
ANALYSIS OF INTEGRATION OF DISASTER EDUCATION IN SCIENCE SUBJECT ON THE TOPIC OF WAVES AND DISASTERS**Mila Dewi Laraswati, Mudmainah Vitasari, Prasetyaningsih**

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Abstract

Formal education is an effective means of providing education related to disaster risk reduction by integrating disaster material into the curriculum. One of the subjects that can be integrated with disaster material is science subjects. In the learning process, science is taught in an integrated manner which means connecting science with various fields of study manifested by a learning theme. This study aims to analyze the integration of disaster education in the 2013 curriculum in the Natural Science subject with the theme of Waves and Disasters in junior high schools. This research uses descriptive qualitative method. The data collection technique in this research is literature study. The results showed that: The theme of learning Waves and Disasters is a theme that is packaged with a webbed integrated model that can teach disaster education in science subjects. Basic competencies (KD) that can teach the theme are KD 3.10 regarding the layers of the earth and disasters and KD 4.10 regarding communicating disaster risk reduction efforts in grades VII and KD 3.11 regarding vibrations, waves, sound and KD 4.11 regarding presenting experimental results of vibrations, waves and sounds in grades VIII.

Keywords: Integration of Disaster Education, Natural Science Subjects, Waves and Disaster Themes

Abstrak

Pendidikan formal merupakan salah satu sarana efektif dalam upaya memberikan edukasi terkait pengurangan risiko bencana dengan mengintegrasikan materi kebencanaan ke dalam kurikulum. Salah satu mata pelajaran yang dapat diintegrasikan dengan materi kebencanaan yaitu mata pelajaran IPA. Dalam proses pembelajarannya, IPA dibelajarkan secara terpadu yang memiliki makna menghubungkan IPA dengan berbagai bidang kajian diwujudkan dengan sebuah tema pembelajaran. Penelitian ini bertujuan untuk menganalisis integrasi pendidikan kebencanaan pada kurikulum 2013 dalam mata pelajaran IPA tema Gelombang dan Bencana di SMP. Penelitian ini menggunakan metode kualitatif deskriptif. Teknik pengumpulan data pada penelitian ini yaitu studi pustaka. Hasil penelitian menunjukkan bahwa: Tema pembelajaran Gelombang dan Bencana merupakan tema yang dikemas dengan model keterpaduan webbed yang dapat membelajarkan pendidikan kebencanaan dalam mata pelajaran IPA. Kompetensi dasar (KD) yang dapat membelajarkan tema tersebut yaitu KD 3.10 mengenai lapisan bumi dan bencana dan KD 4.10 mengenai mengkomunikasikan tindakan upaya pengurangan risiko bencana pada kelas VII dan KD 3.11 mengenai getaran, gelombang, bunyi dan KD 4.11 mengenai menyajikan hasil percobaan getaran, gelombang dan bunyi pada kelas VIII.

Kata kunci: Integrasi Pendidikan Kebencanaan, Mata Pelajaran IPA, Tema Gelombang dan Bencana

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INTRODUCTION

Indonesia is a country with very high potential for natural disasters because of its geographic location at the confluence of the three main tectonic plates of the world and the meeting of two world mountain systems known as the world's ring of fire (Afkar and Hartono, 2017). One of the regions in Indonesia that is prone to natural disasters is Banten Province. Banten is the youngest province and is an expanded area of West Java Province, which is geographically close to the confluence of Indian-Australian and Eurasian tectonic plates and has the active volcano Anak Krakatau. (Kurniawan et al., 2014). In addition, BNPB published data that on December 22 2018 there was a tsunami disaster in the Sunda Strait which was caused by an underwater landslide due to the eruption of Mt Anak Krakatau, this tsunami disaster resulted in 437 deaths, while 16 people were reported missing. and more than 14 thousand people were injured (BNPB, 2018). This caused many residents to suffer, which resulted in the paralysis of the residents' economy.

Given that Indonesia is a disaster-prone area, disaster education needs to be applied in formal education from basic to tertiary education (Directorate of Volcanology and Mitigation, 2012). Students need knowledge and life skills, especially in the early grades, therefore that when a disaster occurs, students can save themselves (National Research Council, 2007). Disaster education is one of the efforts to increase the

knowledge capacity of students about disasters, types of disaster events, signs of imminent disaster, disaster impacts, pre-disaster and post-disaster efforts, efforts to reduce disaster risk and disaster vulnerability and vulnerability in their area (Mardiyati, 2017). Dissemination through educational institutions about disaster risk and safety in schools are two main priorities to do. This is contained in the Hyogo Frameworks which has been adopted by 168 countries including Indonesia, which states that Disaster Risk Reduction (DRR) education is an implementation of the three Hyogo Frameworks that use knowledge, innovation, and education to build a culture of safety and resilience at all levels (ISDR, 2005), so that disaster risk can be reduced if everyone is informed and motivated to have a culture of disaster prevention and resilience to disasters.

