Enhancing Students' Earthquake Disaster Preparedness Through Self Experience, Knowledge, and Self-Efficacy

Resti Kinanthi[1], Preti Askunala Wikan[2], Vinia Anasfisia[3]

{restikinanthi@gmail.com[1], pretiaskunalawikan@gmail.com[2], viniaanasfisia1@gmail.com[3]}

Graduate School, Universitas Gadjah Mada, Yogyakarta, Indonesia[1,2,3]

Abstract. Disaster preparedness is an effective way to reduce disaster risks. Indonesian students as agents of change in disaster risk reduction need to be equipped with preparedness behavior in an event of earthquakes. This research aims at determining the effects of knowledge, experience, and self-efficacy on students' earthquake preparedness behavior. This research used an electronic questionnaire with 51 respondents, who were randomly selected from students in Padang and Surakarta Cities. A questionnaire with 40 question items was developed for this research. The research data were analyzed using multiple regression analyses with SPSS 26.00. The results of this research show that 62,8% of the preparedness behavior variables could be explained by the experience, knowledge and self-efficacy variables. Self-efficacy and knowledge variables had a significant effect on the students' earthquake preparedness behavior. These results indicated that enhancing student's self-efficacy and knowledge are required to improve their preparedness behaviors towards earthquake disaster.

Keywords: Earthquake preparedness, self-experience, knowledge, self-efficacy.

1 Introduction

Indonesia is an archipelagic country that often experiences earthquakes. During July 2022, 574 earthquakes were recorded throughout Indonesia [23]. A total of 368 out of 509 Cities/Regencies in Indonesia experienced an earthquake with a high-risk class index [1]. This fact shows that Indonesian people were not capable of avoiding the risk of earthquake disasters. Therefore, earthquake preparedness behavior is a solution offered to reduce the earthquake disaster risks. Previous research [2]revealed that countries that take steps to improve population disaster preparedness tend to suffer less severe consequences than those not adopting the preparedness concept. To become a nation that is resilient to disasters, individual and community level resilience are essential, after which the the national resilience can be realized. One of the individual earthquake disaster resilience can be done by increasing the preparedness behavior. The individual preparedness behavior begins when individuals in the community are aware of the risks of the earthquake disasters, thus forming disaster preparedness behavior.

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Human behavior is unpredictable at any time and is more severe during an emergency [3]. Earthquake preparedness is a type of self-protection behavior, in which the behavioral approach is the main driver of the earthquake preparedness behavior [4]. Preparation for taking preparedness actions requires the awareness of risk reduction measures, the familiarization with guidelines on appropriate actions in the event of a disaster, and the ability to engage in self-protection activities before the occurrence of a disaster. Disaster preparedness and applicable evacuation behavior during and after disasters have been proven to be effective ways to prevent disasters [5]. Disaster preparedness behavior refers to the implementation of personal activities or actions before a hazard event to reduce the severity of the impact of a disaster[6].

the self-defense behavior of individuals can be shaped by assessing risks and resources available to them (including self-efficacy) concerning threats they are facing [7]. Earthquake preparedness is positively correlated with risk perception, self-efficacy, and trust in information about hazards through media. High self-efficacy people have positive expectations of themselves, which manifest as a strong belief that they can overcome difficulties and take the initiative to overcome obstacles. High self-efficacy can have a positive influence on disaster management actions. Research [8] provides a new perspective on how self-efficacy can encourage community collective participation behavior in disaster management. Self-efficacy is important for overcoming challenges that may become stressful at some point in time[9]. Students' earthquake disaster preparedness behavior, apart from being influenced by self-efficacy factors, is thought to be formed from their knowledge and experiences about earthquakes. The results of the study [10] showed that children participating in earthquake education programs became more aware of earthquakes and were capable of predicting future earthquakes and possible causes of injury. Research [11] revealed that after experiencing disaster education, participants were well aware that without preparation, the irreversible effects of earthquakes would increase. Participants were also more aware of the benefits of earthquake preparedness; In this regard, they believed that better preparedness for earthquakes would lead to less physical and emotional harm to families.

