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## School Preparedness in Anticipating the Threat of Earthquake and Tsunami in Bantul Regency

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# SCHOOL PREPAREDNESS IN ANTICIPATING THE THREAT OF EARTHQUAKE AND TSUNAMI IN BANTUL REGENCY

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**Abstract.** Earthquakes occurring in the subduction zone are the cause of the tsunami. This study aims to determine: (1) school preparedness in Bantul Regency in to face of the earthquake and tsunami disaster, and (2) school efforts in Bantul Regency in improving the preparedness of the earthquake and tsunami disaster. The research design used in this research is descriptive analysis. This research conducted on April-November 2018. The research places is Bantul Regency, D.I. Yogyakarta. Variables in this study are school preparedness in to face of the earthquake and tsunami disaster (knowledge, policies and guidelines, emergency response plans, disaster warning systems, and resource mobilization) and school efforts in improving the preparedness of the earthquake and tsunami disaster. The population of this study is all schools in Bantul Regency that enter the area prone to earthquake and tsunami disaster. All members of the population is expected to be a unit of research analysis. Data collection techniques in this study are observation, interviews, and documentation. The data analysis used in this research is quantitative and qualitative. The results showed: (1) school preparedness in Bantul Regency from the schools aspect in “ready enough” category (76.9 %), the teachers aspect in “full ready” category (73.1%), and the students aspect in “full ready” category (60.1%). (2) Efforts to improve the preparedness of the earthquake and tsunami disaster carried out by schools in Bantul Regency, including: (a) conducting earthquake and tsunami disaster evacuation drills in their school communities, (b) improving school preparedness, teachers preparedness, students preparedness, parents preparedness and volunteers preparedness with various trainings and simulations in the face of the earthquake and tsunami disaster, (c) making routes and evacuation maps, (d) mobilizing all available resources, from the public and private sectors, domestic and foreign to coordinate all disaster response entities based on emergency response plans, (e) integration of earthquake and tsunami disaster studies in the curriculum in schools, and (f) involve the role of various parties in improving the preparedness of the earthquake and tsunami disaster

## 1. Introduction

Indonesia is located at the meeting of three tectonic plates, the Indo-Australian plate, the Eurasian plate and the Pacific plate. The three plates move and collide with each other. The Eurasian plate collides with the Indo-Australian plate and caused an earthquake line and active volcanoes along Sumatra, Java, Bali, Nusa Tenggara, Sulawesi and South Maluku, while the Eurasian plate collides with the Pacific plate gave rise to earthquake line and active volcanoes in Northern Irian and North Maluku. The earthquake is one of the causes of the tsunami, so the earthquake prone areas are also



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prone to tsunami disaster. Earthquakes and tsunamis are destructive natural disasters and produce many losses, including losses from physical, socio-economic and cultural aspects.

Geologically, D.I. Yogyakarta is located in the around of the subduction zone between the Indo-Australian plate and the Eurasian plate. The subduction zone is about 200-250 km from the South Java Coast line and has the potential to cause an earthquake. The earthquake that occurred in D.I. Yogyakarta and surroundings on May 27, 2006 with the Richter scale 5.9 was destructive and caused the fatalities of more than 6,000 people, tens of thousands were injured from bruises to fractures, and hundreds of thousands of buildings were severely damaged to totally destroyed [6].

Earthquakes that occurred in the subduction zone are the cause of the tsunami and have the potential to impact including the beaches in Bantul Regency. The earthquake that occurred in southeast Bantarkalong, Tasikmalaya, West Java on December 16, 2017 at 23.47'58" WIB with the Richter scale 6.9 also caused the coast in Ciamis and Tasikmalaya, West Java have potential tsunami with "alert" level at a height of 0.5 - <3 meters, while in coastal areas of Bantul, Kulonprogo, Cianjur, Garut, Sukabumi, Cilacap and Kebumen districts at the "alert" level of tsunami at an altitude of <0.5 meters [1]. Responding the earthquakes that could trigger potential tsunamis, BPBD of Bantul Regency has classified tsunami-prone areas through tsunami evacuation plan map of Bantul Regency (Picture 1). Based on the map of the tsunami evacuation plan in Bantul District, Srandakan, Sanden and Kretek sub-districts are in the tsunami hazard zone with an estimated water level >3 meters (red zone) and <3 meters (yellow zone).