As educational institutions, schools have a very important role in building knowledge capacity to increase community resilience to disasters. Schools are institutions that are effective in transferring information, knowledge and skills to the surrounding community. The school community has a huge potential as a source of knowledge, disseminating knowledge about disasters and practical instructions on what to prepare before a disaster occurs and what to do during and after a disaster. Disaster education activities in schools are an effective, dynamic and sustainable strategy for disseminating disaster knowledge. Systematic efforts made in increasing the capacity of the school community can effectively reduce the risk of disasters in schools (CDE, 2011; LIPI-UNESCO / ISDR, 2006).

According to the Aceh Qanun Design (2019) disaster education is the learning of knowledge, skills and behavior of a group of people about disasters that are passed down from one generation to the next through teaching, training, or research. Meanwhile, according to Selby and Kagawa (2012) disaster education is education that integrates disaster material in formal education so that students can play a role in building the knowledge, skills, and attitudes needed to prepare for and overcome disasters, as well as helping students and society return to normal lives after the disaster. According to Suhawoto, et al. (2015) Disaster Risk Reduction Education (PPRB) is a long-term activity, as part of sustainable development with an interactive shared learning process in the community and existing institutions. Disaster education is one of the internal solutions in society to reduce the impact of disasters, and familiarize the community to be responsive and alert to disasters that occur (Preston, 2012). Through education it is hoped that disaster risk reduction efforts can achieve broader targets and can be introduced earlier to all students, which in turn can contribute to individual and community preparedness for disasters (Setyowati, 2019).

The importance of disaster risk reduction education, especially in reducing the number of casualties. The implementation of disaster risk reduction education in schools can be done in two ways, namely by inserting disaster mitigation materials in certain subjects and through extracurricular activities held at the school. (Mardiyati, 2017). Formal education is one of the effective means of disaster risk reduction, one of which can be done by integrating disaster material into the curriculum (Government Regulation No. 21 of 2008). Disaster education can be integrated into the curriculum in three ways (Petal, 2008). The first is a Stand-alone course, which is by turning disaster education into an independent subject that discusses disaster risk reduction materials as a whole. Second, Curriculum units, which is an approach by including units, modules or chapters that contain disaster risk reduction in existing subjects. Third, Curriculum infusion, which is an approach by finding and distributing disaster risk reduction materials through all subjects, activities, and enriching existing formal curricula rather than replacing them.

Rusilowati et al. (2012) stated that providing an understanding of disaster can be done through integrated learning in the subject. One of the subjects that can be integrated with disaster material is science or science subjects. Science studies about nature and its causes and is related to everyday life which provides direct knowledge to be searched using systematic scientific methods (Listyawati, 2012). Chiapetta and Koballa (2010) suggest that science is a way of thinking in solving problems related to natural objects, a way of investigating various natural phenomena and problems, a collection of knowledge and their relation to technology and society. This means that IPA also discusses disaster phenomena which are part of natural phenomena.

Integrated science learning implies connecting science with various fields of study. The field of science studies includes biology, physics, chemistry, earth and space (Depdiknas, 2007). The integrated meaning of science learning is the relationship between various aspects and materials contained in the Science Basic Competencies so as to give birth to one or more learning themes (Kemendikbud, 2013). Depdiknas (2006) suggests four of the integrations that are in accordance with science learning at the secondary education unit level.

METHODS

This study used descriptive qualitative research methods that were literature studies using literature as the main object. According to Sukmadinata (2009) descriptive research does not provide treatment,

manipulation or changes to independent variables, but describes a condition as it is. Moleong in Margono (2010) also states that qualitative research is research that produces descriptive data in the form of written or spoken words from people and observed behavior. This study was intended to analyze the integration of disaster education in the 2013 curriculum in science subjects on the theme of Waves and Disasters in Junior High Schools. The population of this study included all KD in the revised curriculum 13 science material for classes VII, VIII, and IX SMP, sourced from Permendikbud no 24 years. 2016 appendix 6. The research sample was taken material containing the theme Waves and Disasters contained in basic competencies (KD).

