Junior high school students’ risk perception of earthquakes in Bandung City

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Abstract. This study aims to determine students' risk perceptions of earthquakes of junior high school students in Bandung City and whether factors such as gender, school location and school status affect their risk perceptions of earthquakes. A questionnaire on risk perceptions was given to 128 junior high school students in six schools in Bandung City. Based on data analysis using the independent t-test, there is a significant difference in risk perception between male and female students where female students (73.48) have a higher average risk perception score than male students (70.50). However, school location and school status do not affect risk perceptions since the results of the independent t-test showed no significant difference. This is because both are external factors, while the perception of risk is influenced by internal factors. In addition, among the risk perception components, the perception component towards disaster risk reduction has the highest value and the perception component toward risk potential has the lowest value. This indicates that the perception component towards disaster risk reduction gave the greatest contribution to the risk perception and junior high school students in Bandung City need to increase their risk perception of potential earthquakes.

1. Introduction
Earthquakes are an unpredictable natural threat. One source of earthquake threat in Bandung is Lembang Fault. Lembang fault can produce an earthquake with a strength of Mw 6.5 - 7.00 which occurs every 170 - 670 years, where the last earthquake was felt in the 15th century AD [1]. This means that no one in Bandung alive today has experienced this earthquake. Earthquakes need to be anticipated because they occur without warning and can cause major damage in a short time [2]. This natural threat can become a disaster if it hits a vulnerable community because humans are one of the things affected by the earthquake, apart from infrastructure, buildings, equipment, and so on [3]. Because earthquakes are natural disasters beyond human control, one way to reduce their impact is to increase people's capacities in dealing with disasters which consists of awareness and preparedness [2]. Not only the government, but every individual in society must take action to reduce the impact of disasters and prepare themselves for disasters [4]. One of the ways is to increase public perceptions of risks to earthquakes. A person who has a low risk perception will think that they do not need to be prepared. Meanwhile, someone who has a high risk perception will prepare himself, for example looking for the possibility of an earthquake that will occur in his residence, preparing first aid kits, repairing items that can endanger safety, and measuring the resistance of residential buildings to earthquakes [2]. If many people have a high risk
perception, the number of deaths and property damage will be less [5]. If there is someone who has a low risk perception, then this low perception can be carried on in society [6].

Risk perception is a psychological state regarding a person's view of the threat that is likely to occur [6]. The risk perception of earthquakes relates to a person's concern about earthquakes when compared to other threats [4]. People who have a fear of earthquakes will prepare themselves well [7]. In addition, someone who has a good risk perception will think that the location where he lives is more prone to earthquakes than other places or closer to the earthquake source [6]. They will also think that their family members will suffer if they are hit by an earthquake [4]. People would think that the building where they live is needed to be tested for durability [5] especially regarding whether the building where they live will survive if an earthquake occurs [7]. People who have a good risk perception will have the view that not only the government, but every individual in the community must take action to reduce the impact of disasters and prepare themselves for disaster caused by earthquakes [4]. Junior high school students in Bandung spend an average of 7-8 hours at school (30% per day). This makes schools one of the places that can be used as a shelter or even a source of disaster when they are in the school environment when an earthquake occurs. Therefore, junior high school students need to have a good risk perception of earthquakes in order to avoid the impact of disasters. Moreover, they are children who will become members of society in the future who will have a role in decision making [5]. With the existence of an earthquake that can be generated by the Lembang Fault, it is necessary to know the risk perceptions of junior high school students in Bandung. In addition, this study also wanted to analyse whether factors such as gender, school location and school status influenced students' risk perceptions of earthquakes. This needs to be done because the risk perceptions of the people in an area can be taken into consideration in making policies in dealing with disasters [8], especially which groups need to increase their risk perception.

