

Artikel JPCS-Q 2019b

by Munasir Nasir

Submission date: 21-Jan-2020 02:20PM (UTC+0700)

Submission ID: 1244351404

File name: 9-Elfiana_2019_J._Phys.__Conf._Ser._1417_012083.pdf (811.58K)

Word count: 4249

Character count: 22767

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To cite this article: D E Elfiana *et al* 2019 *J. Phys.: Conf. Ser.* **1417** 012083View the [article online](#) for updates and enhancements.**IOP | ebooks™**

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Development of The OrSAEv Learning Materials: Preliminary Study of Student's Knowledge about Earthquake and Tsunami Mitigation

D E Elfiana¹, Madlazim^{1,*}, E Hariyono¹ and Munasir¹

¹ Postgraduate, Universitas Negeri Surabaya, Indonesia.

*The corresponding author: madlazim@unesa.ac.id

Abstract. Geologically, Indonesia is a disaster-prone country, especially tsunami. As a country has kind of disaster and so in the schools of Indonesia should be started to give education of hazard. Therefore, this study aims to determine the level of student knowledge about the earthquake and tsunami disasters, know the experience of students facing earthquake and tsunami disasters, and determine the conditions of counseling and disaster learning that have been applied in school. This type of research is a quantitative descriptive. The subjects of this study were 28 students of MTsN 7 Blitar. Data collection techniques carried out by observation, tests, and questionnaires. The sample of respondents was taken by purposive sampling based on advice from the science teacher at MTsN 7 Blitar. The results of the study are as follows: 1) In terms of the level of student knowledge about the earthquake and tsunami disasters can be categorized as less. 2) student's experiences in facing with disasters and actions to save themselves in situations and conditions are categorized as not ready. 3) Disaster counseling and learning activities have never been carried out. After adding up the average percentage of each indicator, it is found that the knowledge and preparedness of the community in dealing with the earthquake and tsunami disaster based on their knowledge is still in the category of less prepared with a percentage of 47.9%, so there is still a need for better knowledge and readiness for students reach the level of full preparedness in the face of disaster. Learning methods and materials are needed that can be used to increase student knowledge about earthquake and tsunami mitigations. Therefore, it can be concluded that disaster learning materials need to be developed.

1. Introduction

Disasters according to UU No 24 Tahun 2007 are "events or series of events that threaten and disrupt human life caused by natural and / or non-natural factors as well as human factors that cause loss of human life, environmental damage, property loss, and psychological impact" [1]. Disaster is a serious disruption to society that results in losses to humans, material, economic, or the environment that exceeds beyond the ability of affected communities to cope with their own resources [2]. Disasters can be in the form of earthquakes, tsunamis, volcanic eruptions, floods, droughts, hurricanes and landslides [3]. Based on these definitions it can be concluded that a disaster is an event that harms humans whether caused by natural factors or human factors themselves.

Indonesia is one of the countries with the highest threat of natural disasters in the world. Horrible disasters, such as earthquakes and tsunamis seem to be 'very familiar' with life in Indonesia in recent times [4]. This is due to Indonesia's geographical position located at the end of the movement of three world plates, namely Eurasia, Indo-Australia, and the Pacific. In this condition, Indonesia cannot escape from the disaster that has befallen [4]. A total of 8 regencies in East Java are prone to tsunami disasters



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that stretch in the southern lane of East Java. The 8 regencies include Banyuwangi, Jember, Lumajang, Malang, Blitar, Tulungagung, Trenggalek, and Pacitan. Blitar Regency is located on the southern coast of Java and has a vast stretch of beach. These areas are located in the hills and prone to landslides.

One of the schools located in disaster-prone areas in Blitar District is MTsN 7 Blitar or commonly known as MTsN Mojorejo located in Wates sub-district which is an area close to Jolosutro beach and 3 other beaches. Disaster mitigation learning materials seem very urgent in Indonesia, and specifically in Blitar district. The reason is that there have been several natural disasters, such as earthquakes, landslides, tornadoes, floods, and tidal waves.

Mitigation includes protection activities and actions that can be started from the preparation before the disaster takes place, assessing the danger of disaster, disaster management in the form of rescue, rehabilitation, and relocation. Knowledge, understanding, and behavioral skills in preventing, detecting, anticipating disasters effectively can be transformed and socialized [5]. Early childhood socialization and types of lessons that touch directly on natural phenomena, such as science. Provision of knowledge and life skills needed by students, especially early classes so that when a disaster occurs students can make efforts to save themselves and can also help others [6]. But the problem that arises is that the Indonesian people still do not have a high enough level of awareness of the disaster. Lack of awareness can increase community risk against disaster threats [7]. 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.