According to Kuhltau (2002) the steps in library research are: (1) Selection of topics; (2) Exploration of information; (3) Determine the focus of research; (4) collecting data sources; (5) Preparation of data presentation; (6) Preparation of reports. Meanwhile, according to Suharwoto et al. (2015) stated that the steps for integrating disaster education into subjects can be carried out in several stages, namely: (1) identification of learning materials about disasters and disaster preparedness; (2) basic competency analysis (KD) which can be integrated with learning materials about disasters and preparedness; (3) describe basic competency into learning indicators; (4) preparation of a syllabus that integrates learning materials about disasters and disaster preparedness.

Based on the opinion of several experts, the steps to integrate disaster education into science subjects with the theme of Waves and Disasters are: (1) Searching for literature in the form of journals and books which form the basis of this research theory; (2) Identifying learning materials about disasters and disaster preparedness in the science subject on the theme of Waves and Disasters; (3) Analyzing basic competencies (KD) which is integrated with learning materials about disasters and preparedness on the theme of Waves and Disasters; (5) Describing KD into learning indicators.

According to Miles and Hubarman (1984), interactive analysis was used to analyse data in the form of words and not a series of numbers from data collected from literature studies. Interactive analysis was carried out through three activity lines: data reduction, data presentation and conclusion / verification. The flow of analysis carried out can be seen in Figure 1.

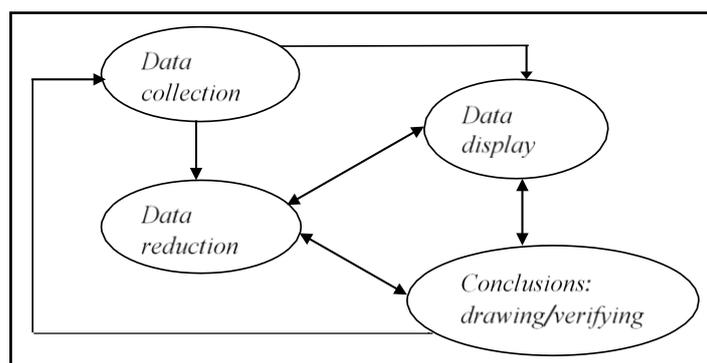


Figure 1. Interactive Model Data Analysis
(Source: Miles dan Huberman, 1992)

RESULTS AND DISCUSSION

The implementation of disaster education in formal education was carried out by integrating disaster education into the curriculum by inserting disaster material into science subjects. In the learning process, science was taught in an integrated manner, which means connecting science with various fields of study, manifested in a learning theme. This study developed a learning theme that was presented with a webbed type integration as a form of efforts to integrate disaster education into science subjects. With the theme of learning waves and disasters, students were expected to think broadly and deeply to capture and understand the conceptual relationship between waves and disasters. Then, it could make the understanding of learning disaster education in science subjects intact and avoid the possibility of overlapping and repetitive concepts. In addition, the theme of learning waves and disasters could also simplify learning steps because of the integration process of basic competencies that was considered to be related.

The webbed type of integration model was integrated by determining the theme first, then identifying more than one basic competency from various fields of study (Hapsari et al. 2013). The theme raised was a vessel is Waves and Disasters to link several of the basic competences of science. The theme of waves and disasters was closely related to the phenomena of earthquakes, volcanoes and tsunami waves. The vibrations below the surface of the land caused earthquakes while the vibrations below the sea surface could cause earthquakes in the oceans resulting in tsunami waves. Therefore, vibration and wave material could be

integrated with disaster so that learning takes place more meaningfully. The following is a mapping of the basic competencies (KD) of the wave theme and webbed type model in Figure 2.



Figure 2. Mapping of Basic Competencies (KD) with Wave and Disaster Themes Webbed Type Model

The theme of waves and disasters is a learning theme designed to introduce disaster education into science subjects in junior high schools. Based on Figure 2, shows that the theme of learning waves and disasters includes KD 3.10 regarding earth and disasters and KD 4.10 regarding communicating class VII disaster risk reduction (DRR) actions. As well as KD 3.11 regarding vibrations, waves and sounds and KD 4.11 regarding presenting the experimental results of vibrations, waves and sounds. The theme of waves and disasters is closely related to the phenomena of earthquakes, volcanoes and tsunami waves. The equilibrium below the land surface causes earthquakes while vibrations below sea level can cause earthquakes in the ocean resulting in tsunami waves.

To be able to integrate disaster education into science subjects which were packaged with a theme of waves and disasters, the first step was to identify learning materials about disasters in science subjects. This was supported by Suharwoto et al., (2015) and Setyowati, et al. (2015) which stated that steps to integrate disaster preparedness into science subjects could be carried out through the identification of learning materials about disasters and disaster risk reduction. Based on this, here are the results of identification of essential learning materials for disaster education in science subjects on the theme of Waves and Disasters in Table 2.

