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Disaster Prevention Education in Merapi Volcano Area Primary Schools: Focusing on Students' Perception and Teachers' Performance

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Abstract

This paper described the implementation of disaster prevention education curricula in 24 purposely-selected primary schools in Merapi volcano area in Java Island by looking at the students' perceptions (knowledge, attitude, and behavior) and the teachers' performance. The study took 548 student and 191 teacher respondents through a field survey with the use of questionnaires for the data collection instruments. The findings showed that, despite of the fact that students in the researched schools have already learnt about natural disasters and prevention for years either under the integrated or isolated teaching method, there are still confusions or problems regarding their effective knowledge, attitude and behavior on natural disasters. This condition is possibly caused by the ineffective disaster prevention teaching practice which relies much on textbooks and pictures as teaching media. The findings also highlight that teachers still have lack of knowledge and skills related to disaster prevention teaching due to limited teacher trainings. Therefore, it is strongly recommended for the local government together with the schools to make efforts in improving the teachers' performance through appropriate teachers' professional development programs by involving the existing related non-governmental organizations for their valuable assistance.

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1. Introduction

At present, in many parts of the world, both natural and man-made disasters have been threatening the lives, rights and needs of millions of children. Various kinds of natural disasters like earthquake, volcanic eruption, tsunami, typhoon, and flood which often occur in countries have made people understand that children are becoming the most vulnerable groups who get direct impacts of disasters. It is predicted that in the coming years, children's vulnerability to disasters is increasing as frequency and intensity of natural hazards rises [1]. Therefore, preparing for disasters has also been the priority on the educational agendas of countries in the world.

Indonesia, one of extremely vulnerable countries to natural disasters, has been making efforts to increase its people's resilience toward natural disasters. In education sector, since the academic year of 2011-2012, Ministry of Education and Culture has newly established and implemented special disaster prevention education curricula at all school levels from primary (students with 7-12 years of age) to lower and upper secondary schools (students with 13-18 years of age). This policy has immediate objective to make children safer during disasters and to prepare them as agents of change who are able to spread knowledge to larger communities, especially to their own families [2].

Volcanic eruption is one of deadly natural disasters that often happen in Indonesia. It is because the country contains over 130 active volcanoes. In Java Island itself, there are 129 volcanoes [3] and the most active and dangerous one is Merapi which is located about 30 kilometers north of Yogyakarta City and administratively situated in two provinces, Yogyakarta Special Region and Central Java [4]. More than 1 million people live on the flanks of this volcano, which erupts effusively (non-explosive) almost continuously and explosively every 8-15 years, and violently every 26-54 years [4].

Historical records showed that Merapi volcano has already experienced at least thirteen major eruptions with death tolls since 1006. The deadliest eruption in historical times happened in 1672, leaving a reported of 3,000 people dead [3]; while in 1930, Merapi volcanic eruption killed at least 1,300 people. Then, in 1994 eruption, it was reported that 64 people were dead and over 2,000 were made homeless [4]. The recent major eruptions of Merapi volcano were in October and November 2010 that killed 339 people and destroyed at least 217 schools.

2. Children and the Importance of Knowledge, Attitude, and Behavior Related to Disasters

There are many influencing factors of attitudes development among students who are actively engaged in environmental protection and disaster prevention [5]; however, it is evident that two most important factors are teaching-learning process at schools and the ties that the students have with their families and communities. Looking at the importance of teaching-learning process, disaster prevention education is continuously practiced at primary schools (for I-VI graders) in Merapi volcano area with the support from both government and privates.

A study by Becker et al. [6] described the effectiveness of disaster prevention education at schools by stating, children would come home with information about preparing for a disaster, and the family or parents and the child would make plans or prepare resources together for their home. This means in homes with children getting disaster prevention education program at school, not only do the children themselves get benefit from an effective program, but also potentially the entire family unit becomes better prepared as a result of the information. Preparedness within the home environment, such as having supplies and plans in place, as well as an emotional awareness of the possibility of a disaster and understanding that they can get through it, has a positive impact on the likelihood that the child will be able to get through a disaster event, both physically and emotionally [7].

