Strengthen Disaster Preparedness for Effective Response on Young People through Geography Education: A Case Study at School in the Tsunami Affected Area of Banda Aceh City, Indonesia

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Abstract. Many initiatives can be carried out by the school community, directly or indirectly, contributing to strengthening disaster preparedness capacity. As a social subsystem inseparable from society, schools have the potential to act as the main actors in building community response and preparedness towards disasters through education. This study aims to build a school-community response and preparedness of the younger generation in tsunami risk areas in the city of Banda Aceh. Analysis of findings from a study in high school in the city of Banda Aceh to explain integration of geography education and disaster preparedness in learning situations. It also explored the contribution of geography education in strengthening students’ response and preparedness to the occurrence of natural disasters and natural hazards. The study was conducted using a case study methodology. Data collection involved interviews with teachers, questionnaire surveys to teachers and students in 10 high schools in the city of Banda Aceh. This study shows that there is a positive contribution to geography education on strengthening student response and preparedness. This can be an active support and needed for schools in disaster-prone areas. Finally, geography learning is an appropriate vehicle for disaster education in the context of disaster risk reduction.

1. Introduction
Indonesia’s geographical location is part of the Circum Pacific lane which forms a ring of fire, leaving vulnerable to natural disasters to the region. According to the Indonesian National Board for Disaster Management (BNPB), there were 695 disaster events in the first quarter of 2015 and more than 1,550 disasters in the previous year [1]. The World Risk Report also shows that Indonesia is at a very high-risk level status [2]. Therefore, Indonesia needs to build resilience and response to various natural disaster risks.

Currently, the Indonesian government is working to improve disaster prevention for the school community by preparing school’s preparedness of disaster through education for the younger generation. Children are important in disaster management because they are the most vulnerable group in the event of a disaster [3-5]. Data from the Indonesian National Board for Disaster Management show that 75% of schools in Indonesia are in disaster areas (moderate or high risk). It is important to provide education to adolescents through formal school education since most children or adolescents spend more time at school. Other than as safety objects, especially at the high school level, it is critical to developing as centers of knowledge and facilities before, during, and after the disaster.

Thus, the purpose of disaster education is not only to enrich knowledge and awareness but also to overcome the importance of translating knowledge that triggers informed decisions or actions to protect against large-scale disasters [3, 4]. The importance of disaster education is highlighted in the Hyogo Framework for 2005-2015 as one of the strategic steps in mitigating the impact of disasters. The Sendai Framework on Disaster Risk Reduction also emphasizes the importance of increasing public education and awareness of disaster risks in recovery, rehabilitation and post-disaster efforts [6-8]. Schools have
a responsibility to provide disaster-safe education in developing knowledge to build community resilience to efforts to manage disaster risk. Schools as educational institutions play an important role in building community resilience to disasters.

This research was conducted in Banda Aceh City, Indonesia, one of the areas worst affected by the 2004 Tsunami. In Banda Aceh City, some external support has promoted school disaster safety [7]. One of them is the concept of Disaster Preparedness School. International and national institutions encourage and introduce the concept of disaster preparedness schools. Before the 2004 tsunami it could be said that internally, the cities of Banda Aceh and Aceh Province had not paid attention to disaster education. After the disaster occurred, the government integrated the curriculum for disaster education. One of them is by learning geography specifically at the high school level.

Geography has several decades of research and practical application in understanding the aspects of hazards and disasters [9, 10]. Geography has a role in understanding the various crises caused by the interaction of natural and social systems, and this discipline is generally recognized as one of the disciplines that study natural hazards. It deals with disaster-related topics include natural hazards and atmospheric agents, such as earthquakes, hurricanes, river and coastal flooding, drought, and global warming.

Indonesia's national curriculum sets disaster education on aspects of national competency standards that must be achieved in learning. Syllabus guidelines for teaching subjects have been provided. These standards have been written and implemented for academic subjects taught in high school, for example, geography, history, economics, language arts, arts education, mathematics, natural science, physical education, and technology. One academic subject that can teach disaster preparedness is Geography.

