Linking Disaster Preparedness Education to Risk Awareness: Should We Teach Our Kids About Risk?

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Abstract. School community could be considered as a vulnerable group, but at the same time, it has a potential role in reducing the risk of disaster. Teaching the school communities about the risk and how to manage it might bring significant effect to the awareness and readiness in facing disaster. Twenty-four respondents from four secondary schools in Yogyakarta were voluntary participated in the interview to investigate DRR program implementation. The respondents consist of school principals (8 people), and teachers (16 people). The results show that disaster preparedness education has been integrated into several school subjects such as Physics (33.33%), Geography (20.83%), Physical Education (16.67%), Bahasa (12.33%), and Natural Sciences (12.33%), and Arts (4.17%). About 29.17% of the participants admitted that they still do not have enough knowledge about the risk of disaster after learning about Volcanoes Eruption, Earthquakes, and Tsunami. About 41.67% of the participants feel they know about what to do after having evacuation drills. However, 83.33% of the participants feel unconfident that they will be able to take proper action when a disaster occurs. Thus, in reducing the risk of disaster, teaching the risk of natural disaster and how to reduce it through Physics is possible to do as contextual learning, especially for students who schooled at a disaster-prone area.

1. Introduction

Many countries threatened by natural disasters for years, and earthquake becomes the most devastating hazard in countries lied on tectonic plates. The risk of disasters threatens schools in disaster-prone countries with no doubt. As a country lied in the ring of fire, Indonesia has been experienced severe geophysical disasters such as volcanic eruptions, earthquakes, tsunamis, and landslides [1]. The occurrence of disasters could disconnect the students to education for a while.

In 2004, the tsunami destroyed 750 schools and damaged 2,135 facilities in Indonesia. In 2006, an earthquake destroyed 2,900 schools in Yogyakarta. Then in 2007, an earthquake destroyed 260 educational facilities and severely damaged 450 more in Sumatera. More schools, about 1,100, collapsed due to an earthquake in 2009 [2]. Until today, scientists still have not been able to predict accurately when earthquakes and tsunamis will occur. It is prominent to teach people to understand natural disasters regarding the risk, a proper reaction in a critical situation, as well as preventive and rescue actions.

A school community could be considered as a vulnerable group, but at the same time, it has potential in reducing the risk of disaster. However, not many pieces of literature discussed how to teach the risk of disaster to the school community. Focusing solely on how to manage the disaster might lead to neglect the real issues behind the vulnerability of such community toward the risk of disaster [3]. Bastidas and Petal (2012) recommended disaster risk reduction (DRR) intervention to the education sector. The DRR
interventions involve the performance of the education system concerning the risk and the management and policy environment [4].

The literature suggests disaster preparedness education as an effort to create awareness of the disaster risk. Disaster preparedness education focuses on structural and non-structural aspects for developing school resilience towards natural disasters [5]. Structural aspects may cover rapid visual screening, quick structural evaluation, and detailed assessment. Non-structural aspects include attitudes towards disaster risk reduction activities, formal regulation related to the disaster education program, and human resources. Lesson material related to the disaster in schools can be developed with three alternatives. The first, the material of disaster can be infused with all subjects. Second, the material disaster may appear as new subjects in school. While the third alternative, disaster materials can be included as an extracurricular activity, like Scouts.

The disaster preparedness education program requires teachers to be able to construct a meaningful understanding of natural disasters and teach their students about it. However, teaching disaster preparedness education could be very challenging for teachers. It is common for a teacher for not confident to communicate DRR to their students [6, 7]. Moreover, research frequently shows that despite the presence of a disaster preparedness program at school or local communities, the majority of the population does not carry out self-protective measures recommended by emergency management authorities during non-crisis times [8, 9].

The implementation of disaster preparedness education involves many organizations, from the government to non-government organizations (NGOs) that offered various programs and strategies [10]. As a result, the school and local communities may have a diverse understanding of the risk and the action to measure, which can lead to complexity and confusion in applying DRR strategy [11]. The differences in the perception of risk associated with natural disasters may become a source of conflict between the government and local communities [12, 13].