Disaster prevention education can reduce anxiety among children [8]. In times of anxiety or stress due to natural disasters, as the children in the family feel overwhelmed, they can model their behaviors on the positive coping of the adults around them. Information from school that effectively flows to homes has a great value, both for the family members and for the children in order that they have a better understanding on how to protect themselves in a disaster.

Another study by Ronan and Johnston [9] reported that, students participating in disaster prevention education at schools perceived a higher risk of personal injury from disasters, but, in the same time, reported significantly lower levels of fear than those who have not taken part in disaster prevention education programs.

Realizing the important role of disaster prevention education that provides knowledge and information to students and promote measures or attitudes and behaviors, a study to examine the implementation of disaster prevention education curricula by exploring the students' perception and teachers' performance is very important to conduct.

3. Methodology

3.1. Objective of the Study and Research Instruments

Regarding the implementation of disaster prevention education curricula at primary schools in Merapi volcano area, this study explored students' perception and teachers' performance by addressing four research questions:

- What do primary school students in Merapi volcano area perceive about their experiences in natural disaster events?
- What do the students learn in disaster prevention lessons and how?
- What weaknesses do the students have related to their perceived knowledge, attitude and behavior on natural disasters?
- What aspects should the teachers improved based on their perceived performance for the effective teaching of disaster prevention?

In order to gather the data, two sets of questionnaires were constructed and delivered to student and teacher respondents to be filled out by them and then statistically analyzed.

The questionnaire for the students had two parts. Part I consisted of 4 items focusing on their personal information, frequency of experiencing natural disasters, perception toward the damage level of their schools and homes due to Merapi volcanic eruption, and experience in learning natural disasters and prevention. Part II focused on the students' perceptions (20 items) for exploring their perceived knowledge, attitudes, and behavior on natural disasters in a simplified three-point Likert scale from agree (A), no idea (NA), to disagree (D).

The questionnaire for the teachers consisted of 10 items for self-assessment toward their performance in the teaching of disaster prevention by a four-points Likert scale from strongly disagree (SD), disagree (D), agree (A) to strongly agree (SA) [10].

3.2. Research Site and Sample for the Data Collection

Data collection was carried out in the 24 purposely-selected primary schools in Merapi volcano area (Sleman District, Yogyakarta Special Region). The schools are located in Cangkringan (13 schools), Pakem (6 schools), and Turi (5 schools) sub-districts that have been determined by the government as high risk areas of having impacts from Merapi volcanic eruption.

The risk levels toward Merapi volcanic eruption of the schools in this study were divided into lower, middle, and higher on the basis of each school location that was relatively estimated by geographic view-points which were mainly distance from both the peak of Merapi volcano and rivers due to high risk-hazard of pyroclastic flows, lava flows, and lahars [11]. Two schools had relatively lower risk-level (more than 15 km from the peak of Merapi volcano); 17 schools had relatively middle risk-level (8-15 km from the peak of Merapi volcano and they were also near rivers, for example Opak and Gendol rivers); and 5 schools had relatively higher risk-level (less than 8 km from the peak of Merapi volcano and they were also near rivers which were passed by lahars and lava during the eruptions).

The 548 students in this study were the fifth graders with ages of 10-13 years old; while the 191 teachers were composed of 112 classroom teachers (teaching almost all subjects) and 79 specialized ones (teaching only one subject) [12]

4. Research Findings

4.1. Students' Side

4.1.1. Students' Experience to Natural Disasters

The research findings indicated that besides Merapi volcanic eruption, there were four other common natural disasters that the students have experienced within their living area: earthquake, mud flood, typhoon, and landslide.