Research [5] revealed that residents who had strong disaster knowledge would conduct more preparation measures to avoid disasters before a disaster occurred, and tended to choose evacuation modes to avoid disasters during and after a disaster occurred The results of the study [12] showed that low levels of knowledge lead to a lack of earthquake preparedness. Community knowledge about disasters is directly proportional to their preparedness in dealing with disasters. Good knowledge is significantly correlated with disaster preparedness [13]. Building societal resilience entails increasing social community's capability of facing disasters, which relies on people's knowledge of disasters and their ability to deal with potential risk in the future. It is critical to improve people's awareness of disaster preparedness and mitigation and to encourage individual/household risk reduction actions. Herein, studying people's risk perception and relevant attitudes toward disasters is essential to formulate more attractive disaster mitigation programs and to enhance societal resilience [14] .

Based on the background described above, this research aimed at determining the effects of knowledge, experience, and self-efficacy on students' earthquake preparedness behavior. The results of this research can provide recommendations for increasing students' earthquake disaster preparedness

2 Method

The variables used in this research were earthquake preparedness behavior, self-experience, knowledge, and self-efficacy. This research used electronic questionnaire with 51 student respondents, randomly selected from Padang and Surakarta Cities. Multiple linear regression analyses using SPSS 26.00 were performed to determine the effects of experience, knowledge, and self-efficacy variables on earthquake preparedness behavior. A questionnaire with 40 question items was developed focusing on five areas: demographic factors (such as age, education, gender and living area); earthquake preparedness behaviour; self-efficacy; knowledge; and self-experience.

Table 1. Categorization of Variable

Variable	Number of Items	Categorization
Earthquake preparedness behaviour	11	Good (<2,33%) Moderate (2,34%-3,66%) Low (3,67%-5,00%)
Self-Efficacy	12	Good (<2,33%) Moderate (2,34%-3,66%) Low (3,67%-5,00%)
Knowledge	10	Good (<2,33%) Moderate (2,34%-3,66%) Low (3,67%-5,00%)
Self-Experience	2	Good (<2,33%) Moderate (2,34%-3,66%) Low (3,67%-5,00%)

Classification follows this equation.

$$\text{Range} = \frac{(Maximum\ Score - Minimum\ Score)}{3} = \frac{(5-1)}{3} = 1{,}33$$

Scores are categorized into good, moderate, or low seen from the scores obtained.

Low = <2,33
Moderate = 2,34-3,66
Good = >3,67

3 Results

3.1 Validity and Reliability

3.1.1 Earthquake Preparedness Behaviour

Validity and Reliability tests were performed using SPSS 26.00. the validity of the behavior item was determined by comparing the correlation value of the Pearson product with the r-table. The item would be declared valid if the r count > r table. The reliability test was performed using SPSS. The reliability of the instrument was determined by comparing the Cronbach's α value. If the r-count value were greater than the r-table (0.65), the measure could be considered reliable.

Table 2. Validity and Reliability of Preparedness Behavior Variable

Item	r count	r table	Description
Behaviour_1	0,771	0,2939	Valid
Behaviour _2	0,727	0,2939	Valid
Behaviour _3	0,805	0,2939	Valid
Behaviour _4	0,655	0,2939	Valid
Behaviour _5	0,839	0,2939	Valid
Behaviour _6	0,878	0,2939	Valid
Behaviour _7	0,877	0,2939	Valid
Behaviour _8	0,904	0,2939	Valid
Behaviour _9	0,803	0,2939	Valid
Behaviour _10	0,696	0,2939	Valid
Behaviour _11	0,786	0,2939	Valid

Cronbach's Alpha	Description
0,778	Reliable

The results of the test show that the r table for the 51 respondents was 0,2939. Earthquake Preparedness Behavior variable consisted of 11 items. The R count value of the 11 items was greater than that of the r table. Therefore, it could be declared that all of the Earthquake Preparedness Behavior items were valid. The cronbach alpha results for all variables were 0,778 (above 0.65), indicating that the questionnaire was reliable.

3.1.2 Self-Efficacy

Self-efficacy variable consisted of 12 items. The validity of the Self-efficacy item was determined by comparing the correlation value of the Pearson product with the r-table. The item would be declared valid if r count> r table. The reliability of the instrument could be determined by comparing Cronbach's α value. If the r-count value were greater than the r-table (0.65), the measure could be considered reliable.