Picture 1. Tsunami Evacuation Plan Map of Bantul Regency [8]

Seeing the impact of an earthquake can cause a potential tsunami and cause various losses, schools that are on the path of the earthquake and tsunami disaster need to improve preparedness. Schools that have potential impact from disaster need to develop a comprehensive disaster management system that considers essential facilities including schools and other educational institutions, between school management in normal situations by controlling them in major emergencies such as earthquakes and

tsunamis [2]. Safe schools are expected to save the lives of students, act as temporary shelters after a disaster occurs, and promote disaster prevention and mitigation efforts to the community [7].

Indonesia implements disaster management by instilling the basics of disaster education in the society. In Indonesian society, disaster is divided into 3 (three): natural disaster, non-natural disaster and social disaster [3]. In this research the focus is more on natural disasters, namely earthquake and tsunami disaster.

Schools play an important role in instilling the values and culture of the community, including in promoting disaster education to students. The disaster education will affect school preparedness in the face of earthquakes and tsunamis. School preparedness in dealing with the earthquake and tsunami disaster can be seen from the aspects of knowledge, policies and guidelines, emergency response plans, disaster warning systems, and resources mobilization. School preparedness studies need to be carried out because students who are exposed to disaster risk are very large in number, especially if the disaster occurs during learning hours in school.

The school community, including students, teachers and employees is a potential agent of change to disseminate knowledge about the earthquake and tsunami phenomena and motivate the surrounding community to improve preparedness in order to reduce disaster risk. School communities can also be trained to create a safe school environment. A safe school environment is prepared with buildings that have earthquake-resistant construction, the presence of disaster evacuation routes, intensive extension activities and simulations of earthquakes and tsunamis involving the participation of local communities, government and NGOs. Preparing the school environment well is the key to "safety".

This study aims to analyze the school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster and school efforts in improving the preparedness. By knowing the efforts that have been made by the school in improving preparedness in facing earthquake and tsunami disaster, it is expected to minimize casualties, infrastructure damage and other losses.

This research is a follow-up study of Institutional Research (Studies Center for Disaster Mitigation, UNY) entitled "Development of Disaster Mitigation Education Based on Disaster Preparedness School in D.I. Yogyakarta" which has been done in 2016 by research team (Purwantara, Khotimah, and Dwiningrum) with the following results:

1. Majority of schools in Yogyakarta have knowledge of various disasters, as well as disaster mitigation methods obtained from related institutions such as BPBD, universities, and mass media.
2. Some schools have attempted disaster risk reduction by inviting stakeholders, even some schools have conducted disaster mitigation simulations. However, only a few Disaster Preparedness Schools (SSB) alone, while most others have never been.
3. In connection with the development of disaster risk education based on Disaster Preparedness School (SSB), some schools have increased disaster knowledge (capacity) through integration of disaster mitigation in the curriculum, some have prepared standard of operational implementation for disaster management until they have evacuation route plan, especially those with SSB status [5].

Based on the results generated by the Institutional Research, further research is carried out by taking the title "School Preparedness in Anticipating the Threat of Earthquake and Tsunami", in the hope of obtaining results on the description of: (1) level of school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster, and (2) efforts that have been done in schools in Bantul Regency in improving preparedness in the face of earthquake and tsunami disaster.

## 2. Research Methods

The research design used in this research is descriptive analysis. This study seeks to explain school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster and illustrates what efforts the school has made to improve disaster preparedness.

