Development of OrSAEv Model Learning Materials to Strengthen the Characters of Tsunami Disaster Mitigation for Middle School Students (Preliminary Study)

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Abstract. Geologically, Indonesia is a disaster-prone country, especially tsunami. One strategic step that can be taken to minimize the impact of the tsunami is through the education sector as the fundamental sector forming student character. Therefore, this research is aimed to determine the process of strengthening students' character about earthquake and tsunami disaster mitigation, to find out the experiences of students facing earthquake and tsunami disasters and to find out the disaster learning that has been implemented in schools. This research belongs to a quantitative descriptive type of research. The subjects of this research were 30 students of ninth grade at Donomulyo 1 Public Middle School. The process of collecting the data was done by giving questionnaires and doing interviews. Questionnaires were given to students in the form of questionnaires about strengthening the character of earthquake and tsunami disaster mitigation, and questionnaires about students' experiences in dealing with tsunami disasters related to learning in class, then interviews were conducted with two science teachers at the school. Samples were taken through the process of purposive sampling which was based on input from science teachers at Donomulyo 1 Public Middle School. Based on the results of the data in related to the analysis and discussion that have been conducted, it can be concluded that there are contradictory results. Where based on the questionnaire is obtained that the character of tsunami disaster mitigation in Donomulyo 1 Public Middle School students is good. However based on the results of interviews with two science teachers and questionnaires how students facing the tsunami and earthquake disasters, the results show that facilities, experience of facing the disasters and disaster learning in classroom are still lack of it. Therefore, it is necessary to test its application to find out whether the character is truly embedded within the students’ mind.

1. Introduction
Disaster is a series of events that threaten and disrupt people’s lives and livelihood caused by natural and/or non-natural factors as well as the human factor, resulting in casualties, environmental damage, property loss, and psychological impacts [1]. Indonesia is ranked 7th as the most vulnerable to natural disaster risk [2].

Geologically, Indonesia is a meeting point of three active tectonic plates namely the Indo-Australian, the Eurasian, and the Pacific plates. Based on the perspective of geography, geology, climatology, and demography. Therefore, Indonesia has various disaster threats that can occur at any time.

Indonesia is referred to as an archipelago because it consists of thousands of islands stretching from Sabang to Merauke. Since Indonesia consists of islands, it is also prone to tsunamis. Tsunami is a very large ocean wave produced by changes in the vertical mass of water and is caused by a sudden
disturbance of the water mass in the deep sea [3]. Tsunamis with large casualties were those that occurred in Aceh in 2004 and Palu in 2018. The earthquake that resulted in a tsunami caused a lot of casualties and losses in the economic field.

Besides in Aceh, the area prone to tsunamis in Indonesia is the southern coast of Java [4]. The area is directly adjacent to the Indian Ocean so that it is potentially affected by the tsunami. There are 5744 villages in Indonesia in the tsunami-prone areas, where Donomulyo sub-district, South Malang, is in the list of villages mentioned [5]. As a sub-district directly adjacent to the southern coast of Java island, Donomulyo has several beaches. Six out of ten villages in this sub-district have a coastline area. Starting from Jonggring Saloka Beach in Mentaraman Village, Ngliyep Beach and Nglurung Beach in Kedungsalam Village, and Modongan Beach in Sumberoto Village.

The most deaths from tsunami in Indonesia are due to people’s unpreparedness towards the arrival of tsunami, the short distance between wave generation areas and settlements, the absence of early warnings, insufficient infrastructure for evacuation, and low residential areas to the sea level so that the tsunami travels far enough to the mainland [6]. The key to dealing with problems caused by tsunamis is providing knowledge to the public about the importance of tsunami disaster mitigation. Mitigation is an action taken to reduce the impact caused by a disaster [7]. In addition, at present, the government has implemented a program to improve the quality of education in accordance with that has been formulated in the national education objectives set out in the Constitution No. 31 of 1945, article 1 which states that “Every citizen has the right to education.” One of the quality issues of Indonesian education is about the education of disaster mitigation.

Based on the cases of natural disasters that are prone to occur in Indonesia, the serious handling from various parties and pragmatic strategies in shaping Indonesian people to be aware of the dangers of natural disasters are very necessary. One strategic step that can be taken is through the education sector as the fundamental sector in forming student character [8]. Through the education sector, knowledge about disaster mitigation can be provided intensively by educators. Disaster education is one of the efforts to increase the students’ knowledge capacity about disasters covering the definition of the disaster itself, types, signs and impacts of disaster, pre-during-post disaster efforts and efforts to reduce disaster risk and vulnerability, as well as disaster vulnerability in the area [9]. The 2013 curriculum developed by the government appears to have been based on awareness so that students in Indonesia recognize the disaster potential. This is especially evident in natural sciences subjects for Junior High level (SMP/MTs). This shows how important disaster mitigation education is in Indonesia. Disaster mitigation education taught in schools will shape the students’ character who are prepared for every disaster that occurs. The ability of students to understand the potential of disasters that are located around their homes (local area) is very important, knowledge and skills become information that is very helpful when a disaster occurs in anticipation of early attitudes and values that encourage students to act prosaically, responsible and responsive when family and community are threatened [10]. The preparedness will be formed if students have a provision in terms of knowledge and disaster mitigation skills that can be embedded in the school environment in Indonesia in learning activities.

