

Development of Lecture Model in Disaster Science Volcanic Dust by LiTMas Approach

Cherly Salawane
*Universitas Negeri Semarang,
 Semarang,
 Semarang, Indonesia*
salawaneinar@gmail.com

Dyah Rini Indriyanti
*Universitas Negeri Semarang,
 Semarang, Indonesia*

Supriyadi
*Universitas Negeri Semarang,
 Semarang, Indonesia*

Achmad Binadja
*Universitas Dian Nuswantoro
 Semarang, Indonesia*

Ani Rusilowati
*Universitas Negeri
 Semarang, Indonesia*

Abstract-This study aims to analyze the effectiveness of the science model of volcanic dust disaster approach to LiTMas (environment, technology, and society) developed for the mitigation of volcanic dust disasters before they are used in large scale trials. The package to support the development of the disaster science lecture model include the guide book model, semester learning plan, lecture program unit, reference books, lecture media, practical guides, disaster simulation guides, lecture products, and evaluation instruments. The method used in this research is the research and development (R&D) method. Subjects in the study were students of the Physics Education Study Program Faculty of Teacher Training and Education. This research produces a model of disaster science lectures by LiTMas approach that is valid, practical, and effective for mitigate volcanic ash disasters as a result of volcanic eruption activities.

Keywords: *lecture models, volcanic ash, LiTMas, mitigation*

I. INTRODUCTION

Volcano is like two sides of a coin. When in a period of rest, humans take benefit from the volcano in the form of beautiful panoramas, fresh air, water sources (cold/hot), fertile agricultural land, a place to depend on the lives of the people who live in the vicinity. But if a volcano erupts, it will change as a source of catastrophic, heartbreaking, even deadly (Wittiri, 2014). Volcanic eruption is the process of removing magma from the earth to the surface (Bronto, 2013). Volcanic eruption is a natural process and has yet to be prevented, so to reduce the occurrence of victims and property losses, disaster management efforts need to be made (Noor, 2006).

Volcanic eruptions are the most frequent events. Several countries in the world have repeatedly experienced disasters due to this event (Riede, 2018). Dangers associated with volcanic activity vary greatly both from the origin of the eruption center and the spread process. The hazard characteristics are closely related to the composition of the erupting magma and the intensity of the eruption. Air hazards result from volcanic eruptions where the acceleration and disintegration of magma produces various particles from large sizes to fine dust particles and volcanic aerosols (Few et al., 2017). Efforts to prevent health

problems due to volcanic ash are the most important in humans. Public complaints about health problems caused by volcanic ash have not started to be felt. However, it is almost certain that it will soon be followed by an increase in respiratory tract infections, eye irritation, and skin. Even so, the most common is cough (Anies, 2015).

Disaster mitigation is part of disaster management. Efforts in disaster mitigation carried out by the community are more related to efforts to reduce their vulnerability. In "mathematical" terms it is often formulated simply as follows:

$$Risk = Hazard \times Vulnerability - Capacity$$

This means that risks arise when hazards overwrite vulnerability and vulnerability can be reduced by increasing community capacity in an effort to minimize the risk of disasters. To achieve the mitigation objectives a risk analysis is needed which produces basic information for the mitigation plan. One of the information needed in analyzing risk is a map of disaster prone areas. Mitigation in the long run is the most cost-effective way to reduce the impact of hazards or disasters that may occur because of a preventive nature (Abdurahman et al, 2011).

Education has an important portion in natural disaster mitigation activities. Educational activities have a strategic impact in the short and long term. In the short term it is hoped that the community will get practical knowledge about natural disasters that is useful for dealing with disasters that can occur at any time. In the long term, it is expected to form a self-response attitude and awareness of the surrounding environment which is a disaster-prone area (Rusilowati et al., 2012).

Efforts to overcome disaster-based problems in reducing disaster risk, one of them is by using a lecture model that is able to direct all forms of learning activities (lectures). The lecture model developed in this study is the lecture model of volcanic dust disaster approach near LiTMas (Environment, Technology, and Society). Disaster science lectures with LiTMas approach are seen as being able to provide an understanding of the role of

science, the environment, technology, and society and their interrelationships so that students are able to utilize the knowledge they learn.

