Disaster preparedness in the red zone schools at 13 years post tsunami 2004

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Abstract. Based on the Indonesian Disaster Risk Index, 75% schools in Indonesia are located in the medium to high-risk disaster-prone area. However, many educational institutions in Indonesia especially in Aceh Province, still consider disaster preparedness as inessential issues and tend to be ignored. This study aims to evaluate the preparedness of the high risk school communities after 13 years of post- tsunami 2014; related to policy parameters, knowledge, emergency planning, disaster warning systems and resource mobilization capacity. This is a descriptive explorative study using questionnaires to collect data from 80 elementary school teachers and 265 elementary students. A semi structured interviews with eight elementary school principals was also conducted to enrich the research findings. The study findings show that the school preparedness is in the low category (total index value 20.50); school teacher preparedness is in the medium category (total index value 61.79) and student preparedness is in the low category (total index value 52.12). The preparedness of the school community (a composite index of school institutions, teachers and students) is also in low category (total index value 43.09). The result of the study indicated that disaster preparedness programs in most elementary schools have not been well implemented. The lack of sustainability of the disaster preparedness school program and its monitoring and evaluation might contribute to this condition.

Keyword: preparedness, disaster, earthquake, tsunami, elementary school children.

1. Introduction
The province of Aceh is one of the regions in Indonesia that is vulnerable to earthquakes and tsunamis due to its closest location to the epicenter of the 2004 Indian Ocean earthquake. Therefore 16 of the 23 districts/cities in Aceh are in high-risk classification or in the red zone of earthquake disaster and tsunami [1]. Based on the map of Disaster Risk Index, district of Aceh Besar located in the red zone of earthquake and tsunami disaster [1]. Reducing disaster risk is not only the responsibility of the government, but also needs the participation of the entire community, including the participation of educational institutions. The participation of educational institution should not be ignored since its potential as an effective, dynamic and sustainable information transfer strategy in building the knowledge capacity to improve community preparedness for disasters [2].

Nevertheless, only few of educational institutions considers disaster preparedness as an important issue. Based on the results of a survey conducted by [3]. 19 schools in the city of Banda Aceh, the sustainability of many disaster preparedness schools or Sekolah Siaga Bencana (SSB) was halted due to the mutation of school principals. This condition affected the discontinuation of SSB policy, which was also contributed from the lack of support from government and non-government institutions and funding problems. In addition, the results of the survey also show that only 15.79% of schools have a high level of preparedness for policy and direction parameters. As for
emergency planning, early warning and resources mobilize capacity, only 47.37% have high preparedness levels. This is a worrisome condition as children are one of the most vulnerable groups to suffer from the impact of disasters due to their weak physical condition and their inability of to make decisions; especially in the occasion when they became separated from their parents during the disaster [4].

Preparing for children to face future disasters could be conducted by increasing the ability of children to make decisions. Thus, if there is a threat to their safety, the child is able to take appropriate actions. Therefore, disaster education is considerably needed in schools, particularly in terms of the individual, family and community education to help the children developing disaster preparedness culture [5]. Vulnerabilities relate to the level of hazard preparedness [4]. Thus, vulnerability can be reduced by increasing the capacity. Capacity building might be achieved by providing education and training about disaster knowledge in schools [6].

Disaster risk reduction strategies in schools could be carried out in the form of structural and non-structural manner, in order to establish a culture of preparedness and safety [7]. With the purpose to emphasize the importance of disaster risk reduction, the government of Aceh Besar district issued a Qanun (sharia law) on regional disaster management, in which mentions the appeals for customary institutions, non-governmental organizations, religious institutions, business institutions and communities in order to play role in disaster management. Furthermore, the Sendai Framework for Disaster Risk Reduction / SFDRR (2015-2030) in Priority for Action 4: also emphasizes the importance to strengthen preparedness to deal with disasters [8].

Considering the importance of disaster preparedness, this study aimed at evaluating the preparedness of the school community in the red zone of the earthquake and tsunami disaster Peukan Bada Aceh Besar community health center working areas. This research will focus on studying the five parameters of the earthquake and tsunami disaster preparedness including: 1) Disaster preparedness policy (PS), 2) Disaster knowledge (K), 3) Emergency planning (EP), 4) Disaster warning system (WS), and 5) Resource mobilization capacity (RMC) [9] [10].