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 process 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 the real contextual learning. Therefore, innovative models and learning tools are needed specifically to strengthen the mitigation disaster character, especially the tsunami disaster for students.

Disaster mitigation learning model is learning that operates using the flow: (1) preparation before the disaster takes place, (2) assessing the danger of disaster, (3) disaster management, such as rescue, rehabilitation and relocation, (4) providing knowledge, understanding and behavioral skills in preventing, (5) detection and anticipation of disasters effectively can be transformed, and (6) socialization [8]. A suitable learning model to improve the knowledge of disaster mitigation in students is the OrSAEv (Orientasi, Siap Siaga, Aksi, dan Evaluasi/Orientation, Preparedness, Action, and Evaluation). The first stage, Orientation (Or) aims to attract students' interests, focus students' attention, and motivate them to play an active role in the learning process. The second stage, Disaster Preparedness (S), conceptual learning is carried out to provide basic knowledge about the disaster. This basic knowledge of disaster includes knowledge of potential disaster threats, vulnerabilities, capacities, and disaster risks. The third stage, Action (A) is practical learning carried out with the intention that students can have skills in disaster. The fourth stage, Evaluation (Ev) aims to evaluate the disaster preparedness of students and prepare follow-up [9]. This OrSAEv learning integrates ICT in the learning process. This is based on a multi-representation theory which shows that students who are supported by multi-representation learning will be easier to master and improve learning outcomes [9].

Based on the above considerations, learning materials that support disaster learning are needed so that students' knowledge in dealing with disasters increases. To determine the level of knowledge and preparedness of students, prior to the development of the device, an analysis of the level of knowledge and preparedness of students in the face of disasters is carried out first. Therefore, the research was conducted "Development of OrSAEv Learning materials: Preliminary Study of Student's knowledge about earthquake and tsunami mitigation".

2. Research Method

This type of research is quantitative descriptive research. Methods of data collection in this study were interview methods, test methods, and questionnaire methods. The instruments used in collecting data in this study include (1) Knowledge and preparedness test sheets to deal with earthquake and tsunami

disasters. (2) Questionnaires of existing questionnaires 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.

The subjects of this study were 28 students in grade VII at MTsN 1 Blitar. Data analysis carried out was univariate analysis. Univariate analysis was carried out on the variables used in this study. 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 knowledge regarding earthquake and tsunami disaster mitigation according to Arikunto, knowledge 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 [10].

This research is conducted by two different activities continuously, first is a preliminary study to determine the level of knowledge about disaster mitigation in MTsN 7 Blitar. 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 (1974). Advanced development research is carried out in four stages, namely: namely define (definition), design (planning), develop (development), and disseminate [11]. The disseminate stage aims to implement the materials, find out the effectiveness of the materials, and obtain proven learning materials.

3. Result and Discussion

The results of this study aim to obtain an overview of students' knowledge and preparedness in dealing with the earthquake and tsunami disasters. The test sheet consisted of 20 questions about tsunami knowledge and preparedness. The questionnaire sheet was divided into 2 parts, the first was a questionnaire about the experiences during a disaster which consisted of 8 points and the second was a questionnaire about the condition of counseling and learning disaster. Interview sheet to find out the history of disasters that have occurred in the Wates sub-district, the conditions of counseling and disaster learning in school.

3.1 Result of interviews with teachers

3.1.1 Result of interviews with teachers 1

Teacher 1 is a science teacher at MTsN 7 Blitar who has been teaching for 23 years. The teacher said that in Blitar MTsN 7 there were frequent minor earthquakes and there was a strong earthquake around 2005 at 1 pm and caused damage to people's homes. "minor earthquakes occur frequently during lesson, It is not to cause harm in school but students panic during class". According to teacher 1 in disaster learning is usually taught with powerpoint media "for a rescue simulation when a disaster has never been done". Disaster specific learning materials do not yet exist. Disaster counseling has never been done. There is no evacuation route at the school, the school building consists of 2 floors but there is only one staircase

3.1.2 Result of interviews with teachers 2

Teacher 2 is the deputy head of the curriculum at MTsN 7 Blitar. Disasters that often occur in the Wates area are landslides and earthquakes. The earthquake did not cause damage and heavy losses. According to teacher 2 regarding disaster counseling it was stated that "there has never been a disaster counseling, the discourse is there but it has never been carried out. There was no encouragement from the government and the principal to specifically teach disaster.