Disaster preparedness education relies heavily on teachers. As the implementers of curriculum, teachers expected able to translate the learning objectives in the curriculum as a teaching-learning activity. Teachers also are expected to be able to select and use proper learning resources for students. This situation often becomes an impediment, since the process of integrating DRR into Indonesian curriculum itself is an enormous challenge for teachers [14]. This situation is also compounded by the fact that teachers have limited knowledge about natural disasters risk reduction strategies [11].

Performing disaster preparedness education could take diverse ways in science education. In the secondary school curriculum, DRR topics every so often present in Physics lessons. The topic related to Volcanic eruption is linked to geothermal energy which is the heat energy stored the interior of the Earth. Meanwhile, an Earthquake is explained as a complex slip motion reflected variation in introductory physics that leads to fault motion in the tectonic plate. Indeed, Physics has sub-fields learnt about the Earth and the Universe. Therefore, teaching science behind phenomena such as Volcanic Eruptions and Earthquake in Physics that is only natural. Teaching the risk behind those phenomena has been dealt with diverse ways in science education [15, 16]. However, the discussion about the risk itself is often excluded from the class lesson.

This study argues that teaching risk in science subjects met with social issues could be a strategy in implementing disaster preparedness education at secondary school. Further, teaching the risk caused by misbehaviour towards such phenomena could be linked to some lesson material in Physics. A better understanding of risk in daily life may lead to better ability in making a crucial decision in a critical situation. In order to link the disaster preparedness and risk awareness, there are two questions formulated in this study which are how the implementation of disaster preparedness education at school, and how to teach risk awareness effectively to students according to teachers and school principals.

This study unravels the red thread between the disaster preparedness education and the school communities’ awareness based on the field study report in Yogyakarta. The field study assessed the disaster preparedness education that focused on integrating disaster risk reduction into school subjects and evacuation drill.
2. Method
This study investigated the implementation of the disaster preparedness school program set in 2012 by the local disaster management agency collaborated with the department of education of the Special Region of Yogyakarta. The epistemology of this study is qualitative research which underpinnings how does qualitative research conducted, how do data collected, and analysed, and how do conclusions reach and linked [17]. This study applied semi-structured interviews with flexibility in terms of time and way to organise the data analysis. Each interview was recorded, and permission from the participant was required. The participants were asked the following questions:

1) What do you think about teaching natural disasters in the class as part of school subjects? Do you think the existence topics fit with the school subjects? Do you have any suggestion what is the best school subject to be integrated with the disaster education material?

2) What do you think about the disaster preparedness program at your school? Do you think it increases your knowledge of natural disasters? Do you know what the right thing to do when the event occurs?

3) What do you think about the risk of a natural disaster? Do you think disaster education covers risk management adequately? Should we teach more about the risk to the students? And how? These questions are formulated based on the preliminary research for scoping the DRR research work area in the education sector conducted in 2016 in Yogyakarta.

The information from the interviews was analysed separately and written. This study used thematic analysis by Braun and Clarke in 2006. The thematic analysis used for identifying a similar response from the participants based on the keywords, patterns, and the meaning within the transcription of the interviews [18]. This strategy, also known as coding system [19-21]. The data, then, were organised under themes based on the framework. The results were presented as qualitative data with frequency and percentage. Twenty-four respondents from four secondary schools in Yogyakarta participated in this study. Eight school principals and sixteen teachers from secondary schools that implemented disaster preparedness school program for at least four years have been interviewed voluntarily. The interviews were conducted after the participants got the disaster preparedness lesson from the officers of the local disaster agency, BPBD. Fieldwork notes accompanied the manuscript of the interviews to track the context, situation and gesture of the participants during the interviews.

3. Results and Discussion
The implementation of disaster preparedness education at schools according to teachers and school principals has positive effects on the school community at some levels. The results gathered from the interviews are described below. Direct quotations as example sentences are chosen according to their high frequencies. Regarding to the coding system based on the themes, the participants may not give a single answer to each question. In other words, the participants may response more than once.

