp group. | 84             | Very good |
| 5  | Using mobile learning make student easier to more active in science learning. | 67             | Good     |
| 6  | Using mobile learning make student easier to master the material.       | 64             | Good     |
| 7  | Online mobile learning consumes a lot of internet data.                | 76             | Good     |
| 8  | Learning with online mobile learning is not effective in areas with a signal which is 4G not available. | 80             | Very good |
| 9  | Platforms such as google class, edmodo, and other web sites limit students to express their opinions.* | 71             | Low      |
| 10 | The less sophisticated mobile features cause students to be constrained from accessing the mobile learning. | 77             | Good     |
| 11 | Students prefer learning with mobile learning than face-to-face learning in class. | 44             | Enough   |
| 12 | Mobile learning equipped with audio or video features increases students’ interest in learning science. | 76             | Good     |

*) Negative items

The development of new technologies and teaching-learning process have caused the emergence of new mobile devices strategic tools with the capacity to deliver such an instruction. Due to the relationship with technological innovation, mobile learning has been adapting to the new possibilities and demands, evolving into industrial revolution 4.0.
Understanding mobile learning means that learning can do in everytime and anywhere. Student’s appreciation, skills, and motivation play significant roles in engaging and sustaining to apply mobile devices to meaningful learning. The survey result of student’s understanding on mobile learning indicates that 2 items meet the criteria very good, 7 items meet criteria good, 2 items meet criteria enough, while 1 item meet criteria low. Based on result can be concluded that students already have a good understanding about mobile learning, but they still have a negative perception if their expression will be restricted when engage in online learning.

3.2. Student’s understanding on volcano eruption.
The second question research is about student’s understanding on volcano eruption. This research measure using indicators characteristics of active volcano, the stages of volcano eruption alert level, volcanic materials, volcanology information, self eruption experience, volcano eruption in science learning, and type of volcano eruption. The percentage data of student’s understanding about volcano eruption in Merapi Volcano-prone area can be seen in table 5.

| No | Items                                                                 | Percentage (%) | Category   |
|----|-----------------------------------------------------------------------|----------------|------------|
| 1. | I know the observable characteristics of an active volcano.          | 85             | Very good  |
| 2. | Volcano with normal status means that volcanic activity increased. The threat is in the form of eruptions around the crater.* | 64             | Low        |
| 3. | The characteristics of volcano “waspada” alert level is when the activity of the volcano has increased due to magma, tectonic, and hydrothermal activity.* | 81             | Very low   |
| 4. | The characteristics of volcano “awas” alert level is when the activity of the volcano has increased due to magma, tectonic and hydrothermal activity. | 79             | Good       |
| 5. | The characteristics of volcano “siaga” alert level is when the activity of the volcano continues to experience an increasingly obvious increase or an eruption occurs.* | 81             | Very low   |
| 6. | Hazardous materials from volcanic eruptions include hot clouds, lava flows, poisonous gases, ash rain, and eruptive lava. | 86             | Very good  |
| 7. | I follow the latest information on Volcano activity at http://www.merapi.bgl.esdm.go.id/ and https://magma.esdm.go.id/. | 68             | Good       |
| 8. | I was one of the people affected when the volcano erupted.           | 53             | Enough     |
| 9. | I feel scared when volcano erupted because I didn't have the knowledge about self-evacuation efforts.* | 63             | Low        |
| 10.| I always feel anxious when a volcanic eruption suddenly occurs due to trauma in the past.* | 66             | Low        |
| 11.| The science lesson in junior high school discusses volcanoes and their eruptions deeply. | 76             | Good       |
| 12.| I understand the type of volcanic eruptions because it discussed circumstantially in science learning. | 72             | Good       |
| 13.| Hazardous materials from volcanic eruptions are discussed circumstantially in science learning. | 79             | Good       |

*) Negative items
Disasters affect segments of the population in different ways while education provides protection in the face of a large-scale natural disaster is investigated. One of natural disaster that threaten Indonesia is volcano eruption. Volcano eruptions are one of the disasters that result in complex consequences. Volcano eruption understanding have an urgency to be owned by students who lives in merapi volcano prone area.

Understanding about volcano eruption for the surrounding communities is a knowledge to know and understand the dangers and preventive effort deal with the Merapi Volcano eruption. These research result indicates that 2 items meet the criteria very good where it's signifying student knows the characteristic, trigger and hazard of volcano eruption. 3 items meet the criteria good, 1 item meet criteria enough, 3 items meet the criteria low, and 2 items meet criteria very low. It might caused by student's lack of understanding to the negative items statement. Due to the statements relate to the 4 stages alert level of volcano when the eruption will occur.

Indonesia Volcano Alert Level consists of 4 stages, from the lowest to highest level of unrest and eruption there are: Normal, Waspada, Siaga, and Awas. Every stage indicates a particular level of activity and each include a recommendation for community response. When students have a limited knowledge to understanding volcano alert level, it will influence actions that will be taken in order to mitigate disasters.