Table 1. Frequency of students' experience to natural disasters

No	Natural Disasters	Experience frequency and number of students			
		0 times (N)	1-3 times (N)	4-6 times (N)	>6 times (N)
1.	Volcanic eruption	10	532	5	1
2.	Earthquake	55	474	16	3
3.	Mud flow	200	194	56	98
4.	Typhoon	414	133	0	1
5.	Landslide	529	18	1	0

Source: Field survey, 2012

In relation to the damage level of their homes and schools due to Merapi volcanic eruption in 25 October 2010, 325 students found their homes safe, 149 students found their homes partly damaged, and 66 students found their homes seriously damaged; meanwhile, 319 students noticed their schools were safe, 158 students found their schools partly damaged, and 67 students noted their schools were seriously damaged.

4.1.2. Students' Learning Experience in Disasters Prevention

The fifth grade students in the researched schools had formally learnt about natural disasters and prevention from their teachers since they were in kindergarten. The common topic learning contents based on their answers in the questionnaire were, among others: volcanic eruption, earthquake, flood, typhoon, and tsunami.

Table 2. Grades of the students' learning about natural disasters and prevention

No	Topics	Grades						
		Kindergarten	1	2	3	4	5	6
1.	Volcanic eruption	✓			✓	✓		
2.	Earthquake	✓	✓		✓	✓	✓	
3.	Flood and Typhoon	✓	✓	✓	✓	✓	✓	
4.	Tsunami						✓	

Source: Field Survey, 2012

At primary schools, the students learned about natural disasters and prevention in the integrated lessons of Natural Science, Social Science, Sport/Physical education, Religion/Moral, and other subjects. Moreover, other than in school, the students also learned from TV, radio, newspapers, family, neighbors, and internet.

4.1.3. Children' Perceptions about Natural Disasters and Prevention

As it has been mentioned, the students' perceptions in this study referred to their perceived knowledge (item number 1-6), attitude (item number 7-13), and behavior (item number 14-20) on natural disasters and prevention.

Table 3 described the frequency of the students' responses to the questionnaire:

Table 3. Students' perceptions on natural disasters and prevention

Statements	Agree (%)	Response (N: 548)	
		No Idea (%)	Disagree (%)
1. When a big earthquake is happening, running out of home is really very dangerous.	56	6	38
2. Hot ashes from Merapi volcano are not dangerous for health.	12	4	84
3. Big earthquake can cause fire at houses.	49	11	40
4. Big earthquake sometimes is followed by volcanic eruption.	71	19	10
5. Frequent raining can cause flood and landslide.	86	10	4
6. When there are many animals going down from the mountain, it is one of the signs that Merapi volcano will erupt.	78	14	8
7. I think watching weather forecast is useless.	7	7	86
8. I think joining disaster training is useful.	94	3	3
9. When there is a super natural person said that tomorrow there will be a disaster in my living area, I believe it.	7	28	65
10. I think we need to plant trees in bare hills.	98	1	1
11. I am aware that my living area is prone to natural disasters.	70	20	10
12. I think humans' misbehaviors can make God angry and give disasters.	62	23	15
13. I think collecting photos, pictures on natural disaster is useful for learning.	79	9	12
14. When there is a warning from authorities that Merapi Volcano will erupt and my family is advised to evacuate, my family and I just stay at home.	3	3	94
15. When there is a big earthquake, in a room I hide under a strong table.	90	4	6
16. I dispose garbage to rivers.	4	5	90
17. I discuss with family about information on natural disaster prevention that I have got from school.	80	14	6
18. I wear masker when Merapi Volcano is erupting.	98	2	0
19. My family and I keep important documents in a safe box.	90	6	4
20. I often read books about natural disasters.	78	12	10

Source: Field survey, 2012

The data in Table 3 can explain that: firstly, in relation to the students' perceived knowledge; 84% of the students understood that hot ashes from Merapi volcano could be dangerous for health, with the evidence that during Merapi volcanic eruption, 98% of them admitted to wear maskers to protect themselves. In addition, 86% of the students were aware that frequent raining could cause flood and landslides. However, the findings showed the students' poor knowledge regarding the consequences of earthquake, such as 44% of them did not know that running out of home while a big earthquake took place was dangerous to do; that big earthquake could cause house fire (51%); that big earthquake was sometimes followed by volcanic eruption (29%); and that the phenomenon of many animals going down to people's settlement was one of signs that the volcano might erupt (22%).