After determining the essential learning material, then the basic competence (KD) were analysed (Suharwoto et al., 2015). Basic competency analysis in science was a study of basic competencies in standard content of science subjects that could be integrated with disaster education learning topic. The following was an analysis of basic competency in science subjects SMP / MTs based on the theme Wave and Disaster which could be integrated with disaster education in Table 3.

Table 2. Essential Materials of Disaster Education in Science

No.	Essential Learning Materials on Disaster Education in Science
1.	Understanding earthquake, tsunami, volcanic eruption and flood
2.	The cause of earthquakes, tsunamis, volcanic eruptions and floods
3.	Body waves and surface waves
4.	As a result of earthquakes, tsunamis, volcanoes erupt and floods for people and the environment
5.	The relationship between Indonesia's geographic location and vulnerability to earthquakes, tsunamis, volcanic eruptions and floods
6.	Actions that must be taken before, during and after an earthquake, tsunami, volcanic eruption and flood
7.	Actions to deal with catastrophic emergencies
8.	How the earthquake strength meter (seismograph) works
9.	The application of vibration in the form of construction technology to minimize the impact of natural disasters
10.	Early warning system to detect earthquakes, tsunamis, volcanic eruptions and floods

Table 3. Basic Competence which contains Disaster Education Material in Science

Essential Learning Materials on Disaster Education	Basic Competence that can be integrated
<ol style="list-style-type: none"> 1. Definition of earthquakes, tsunamis, volcanic eruptions, and floods 2. Causes of earthquakes, tsunamis, volcanic eruptions, and floods 3. The relationship between Indonesia's geographic location and vulnerability to earthquakes, tsunamis, volcanic eruptions, and floods 4. How to measure the strength of an earthquake (seismograph) 	Grade 7 semester 2 1.10 Understand the layers of the earth, volcanoes, earthquakes, and risk reduction measures before, during and after a disaster according to the threat of disasters in the area.
Body waves and surface waves	Grade 8 semester 2 3.11 Analyze the concepts of vibration, waves, sound, and auditory systems in everyday life, including the sonar system in animals.
The application of vibration in the form of construction technology is to minimize the impact of natural disasters	Grade 8 semester 2 4.11 Present experimental results about vibrations, waves, and sounds.
<ol style="list-style-type: none"> 1. Actions that must be taken before, during and after an earthquake, tsunami, volcano, and flood 2. Actions to deal with catastrophic emergencies 3. Early warning system to detect earthquakes, tsunamis, volcanic eruptions, and floods 	Grade 7 semester 2 4.10 Communicate efforts to reduce the risk and impact of natural disasters as well as rescue actions in the event of a disaster according to the type of disaster threat in the area.

The next step was to identify basic competency in accordance with the theme of Waves and Disasters, which was to describe KD into indicators of competency attainment (Suharwoto et al. 2015), as shown in Table 4. Education is a sector that is very basic in changing and shaping the character of students. Disaster education is an effort to increase the knowledge capacity of students about disasters, starting from knowledge of types of disasters, signs of imminent disaster, impacts of disasters to efforts to reduce disaster risks. Disaster education in schools is shown to improve protection efforts by presenting information about the dangers and risks of its impacts, especially to reduce the number of casualties. Formal education is one of the effective means of disaster risk reduction by integrating disaster materials into the curriculum (Government Regulation No. 21 of 2008).

Desfandi (2014) revealed that knowledge about disasters is important to be socialized, especially children in elementary and middle school age who still do not understand what they should do if a disaster strikes. Curriculum units are one of three ways to integrate disaster education into the curriculum through school educational institutions according to Petal (2008). This method was done by inserting disaster risk reduction material into existing subjects. As Ariantoni et al. (2009) stated that in implementing the integration of disaster education, it is not used as a separate subject but is integrated into subjects containing material related to disaster risk reduction.

The implementation of disaster education in formal education was carried out by integrating disaster education into the curriculum by inserting disaster material into science subjects. This aims to build the knowledge, skills and attitudes needed to prepare for and cope with disasters and to help students and communities return to normal lives after a disaster, especially in schools located in disaster risk areas. According to Duong (2009), integration of disaster education will improve disaster knowledge and skills of students in dealing with disasters. These three domains must be aligned because the dominance of the development of one of the aspects used will create disparities in the achievement of science learning objectives. (Subagia et al., 2002).