2. Method

Data on risk perceptions were collected through a questionnaire. This questionnaire consists of 34 statements about risk perception consisting of 5 components. These components can be seen in Table 1. The statements consist of positive and negative statements for each component of risk perception. Each respondent was asked to provide one response which was limited to the response to strongly agree, agree, neutral, disagree and strongly disagree. For positive statements, each response is given a value of 5 - 1 sequentially. For negative statements, each response is assigned a value of 1 - 5 in sequence. All values from each statement are then added up and converted into a scale of 1-100. Before being given to respondents, this questionnaire was tested first so that each statement was valid, and the reliability value of this questionnaire is 0.751. Respondents in this study were 128 junior high school students in six different schools in Bandung City. They are students in grades 7 and 8 who have studied earthquakes at school and range in age from 11 to 15 years old. All respondents were divided into 3 categories as shown in Table 2. For the gender category, there were 51 male students and 77 female students. For the category of school location, respondents were divided into students whose schools are close to Lembang (69 students) and students whose schools are far from Lembang (59 students). Schools close to Lembang are schools located on the border between Bandung City and West Bandung Regency with a distance of ± 5 km from Lembang, while schools that are far from Lembang are schools located on the border between Bandung City and Cimahi City as well as Bandung City and Bandung Regency with a distance of ± 12 km from Lembang. Respondents were also divided into 2 groups based on their school status, so that there are 79 students who attend public schools and 49 students who attend private schools. The risk perception scores for each group were then compared using an independent t test to determine whether there were significant differences in risk perception between groups in each category.
Table 1. Risk perception questionnaire rubric.

| Risk Perception Component | Aspect                        | Item number | N  |
|---------------------------|-------------------------------|-------------|----|
| Fear of earthquake disaster | Believe that earthquake is unpredictable | 1, 2, 3, 4, 9, 10 | 6  |
|                           | Threat of an earthquake       | 5, 6        | 2  |
|                           | Fear of an earthquake         | 7, 8        | 2  |
| Perception of potential risk | Security of school location  | 11, 12      | 2  |
|                           | Information of threat near school | 13, 14     | 2  |
|                           | Frequency of an earthquake    | 15, 16      | 2  |
| Perception of impact of earthquake disaster | Impact to school activities | 17, 18      | 2  |
|                           | Impact to properties          | 19, 20      | 2  |
|                           | Impact to human live          | 21, 22      | 2  |
| Perception of resistance of school building | Worry about school building resistance | 23, 24      | 2  |
|                           | Urgency to know school building resistance | 25, 26   | 2  |
|                           | Urgency of building renovation | 27, 28     | 2  |
| Perception of disaster risk reduction | Responsibility in risk reduction | 29, 30     | 2  |
|                           | Urgency of risk reduction     | 31, 32, 33, 24 | 4  |

3. Results and discussion
The results of the independent t-test conducted on the six groups can be seen in Table 2. Based on the table, the p-value in gender characteristics (0.006) has a value lower than 0.05. Thus, there is a significant difference in risk perception between male and female students. The mean score of female students (73.48) was higher than that of male students (70.50). This indicates that female students perceive risk of earthquakes better than male students. For the other two characteristics, namely school location and school status, the two p-values (0.210 and 0.684) were greater than 0.05. Thus, school location and school status did not provide a significant difference in risk perceptions. This is consistent with research conducted by Takeli-Yesil et al which showed that women have a better risk perception apart from gender. A person's experience of experiencing earthquakes in the past can also affect risk perceptions [6], [9]. In addition, emotional and socio-cultural conditions as well as how often earthquakes occur also affect a person's risk perception [5], [7]. Some of these factors are conditions that exist within a person or are called internal factors. This means that internal factors have a very strong influence on a person's risk perception of earthquakes than external factors which in this study are school location and school status.

Table 2. The results of the Independent T-test on the risk perceptions of junior high school students based on certain characteristics.

| Categories           | Characteristic | N  | Mean  | SD   | p-value |
|----------------------|----------------|----|-------|------|---------|
| Gender               | Male           | 51 | 70.50 | 6.12 | 0.006   |
|                      | Female         | 77 | 73.48 | 6.12 |         |
| School Location      | Near Lembang   | 69 | 72.81 | 5.63 | 0.210   |
|                      | Away from Lembang | 59  | 72.02 | 7.14 |         |
| School Status        | State school   | 79 | 72.48 | 5.61 | 0.684   |
|                      | Private school | 49 | 72.07 | 6.99 |         |
Figure 1. Average value for each component of risk perception of female and male students.

