

Constructing the Test for Describing the Students' Problem Solving Skill to Mitigate the Earthquake Disaster

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Abstract—A set of problem solving test had been constructed to describe the problem solving skill to mitigate the earthquake disaster emergency conditions of the junior high school in the coastal area of the city of Bengkulu. The method which is utilized in this study is R and D, quasi experimental was conducted to implement the instrument test. This study conducted to the junior high school students at coastal area of the city of Bengkulu. The number of defendants involved in the study is 36 students. The data was collected by implementing the problem solving questions to the respondent and by validating the content of the problem solving test by expert. The result indicates that the problem solving test that have been constructed is valid in terms of content. The result of implementing shows that the test is reliable with 0.76 of reliable score. The problem solving test is able to describe the students' problem solving skill that showed by ability to choose alternative problem solving and the ability to make mitigation procedures for emergency conditions of earthquake disasters. In conclusion, a set of problem solving test had been constructed and implemented. The test has ability to describe the students' the problem solving skill to mitigate the earthquake disaster emergency conditions.

Keywords—*instrument test; problem solving skill; mitigate skill; earthquake disaster*

I. INTRODUCTION

Bengkulu is geographically located at the confluence of tectonic plates. Bengkulu is prone to geographic disasters, especially earthquakes and tsunamis. Bengkulu passed by mountains that formed from subduction events between continental plates and oceanic plates. The plates are Indo-Australia plate that runs along the mountains of the Sumatera Island [1]. The meeting plates are becoming a major zone of natural disaster in the form of an earthquake that can cause a tsunami. Figure 1 show how the earthquake and a tsunami are made at the fault zone.

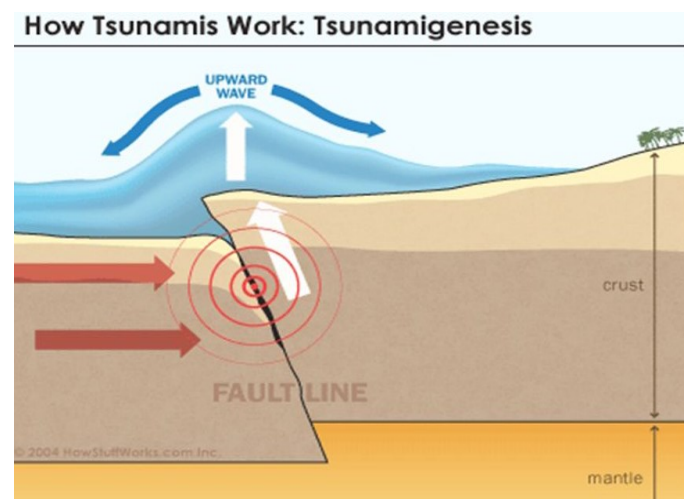


Fig. 1. How the earthquake and a tsunami made at the fault zone (source: geological mindset).

The earthquake and a tsunami disaster will cause damage and casualties. Based on data from the National Disaster Management Agency in 2013-2018, in Bengkulu recorded damage and 9464 people displaced by the earthquake, 48 people died, and 11 were injured. In addition there were damage to public facilities and other consequences caused. National Disaster Management Agency (BNPB) recorded that there had been various disasters in Indonesia [2]. It is such as graph data in Figure 2.

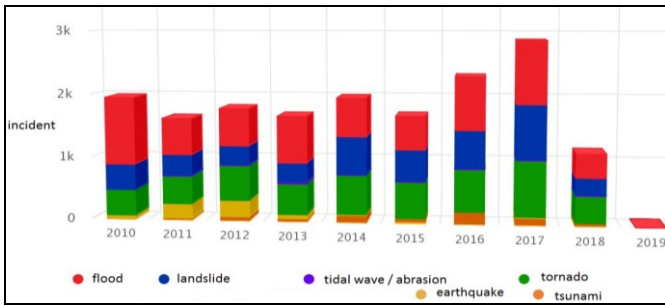


Fig. 2. The data of various disasters at Indonesia from 2010 to 2019.