Table 4. Indicators of Achievement of Disaster Education Competencies in Science

Basic Competence that can be integrated	Indicators of Achievement of Competencies
Grade 7 semester 2 3.10 Describe the layers of the earth, volcanoes, earthquakes, and risk reduction measures before, during and after a disaster according to the threat of disasters in the area.	3.10.1 Name the layers of the earth 3.10.2 Describe the characteristics of the layers that make up the earth 3.10.4 Describe the characteristics of earthquakes and reduce their risk of disasters 3.10.5 Describe the characteristics of an erupting volcano and reduce its risk of disaster 3.10.6 Describe the characteristics of a tsunami and reduce its disaster risk 3.10.7 Describe the characteristics of floods and reduce their risk of disasters 3.10.8 Describe the impact of Indonesia's geographic location on earthquake vulnerability, particularly Banten Province 3.10.9 Describe how an earthquake strength measuring device (seismograph) works.
Grade 7 semester 2 4.10 Communicate the efforts to reduce disaster risk and the impact of natural disasters as well as rescue actions in the event of a disaster according to the type of disaster threat in the area	4.10.1 Communicate an early warning system to detect earthquakes 4.10.2 Simulate the actions to be taken before, during and after an earthquake, tsunami, volcano, and flood
Grade 8 semester 2 3.11 Analyze the concepts of vibration, waves, sound, and auditory systems in everyday life including the sonar system	3.11.1 Explain the definition of waves and disasters 3.11.2 Describe the relationship between waves and disasters 3.11.3 Explain the definition of vibration 3.11.4 Explain the definition of the frequency and period of the pendulum vibration swing 3.11.5 Distinguishing transverse waves and longitudinal waves 3.11.6 Analyze the relationship between wavelength, frequency, propagation velocity and wave period 3.11.7 Calculate the wavelength and velocity of the wave 3.11.8 Determining the characteristics of the sound 3.11.9 Calculate the speed of propagation of a sound wave 3.11.10 Understand sound frequency 3.11.11 Describe the Doppler effect
Grade 8 semester 2 4.11 Presents experimental results about vibrations, waves, and sounds	4.11.1 To apply knowledge about vibration in the form of construction technology that is useful in minimizing the impact of natural disasters

Integration of disaster education in science subjects was an effort to integrate or insert chapters containing disaster material into science learning. Integrated science learning had the meaning of being able to connect and link various aspects and materials contained in the basic science competencies so as to generate learning themes, such as disaster education which contains various fields of study. The webbed type learning model was an integrated learning model whose development begins with determining the theme first, the theme raised as a forum that links some of the basic competencies of science to contain disaster education, which was the Waves and Disasters topic. The waves and disasters topic itself includes integration between fields of science studies: the concept of Earth and Space Sciences (IPBA) and physics.

Based on Table 4, the integration of disaster education in science with the theme of waves and disasters, there were four basic competencies (KD) in the 2013 science curriculum for SMP / MTs, namely KD 3.10 and 4.10 grade VII which explain the layers of the earth, volcanoes, earthquakes, tsunamis, floods and disaster risk reduction measures. This basic competency could support disaster learning with material content on various types of disasters and the risks. Then this basic competency could be inserted with disaster mitigation content in order to reduce casualties if the disaster occurs.

The nexts were two basic competences in class VIII (KD 3.11 and 4.11), about analyze the concepts of vibration, waves and sound in everyday life. Earthquakes are the result of plate interactions that are actively moving and when they collide, they will generate waves and will vibrate objects on the surface of the earth. This basic competencies could explain the causes and effects of disasters with the concept of physics that could be done with scientific experiments so that students could apply knowledge about vibrations in the form of products and technologies that were useful in minimizing the impact of natural disasters.

CONCLUSION

Based on the results of research and discussion, it could be concluded that disaster education could be implemented in formal education. In this study, implementation was carried out by integrating disaster education into the curriculum by inserting disaster material into science subjects. The integration of disaster education into science was carried out by developing a theme of waves and disasters that supports learning disaster education in a webbed integrated model. Basic competencies that can be integrated with the theme of waves and disasters were KD 3.10 and 4.10 grade VII and KD 3.11 and 4.11 grade VIII. In addition, we also have suggestions for teachers, it is hoped that this research will become a reference so that teachers can provide learning science subjects for SMP / MTs integrated with disaster education to students. On the other hand, for the government, it is hoped that they can review the 2013 curriculum so that it can make education a place of socialization to the public about the potential for natural disasters in Indonesia, especially in their regions and strengthen the formation of a character for natural disaster preparedness.

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