Table 3. Self-Efficacy Variable Validity and Reliability

Item	r count	r table	Description
Self_Efficacy_1	0,642	0,2939	Valid
Self_Efficacy _2	0,666	0,2939	Valid
Self_Efficacy _3	0,788	0,2939	Valid
Self_Efficacy _4	0,770	0,2939	Valid
Self_Efficacy _5	0,799	0,2939	Valid
Self_Efficacy _6	0,583	0,2939	Valid
Self_Efficacy _7	0,675	0,2939	Valid
Self_Efficacy _8	0,733	0,2939	Valid
Self_Efficacy _9	0,714	0,2939	Valid
Self_Efficacy _10	0,608	0,2939	Valid
Self_Efficacy _11	0,799	0,2939	Valid
Self_Efficacy _12	0,650	0,2939	Valid
Cronbach's Alpha		Description	
0, 765		Reliable	

The results of the test show that the r table for the 51 respondents was 0,2939. The R count value from the 12 items was greater than that of the r table. Therefore, it could be declared that all of the Self-Efficacy items were valid. The cronbach alpha results for all variables were 0,765 (above 0.65), indicating that the questionnaire was reliable.

3.1.3 Self-Experience

Self-experience variable consisted of 2 items. The validity of the Self-experience item was determined by comparing the correlation value of the Pearson product with the r-table. The item would be declared valid if the r count> r table. The reliability of the instrument could be determined by comparing Cronbach's α value. If the r-count value were greater than the r-table (0.65), the measure could be considered reliable

Table 4. Experience Variable Validity and Reliability

Item	r count	r table	Description
Experience_1	0,780	0,2939	Valid
Experience_2	0,811	0,2939	Valid
Cronbach's Alpha		Description	
0,829		Reliable	

The results of the test show that the r table for the 51 respondents was 0,2939. Self-Experience variable consisted of 2 items. The R count value from the 2 items was greater than that of the r table. Therefore, it could be declared that all of the Self-Experience items were valid. The cronbach alpha results for all variables were0,829 (above 0.65), indicating that the questionnaire wasreliable.

3.1.4 Knowledge

Items on the knowledge variable consisted of 10 questions. The validity of Self-efficacy item was determined by comparing the correlation value of the Pearson product with the r-table. The item would be declared valid if r count> r table. The reliability of the instrument could be determined by comparing Cronbach's α value. If the r-count value was greater than that of the r-table (0.65), the measure could be considered reliable.

Table 5. Knowledge Variable Validity and Reliability

Item	r count	r table	Description
Knowledge_1	0,384	0,2939	Valid
Knowledge_2	0,787	0,2939	Valid
Knowledge_3	0,759	0,2939	Valid
Knowledge_4	0,659	0,2939	Valid
Knowledge_5	0,478	0,2939	Valid
Knowledge_6	0,473	0,2939	Valid
Knowledge_7	0,536	0,2939	Valid
Knowledge_8	0,537	0,2939	Valid
Knowledge_9	0,617	0,2939	Valid
Knowledge_10	0,599	0,2939	Valid
Cronbach's Alpha		Description	
0, 738		Reliable	

The results of the test show that the r table for 51 respondents was 0,2939. The R count value from the 10 items was greater than that of the r table. Therefore, it could be declared that all of the knowledge items were valid. The cronbach alpha results for all variables were 0,738 (above 0.65), indicating that the questionnaire was reliable.

3.2 Descriptive Variables

The variables of the research are presented in table 6.

Table 6. Descriptive variable score

Variables and Indicators	Average Score	Category
Earthquake preparedness behavior	4,18	**Good**
Behavior before an earthquake	4,17	Good
Behavior during an earthquake	4,20	Good
Self-Efficacy	3,78	**Good**
Confidence in Self-Ability	2,31	Moderate
Enthusiasm	4,18	Good
Ability to Face Obstacles	4,14	Good
Self-Control Ability	4,51	Good
Knowledge	4,30	**Good**

Knowledge of Earthquake Causes and Risks	3,85	Good
Knowledge of Disaster Risk Reduction Measures	4,74	Good
Self-Experience	3,41	**Moderate**
Earthquake Training	3,82	Good
Earthquake Class	3,00	Moderate

on The data in **Table 6** show that the Earthquake Preparedness Behaviour variable consisted of two indicators, namely behaviour before earthquake and behaviour during earthquake. The results show that the average score obtained from the two indicators were 4,17 and 4,20, categorized into good category. Self-efficacy consisted of four indicators, namely Confidence in Self-Ability, Enthusiasm, Ability to Face Obstacles, and Self-Control Ability. The results show that Enthusiasm, Ability to Face Obstacles, and Self-Control Ability scores were 4,18, 4,14, and 4,51, categorized into good category. While in indicator Confidence in Self-Ability score was 2,31. In general, Self-Efficacy variable score was 3,78 categorized into good Self-Efficacy.