However, in reality, it is very rare for basic competencies provided into good, appropriate, interesting, enjoyable, and beneficial learning plans and practices for students. Most learning processes seem to rely more on text from books and student workbook which is practical to provide material summaries and practice questions. Not many take the initiative to develop real contextual learning. Therefore, innovative models and learning tools are needed specifically to strengthen the mitigation disaster character, especially the tsunami disaster for students. Learning model is a holistic approach in planning learning with its attributes including the theoretical framework, orientation towards the materials learned, and procedures [11]. A suitable learning model to strengthen the character of disaster mitigation in students is the OrSAlE (Orientasi, Siap Siaga, Aksi, dan Evaluasi--Orientation, Preparedness, Action, and Evaluation). The instructional impact of the OrSAlE learning model is to improve disaster preparedness, especially knowledge on the disaster, disaster response attitudes, and post-disaster evacuation skills. The accompanying impact of the OrSAlE learning model is to increase awareness and motivation towards the environment and nature in Indonesia in particular [12].

Based on the description above, this research is aimed to determine the process of strengthening students’ character about earthquake and tsunami disaster mitigation, to find out the experiences of
students facing earthquake and tsunami disasters and to find out the disaster learning that has been implemented in schools. The researchers will conduct research under the title of Development of OrSAEv Model Learning Materials to Strengthen the Characters of Tsunami Disaster Mitigation for Middle School Students.

2. Research Method
This quantitative research was conducted at Donomulyo 1 Public Middle School on July 17th, 2019. Donomulyo 1 Public Middle School is surrounded by several beaches, these are 12 km from Jonggring Saloka Beach in Mentaraman Village, 16 km from Ngliyep Beach, 12 km from Nglurung Beach in Kedungsalam Village, and 14 km from Modangan Beach in Sumberoto Village. This research is carried out development research. The development plan that will be carried out is to develop learning materials in the form of syllabus, lesson plan, handout, worksheet and disaster character assessment.

Methods of data collection in this research were questionnaire and interview methods. The instruments that used in this research are (1) questionnaire about strengthening the characteristics of earthquake and tsunami disaster mitigation (2) questionnaire about students’ experiences in facing tsunami disasters and classroom learning refer to the standard earthquake procedures issued by FEMA (Federal Emergency Management Agency) and disaster guidebooks published by the volcanology center and Geological Disaster mitigation. (3) interview sheet for the teacher.

Purposive sampling technique was used during the assessment of Donomulyo 1 Public Middle School teachers in which the samples of this research were 30 graders from 9A class in the education year of 2019/2020. Data analysis carried out was univariate analysis. Univariate analysis was carried out on the variables used in this research. The purpose of this analysis is to see an overview of the frequency distribution of each variable studied. The results of the analysis will be presented in the form of a frequency distribution table. Interpretation of the level of student character regarding earthquake and tsunami disaster mitigation according to Arikunto, character is divided into 3 categories, namely (1) Good = If the subject is able to answer 76% -100% correctly of all questions (2) Enough = If the subject is able to answer correctly 56% -75% of all questions (3) Less = If the subject is able to answer correctly 40% -55% of all questions [13].

This research is conducted by two different activities continuously, first is preliminary research to determine the students’ character in facing tsunami disaster in Donomulyo 1 Public Middle School. The next stage of research is to develop disaster learning materials based on the 4D development method by Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel in 1974. Advanced development research is carried out in four-phase, namely: namely define, design, develop, and disseminate [14]. The disseminate phase aims to implement the materials, find out the effectiveness of the materials, and obtain proven learning materials. Please follow these instructions as carefully as possible so all articles within a conference have the same style to the title page. This paragraph follows a section title so it should not be indented.

3. Result and Discussion
The result contains questionnaire percentage answers about strengthening the character of earthquake and tsunami disaster mitigation table, questionnaire percentage answers for students' experiences in facing earthquake and tsunami disasters and classroom learning table, and interviews’ result with teachers.