This research conducted on April-November 2018. The research place is Bantul Regency, D.I. Yogyakarta. Bantul Regency is a major area affected by the earthquake on May, 27<sup>th</sup> 2006.

Variables in this study are: (1) school preparedness in to face of the earthquake and tsunami disaster, which can be seen from indicator: (a) knowledge, (b) policies and guidelines, (c) emergency response plans, (d) disaster warning systems, (e) resources mobilization, and (2) school efforts in improving the preparedness of the earthquake and tsunami disaster.

**Table 1.** Framework for School Preparedness for Anticipating the Earthquake and Tsunami Disaster

Variable	Indicator	Sub Indicator
Knowledge	knowledge of earthquakes, including:	<ul style="list-style-type: none"> <li>• understanding of natural disasters</li> <li>• events that cause disaster</li> <li>• the cause of the earthquake</li> <li>• strong earthquake characteristics</li> <li>• earthquake resistant buildings</li> <li>• actions taken in the event of an earthquake</li> </ul>
	knowledge of tsunami, including:	<ul style="list-style-type: none"> <li>• the cause of the tsunami</li> <li>• signs of a tsunami</li> <li>• tsunami resistant buildings</li> <li>• actions taken when sea water suddenly recedes</li> </ul>
Policies and guidelines	education policy, related to:	<ul style="list-style-type: none"> <li>• school community preparedness</li> <li>• Law of the Republik Indonesia No. 24 of 2007 concerning Disaster Management</li> <li>• Ministry of Education and Culture Regulation (Circular 70a/MPN/ 2010)</li> <li>• District/City Education Service Regulations</li> <li>• School Principal Decree concerning Disaster Preparedness Cluster at school</li> <li>• school policy on integrating preparedness material in relevant subjects or extracurricular activities at school</li> <li>• mobilization of resources in schools to improve school community preparedness</li> </ul>
Emergency response plan	related to evacuation, relief and rescue so that disaster victims can be minimized, including:	<ul style="list-style-type: none"> <li>• evacuation sites</li> <li>• maps and evacuation routes</li> <li>• equipment and supplies</li> <li>• practice / simulation</li> <li>• evacuation fixed procedures</li> </ul>
	rescue important school documents	<ul style="list-style-type: none"> <li>• Copies of documents are stored in a safe place</li> </ul>
Disaster warning system	warning signs and distribution of information on disasters to reduce casualties	<ul style="list-style-type: none"> <li>• knowledge of warning signs / sounds</li> <li>• cancellation of warnings / conditions safe from disasters</li> <li>• preparation of equipment and equipment to determine warnings</li> <li>• exercises and simulations what to do when hearing a warning</li> <li>• where and how to save themselves at certain times according to the location where the community is in the event of a disaster</li> </ul>
Resources	human resource	<ul style="list-style-type: none"> <li>• training, workshops, or lectures</li> </ul>

Variable	Indicator	Sub Indicator
mobilization	mobilization (HRM), in the form of increasing teacher and student preparedness obtained through various:	<ul style="list-style-type: none"> <li>• provision of preparedness materials in schools that can be accessed by all components of the school community</li> </ul>
	preparation and improvement of the capacity of disaster preparedness groups needed by the school community, including:	<ul style="list-style-type: none"> <li>• disaster warning group</li> <li>• first aid group</li> <li>• evacuation and rescue groups</li> <li>• logistics group</li> </ul>

Source: Community Preparedness Assessment [4]

The population of this study is all schools in Bantul Regency that enter the area prone to earthquake and tsunami disaster. All members of the population is expected to be a unit of research analysis.

The data collected in this research are 2 (two) types, they are: (1) primary data, relating to school preparedness in to face of the earthquake and tsunami disaster and school efforts in improving the preparedness of the earthquake and tsunami disaster, and (2) secondary data, in the form of information about the physical, social, economic, and demographic conditions in the research location, which is expected to support the research findings.