Geography contains material that consists of 6 main aspects in themes, namely: (1) The world in spatial terms, (2) Places and regions, (3) Physical systems, (4) Human systems, (5) Environment and Society, (6) The use of geography [9, 11]. These themes examine the relationship of spatial aspects which is related to the various physical and social phenomena risks and vulnerabilities to disasters, including natural disasters. Therefore, this study explores how to strengthen student responses to natural disasters and disaster preparedness as well as to provide insight into how effective school preparedness plans are. It also discusses the potential of geography education in increasing students' knowledge and response during disaster events.

2. Methods
This study used a structured survey and interview method with a qualitative approach. Qualitative research aims to holistically understand the phenomena experienced by research subjects. Structured interviews were used to gather detailed information from sources. Research subjects included: principals, teachers and 300 students from 10 state high schools. The results of the interview were then reduced to obtain data following the objectives of the study. The survey was conducted in ten schools, which locations represent Tsunami prone areas in Banda Aceh City, namely: SMAN 1, SMAN 2, SMAN 3, SMAN 4, SMAN 5, Lab School Unsyiah High School, SMAN 6, SMAN 8, SMAN 13, and SMAN 14. The following table 1 presents the profiles of ten high schools in Banda Aceh City that were affected by the tsunami on 26 December 2004.

Table 1. Survey Results of Public High Schools in Banda Aceh City that were affected by Tsunami 2004

| School Name       | Districts      | School Conditions     |
|-------------------|----------------|-----------------------|
| SMAN 1            | Meuraksa       | Heavily Damaged       |
| SMAN 2            | Kuta Alam      | Totally Destroyed    |
| SMAN 3            | Kuta Alam      | Light Damage          |
| SMAN 4            | Kuta Alam      | Light Damage          |
| SMAN 5            | Syiah Kuala    | Light Damage          |
| SMAN 6            | Meuraksa       | Totally Destroyed    |
| SMAN 8            | Kuta Alam      | Light Damaged         |
| SMAN 13           | Kuta Raja      | Totally Destroyed    |
| SMA Lab School Unsyiah | Syiah Kuala | No Damaged          |
| SMAN 14           | Kuta Raja      | Totally Destroyed    |
Table 1 shows the location of the high school affected by the tsunami. Some schools had mild damage to total destruction. Therefore, it is very important to provide knowledge to the community for disaster preparedness and response to emergencies [6, 7]. The following is a map of schools affected by the Tsunami in the city of Banda Aceh.

![Map of schools affected by Tsunami](image)

**Figure 1. High Schools Location Map Affected by Tsunami**

### 3. Results and Discussion

A school is a learning place where students are introduced to a variety of knowledge including knowledge about disaster problems. Dewey explained that schools are the most effective media to provide education to the community [12]. One needed to be developed is disaster education. Schools located in disaster-prone areas must have good preparedness to face natural disasters that occur in the region. Banda Aceh City is the capital of Aceh Province. This area was affected by the 2004 earthquake and tsunami. Most of the city was destroyed and many public facilities were destroyed including schools.

#### 3.1 Students Responses to Geography Learning

The aspects of knowledge about earthquake disaster preparedness and the knowledge of the school community are generally found decent. This can be seen from the answers to the questionnaire that learning geography helps students understand the material of natural disasters. The detailed responses are presented in Table 2.

| Responses       | Frequency | Percentage |
|-----------------|-----------|------------|
| Very unhelpful  | 0         | 0%         |
| Unhelpful       | 0         | 0%         |
| Less helpful    | 33        | 11%        |
| Helpful         | 150       | 50%        |
| Very helpful    | 117       | 39%        |
| **Total**       | **300**   | **100%**   |
Table 2 shows that student positively responded towards learning geography. Students suggested that learning geography can help understand the problem of disaster. 150 respondents out of 300 respondents or 50% of students in schools stated geography as a medium to get disaster-knowledge. This is because the substance of teaching materials, especially in the second year of high school (level XI) has been integrated with natural disaster mitigation and adaptation materials.