1) What do you think about teaching natural disasters in the class as part of school subjects? Do you think the existence topics fit with the school subjects? Do you have any suggestion what is the best school subject to be integrated with the disaster education material? Table 1 shows the participants’ responses to this question.

Table 1. Participants Responses to Teaching Natural Disasters in The Class as Part of School Subjects at Secondary Schools

| Answer* | Examples of Sentence | f  | %   |
|---------|----------------------|----|-----|
| Yes     | It is a good thing to do; It is important to be taught; We already integrated the topics into our subjects | 24 | 100 |
Answer* | Examples of Sentence | f | %
--- | --- | --- | ---
Yes | We have a lot of reading material related to volcanic eruptions that we can use in class; We experienced earthquakes and Merapi eruptions and we talk about it in class; We got lesson material about Tsunami, Earthquakes, and Volcanoes from BPBD and they help us to teach students about it. | 20 | 83.33

Physics | We can integrate it in Physics | 8 | 33.33
Geography | I teach Geography and we learn about natural disasters | 5 | 20.83
Physical Education | We do evacuation practice in physical and health education | 4 | 16.67
Bahasa | I use the natural disaster topics as reading material in Bahasa class | 3 | 12.33
Natural Sciences | It is easy to teach the phenomena in natural sciences | 3 | 12.33
Arts | My students make handcraft related to Merapi | 1 | 4.17

No | However, not all school subjects could be fit to teach disaster topics; Sometimes, we just don’t have enough time to search which material to be used; I’m not quite sure whether the lesson material is adequate or not. | 4 | 16.67

*Answer: classified based on the themes.  
 f: Frequency

According to Table 1, it becomes clear that the participants agree to integrate natural disaster topics in the school subjects. It seems like the participants already integrated disaster topics in the school subjects since their schools implemented disaster preparedness program. In fact, the results show that disaster preparedness education has been integrated into several school subjects such as Physics, Geography, Sports, Bahasa, and Natural Sciences, and Arts. However, some participants said that not all the topics fit with the school subjects (16.67%).

The participant's responses indicate that the disaster preparedness education already implemented since the school already received DRR training from the local disaster management agency. The DRR training, which includes DRR presentation and evacuation drill performed by the local disaster management agency was able to increase DRR awareness of the school community. Further, the DRR training has been facilitating teachers to be able to integrate DRR topics into their teaching material. However, as predicted based on the literature review, not all school subjects are necessarily integrated with DRR material. These results in line with what the literature (i.e. [6, 7, 10, 11, 14]) said about the challenging in integrating DRR into the school curricula.

2) What do you think about the disaster preparedness program at your school? Do you think it increases your knowledge of natural disasters? Do you know what the right thing to do when the event occurs? Table 2 shows the participants’ responses to this question.

| Answers* | Example Sentences | f | %
--- | --- | --- | ---
Yes | We need it; We should do it; It is important | 24 | 100
Yes | I know more about volcanic eruptions, and earthquakes; Before, I don’t know much about tsunami; I think I know about it better; | 16 | 66.67
Yes | I think I know what to do when there is earthquake; We know more what we need to do when disaster occur; I think we know the basic | 10 | 41.67
Answers*  

| Example Sentences                                                                 | f  | %   |
|----------------------------------------------------------------------------------|----|-----|
| No                                                                               | It covers some important information (about natural disasters) but I’m not sure; I don’t think it increase since we already knew based on real experience. | 8  | 33.33 |
| No                                                                               | However, I believe I will be very panic at the time; That’s different situation, so I’m not sure; I probably forgot everything | 20 | 83.33 |

*Answer: classified based on the themes.  f: frequency

All participants gave very positive responses to the disaster preparedness program. Regarding the disaster preparedness educational lessons received by the participants, more than 60% of the participants feel their knowledge increased after getting information about Volcanic Eruptions, Earthquakes, and Tsunami. Less than 50% of the participants feel the information they received is not new anymore. The participants also feel they know about what to do after having evacuation drills. However, over 80% of the participants feel unconfident that they will be able to take proper action when a disaster occurs.