2. Material and method
This research employed an explorative descriptive design with qualitative and quantitative data collection. The study was conducted in eight elementary schools located in the red zone of the earthquake and tsunami disaster prone area. The quantitative data was collected using a questionnaires developed by [10]. The questionnaires was filled by eight school principals, 80 teachers and 265 students at fourth and fifth grade of elementary school located in Peukan Bada sub-district. The sample size was determined based on [11] table, using a power of 0.8; the value of $\alpha = 0.05\%$; and effect size 0.2; which resulted 241 samples. To avoid the lack of response rate, the researchers added 10% of the sample size to 265 people. Probability random sampling technique was performed by a systematic random sampling.

In addition to collecting quantitative data, this study also collected qualitative data using a semi-structured interview method and windshield survey. The semi-structured interviews were conducted to collect qualitative data related to disaster preparedness programs in schools. Whereas windshield survey were conducted to observe the surrounding conditions of the schools which are relevant to the earthquake and tsunami disaster preparedness. The interview guide was prepared by the researchers by addressing the input, process and output aspects in carrying out the disaster preparedness program [9]. While the windshield guide was developed based on the components described in the table of Learning about the Community on Foot as part of the Community as Partner Model [12].

The study was conducted by distributing two type of questionnaires which both implied several parameters including policy, knowledge, emergency planning, disaster warning system, and resource mobilization capacity pertinent to earthquake and tsunami disaster. The first type of questionnaire is designed to be filled by the elementary school principals, while the second one is to be distributed for the teachers and students of the elementary schools. The data collected by those questionnaires will be used to estimate the parameter index as follows.
Furthermore, the index value is interpreted based on the following categories: a) high preparedness (value index 79.50 - 100), b) moderate preparedness (index values 55.00 - 79.49) and c) low preparedness (index value <55).

### 3. Result

The questionnaires that distributed to the school institutions achieved 100% response rate and another one distributed to students achieved a response rate of 96.23%. Whereas from 80 questionnaires distributed to elementary school teachers, the response rate was 98.75%. Quantitative data collection using a questionnaire identified the school distance from the beach is less than 500 meters (50%). Most of the building walls type are 100% concrete/brick. The condition of the walls on the lower floors of a multi-stores school building was half solid and has enough windows/ventilation (66.7%). Most respondents did not know the condition of the school buildings (62.5%) and only 12.5% school buildings that follow earthquake resistant building standards and consider the influence of a tsunami load was only 12.5%.

#### 3.1. The school preparedness

The results of the earthquake and tsunami disaster preparedness evaluation at eight elementary schools in Aceh Besar District can be seen in the figure below. The parameters used in this study were 1) Disaster preparedness policy (PS), 2) Disaster knowledge (K), 3) Emergency planning (EP), 4) Disaster warning system (WS), and 5) Resource mobilization capacity (RMC).

![Figure 1. The school preparedness index](image)
Table 1. The percentage of school preparedness parameters

| Parameter | Number Of Schools | Low | Medium | High |
|-----------|-------------------|-----|--------|------|
| PS        | 8                 | 100 | -      | -    |
| EP        | 8                 | 100 | -      | -    |
| WS        | 7                 | 87.5| 1      | 12.5 |
| RMC       | 8                 | 100 | -      | -    |

The evaluation results show school preparedness is in the “low” category in the policy parameters with an index value of 19, emergency planning with an index value of 22, disaster warning system with an index value of 23 and resource mobilization capacity with an index value of 19. Therefore, it can be concluded that school preparedness for the earthquake and tsunami disaster is in the “medium” category with an index value of 20.50.

3.2. The teacher preparedness

The results of the teacher preparedness evaluation for the earthquake and tsunami disaster in 79 teachers from 8 elementary schools in Aceh Besar District can be seen in the figure below.

Figure 2. The teacher preparedness index
Table 2. The percentage of teacher preparedness parameters

| Parameter | Low | Medium | High |
|-----------|-----|--------|------|
| KAP       | 5   | 33     | 41   |
| EP        | 24  | 31     | 24   |
| WS        | 28  | 24     | 27   |
| RMC       | 79  | -      | -    |

The evaluation results show teacher preparedness in the "medium" category in three parameters, such as: Knowledge (77.77) index value, emergency planning (66.21) and disaster warning system (64.48). However, it was in the "low" category on resource mobilization capacity parameters with an index value of 38.69. The study concluded the teacher preparedness for the earthquake and tsunami disaster is in the "medium" category with an index value of 61.79.