From interviews conducted with 2 teachers in MTsN 7 Blitar, it is known that disaster counseling has never been done so there is no awareness in being alert to the possibility of a disaster. The absence of encouragement from the government or the school causes disaster-based learning to be carried out only briefly without the direct action of a disaster simulation. School facilities do not support disaster learning specifically, besides there is also no evacuation route in the school and there is only one stair so that at any time there is a disaster it will be difficult to evacuate students on the upper floors.

3.2 Level of student knowledge about earthquake and tsunami disasters

Based on data obtained from a knowledge test with 20 questions given to 28 students of MTsN 7 Blitar. where junior high school student's knowledge about disaster preparedness is calculated based on the respondent's answer, if the wrong answer gets a value of 1 and if the correct answer gets a value of 2. The percentage of student's answers in answering earthquake and tsunami knowledge tests is presented in Table 1.

Table 1. Distribution of respondents answers according to knowledge test about the earthquake and tsunami in MTsN 7 Blitar

No	Questions of disaster knowledge	Student answers	
		True (n=28) %	False (n=28) %
1.	A series of events both caused by humans, nature and a combination of both that can cause casualties, property losses, and environmental damage are called ...	75	25
2.	Activities in the disaster management cycle in the pre-disaster phase are	57,1	42,9
3.	A series of efforts to reduce disaster risk, for example, the installation of a disaster warning system is a step ...	78,6	21,4
4.	Activities to find out the actions that are fast and appropriate in dealing with disasters in order to minimize losses due to disasters are...	64,3	35,7
5.	what causes earthquakes?	53,6	46,4
6.	What action is taken when an earthquake occurs?	64,3	35,7
7.	what salvation will be done when a tsunami strikes?	57,1	42,9
8.	When does a tsunami occur?	71,4	28,6
9.	Which are the main causes of the Tsunami	46,4	53,6
10.	The meaning of the word "Tsunami"	7,1	92,9
11.	The deadliest tsunami ever recorded	10,7	89,3
12.	What are the warning signs of the coming of the Tsunami	46,4	53,6
13.	Where is the most active Tsunami area?	17,9	82,1
14.	The Tsunami Sound is approaching...	46,4	53,6
15.	If an earthquake produces a Tsunami, what should you do	50	50
16.	What do you do if the seawater suddenly drops	39,3	60,7
17.	A place to save yourself in the event of an earthquake and tsunami	57,1	42,9
18.	Does every earthquake cause a tsunami	57,1	42,9
19.	Characteristics of a tsunami resistant building / house	21,4	78,6
20.	What will you do if an earthquake occurs and your position is in the room?	46,4	53,6
Average		47,9	52,1

The level of student knowledge about earthquake and tsunami disaster mitigation after adding the percentage of each question then divided by the number of questions obtained 47.9% results or in intervals of 3 categories of knowledge according to Arikunto, then expressed in the less category [10].

3.3 Students' experiences in facing earthquake and tsunami disasters.

To find out student's experiences in facing disasters, 8 questionnaire questions are presented in **Table 2**.

Table 2. Distribution of respondents according to the disaster experience of MTsN 7 Blitar students

No	Questions about the Experience of Earthquakes and Tsunamis	Student answers	
		Yes (n=28) %	No (n=28) %
1.	Have you ever experienced an earthquake	100	0
2.	Is your school close to the source of the disaster (beach/mountain)	100	0
3.	An earthquake that is felt to have a direct impact on yourself	85.7	14.3
4.	The earthquake that you feel, makes you introspective wherever you are	53.6	46.4
5.	Do you experience panic when you feel the earthquake?	60.7	39.3
6.	Because the direct impact that you feel is not too large, your attitude towards the recent earthquake has become normal.	35.7	53.6
7.	The earthquake event that you feel makes you want to dig more information about earthquake events and how to react to them	57.1	42.9
8.	Besides earthquakes, have there been other disasters (landslides, tsunamis)	85.7	14.3

From table 2 it is known that all respondents had felt the earthquake that occurred in their area. Even though the felt earthquake event did not have a large direct impact, it did have the panic effect of some respondents, with a percentage of 60.7%. This is in accordance with UU No 7 Tahun 2007 that disasters have psychological impacts [1]. In addition to the earthquake, in the sub-district of Wates, there were also landslides and large waves. Therefore knowledge and readiness are needed if at any time a disaster occurs. Because the direct impact that they feel is not too large, the attitude towards the recent earthquake has become normal. To make the people develop a conscience about disaster mitigation and gain a knowledge 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 [12].