The positive response from the school community towards DRR training does not guarantee the program sustainability. This fact shows that the DRR training may have a short-term effect on the school community's risk-taking behaviour as well as their understanding of disaster risk management. In other words, the implementation of disaster preparedness education has not been able to escalate the school community behaviour and ability ultimately. Learning could be interpreted as knowledge, beliefs, attitudes, and behaviour changes [22]. Behavioural change is a consequence of the learning process [23].

However, the behaviour change is more complicated to be identified in a learning program for a brief period. Adiyoso and Kanagea (2012) explained in their study that changing community behaviour towards disaster risk is still challenging. Tuswadi and Hayashi (2014) also added that teachers may still face obstacles in integrating DRR into the school subjects. Indeed, the results of this study in line with what literature stated as the participants said not all the school subject could be integrated into disaster preparedness education. Moreover, the results also show that the participants feel unconfident to be able to recall their knowledge from the training when a disaster occurred.

3) What do you think about the risk of a natural disaster? Do you think disaster education covers risk management adequately? Should we teach more about the risk to the students? And how?

Table 3 shows the participants’ responses to this question.

Table 3. Participants Responses to Teaching Natural Disasters in The Class as Part of School Subjects at Secondary Schools

| Answers* | Example Sentences                                                                 | f  | %   |
|-----------|----------------------------------------------------------------------------------|----|-----|
| Yes       | We cannot separate the risk from disaster We need to learn about the risk of natural disasters; We should understand the risk in our environment | 20 | 83.33 |
| Yes       | We learn about the risk at some level; When we had evacuation training, we also learn about the risk; It already covered by BPBD | 17 | 70.83 |
| No        | I’m not quite sure how to answer it; Is it the same thing with how dangerous is it?; I think it’s related to disaster management | 4  | 16.67 |
| No        | It’s not adequately covered since we have so many things to do; I don’t think I fully understand about the risk after the training; I need more example of how to calculate the risk | 7  | 29.17 |
| Yes       | Yes, absolutely; If we knew it better, we could make a better decision; Understanding the risk helps us to make better preparation | 24 | 100  |

*Answer: classified based on the themes.  f: frequency
According to Table 3, the participants think that the risk could not be separated from natural disasters. Over than 70% of the participants think that disaster education covers risk management through evacuation drill trained by BPBD. However, less than 30% of the participants admitted that they still do not have enough knowledge about the risk of disaster even after learning about Volcanic Eruptions, Earthquakes, and Tsunamis. Regarding better in managing the risk of disasters, all participants agree to teach the risk to the students. The participants believe that teaching risk in class will give a better understanding of the threat that lead to better decision making.

Teaching the risk to the students may give them a better understanding of the effort of minimalizing the damage caused by natural disaster. Natural sciences have the potential to integrate the risk theory in the lesson material. Physics mentioned by the participants as one of the school subjects to teach the risk to the secondary students. Many works of literature have suggested this result (i.e. [24-26]). Teaching about risk in the field of physics study is not a new issue. Some physics material linked closely with the risk, for example, radiation risk. In 1996, Ejkelhof already described beautifully on how the risk could not be separated from science education, especially physics. Teaching radioactivity is impossible without mentioning radiation risk towards human and environment [27]. Research in DRR school curricula conducted by Selby and Kagawa (2012) also shows teaching risk blended with science subjects is possible as long as teachers supported by good learning material. However, it is essential to consider local knowledge as well as the beliefs system in communicating the risk as contextual and factual learning processes. In some part of Indonesia, the local belief system influenced the perspective of risk significantly [28].