3.3. The student preparedness

The results of the student preparedness evaluation for the earthquake and tsunami disaster in 255 students in 8 elementary schools in Aceh Besar District can be seen in the figure below.

Figure 3. The student preparedness index
Table 3. The percentage of student preparedness parameters

| Parameter | Low       | Medium    | High       |
|-----------|-----------|-----------|------------|
|           | Number    | Number    | Number     |
|           | Of Students | % of Schools | % of Schools | %          |
| K         | 83        | 32.5      | 145        | 56.9       | 27         | 10.6       |
| EP        | 95        | 37.3      | 127        | 49.8       | 33         | 12.9       |
| WS        | 182       | 71.4      | 58         | 22.7       | 15         | 5.9        |
| RMC       | 151       | 59.2      | 87         | 34.1       | 17         | 6.7        |
| Student Preparedness | 140 | 54.9 | 104 | 40.8 | 11 | 4.3 |

The evaluation results show student preparedness in terms of the knowledge parameter was in the "medium" category with index value (61.61) and disaster emergency planning (57.97). However, the disaster warning system parameter was in the "low" category (46.56) and resource mobilization capacity (42.35). Thus, the study concluded that student preparedness for the earthquake and tsunami disaster is in the "low" category with an index value of 52.12.

3.4. The school community preparedness (SCP)
The results of the school community preparedness evaluation in 8 elementary schools in Peukan Bada Aceh Besar described in the figure below.

![SCP](image)

Figure 4. The school community preparedness index
Table 4. The percentage of school community preparedness parameters

| Parameter | Low | Medium | High |
|-----------|-----|--------|------|
|           | Number of Teachers | % | Number of Teachers | % | Number of Teachers | % |
| School    | 8 | 100 | - | - | - | - |
| Teacher   | 24 | 30.4 | 51 | 64.6 | 4 | 5.1 |
| Student   | 140 | 54.9 | 104 | 40.8 | 11 | 4.3 |

The evaluation results show that the preparedness of the school community was in the "low" category in the policy parameters with index value of 19. Disaster emergency planning (48.73), disaster warning system (44.68) and resource mobilization capacity (33.35). However, the knowledge parameter was in the "medium" category with the index value of 69.69. The study concluded that the school community preparedness for the earthquake and tsunami disaster is in the "low" category with an index value of 43,09.

From the results of the windshield survey at eight elementary schools in the Peukan Bada showed that all the schools did not have the evacuation route mark and disaster gathering point. In addition, there were no banners or posters related to earthquake and tsunami disaster preparedness. This result was in contrast with the interviews with the stakeholder of community health center and schools’ principals about the earthquake and tsunami preparedness.

The interviews with stakeholders in the community health center found that the disaster preparedness program at had not optimally implemented. Whereas disaster preparedness was very important since the location of the community health center was in the coastal area and prone to earthquakes and tsunamis. The monitoring and evaluation of the disaster preparedness program at the community health center should be conducted in order to perceived some barriers and challenges in running the disaster preparedness program. The community health center has never provided disaster-related promotive and preventive services to the elementary school children; since officers in charge of the disaster preparedness at the community health center have never been trained to make programs. Therefore, most of them had lack of knowledge in commencing promotive and preventive efforts towards disaster preparedness. For this reason, the head of the community health center felt that it was better for the officers whom responsible for disaster preparedness programs to be trained in order to establish and implement the programs based on the guidelines on disaster preparedness.

From the results of the interviews with all eight school principals found that all schools did not have the disaster preparedness program. Therefore, some teachers delivered the knowledge about earthquake and tsunami disasters to students according to their abilities, despite the implementation of the programmes was inadequate and unstructured. To this point, the schools did not have any guideline on the implementation of the earthquake and tsunami preparedness program. Nevertheless, before 2010 many government and non-government institutions visit the school regarding the disaster preparedness. However, none of them conducted or following up any plans for disaster preparedness program sustainability. According to the school principals, the schools were ready to implement disaster preparedness programs under the programmes’ guidance to school institutions, teachers and students. Based on the interview it was obtained about the obstacles affecting the implementation of disaster preparedness programs in schools, such as the absence of good cross-
program and cross-sectoral collaboration with related sections. In the future, the authorities need to facilitate good cooperation between cross-programs and cross-sectors.

Besides establishing cross-program and cross-sectoral cooperation, it is necessary to manage education that emphasizes school independence and creativity in order to improve earthquake and tsunami disaster preparedness in schools. The innovative learning strategies was one of the strategies which emphasize on actively involving students' participation in disaster preparedness program.