Data collection techniques in this study are: (1) observation, carried out by observing the conditions around the research location to obtain an overview of the study area, (2) interviews, conducted to respondents (schools, teachers, students) using questionnaires to obtain information about school preparedness that seen from indicator: knowledge, policies and guidelines, emergency response plans, disaster warning systems, and resource mobilization. Interviews with key informants using a questionnaire were used to obtain information school efforts in improving preparedness in the face of the earthquake and tsunami disaster, and (3) documentation, carried out by taking data, such as topographic maps, administrative maps, land use maps, population data, school data, and other data that can support research activities.

The data analysis used in this research is quantitative and qualitative descriptive analysis. The description of school preparedness in Indonesia in the face of earthquakes and tsunamis is obtained from the results of preparedness parameter scoring. Scoring is done to change the information that has been obtained into data in the form numbers. The answer "yes" on each research instrument will be given a value of 2, the answer "no" is given a score of 1, and the answer "do not know" is given a score 0. Determination of the number of scores for each class is based on the range of minimum values up to the maximum range and the number of classes desired namely "full ready", "ready", "ready enough", "less ready", "not ready", so that interval determination class is obtained by formula:

$$\text{Length of class interval} = \frac{\text{maximum value} - \text{minimum value}}{\text{number of classes (=5)}}$$

Efforts made by schools in Bantul Regency to improve preparedness in the face of earthquakes and tsunamis were obtained from the results of qualitative data analysis based on information from teachers and disaster management organizations.

### 3. School Preparedness in Bantul Regency in to Face of the Earthquake and Tsunami Disaster

Preparedness to deal with earthquakes and tsunamis should ideally have been given since early childhood, especially in disaster-prone areas. Schools are very potential to disseminate knowledge of the earthquake and tsunami disaster and motivate students to improve preparedness in order to reduce the risk of disasters that can occur. Next, a study of school preparedness in Bantul Regency will be presented in to face the earthquake and tsunami disasters using a framework developed by LIPI in collaboration with UNESCO/ISDR in 2006. The school preparedness study is based on 5 (five) indicators, they are: (1) knowledge of phenomena earthquakes and tsunamis, (2) policies and guidelines, (3) emergency response plans, (4) disaster warning systems, and (5) resource mobilization.

Study of school preparedness in the face of the earthquake and tsunami disaster can be carried out at various levels of education, in this study carried out at the level of Elementary School/equivalent, Junior High School/equivalent, and Senior High School/equivalent. Based on tsunami evacuation plan map of Bantul Regency (Picture 1), it can be seen that 13 schools in Srandakan Subdistrict, Sanden Subdistrict and Kretek Subdistrict are exposed to the risk of a tsunami disaster (entering the red/yellow zone). Names list of schools in Bantul Regency that are exposed to the risk of a tsunami disaster are:

**Table 2.** Names list of schools in Bantul Regency exposed to the risk of a tsunami disaster

No	Subdistrict	Schools Names
1	Srandakan	Krajan Elementary School
2		Koripan Elementary School
3		Muhammadiyah Babakan Elementary School
4		Muhammadiyah Sambeng Elementary School
5		Muhammadiyah Srandakan Junior High School
6		Binawiyata Srandakan Vocational High School
7	Sanden	Gadingharjo 2 Elementary School
8		Tegalsari Elementary School
9		Rojoniten Elementary School
10		Sanden 1 Vocational High School
11	Kretek	Bungkus Elementary School
12		Parangtritis 2 Elementary School
13		Tirtohargo Elementary School

Source: Primary data, 2018

After being determined the school in this study, the next step is taking data in the field. The subject of school community preparedness studies consists of 3 (three), they are: (1) school as an institution, in this study 13 questionnaires were prepared to be filled by school managers (headmaster or vice principal), (2) teachers, in this study the school were given 10 questionnaires to be filled out by the teacher, so that there were 130 teacher questionnaires in total, and (3) students, in this study 50 the schools were given questionnaires to be filled out by students, so that there were 650 student questionnaires in total, but because there are schools with few students, the total is only 622 student questionnaires. For elementary level students in grades 4 and 5 were chosen as respondents, while for junior and senior high school student grades 8 and 11. Class students at grades 6, 9, and 12 were not used as respondents remember that thee busyness related to school exam preparation and national examinations. In filling out the questionnaire, students were guided by researchers and researcher assistants.