3.1 Result of questionnaire about strengthening the characteristics of earthquake and tsunami disaster mitigation
This questionnaire contains eight questions in five indicators of characters with multiple choice answer type. The result is presented in Table 1.
Table 1. Questionnaire Percentage Answers About Strengthening
The Character of Earthquake and Tsunami Disaster Mitigation

| Character’s Indicators | Questions                                                                                         | Percentage Answers |
|------------------------|---------------------------------------------------------------------------------------------------|---------------------|
|                        |                                                                                                   | Correct (n=30) %    | Incorrect (n=30) % |
| **Caring**             | 1. When in class and an earthquake occurs, what we should do with friends who are around us is ... | 93.3                | 6.7                |
|                        | 2. After knowing what we have to do when a tsunami occurs, what we should do is ...                | 93.3                | 6.7                |
| **Religious**          | 3. Earthquake and tsunami disasters can occur at any time especially in areas close to the coast, as humans, we should... | 100                 | 0                  |
| **Orderly**            | 4. When the sirens sound a sign of an earthquake and tsunami, what must be done is ...              | 80                  | 20                 |
|                        | 5. The action that must be taken before a tsunami occurs is ...                                       | 60                  | 40                 |
|                        | 6. When on the beach and an earthquake occurs, the action that should be taken is ...               | 70                  | 30                 |
|                        | 7. As a student, what needs to be prepared to deal with a tsunami disaster that can come at any time is ... | 100                 | 0                  |
| **Alert**              | 8. After the tsunami was declared safe by the BMKG, what must be done with damaged objects is ...   | 80                  | 20                 |
| **Love cleanliness and environment** |                                                                                                       | Averages            |                     |
|                        |                                                                                                   | 81.7                | 18.3               |

It is known that 30 students were taken as the sample for tsunami mitigation character questionnaires. Tsunami mitigation character indicators include caring, religious, orderly, stay alert, and love cleanliness and environment. Based on the above data, the average percentage of strengthening the tsunami mitigation character of students is 81.7% in the strong or good category according to Arikunto. In detail, it can be explained that in the caring indicator, there are 28 students who answered correctly with the percentage of 93.3% on both questions. On the religious indicators, all students answered correctly with the percentage of 100%. On the orderly indicator, there were 24 students who answered correctly with the percentage of 80%. On the stay alert indicator, where there are three questions, the first question related to actions that must be taken before the tsunami is only 18 students who answered correctly with the percentage of 70%, namely determining the closest evacuation route from the house to the evacuation site. C's answer choice is to take refuge in the house. In the second question, related to the actions that should be taken while on the beach and an earthquake, there were 21 students answered correctly with the percentage of 70%, which was immediately heading to a high place, the
rest mostly chose to wait until the tsunami incident was announced. In the third question, all students answered correctly about the things that are needed to be prepared in the face of the tsunami. In the last indicator, which is love of cleanliness and environment, there are 24 students correctly answered with the percentage of 80%. These results are theoretical results, while characters are derived from the results of learning directly or observing others. Direct learning can be in the form of lectures and discussions about character, while observations are obtained through daily experience what is seen in the environment and related to attitudes and values [15]. So the above theoretical results need to be tested for application to find out whether the character is truly embedded within the students’ mind.

3.2 Result of questionnaire about students' experiences in facing earthquake and tsunami disasters and classroom learning

This questionnaire contains twenty questions with yes or no answers. The result is presented in Table 2.

| Questions                                                                 | Yes (n=30) % | No (n=30) % |
|---------------------------------------------------------------------------|--------------|-------------|
| Has it ever been felt an earthquake when a school?                        | 100          | 0           |
| Have you ever been warned by the teacher to always get closer to God because a disaster can happen anytime? | 100          | 0           |
| Does your teacher warn you to help and care for each other in the event of a disaster? | 100          | 0           |
| Have you ever been explained about the character (caring, religious, orderly, stay alert, hygiene and environment) regarding things before, during and after a disaster occur? | 40           | 60          |
| Can an earthquake not be predicted when it will occur?                    | 100          | 0           |
| Have you ever learned about the earthquake and tsunami disaster at school? | 46.7         | 53.3        |
| Are there school subjects’ specifically discussing about disaster?         | 46.7         | 53.3        |
| Have disaster management skills been carried out during the teaching and learning process? | 0            | 100         |
| Has your school ever conducted a tsunami disaster mitigation simulation training conducted by the school? | 0            | 100         |
| Do you have medicines and first aid kits at your school?                  | 100          | 0           |
| Do you know of the existence of equipment/equipment for first aid for disasters, such as first aid kits or medicines, other stretchers at school? | 50           | 50          |
| Do you have a disaster evacuation route in your school?                   | 0            | 100         |
| Are there in your school students who are members of the PMR (Red Cross volunteers) who are trained in disaster management? | 80           | 20          |
| Do you have books, VCDs, or posters about disaster in the school especially about earthquakes and tsunamis? Does your school have a disaster warning system? | 0            | 100         |
Based on the data above especially from question number 1 and 2, it is shown that students realize if their school belongs to a disaster-prone school. From question number 3, 4, 5 and 17, it is shown that students theoretically have strong character of disaster mitigation. Question number 6 to 20 showed that the level of disaster preparedness at Donomulyo 1 Public Middle School is still very low. This can be seen from the answers of each student, which there are still students who feel they have never learned about the earthquake and tsunami disaster, and have never been done and provided facilities to face the disasters. There are some reasons why it can be happened, first because there is no proper learning material for disaster mitigation. Second, the lack of support from the government to conduct counselling related to disaster mitigation. Third, there are no facilities such as disaster mitigation book, poster, evacuation route that provide to support disaster mitigation education. In its implementation, disaster mitigation education can’t be done only by one side. To make the people develop a conscience about disaster mitigation and gain a culture for disaster prevention and preparedness, what to be needed is to provide nation-wide policies and determinism to execute these policies. So, the government, the social institutions, the schools, and the people, in general, should work together collaboratively and incessantly, to be successful in the long run [16].