3.4 The conditions of education and disaster learning in schools

In this questionnaire, six questions were given regarding counseling and learning about disaster mitigation in MTsN 7 Blitar which are presented in **Table 3**.

Table 3. Distribution of respondents' answers about counseling and student learning in MTsN 7 Blitar

No	Counseling and learning	Student answers	
		Yes (n=28) %	No (n=28) %
1.	Had received an earthquake counseling	0	100
2.	Had received a tsunami counseling	0	100
3.	Never been given learning about disaster mitigation	100	0
4.	Learning disaster mitigation is accompanied by simulation practices	100	0
5.	There is a specific book on disaster mitigation learning	78.6	21.4
6.	There is an evacuation route at school	100	0

Counseling about earthquake and tsunami disasters does not yet exist. According to 78.6% of students answered that there are no books and special learning of disaster mitigation learning, 21.4 students answered that the earthquake and tsunami disaster learning had been done, indicating that disaster learning had actually been carried out but because it was not accompanied by interesting learning so most did not leave an impression on the student's memory. Facilities that support disaster learning are also not yet in school. According to all school respondents, there was also no evacuation route, this was in accordance with what the teacher had stated in the interview.

The experience of an earthquake that does not cause a large loss makes the alert level is low. People tend to underestimate signs of disaster. In addition, there was no encouragement from the government and local agencies so that disaster preparedness education was considered unnecessary special learning. It has an impact on disaster mitigation knowledge of students who are still in the low category based on the disaster knowledge test. School community preparedness in reducing disaster risk is still at the stage of knowing rescue actions but not yet accompanied by skills so the action is needed in the form of simulations in dealing with disasters [13]. Simultaneous learning can increase student's enthusiasm for learning based on an interview with teachers.

Preparedness is strongly influenced by children's cognitive development, where children develop their thought processes so that initiatives arise in carrying out the skills taught and psychological development so that children are able to anticipate, identify and control themselves against actions that should be taken to be alert when disasters occur and increase awareness of others in facing disaster [14] [15]. Someone is said to be prepared to face a disaster if they have the knowledge in anticipating, responding to, and recovering effectively from the impacts of events or conditions of hazard that may be present, will soon or currently exist [16]. Seeing the reality of the importance of student knowledge in disaster mitigation, researchers increasingly believe that disaster mitigation education must be implemented as soon as possible. This is because MTsN 7 Blitar is at a radius of approximately 12 km from Jolosutro beach. The choice of learning model also greatly influences the condition of student's backgrounds and student's interest in learning [17]. While learning methods and learning resources also need to be developed to realize innovative learning. Students who receive disaster preparedness education have increased knowledge about disasters, mitigation actions, and emergency response. Disaster education in schools should be supported by appropriate learning materials [18]. With appropriate learning, methods can increase student enthusiasm so disaster preparedness can increase. Disaster preparedness increases with increasing knowledge of disasters, appropriate attitudes towards disasters and more appropriate actions in dealing with disasters [19]. The alignment of teacher interview answers and the results of student questionnaires about the conditions of disaster learning in school can formulate that the need for disaster learning is accompanied by appropriate learning models and accompanied by direct simulations in dealing with disasters, therefore the development of learning materials is needed to be developed.

4

4. Conclusion

Based on the results, analysis, and discussion it was found that knowledge about tsunami mitigation in MTsN 7 Blitar was still in the less category based on tests of knowledge about the tsunami and earthquake disasters that have been conducted. All of the respondents stated that they had felt an earthquake but had never felt a large impact. Disaster counseling at MTsN 7 Blitar has never been done. Learning methods and materials are needed that can be used to increase student knowledge about earthquakes and tsunamis and how to deal with them. Someone is said to be ready to face a disaster if they have the knowledge to anticipate, respond to, and recover effectively from the impacts of an event or condition of a hazard that may exist, will soon or currently exist. Therefore it can be concluded that the development of earthquake and tsunami disaster learning developed for science teachers and students needs to be developed.

Acknowledgments

The author would like to thank Prof. Dr. Madlazim. M.Si. for the support, advice, and inspiration in doing this research. Thanks to MTsN 7 Blitar (Blitar, Indonesia) for allowing us to conduct research, as well as and VII-B class students and teachers who have many roles in this research. Thanks to my sister Bethari Uswatul Isna for her help and support during the research.

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