Secondly, in relation to the students' perceived attitudes toward natural disaster and prevention, they (86%) felt the importance of watching weather forecast program as well as joining disaster training or drill (94%); however, 30% of the students were not aware that their living area was prone to natural disasters; 35% of them still believed about the myth of super natural person's power regarding natural disasters within their area; and 38% of them did not realize that humans' misbehaviors could make God angry and result in disasters.

In addition, in relation to the students' perceived behavior, it was noted that during disaster events, 94% of the students, together with their family members, followed the warning from the government to evacuate. Ninety percent of the students also hid under a strong table when they were in a room during the event of earthquake; 90% of the students admitted to keep important documents in a safe box and did not dispose garbage to rivers. The problems were that 20% of the students still did not discuss or share the information about natural disasters to their family, and 22% of them often did not read books related to natural disasters and prevention.

4.2. Teachers' Performance in the Teaching of Disaster Prevention

In this study, the teachers were given 10 statements to be responded related to their teaching materials and media (item number 1 and 8), teaching method (item number 2 and 5), teaching contents (item number 3 and 4), knowledge and teaching ability (item number 6 and 7), as well as evaluation and students motivation in learning natural disasters and prevention-related content (item number 9 and 10).

Table 4. Teachers' performance in the teaching of disaster prevention

Statements	SD (%)	D (%)	Response (N:191)	
			A (%)	SA (%)
1. I use textbooks or modules to teach children about natural disasters and prevention.	2	26	60	12
2. I would rather teach about natural disasters alone than integrate it to the main subject such as natural science and social science.	2	60	31	7
3. I have ever taught about earthquake and volcanic eruption to my students.	1	5	68	26
4. I never teach about flood and landslides to my students.	25	61	12	2
5. I only use chalk and talk when teaching about natural disasters.	12	73	14	1
6. My knowledge about natural disaster prevention is still limited.	2	11	78	9
7. I can effectively integrate the natural disaster-related content to my teaching subjects.	1	22	69	8
8. I use media for teaching students about natural disasters prevention.	1	8	74	17
9. I check the students' learning understanding on disasters prevention lesson.	1	6	76	16
10. My students have motivation to learn disaster prevention.	2	3	87	8

Source: Field survey, 2012

Based on the data in Table 4, it was noted that: firstly, in relation to teaching materials and media, for the lesson of natural disaster and prevention, 72% of the teachers used textbooks or modules, and 91% of the teachers used teaching media. The textbooks or modules that the teachers used were supplied either by the government or by non-governmental organization (NGO) like Muhammadiyah Disaster Mitigation Centre in Yogyakarta City; and the common teaching media used by the teachers based on their choice were pictures, maps, video/movie, and toys/puppets.

The usage of textbooks or modules among the teachers (item number 1) had significant correlation with the usage of teaching media (item number 8). It was proven by the Fisher's exact test (extended) in which the correlation coefficient was 0.000 (less than 0.001).

In more detail, Table 5 showing the relationship between the usage of textbook and teaching media is presented as follows:

Table 5. Cross table of textbook and teaching media

		Textbook-Media cross table					
		The use of teaching media					
		Pictures	Map	Toys	Video Movie	Total	
The use of textbook	Strongly disagree	Frequency	2	1	0	1	4
	Disagree	Frequency	25	15	2	10	52
	Agree	Frequency	70	45	14	30	159
	Strongly agree	Frequency	13	8	4	10	35
Total	Frequency	110	69	20	51	250	

In the questionnaire, the teachers could choose teaching media more than one; based on the data in Table 5, 110 teachers chose picture as teaching media, followed by map (69), video/movie (51), and toys (20) in which the frequency of the teacher respondents who strongly agreed and agreed to use textbook and pictures was the highest ones (83) compared with those who used textbook with map, textbook with video/movie, and textbook with toys.