The corrected questionnaire and given the sequence number are then processed and analyzed using frequency tables. From the results of the analysis, it is known that school preparedness in Bantul Regency in facing the earthquake and tsunami disaster as follow:



- a. The school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the schools aspect

**Table 3.** The school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the schools aspect

No	Indicator	Category (%)					Total
		Full ready	Ready	Ready enough	Less ready	Not ready	
1	Policies and guidelines	15.4	0.0	38.5	<b>46.2</b>	0.0	100
2	Emergency response plan	30.8	7.7	<b>53.8</b>	7.7	0.0	100
3	Disaster warning system	30.8	15.4	<b>46.2</b>	7.7	0.0	100
4	Resources mobilization	15.4	0.0	<b>53.8</b>	30.8	0.0	100
5	All indicators	15.4	0.0	<b>76.9</b>	7.7	0.0	100

Source: Primary Data, 2018

Based on Table 3, it can be seen that schools are in the category of “less ready” in policies and guidelines related to school preparedness in the face of the earthquake and tsunami disaster (46.2%). Most schools have not yet formed a disaster preparedness group (85.0%) and also have not issued a budget allocation policy for school preparedness (76.9%). However, the school has integrated preparedness material in relevant subjects in school (84.6%), increased preparedness knowledge and skills in extracurricular activities (69.2%), increased knowledge and skills of teachers about preparedness (76.9%), and regular evacuation simulation exercises (61.5%).

Emergency response plans in schools are in the category of being “ready enough” in the face of the earthquake and tsunami disaster (53.8%). Most schools do not have back up or copy/duplicate important documents stored in a place that is safe from earthquake and tsunami disasters (61.5%).

Disaster warning systems in schools are in the category of being “ready enough” in the face of the earthquake and tsunami disaster (46.2%). The tsunami warning information in the school does not include a sign stating that a tsunami did not occur (69.2%) and does not include a sign stating that the situation is safe after the tsunami (69.2%).

Resources mobilizations in schools are categorized as “ready enough” in the face of the earthquakes and tsunami disaster (53.8%). Schools do not receive assistance/guidance related to disaster preparedness from NGOs (69.2%), other non-governmental organizations (53.8%), and companies/ private parties (84.6%).

Overall school preparedness in Bantul Regency in the face of the earthquake and tsunami disasters from the schools aspect are categorized as “ready enough” (76.9%). This cannot be separated from the policies and guidelines taken by the school. School policies and guidelines will then determine emergency response plans, disaster warning systems, and resource mobilization by schools.



- b. The school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the teacher aspect

**Table 4.** The school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the teacher aspect

No	Indicator	Category (%)					Total
		Full ready	Ready	Ready enough	Less ready	Not ready	
1	Knowledge	<b>73.8</b>	23.1	2.3	0.0	0.0	100
2	Emergency response plan	<b>85.4</b>	14.6	0.0	0.0	0.0	100
3	Disaster warning system	<b>90.8</b>	9.2	0.0	0.0	0.0	100
4	Resources mobilization	<b>81.5</b>	14.6	3.8	0.0	0.0	100
5	All indicators	<b>73.1</b>	25.4	1.5	0.0	0.0	100

Source: Primary Data, 2018

Based on Table 4, it can be seen that overall school preparedness in Bantul Regency in the face of the earthquake and tsunami disasters from the teacher aspect are in “full ready” category (73.1%). This cannot be separated from the teacher knowledge in the face of the earthquake and tsunami disaster which is also in “full ready” category (73.8%). Knowledge of the teachers will determine the emergency response plan to be categorized as “full ready” (85.4%), the disaster warning system in “full ready” category (90.8%), and resource mobilization by the teacher in “full ready” (81.5%). The teachers knowledge of earthquake and tsunami disasters is not only from learning at school, but also from experiences they have experienced.