In order to minimize the risk of disaster so it is necessary to develop a culture of disaster preparedness and awareness of natural disaster mitigation. Awareness of disaster mitigation needs to be instilled as early as possible to minimize victims due to natural disasters. Disaster preparedness and mitigation capabilities by secondary school students as agents of change need to be assessed. To assess their ability to take mitigation actions so it is necessary to develop a set of instruments based on problem solving capabilities in disaster emergency conditions. Mustari revealed that the level of socialization and high curiosity was found in junior high school children [3]. This school-age child is expected to be an agent of change in the surrounding environment to instill a culture of preparedness and mitigation of natural disasters. The complex and multidisciplinary nature of disaster management education is important [4-7]. Previous research has never reported on the development of instruments for assessing mitigation capabilities based-problem solving. This research aimed to construct the set of problem solving test had been constructed to describe the problem solving skill to mitigate the earthquake disaster emergency conditions. Constructed the instrument followed the R and D carryout by Borg and Gall. This instrument was implemented at the junior high school using a quasi-experimental with one group pre-test post-test design. The data was analyzed qualitatively and quantitatively.

II. EXPERIMENTAL METHOD

A. Research Design

This instrument was implemented at the junior high school using a quasi-experimental with one group pre-test post-test design. Constructed the instrument followed the R and D carryout by Borg and Gall. Design of a quasi-experimental in this study is shown in Figure 3.

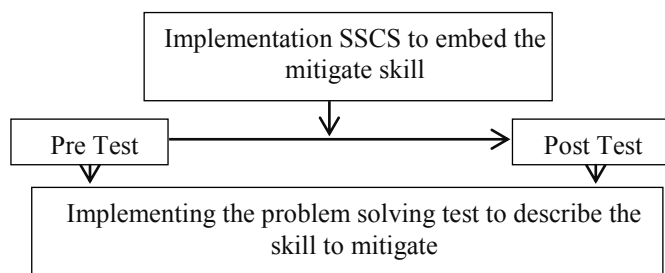


Fig. 3. One group pre-test post-test design used in study.

Quasi experimental with one group pre-test and post-test design was applied in this study. Indicators of ability to choose problem solving to carry out mitigation actions were implemented in this study.

B. Research Subject

36 junior high school students were involved in this study. It included 24 girls and 12 boys. Subject in this study is at junior high school around the coastal area of the city of Bengkulu.

C. Instrument Collecting Data

Data were collected by validating form of the instrument by expert and then implementing it to the 36 junior high school students. Validating includes content and editorial of the set of instrument that constructed.

D. Analysis Data

The data was analysis using both descriptive qualitatively and quantitatively. Data from expert validating and from implementing proses was analyzed and then perform inference.

III. RESULT AND DISCUSSION

This study created a set of instruments based on problem solving skill to measure students' ability to carry out mitigation actions in disaster emergency conditions. Indicator in this study was the ability to identify the alternative problem solving based on illustrations / cases given in the earthquake disaster to give the mitigation measures. The framework of instrument development follows the following picture at Figure 4.


Pay attention to the following situation during earthquake:	The illustration of the possible earthquake disaster conditions	expected answer : students are able to provide alternative problem solving which is a series of mitigation measures based on conditions that might occur during an earthquake
		
If we are on the road or driving Then an earthquake occurs so What are the rescue actions that can be taken? What are the actions that should be avoided?	Question based the illustration: actions to be taken and/or actions that must be avoided as a mitigation effort during an earthquake	

Fig. 4. The frame of the developing the instrument to assess the mitigate skill.

The illustrations of the situation at earthquake disaster are given to the student and then they are asked to make a series of mitigation procedures based on various situations. To answer

the question, student must analyze the problem based on illustration and take the alternative of the solution as a mitigation effort during an earthquake (as in the picture). Validating procedure involved experts to valid the instrument both content and editorial. Sample of the result from expert can be seen at Figure 5.