Secondly, in relation to teaching method, there were teachers who adopted integrated teaching of disaster prevention as suggested by the Ministry of Education and Culture. It was proven by the teachers’ response that 78 of them agreed to the statement of number 7 in the questionnaire: “I can effectively integrate the natural disaster content to my teaching subjects” while disagreed with the statement of number 2: “I would rather teach about natural disasters alone than integrate it to the main subject”.

Table 6 explained the usage of textbook in the integrated teaching practice.

Table 6. The usage of textbook in the integrated teaching

			Textbook-Integrated Teaching cross table				
			Integrated teaching practice				
			Strongly disagree	Disagree	Agree	Strongly agree	Total
The use of textbook	Strongly disagree	frequency	0	3	0	1	4
	Disagree	frequency	2	20	22	2	46
	Agree	frequency	0	17	87	5	109
	Strongly agree	frequency	0	2	13	5	20
Total	frequency	2	42	122	13	179	

The data in Table 6 showed that among 179 teacher respondents, 135 teachers chose integrated teaching method in which 87 respondents in this group agreed to use textbook. This finding was strengthened with the data in Table 7 which explained the usage of textbook in the isolated teaching.

Table 7. Cross table of the usage of textbook in the isolated teaching

			Textbook-Isolated Teaching cross table				
			Isolated teaching practice				
			Strongly disagree	Disagree	Agree	Strongly agree	Total
The use of textbook	Strongly disagree	frequency	1	3	0	1	5
	Disagree	frequency	3	12	31	1	47
	Agree	frequency	4	36	68	0	108
	Strongly agree	frequency	4	7	8	1	20
Total	frequency	12	58	107	3	180	

Based on the data in Table 7, it was found that among 180 teacher respondents, 110 teachers chose isolated teaching method in which 68 of them agreed to use textbooks.

Table 8 shows the consistency of the teachers in using integrated and isolated teaching methods.

Table 8. Cross table of integrated and isolated teaching methods.

		Isolated Teaching-Integrated Teaching cross table				Total	
		Integrated teaching practice					
		Strongly disagree	Disagree	Agree	Strongly agree		
Isolated teaching practice	Strongly disagree	frequency	1	3	1	6	11
	Disagree	frequency	0	17	39	0	56
	agree	frequency	1	20	78	6	105
	Strongly agree	frequency	0	1	1	0	2
	Total	frequency	2	41	119	12	174

The data in Table 8 showed that among 174 teacher respondents, 39 teachers were consistent in using integrated teaching method only; 20 teachers were consistent in using isolated teaching method only, and 78 teachers agreed to use both integrated and isolated teaching methods.

Third, in relation to teaching topics content, 94% of the teachers reported to have already introduced earthquake and volcanic eruption to the students; meanwhile, 86% of them have already taught about flood and landslide. In addition, in relation to their professional capacity in teaching, 87% of the teachers admitted that their knowledge about natural disaster prevention was still limited. Furthermore, in relation to evaluation, 92% of the teachers checked their students' understanding toward the materials they have learnt by using behavioral, attitude, and written tests.

Finally, when being asked about their students' motivation, 95% of the teachers confessed that their students had motivation in learning disaster prevention. Thirty-three teachers reported their students' learning motivation was very strong; 83 teachers had their students' motivation was strong; 15 teachers had their students' motivation was fair and only one teacher admitted his/her students' motivation was low.

5. Discussion

Schools and children in Merapi volcano area were vulnerable to get negative impacts of at least five kinds of natural disasters, namely Merapi volcanic eruption itself, earthquake, mud flood, typhoon, and landslide. Fortunately, the children in the researched schools have already learnt about natural disasters and prevention relatively for long time before the implementation of the recent disaster prevention education curricula in the academic year of 2011-2012. The students admitted to learn about natural disaster topics when they were in kindergarten as well as in grade I-V of primary schools under integrated learning of disaster prevention within the main subject matters, such as Natural and Social Sciences. This information was in line with what the teacher respondents reported that they had already introduced natural disasters and prevention to their students either under integrated or isolated teaching practice.