II. LITERATURE REVIEW

A. The Disaster Science Lecture Model with LiTMas Approach

The learning model has four special characteristics that are not owned by the strategy, method or procedure. These characteristics are: (1) logical theoretical rational compiled by the creators or developers; (2) rationale for what and how students learn (learning objectives to be achieved); (3) the teaching behavior needed for the model to be implemented successfully; and (4) the learning environment needed for learning objectives can be achieved (Kardi and Nur, 2000). The term learning model encompasses the approach of a broad and comprehensive learning model. Learning models can be classified based on learning objectives, syntax, and the nature of the learning environment. The syntax of a learning model is a pattern that illustrates the sequence of the flow of the overall stages which are generally accompanied by a series of learning activities. Each learning model requires a slightly different management system and learning environment.

The lecture model used in this study is the lecture model of LiTMas volcanic dust disaster approach (environment, technology, and society). This model is adapted from the SETS learning model (science, environment, technology, and society), which connects science elements as a concrete knowledge obtained through the learning process, which is connected to the environment, technological development, and its impact on society. The LiTMas lecture model is a derivative or differential of the SETS learning model. The LiTMas approach is expected to be able to manage science (the concept of disaster) with three other interconnected elements namely the environmental element, the technological element, and the community element in increasing disaster response knowledge. Where the science in question is a knowledge (body of knowledge) which is conceptualized scientifically and formally textually and contextually (Sudarmin, 2014; Safitri, Rusilowati, & Sunarno, 2015).

B. Disaster Mitigation Education

Disaster is still one of the main challenges faced by developing countries in the world. Not only does this cause death and prolonged suffering, it can also damage the local economic growth process (Mohammed, 2018). Good quality education will bring success to individuals or the community in facing the threat of disasters around their lives.

Disaster resilience is a term used to describe a process to help people be better prepared to survive

and recover immediately from the threat of disasters such as earthquakes, droughts, floods or hurricanes. Thus the concept of resilience in professional education programs at the university level becomes increasingly important, so it is necessary to integrate disaster resilience education into undergraduate and graduate education programs, as a key factor to reduce the adverse effects of future disasters (Zhou et al., 2014). Higher education has a great responsibility and can deliver relevant programs to provide special skills and knowledge to the community (Haigh & Amaratunga, 2010).

Education is a long-term defense against natural disasters that enables communities to deal with disaster hazards in different ways, and directly influences risk perception, promotes access to information and resources, and teaches the skills and knowledge needed for disaster mitigation (Bernhardsdottir, Musacchio, Ferreira, & Falsaperla, 2016). Disaster education for residents or communities who volunteer for disaster risk reduction activities and participate in evacuation drills has a higher perception of disaster resilience (Cui, Han, & Wang, 2018). Mitigation education as a stage of preparedness in order to minimize losses due to disasters (Ozkazanca & Yuksela, 2015).

III. METHODS

The development model used in this study is a research and development (R&D) model. The research and development model is used to produce a new product and test the effectiveness of the product that has been produced. This study aims to produce a valid, practical, and effective model of volcanic ash disaster science lectures.

The lecture model of volcanic ash disaster science approached by LiTMas (Environment, Technology, and Society) has not been integrated in courses related to volcanic natural disasters. Three main pillars for the implementation of the Disaster Preparedness College (DPC) in North Maluku Province have not been implemented efficiently. Based on this, it is necessary to develop a science lecture model of LiTMas volcanic ash approach to Mount Gamalama volcanic ash disaster mitigation and examine the supporting factors in the implementation of the Disaster Preparedness College. Learning packages that are used to support the development of the LiTMas model include: Guide Book Model, Semester Learning Plans, Lecture Program Units, Reference Books, Learning Media, Practicum Guides, Disaster Simulation Guides, Learning Products,

IV. RESULTS

A limited scale trial was conducted with two lectures. Student lecturing activities on a limited scale trial have reached the effective criteria of 15 students actively involved (the average value for meeting one

"66" and the average value for meeting two "74"), so that the average pretest value in the test try a limited scale of "70". Thus it can be concluded that the scientific lecture model of volcanic ash disaster is effectively used in lecturing activities.

Table 1. Recapitulation of Pretest Score in Limited Scale Trials (simplified)

| No | College student code | Pretest Score | |
|---------------|----------------------|-------------------------|-------------------------|
| | | 1 st meeting | 2 nd meeting |
| 1 | M-1 | 60 | 70 |
| 2 | M-2 | 70 | 80 |
| Table 1 cont. | | | |
| 3 | M-3 | 60 | 65 |
| 4 | M-4 | 70 | 75 |
| 5 | M-5 | 75 | 85 |
| 6 | M-6 | 60 | 60 |
| 7 | M-7 | 70 | 80 |
| 8 | M-8 | 75 | 75 |
| 9 | M-9 | 65 | 75 |
| 10 | M-10 | 70 | 75 |
| 11 | M-11 | 65 | 70 |
| 12 | M-12 | 60 | 80 |
| 13 | M-13 | 65 | 80 |
| 14 | M-14 | 70 | 75 |
| 15 | M-15 | 60 | 70 |
| | Average | 66 | 74 |