- c. The school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the student aspect

**Table 5.** The school preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the student aspect

No	Indicator	Category (%)					Total
		Full ready	Ready	Ready enough	Less ready	Not ready	
1	Knowledge	<b>60.0</b>	37.1	2.7	0.2	0.0	100
2	Emergency response plan	<b>69.6</b>	28.3	1.9	0.2	0.0	100
3	Disaster warning system	41.3	<b>52.1</b>	5.5	1.1	0.0	100
4	Resources mobilization	38.7	<b>46.9</b>	14.3	0.0	0.0	100
5	All indicators	<b>60.1</b>	37.9	1.9	0.0	0.0	100

Source: Primary Data, 2018

Based on Table 5, it can be seen overall that school preparedness in Bantul Regency in the face of the earthquake and tsunami disasters from the students aspect are in “full ready” category (60.1%). This cannot be separated from the student knowledge in dealing with earthquake and tsunami which is also in “full ready” category (60.0%). Knowledge of students will determine emergency response plans in

“full ready” category (69.6%), disaster warning system in “ready” category (52.1%), and resources mobilization by students in “ready” category (46.9%).

#### **4. School Efforts in Bantul Regency in Improving the Preparedness of the Earthquake and Tsunami Disaster**

Some efforts made by schools in Bantul Regency after the 2006 earthquake as follows:

- a. Improving school preparedness, teacher preparedness and students preparedness in the face of the earthquake and tsunami disaster.
- b. Making routes and evacuation maps.
- c. Every year try to carry out counseling and simulations earthquakes and tsunamis by involving BPBD Bantul Regency and FPRB of the subdistricts.
- d. Mobilize all available resources by coordinating all disaster response entities based on emergency response plans.
- e. Integration of earthquake and tsunami disaster studies in the curriculum in schools.
- f. Involving the role of various parties in improving the preparedness of the earthquake and tsunami disaster.

#### **5. Conclusion**

- a. School preparedness in Bantul Regency in the face of the earthquake and tsunami disaster from the schools aspect in “ready enough” category (76.9%), the teachers aspect in “full ready” category (73.1%), and the students aspect in “full ready” category (60.1%). School preparedness from the school aspect enter into "ready enough" category because there is still a lack of emphasis on policies and guidelines, emergency response plans, disaster warning systems and resource mobilization in schools.
- b. Efforts to improve the preparedness of the earthquake and tsunami disaster carried out by schools, including:
  - 1) Conducting earthquake and tsunami disaster evacuation drills in their respective school communities.
  - 2) Improving school preparedness, teachers preparedness, students preparedness, parents preparedness and volunteers preparedness with various trainings and simulations in the face of the earthquake and tsunami disaster.
  - 3) Making routes and evacuation maps.
  - 4) Mobilizing all available resources, from the public and private sectors, domestic and foreign to coordinate all disaster response entities based on emergency response plans.
  - 5) Integration of earthquake and tsunami disaster studies in the curriculum in schools.
  - 6) Involve the role of various parties in improving the preparedness of the earthquake and tsunami disaster.

#### **6. Recommendation**

- a. For schools:
  - 1) Schools must mark the safe and insecure zones of all school buildings to avoid disasters.
  - 2) Schools must be conditioned to make temporary evacuation sites.
  - 3) Schools are able to reduce the possibility of damage caused by disasters.
  - 4) Increasing school preparedness from the aspect of schools, teachers and students.
- b. For Governments:
  - 1) The government has more support for improving school preparedness in the face of disasters with various trainings and simulations.
  - 2) The government designs national action plans for schools safe from the impact of disasters, both in the short, medium and long term.

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