There is a continuum of options for how to integrate disaster prevention education into school curricula. On one hand are stand-alone courses devoted to the subject matter and on the other hand is the infusion of lessons, activities, and problems into a broad range of course materials at every grade level [13]. In Indonesia itself, because the schools curricula have already put many subject matters, it is recommended that the disaster prevention education to be integrated within the main teaching subjects and not to be considered as the separated subject matter.

The natural disaster topics learnt by the students are flood, typhoon, earthquake, volcanic eruption, and tsunami. In the researched schools, it was found out that only flood and typhoon which were learnt by the students at all grades (I-V), while earthquake was not learnt at grade II; volcanic eruption was not learnt at grade I and II either; and tsunami was learnt only at grade V. Ideally, because the children in the researched schools were vulnerable to get impacts of volcanic eruption and earthquake disasters, they should have learnt about these two issues at all grades.

Beside from formal learning at schools, the students also get information about natural disasters and prevention from mass media, mainly television and radio. By doing so, it is expected that children in Merapi volcano area have enough capacity in protecting themselves during the events of natural disasters within their living area. However, in spite the fact the students have already learnt, it was noted that there were still confusions or problems regarding their effective knowledge, attitude, and behavior related to natural disaster prevention measures.

The first problem was the students' poor knowledge regarding the consequences of earthquake: the students (44%) did not know that running out of home while a big earthquake stroke was dangerous to do; big earthquake could cause house fire (51%); big earthquake was sometimes followed by volcanic eruption (29%); and the phenomenon of many animals going down to people's settlement was one of signs that volcano might erupt (22%). The second problem was the students' poor attitude: 30% of the students did not feel that their living area was prone to natural disasters; 35% of them still believed about the myth of super natural person's power about natural disasters; and 38% of them did not realize that humans' misbehavior could make God angry and result in disasters. The third problem was the students' misbehavior: there were 20% of the students who did not discuss or share the information about natural disasters from the schools to their family; and there were 22% of them who often did not read books related to natural disasters and prevention.

The students' problems emerged due to some factors. The first factor could be the weak performance of the teachers in teaching natural disaster prevention. The fact showed that there were many teachers (80%) who still lacked knowledge related to natural disaster prevention; based on our previous research findings [11], it happened because of the limited frequency of professional teacher trainings. In addition, the disaster prevention teaching practice which relied much on textbooks and pictures as teaching media seemed ineffective. The second factor could be the influence of local people's belief to the *Juru Kunci* (the keeper of the Merapi volcano) who was trusted to be able to communicate with the spirits who look after the mountain. On the slopes of Merapi volcano, there were local people who put their trust in the local mystic *Juru Kunci* called *Mbah Marijan* who was appointed by the Sultan of Yogyakarta. In this perspective, there were children who possibly followed their parents' belief about the myth of the late *Mbah Marijan* who was believed to have super natural power. The third factor was the limited students' reading resources at schools. According to the headmasters and teachers, each school or the school library could not provide adequate reading books related to natural disasters and prevention so that the students had no access much to develop their knowledge of natural disasters.

6. Conclusion

The 24 researched primary schools which are located in Merapi volcano area and prone to natural disasters have already implemented the disaster prevention education curriculum as required by the government. The students formally learn about natural disasters and prevention at schools almost at all grades under either integrated or isolated teaching method that mainly uses textbooks and pictures as teaching media. Besides having learnt at schools, the students also utilize mass media like television and radio for learning natural disasters and prevention. Due to the fact that there are still problems regarding the students' effective knowledge, attitude and behavior on natural disasters that are caused by some factors, including the ineffective teaching practice, it is highly recommended for the local government and schools to make strategic efforts in order to improve the teachers' performance in teaching natural disaster and prevention, including in developing their skills of making and using appropriate diverse teaching media.

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