3.2 Disaster Preparedness in High School
One effort to increase preparedness is carried out at the senior high school level through the Disaster Preparedness School or call Sekolah Siaga Bencana (SSB) program. The establishment of SSB aims to create a culture of readiness and security in the school community, namely students, teachers, principals, school committees, and others. Based on observations, not all Banda Aceh Public High Schools have SSB programs. In another hand, SSB can contribute to every component of the school community to understand the signs of disaster and how to overcome them. The Disaster Preparedness School has been applied in Banda Aceh City namely SMAN 1 and SMAN 6. Since 2009, it has been supported by UNESCO in collaboration with LIPI, the Tsunami Disaster Mitigation Research Center (TDMRC), and the Education Office in the Banda Aceh City area. From the interview with the schools’ principal, found that the monitoring and evaluation had supported the school to continue to maximize the education of disaster risk reduction. The schools have high commitment to increase disaster-knowledge. This becomes an important note when conducting further coaching to schools in support of the achievement of disaster-prepared schools. The survey results indicated that SMAN 1, SMAN 6, SMAN 13 and SMAN 14 were the most severely affected by the tsunami. Therefore, to measure school preparedness developed to arouse the awareness of all stakeholders in the field of education, both individually and collectively in schools and the school environment in terms of disaster preparedness, a study can be done using five parameters that refer to LIPI [13, 14] as follows.

3.2.1 Knowledge and attitude
Based on observations in ten schools affected by the tsunami in 2004, disaster-related knowledge was obtained from learning geography. Knowledge of natural phenomena, especially earthquakes and tsunamis, also preparedness to reduce disaster risks are important factors. Therefore, to improve the knowledge and attitudes of students and teachers, schools must incorporate material related to disaster preparedness into the teaching and learning process. Integration of DRR education into the main subject school curriculum, local and extracurricular content and the preparation of syllabus competency standards, lesson plan and the implementation on preparedness as well as capacity building in providing preparedness and availability of teaching materials based on natural disaster mitigation and adaptation.

3.2.2 Policies
The researched schools have a disaster-prepared school policy in the form of regulations, clear guidelines to be used as a basis and legal reference for implementing various activities in schools. The form of achievement of indicators is marked by 1) inclusion of disaster preparedness materials in teaching and learning in schools, especially in disaster-related subjects such as Geography, 2) the existence of disaster evacuation simulations conducted in schools 3) disaster preparedness groups in schools, and 4) the allocation of funds for preparedness activities in schools.

3.2.3 Emergency response plan
The emergency response plan is a parameter of school community preparedness. It is closely related to the preparation of plans and actions in responding to conditions before and during the disaster [13]. The preparedness of the school emergency response plan is indicated by several things, namely rescue and evacuation plans as well as first aid, the provision or security of basic school needs, the provision of evacuation equipment, and evacuation drills/simulations. Simulations are usually carried out in collaboration with disaster-related institutions such as LIPI (The Indonesian Institute of Sciences), TDMRC Unsyiah (Tsunami and Disaster Mitigation Research Center Unsyiah), BNPB (Indonesian National Board for Disaster Management) Aceh Province.
3.2.4. Resource mobilization  
Resource mobilization is related to the efforts of schools to mobilize all the capabilities and capacities of schools’ infrastructure, equipment, and funding as well as human resources (school residents). Not only in terms of material, but the existence of schools amid the community can also provide more value to improve disaster preparedness by increasing cooperation involving government/non-government institutions engaged in disaster risk reduction. Resource mobilization also includes the provision of equipment for evacuation and safety building access, and basic needs/logistics of first aid and disaster warning [14].

3.2.5. Disaster warning system  
The disaster warning system has a significant role in efforts to increase disaster preparedness in the school environment. The disaster warning system in the school environment is related to the equipment used by the school and the signs/sounds that signal to the school community to be able to provide an appropriate response when a disaster will occur. Besides, school residents are also taught to recognize the sound of an early warning siren system that is scattered in several points in the coastal area of Aceh. They are expected to respond to emergencies and strive to save themselves when a disaster occurs. Schools as educational institutions have a great moral responsibility to build a safe environment for students, teachers and all components of the school community. The level of education, awareness, and self-regulation is the greater potential to avoid or reduce the negative consequences of natural disasters [15].