Figure 2. Average value for components of risk perception of students whose school near and away from Lembang.

Figure 3. Average value for components of risk perception of students in state and private schools.

The value of the risk perception of each characteristic can be seen in Figs. 1, 2 and 3. Based on the mean value of risk perception for all components in Fig. 1, female students have a higher risk perception (73.48) than other groups of students. Female students also had a higher risk perception for each component of risk perception than male students. Of all components of risk perception, the perception component for disaster risk reduction has the highest average value and the perception component of the potential risk of an earthquake has the lowest average value compared to the other components. Students who attend school near Lembang have the highest perception of disaster risk reduction.
compared to other groups of students. This means that students who study near Lembang already understand how to prepare for an earthquake and the efforts made by the government and society to reduce the impact of an earthquake disaster on human life. Meanwhile, the value of perception of potential risk in each group of students has the smallest value compared to the other components. Students still do not know whether the school is safe or prone to earthquakes. For this perception component to increase, students need to be exposed to information about the threat of earthquakes that occur around their school location, where the closest potential earthquake is the potential earthquake that can be generated by the Lembang Fault.

The low perception of potential risk can be influenced by various factors. One factor is that ordinary people and scholars have different understandings regarding risk or other terms in earthquakes [6]. People living near the source of the disaster must learn about the disaster so that they understand the characteristics of the source of the disaster. Another factor that can lead to a lower risk perception is the assumption that the threat is something new, unknown and unobserved [8]. This is because they have only felt an earthquake a few times or have never experienced an earthquake so they do not feel the impact directly. Moreover, the last earthquake caused by the Lembang Fault was recorded to have occurred in the 15th century [1]. People who have not experienced a disaster generally feel no need to be prepared. For example, people whose areas are frequently flooded will be more vigilant when the rainy season arrives and will do whatever it takes to prevent flooding from reoccurring their homes. This is done because they do not want to feel the difficulty of saving themselves or losing their belongings. So that junior high school students living in the present have never felt the impact of the Lembang Fault earthquake. Furthermore, earthquakes are not a popular threat [5] and a person's risk perception is also influenced by the characteristics of the source of the threat [6]. For example, people tend to have a high-risk perception of a terrorist threat because it is widely reported in the media. In addition, the order of priority of threats also affects the perception of risk [4]. Therefore, people need to get exposed more to any information related to earthquakes, the potential sources of earthquakes in their neighbourhood and how bad the impact this earthquake can have on their lives.

Although earthquakes can also describe how members of the community deal with earthquakes [4], it is necessary to increase the perception of risk. This can be done through education, because education is a fundamental thing to improve skills in recognizing dangerous situations and introducing them in an acceptable way [5]. Earthquake learning for students around the earthquake source can be done in various ways including visiting geology museums, using interactive learning media, watching films about how devastating an earthquake is to someone's life, presenting an earthquake expert, doing field study to observe real evidence of faults as one of source of earthquake and carrying out simulations in preparing and saving themselves when an earthquake occurs. There are several limitations in this study, including the number of schools that are used as respondents, the location of the schools and some other information that needs to be extracted from the respondents. For the category of schools that are far from Lembang, it should be added with schools on the border of Bandung City with Sumedang Regency and another Bandung Regency area. The number of schools must also be greater with more diverse school conditions. Therefore, further research on the risk perceptions of junior high school students against earthquakes needs to be carried out by considering the number, location and condition of schools.

4. Conclusion
Gender affects junior high school students' perceptions of risk to earthquakes in Bandung City, while school location and school status do not. This is because the risk perception of an earthquake is influenced by internal factors of a person, one of which is gender. Female students have a higher risk perception than male students. This means that male students are the group that needs to pay more attention in earthquake preparation. In addition, perceptions of disaster risk reduction have the highest score and students' perceptions of potential risks have the lowest score among risk perception components. This indicates that students already know what the government and society should do to prepare for an earthquake so that the impact of the damage it causes can be reduced. Other than that,
students need to increase their risk perception of the threat of earthquakes lurking in their homes, especially one that can be generated by the Lembang Fault.

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