Regarding how to teach the risk to students, teachers and school principals have various answers but at the same time also persistent. To get a clear picture of how the participants’ response to this question, the researcher needs to make separated classification of the themes. Table 4 presents the participants' response on how to teach the risk to students.

| Answers*                  | Example Sentences                                                                 | f  | %    |
|--------------------------|----------------------------------------------------------------------------------|----|------|
| Integrated in Natural Sciences | It easier to teach the risk in natural sciences; The natural disaster actually is a natural phenomenon that mismanaged; We can teach the risk through science subjects | 12 | 50   |
| Integrated in Physics    | I think, integrate the DRR into Physics is the best things to do; In Physics we can explain the cause of volcanic eruption, earthquake, and tsunami; I teach about the risk of earthquake by explaining S-P wave. | 10 | 41.67|
| Integrated in Scouts     | I already told Scouts teacher to integrate the DRR into students’ activity; I think Scouts program already had some lesson related to DRR; Well, Scouts program is compulsory, so maybe we could teach about risk in this activity. | 8  | 33.33|
| Integrated in Social Sciences | When we learnt about Geography we also learnt about the risk; It’s a bit tricky, we actually have the topic in Social subjects; I believe, the risk of natural disaster affected on social and economy, so we should learn about it. | 6  | 25   |
| Separated from the School Subjects | We already had a busy agenda in each semester, so better if we have special teacher to teach about it; I don’t think I can teach about the risk in my subject | 2  | 8.33 |
| Should be new subject at school | Is it possible to have it as a new school subject? I’m not sure, maybe better to have new school subject. | 2  | 8.33 |

*Answer: classified based on the themes.  f: frequency
The majority of the participants agree to teach the risk by integrating the material into school subjects. More than half of the participants suggested teaching the risk of disaster by integrating it into natural sciences; 41.67% in Physics; and 25% in social sciences. According to the school principals, the Scouts is a compulsory program, and it has the potential to deliver the lesson about the risk through Scouts’ activity. However, less than 10% of the participants still think that lesson about the risk should be separated from the school subjects or become a new subject at school.

Although the majority of the participants suggested teaching the risk by integrating DRR material into school subjects, the obstacle in implementing the disaster preparedness education at school remains. Teachers may still face problems in teaching about the risk to the students indicates that the material provided in disaster preparedness education is not adequate to help teachers in class. Teaching the risk as part of natural sciences subjects may help students to construct their knowledge and make a decision to avoid fatal damage caused by uncontrollable natural phenomena [29].

The implementation of the disaster preparedness education at secondary schools gets positive responses from the teachers and school principals. The design of disaster preparedness education programs should be integrated with community development initiatives will be more effective than stand-alone, one-off programs [30]. In making the program sustainable, the school community should get accompaniment from the relevant institutions such as the local disaster management agency and department of education for a certain period until all the members of school community, especially the school principals and teachers have a confidant to conduct the program independently.

4. Conclusions
In brief, should we teach our kids about risk? In promoting DRR awareness to the school community, it is essential to teach the risk of natural disaster as well as the action to reduce the risk. Natural sciences subjects at school have a potential role in teaching the risk of natural disasters. According to the school curricula, Physics at secondary school has several chapters that fit in with the DRR topics. Teaching the risk of natural disaster and how to reduce it through Physics is possible to do as contextual learning, especially for students who schooled at a disaster-prone area. In this study, the school community seems to have an awareness of the risk in their school environment at some level; however, they still could not initiate disaster risk reduction effort independently. In reducing the risk of disaster, teaching the school communities about the risk and how to manage it might bring significant effect to the awareness and readiness in facing disaster. However, teaching the risk that integrated into school subjects is still challenging for teachers. Indeed, understanding the risk possessed by the school community has not been discussed thoroughly in many works of literature. It is possible to link the school communities’ behavior toward the risk and their local knowledge and belief system. Therefore, further study in the school community knowledge, beliefs, and behavior toward risk should be done to improve the disaster preparedness education at secondary schools. However, discussion of the local belief system could be complicated as the local Indonesian communities have a robust bonding with their culture and religion. This study is a start point to further study on science communication and community education for reducing disaster risk at prone-disaster areas.

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