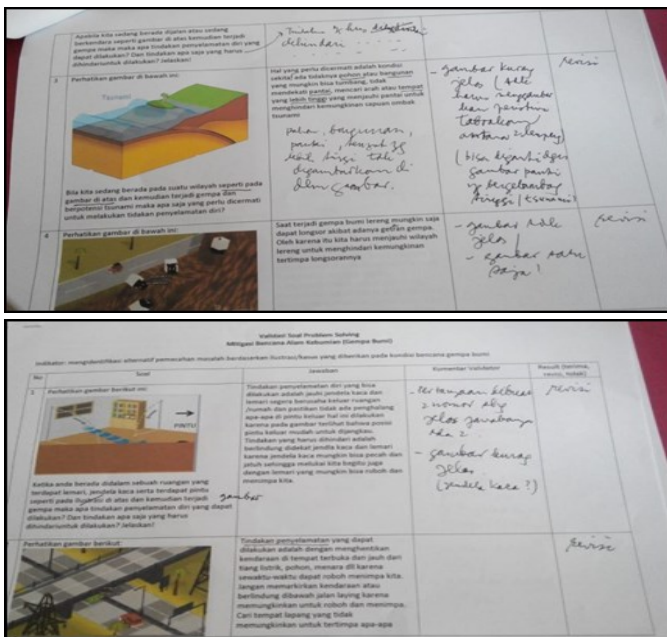


Fig. 5. Sample of expert suggestion at the validating process.

Based on the expert validating it could be concluded that the item of the test has good content validity and needed to revise for its editorial case. Reliability of the instrument to assess student problem solving skill to create the mitigation procedure were obtained by implementing this instrument to the 36 students. Result of implementing step showed that the test has good reliability with score 0.76. Implementing process can be seen at Figure 6.

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Fig. 6. Implementing process.

Indonesia is very prone to earthquakes disaster because it is geologically located at the meeting area of plates and faults. Fault exists along the west coast of the Sumatra Island. Movement of tectonic plates in the fault area produces earthquakes [8]. Geological conditions and earthquake events that occur in the fault area can be seen in Figure 7.

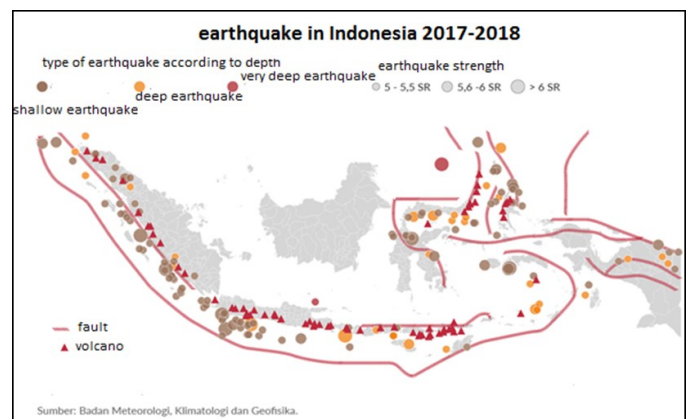


Fig. 7. Fault zone and earthquake during 2017-2018 in Indonesia (source: Meteorology and geophysics agency).

Figure 7 show that many earthquake had been happen around fault zone in Indonesia. Students must have the ability to mitigate by understanding these conditions. Instruments that have been developed can measure students' ability to make a mitigation procedure. Based on their answers, it can be seen that the mitigation procedures for each different condition when an earthquake occurs. Procedure mitigation indicates their problem solving at the disaster condition. Student's answer also indicates that the instrument can measure the students' ability to create the mitigation steps when earthquake disaster is happening. Students' understanding of earthquake

natural disasters and the mitigation procedures that can be carried out are also expected to get closer to the creator. They can understand that nature was created to be protected for the common good [9-12]. The results of the analysis show that the instruments that have been developed are valid and reliable. The result of this result can be used to construct the profile of student ability of creating the mitigation procedure at the natural disaster. It also can be the basis for further research related to the mitigation at the emergency situation of the natural disaster.

IV. CONCLUSION

Based on the findings in this study, it can be concluded that the instruments that have been developed are valid and reliable. Students' answers show a mitigation procedures for each different condition when an earthquake occurs. Validating by expert shows that this instrument is valid in terms of content. Some editorial case must be focus to re-construction. 0.76 point of the reliability score was obtained. It means that this instrument has good reliability. This instrument offers the students' understanding of earthquakes and Indonesian geological conditions.

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