3.3 Geography Education as a Vehicle to Learn about Disaster Preparedness and Effective Response  
Geography education has the potential to increase disaster preparedness. Based on interviews that have been conducted with teachers in ten high schools in the city of Banda Aceh, especially in geography teachers stated that geography lessons have links with disaster education. It has been widely recognized that geography has an important role in efforts to reduce disaster risk and build preparedness [9,16]. Students who have been taught the phenomenon of disaster and how to react to the situation have been proven to be able to respond quickly and appropriately, thereby warning others and protecting themselves during emergencies. Geography learning has the potential to accommodate the introduction of territory, vulnerability, and risk of natural hazards that will cause disasters [10,17,18]. So that geography subjects can increase disaster preparedness. Geography content taught in the national curriculum (Curriculum 2013) in Indonesia contains aspects of disaster education at the high school level. The following are presented in table 3 below.

| Basic Competencies | Learning Material Learning | Activities |
|--------------------|---------------------------|------------|
| 1. Analyzing the types and management of natural disasters through education, local wisdom, and the use of modern technology. | NATURAL DISASTER MITIGATION AND ADAPTATION  
- Types and characteristics of natural disasters.  
- Disaster management cycle.  
- The distribution of areas prone to natural disasters in Indonesia.  
- Institutions that play a role in natural disaster management.  
- Community participation in mitigating natural disasters in Indonesia. | Read geography textbooks and reference books, and/or observe videos related to natural disasters and disaster mitigation  
Ask and discuss about natural disasters and disaster mitigation in Indonesia  
Present the discussion reports on natural disasters and disaster mitigation with sketches, floor plans, and/or map  
Conducting disaster mitigation simulations in school  
Making disaster evacuation maps in the surrounding environment |
| 2. Make sketches, floor plans, and/or maps of potential local disaster and disaster mitigation strategies based on these maps. | | |

Source: [19]
Table 3 shows that geographic content contains aspects of knowledge and forms attitudes of disaster preparedness. It is found in the standard competency that is in the syllabus of geography. In addition to achieving knowledge and attitude competencies, in learning geography skills are also formed namely the mastery of geography skills [20, 21]. Mastering these skills increases disaster understanding [9, 22].

Disaster preparedness requires not only organizing skills but also spatial thinking and decision-making abilities. An important goal of lesson plans for disaster preparedness is to facilitate students learning spatial concepts when dealing with disaster situations. Spatial thinking in learning geography includes three components, namely: 1) the concept of space, 2) knowing about representations of space and 3) Knowing about processes of reasoning [9]. These three aspects can outgrowth students to use cognitive and decision-making skills that lead to spatial problem-solving. For example, how to determine the best evacuation route during an evacuation during an earthquake and how to reach a place higher than the coast when a tsunami occurs. Thus, teaching spatial thinking and spatial literacy to students is an important component in disaster preparedness. Thinking describes mental processes that enable humans to effectively manipulate information to conceptualize, engage in problem-solving and reasoning, and make decisions [9, 23, 24]. Through geography, learning can support disaster risk reduction efforts by increasing the preparedness of school community in achieving disaster preparedness schools.

4. Conclusion
The results of research conducted at ten high schools in Banda Aceh city that were affected by the tsunami in 2004 has explored disaster-related knowledge gained from learning Geography. It involved knowledge of natural phenomena, especially earthquakes and tsunamis, and preparedness to reduce disaster risks are important factors. Therefore, to improve the knowledge and attitudes of students and teachers, schools must incorporate material related to disaster preparedness into the teaching and learning process. Geography learning accommodates disaster education in which geographic content contains natural disaster mitigation and adaptation material and specifically addresses the introduction of disaster areas and their mitigation efforts. Student responses to geography learning reached 50% (150 out of 300) respondents stated that geography learning helps students understand disaster-related material and increase their knowledge of natural hazards that can cause disasters.

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