3.3. Student’s understanding on disaster mitigation

The third question research is about student’s understanding toward disaster mitigation. This research measure using indicators understanding disaster mitigation, disaster mitigation purposes, disaster risks, disaster-prone areas, volcano eruption sign, evacuation routes, pre-disaster mitigation, disaster mitigation when eruption occurs, and post-disaster mitigation. The percentage data of about student’s understanding toward disaster mitigation in Merapi Volcano-prone area can be seen in table 6.

| No | Categories                                                                                                                                                                                                 | Percentage (%) | Category  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------|
| 1. | Effort when a volcanic eruption occur is disaster mitigation. Disaster mitigation is an effort to reduce the risk of disaster through physical development and improving people’s capabilities.          | 82             | Very good |
| 2. | Long-term disaster risk reduction, reducing casualties, and minimizing impacts are the goals of disaster mitigation.                                                                                          | 81             | Very good |
| 3. | Understanding Disaster Prone Area is important to determine action in disaster mitigation efforts.                                                                                                          | 85             | Very good |
| 4. | As a resident of leren volcano, I understand the early warnings and signs of nature when there will be eruptions.                                                                                             | 73             | Good      |
| 5. | As a resident of the volcano slopes, I know the evacuation route and the closest gathering point from home or school.                                                                                         | 69             | Good      |
| 6. | Heeding the direction of the Center for Volcanology and Geological Disaster Mitigation (PVMBG) and the development of volcanic activity is not a mitigation effort before a disaster occurs.*                                                               | 69             | Low       |
| 7. | Not in valleys or watersheds, avoiding open spaces, and not in the recommended location to be emptied is                                                                                                      | 79             | Good      |
an attempt at disaster mitigation in the event of a volcanic eruption.

8. Avoid driving in areas affected by volcanic ash and being wary of potentially cold lava-stricken watersheds is not a mitigation effort after a disaster.*

*) Negative items

Disaster mitigation can be implemented in Natural Science (IPA) subjects at junior high school level, in line with the contents of Law No. 24 of 2007 that disaster management should be integrated into development programs, including in education. Natural Science learning is very strategic to integrate with disaster mitigation. Understanding disaster mitigation through science perspective so as to better meet the challenges of natural disasters.

The result about disaster mitigation understanding indicates 3 items meet the criteria very good, 3 items meet the criteria good, and 2 items meet the criteria low. It's low criteria included 2 negative items about pre-disaster mitigation and post-disaster mitigation. There are two important lesson to effective mitigation measures against natural disaster. The first is disasters must be considered as unresolved development problems and that they are not unpredictable, isolated or independent events. Natural disaster must be increased the vulnerability. The second lesson is that mitigation of natural disasters cannot depend solely upon technological solutions and should be based on a wide range of measures including engineering devices, land management, social regulation and economic improvements [7].

In line with The Sendai Framework by United Nations (UN) have 4 priority due for action. This research include one of 4th priority. Understanding disaster mitigation belong to 1 priority: understanding disaster risk. This framework prevent new and reduce disaster risk through implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political, and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.

Disaster education and disaster mitigation is gonna be forever concern for every research and focus in every aspects of living. It’s not only understood and strengthened by people who lives in disaster prone areas but in every place. Disasters never know the time and place and it so importance to have an understanding about disaster and mitigation disaster. From this research can be inferred, there are great opportunities to integrate technologies such as mobile learning with volcanic eruptions. It’s supported by level of student understanding that can be seen in the figure 1.

Figure 1. Student's understanding on mobile learning based volcano eruption.
Based on the summary of the figure 1, it can be known entirety that the level of student's understanding on mobile learning based volcano eruption meet the criteria good. Proven with percentage mobile learning understanding 72.80%, volcano eruption understanding 73.4%, and understanding on disaster mitigation 76.40%.

Furthermore, it takes a serious development of disaster education in junior high school that following technological advances. Technology and education integration such as mobile learning supports students who live on the slopes to still be able to learn anywhere and anytime. Undeniable, settling in volcanic regions is a challenge for most people to survive and live in disaster-prone areas. The threat of an eruption occurs at all times and is unpredictable. This causes people around the volcanic region to have knowledge and readiness at any time the disaster happens.

Knowledge is a key factor in understanding natural disasters. The inability of people to evacuate in mitigation when disasters occur will only create new problems. People's lack of understanding of volcanoes and dangers is key to dealing with the eruption crisis. This condition influenced by the role of Natural Science education in secondary schools.

In an effort to support improving people understanding on volcanic disaster and mitigation, there are things to do, among others: 1.) Strengthening the SSB (Sekolah Siaga Bencana), because it plays an optimal role in preparedness and response to volcanic eruptions; 2.) Continued socialization of BNPB to teachers about the importance of disaster knowledge and disaster mitigation capabilities in science learning; and 3.) Development of integrated disaster learning technology to realize a thriving mountainside community and live peacefully with the threat of catastrophic eruptions of Merapi Volcano.

4. Conclusion
Merapi Volcano will always be a threat to people who have an understanding of volcano eruptions and low disaster mitigation. To deal with disasters, there should be a harmonization and strengthening efforts from government, education, health and the community itself. In the aspect of education, disaster education can be synergized with learning technologies such as mobile learning. The findings of this study indicate that students who live in Merapi Volcano prone area have a good understanding about mobile learning based volcano eruption. Level of student's understanding on mobile learning meet a good criteria with percentage 72.80%, level of student's understanding on volcano eruption meet a good criteria with percentage 73.40%, and student's understanding on disaster mitigation meet a good criteria with higher percentage 76.40%.

Disaster management involves all component of the community and stakeholders. Disaster management cycle explains 4 frame work (mitigation, preparedness, response, and recovery) to control disasters and emergencies. Disaster management development efforts must be sustainable because disasters will continue to be a threat. This research is a preliminary study on the understanding of students living in disaster prone areas of Mount Merapi. Further research was conducted to validate these results as a reflection and introduction research of mobile learning based on volcanic eruptions.

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