4. Discussion

4.1. The school preparedness

The result showed that school preparedness for the earthquake and tsunami disaster was in the "low" category. These results identified the school institutions categorized as "unprepared" to deal with the earthquake and tsunami disasters. Based on the 2013 Aceh earthquake and tsunami risk map, 100% of elementary schools in Peukan Bada are in the red zone of the earthquake and tsunami disaster prone area. Therefore, it is necessary to strengthen school capacity to support teachers and students’ preparedness in improving earthquake and tsunami disaster preparedness through School-Based Management [3].[13] also strongly recommends reactivating disaster preparedness which supported by the local government policies to ensure the implementation of preparedness throughout the schools. Moreover, according to [14] realizing the importance of disaster safe education unit, it is necessary for the schools to undertake disaster resilient education efforts through the pillars of safe school facilities. The activities include the placement of school locations in disaster safe areas with the design of school buildings in accordance with the building rules and standards. In addition, these efforts must also be accompanied by the support of education sector policies and planning also local disaster management plans [14].

4.2. The teacher preparedness

From the study result showed that the teacher preparedness for the earthquake and tsunami disaster was in the "medium" category. These results identified teachers as "almost ready" to face the earthquake and tsunami disasters based on 3 parameters; such as knowledge, emergency response plans and disaster warning systems. While the resource mobilization parameters of all teachers were in "unprepared" condition. The teacher is the biggest source of information for the students to obtain knowledge of the earthquake and tsunami disasters in schools. If teacher resource mobilization is ready, the teacher will understand and be able to convey information about the earthquake and tsunami disaster preparedness to the school community. In accordance with the results of the research conducted by [15] showing the higher the knowledge of psychosocial disaster preparedness of the teachers, the better the knowledge of children who learn from them. In order to improve the resource mobilization, teachers need to be provided the education, trainings and workshops in order to be capable in simulating the earthquake and tsunami disasters in the schools also to strengthen the other 3 parameters. Thus, the high disaster preparedness could be achieved.

4.3. The student preparedness

The result of the study identified the students’ preparedness for the earthquake and tsunami disaster was in the "low" category. This result identifies students as "unprepared" in facing the earthquake and tsunami disasters. The children are vulnerable group to the earthquake and tsunami disasters [16]. Most children also spend of their time in the schools; therefore, they need to be assured to be always ready to face the earthquake and tsunami disasters. To understand the disaster-resilient, education need to be implemented in comprehensive efforts which is child-centered. Understanding the children specific needs in dealing with disasters is important, by actively engaging the children according to their capacities and interests [14]. This opinion is in accordance with the results of research by [17] which provides strong empirical evidence that education shows positive externalities to disaster risk reduction. [18] also found that knowledge and information received will be processed to produce a decision to act towards disasters.
4.4. The school community preparedness

The result of the study showed that the school community's preparedness for the earthquake and tsunami disasters was in the "low" category. This result identified the school community as "unprepared" to face the earthquake and tsunami disaster. Disaster events are unpredictable and can occur during the school hours. Therefore, it is necessary to develop a school institutional capacity to improve the preparedness through the School-Based Management (SBM). Thus, the schools are expected to have continuous independence in order to ensure sustainability of programs that aim to increase resilience to earthquake and tsunami disasters in schools and communities [3]. This opinion is also supported by the research conducted by [19], that school-based disaster management can facilitate the schools to regularly check and verify various disaster management tasks and to improve their ability to disaster preparedness.

5. Conclusion

The study showed that the school and student preparedness were in a low category, while teachers were in the medium category. This condition affected the preparedness of the school community in the Peukan Bada as in the low category. This conditions needs to be anticipated by various efforts to improve the preparedness that aimed at children, teachers, school administrators and other relevant parties.

The improvement of children's preparedness to deal with the disasters could be conducted by improving the ability of children to make decisions and followed by disaster education in schools in a sustainable manner. Decision-making ability in children is very necessary since the children are vulnerable groups. Therefore, the need to educated in order take appropriate action towards disasters. These efforts could be achieved by incorporating disaster preparedness education into formal and informal education; thus, disaster education will be sustainable. Sustainable disaster education is considered essential and very effective also dynamic information transfer strategy. To ensure the sustainability of disaster education, the role of teachers, principals and related parties will be needed optimally. With the active role of all parties, it is expected that the disaster preparedness of the school community will be improved. Therefore, the disaster impact will be reduced in the event of disasters.

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