V. CONCLUSION

The science lecture model of volcanic ash disaster approached by LiTMas (environment, technology, and society) has been declared valid by experts, then this model was tested on a limited scale. This trial aims to determine the effectiveness and practicality of the lecture model that was developed before it is used in large scale trials. After a limited scale trial the results of the cognitive, psychomotor, and affective evaluation of students based on the results of the evaluation at the first meeting with an average value of "66" increased to "74" at the second meeting, so it can be concluded that the science lecture model of volcanic ash by LiTMas approach is declared valid, practical, and effective for use in large-scale trials in lecture activities and can minimize the risk of volcanic ash disasters.

REFERENCES

- [1] Abdurahman, O, dkk, Hidup di Atas Tiga Lempeng. Badan Geologi, Bandung (2011).
- [2] Anies, Penyakit Berbasis Lingkungan. Ar-Ruzz Media, Yogyakarta (2015).
- [3] Bernhardsdottir, A. E., Musacchio, G., Ferreira, M. A., & Falsaperla, S. (2016). Informal Education for Disaster Risk Reduction. *Bulletin of Earthquake Engineering*, 14, 2105–2116.
- [4] Binadja, A. 2002. *Pemikiran dalam SETS (Science, Environment, Technology, and Society)*. Semarang: Universitas Negeri Semarang.
- [5] Bronto, S, Geologi Gunung Api Purba. Badan Geologi, Bandung (2013).
- [6] Cui, K., Han, Z., & Wang, D. (2018). Resilience of an Earthquake-Stricken Rural Community in Southwest China: Correlation with Disaster Risk Reduction Efforts. *International Journal of Environmental Research and Public Health*, 407, 1-14.
- [7] FEW, R., Armijos, M. T. & Barclay, J. (2017). Living with Volcan Tungurahua: The Dynamics of Vulnerability During Prolonged Volcanic Activity. *Geoforum*, 80, 72-81.
- [8] Haigh, R. & Amaratunga, D. (2010). An Integrative Review of the Built Environment Discipline's Role in the Development of Society's Resilience to Disasters. *International Journal of Disaster Resilience in the Built Environment*, 1, 11-24.
- [9] Kardi, S & Nur, M, Pengajaran Langsung. Universitas Negeri Surabaya Universiti Press, Surabaya (2000).
- [10] Mohammed, D. M. P. (2018). Disaster Risk Reduction and Management of Tarlac City. *Procedia Engineering* 212, 77-84.
- [11] Noor, D, Geologi Lingkungan. Graha Ilmu, Yogyakarta (2006).
- [12] Ozkazanca, S. & Yuksela, U. D. (2015). Evaluation of disaster awareness and sensitivity level of higher education students. *Procedia - Social and Behavioral Sciences* 197, 745-753.
- [13] Riede, F. (2018). Doing palaeo-social volcanology: Developing a framework for systematically investigating the impacts of past volcanic eruptions on human societies using archaeological datasets. *Quaternary International* 1-12.
- [14] Rusilowati, A., Supriyadi, Binadja, A. & Mulyani, S. E. S. (2012). MITIGASI Bencana Alam Berbasis Pembelajaran Bervisi Science Environment Technology and Society. *Jurnal Pendidikan Fisika Indonesia*, 8, 51-60.
- [15] Rusilowati, A., Binadja, A., Supriyadi. & Widyatmoko, A, Model Pembelajaran Kebencanaan Alam Bervisi SETS. Semarang (2014).
- [16] Safitri, A. D., Rusilowati, A. and Sunarno (2015) 'Pengembangan Bahan Ajar IPA Terpadu Berbasis Literasi Sains Bertema Gejala Alam', *Education Journal*, 4(2), 41–40.
- [17] Sudarmin, (2014). Pendidikan Karakter, Etnosains dan Kearifan Lokal. Semarang: Unnes Semarang.
- [18] Wittiri, S. R. (2014). Mengenal Gunung Api Indonesia. Badan Geologi, Bandung (2014).

[19] Zhou, L., Perera, S., Jayawickrama, J. & Adeniyi, O. (2014). The Implication of Hyogo Framework for Action for Disaster Resilience

Education. *Procedia Economics and Finance*, 18,576-583.