3.3 Result of Interview with the teachers

3.3.1 Result of Interview with the teacher 1
Teacher 1 has taught at Donomulyo Middle School 1 for 22 years and she is a science teacher. During the interview, it was explained that the disaster that often happened at Donomulyo 1 Public Middle School was earthquake and landslide. The most recent disaster occurred was an earthquake on July 15th, 2019 at around 8:00 a.m., when the learning took place. It was also said that there were no signs of the earthquake happened. Apart from that, there was no loss whatsoever other than the time of the lesson taken. Teacher 1 said that previously there had never been counselling or socialization related to any disaster mitigation as a whole. Socialization is only obtained by students who take PMR extracurricular activities. In addition, he explained that there were no disaster evacuation routes in the school, so when an earthquake occurred the teachers instructed students to move to a safer place. Regarding learning in class, it was explained that there was indeed Basic Competence related to disaster mitigation in seventh grade, but in the process of learning the material was only delivered by the lecturing method.

3.3.2 Result of Interview with the teacher 2
The second teacher interviewed was also a science subject teacher. As far as 26 years the teacher has been teaching at Donomulyo 1 Public Middle School, there had never been a tsunami and it was assumed that there would not be a tsunami in the school because the location of the school was on a hill. It was also explained that natural disaster that often occurs as earthquakes and landslides. The most recent occurrence was an earthquake on July 15th, 2019, at which time the learning process took place around 8:00 a.m. At that moment teachers were inviting all students to leave their respective classes and move to a field near the school. Because the strength of the earthquake at that time was not quite strong, he said that there was no damage whatsoever in the school. Previously, at Donomulyo 1 Public Middle
School there had never been any socialization related to disaster mitigation from the SAR Team or others. It was known that only students who took extracurricular activities from PMR and Scouts were given training related to disaster mitigation by their respective supervisors. Regarding disaster mitigation learning in the classroom, it was explained that there were indeed Basic Competencies related to disaster mitigation in grade 7, but in the process of learning the material was only delivered by the lecturing method and based on the questions in the workbook.

From the results of interviews conducted with two science teachers at Donomulyo 1 Public Middle School, it was found that there was a lack of awareness regarding the potential of the area there for the tsunami. This is quite reasonable because the location of the school is on a hill while the location of the nearest beach which was Ngliyep located below the hill. They only understand that the disasters that are likely to occur there are earthquakes and landslides, even though the location of the school is surrounded by four beaches. During the earthquake on July 15th, 2019, the students’ condition was not conducive because the number of teachers was not comparable to the number of students. The students should first be given insight into disaster mitigation so that they can save themselves and can help their friends who have difficulty in the process of evacuation. In addition, there should be an evacuation route so students do not need to wait for teacher instructions when earthquake and tsunami disaster suddenly occur. In the learning process, it is better if the material on disaster mitigation is not only delivered by the lecture method and working on the questions, but also by showing them ways to deal with disasters when suddenly coming in the form of posters and simulating evacuation activities for earthquake and tsunami. It happens because there is no effective learning material to support learning process. However, learning material provides the much needed sensory experiences needed by the learners for an effective and meaningful behavioural change [17]. In addition, so far there has never been a government in providing counselling related to disaster mitigation in schools. So, the character of disaster mitigation and experience of students in dealing with earthquakes and tsunamis as well as tsunami disaster learning that has been implemented in schools is still very lacking.

4. Conclusion
Based on the results of the data in related to the analysis and discussion that have been conducted, it can be concluded that there are contradictory results. Where based on the questionnaire is obtained that the character of tsunami disaster mitigation in Donomulyo 1 Public Middle School students is good. However based on the results of interviews with two science teachers and questionnaires how students facing the tsunami and earthquake disasters, the results show that facilities, experience of facing the disasters and disaster learning in classroom are still lack of it. Therefore, it is necessary to test its application to find out whether the character is truly embedded within the students’ mind.

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