The knowledge variable consisted of two indicators, namely knowledge of earthquake causes and risks, and knowledge of disaster risk reduction measures. The results show that respondents had good knowledge on the two indicators obtained. Generally, the knowledge variable score was 4,30, categorized into good knowledge. The last variable measured was Self-Experience. The respondents had good experience on earthquake training, and moderate experience on earthquake classes. Generally, Self-Experience variable score was 4,41, categorized into moderate experience. The score distribution of the respondents on the variables is presented in table 7.

Table 7. Distribution score

Variable	Category (%)		
	Good	Moderate	Low
Earthquake Preparedness Behaviour	80,39	17,65	1,96
Self-Efficacy	74,51	23,53	1,96
Self-Experience	13,73	47,06	39,22
Knowledge	94,12	5,88	0,00

The data in Table 7 shows that most of the 51 respondents had good category on earthquake preparedness behaviour (80,39%), 17,65% had moderate category, and 1,96% had low category. On Self-Efficacy variable, most of the respondents (74,51%) were categorized into good Self-Efficacy, 23,53% moderate, and 1,96 classified into low Self-Efficacy. The Self-Experience Variable score of most of the respondents was moderate experience (47,06), 39,22% was categorized into low experience, and 13,73% respondents was categorized to have good experience. Last, on the knowledge variable, most of the respondents (94,12%) had good knowledge, and 5,88% had moderate knowledge on earthquake.

The second aim of this research is to determine the effect of knowledge, experience, and self-efficacy on students' earthquake preparedness behaviour. Multiple linear regression analyses using SPSS 26.00 were performed to determine the effect of experience, knowledge, and self-

efficacy variables on students' earthquake preparedness behaviour.

Table 8. Model Summary

Model Summary [b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.807[a]	.651	.628	4.63775	1.203

Predictors: (Constant), Knowledge, Experience, Efficacy
Dependent Variable: Preparedness_Behaviour

From table 8, it is known that the Adjusted R Square value in the model was 0.628. It means that the Self Efficacy (X_1), Experience (X_2) and Knowledge (X_3) variables had 62,8% contribution towards the Earthquake Preparedness Behavior (Y).

Table 9. ANOVA

ANOVA [a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1882.072	3	627.357	29.168	.000[b]
	Residual	1010.908	47	21.509		
	Total	2892.980	50			

a. Dependent Variable: Preparedness_Behaviour
b. Predictors: (Constant), Knowledge, Experience, Efficacy

The F test was performed to determine the simultaneous effect of Self Efficacy (X1), Experience (X2) and Knowledge (X3) on the dependent variable Earthquake Preparedness Behavior (Y). This research used level of significance 5% (0,05), thus the p-value should be less than 0.05. Tabel 9 shows that the p-value (sig.) obtained on this research was 0,000. It means that Self-Efficacy (X1), Experience (X2) and Knowledge (X3) simultaneously had a significant effect on the Earthquake Preparedness Behavior. The effects of each independent variable to the dependent variables are presented in the following table.

Table 10. Multiple Linear Regression Test Results 2

Coefficient [a]					
Model	Unstandardized B	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.
(Constant)	-10.072	6.314		-1.595	.117
Efficacy	.407	.100	.375	4.082	.000
Experience	-.238	.319	.065	-.747	.459
Knowledge	.870	.133	.598	6.529	.000

a. Dependent Variable: Preparedness_Behaviour

Variables with a sig<0.05 are variables that have a significant effect on earthquake preparedness behaviour. The self-efficacy and knowledge variables had a sig. value less than 0.05, while the experience variable had a significance greater than 0.05. It means that self-efficacy and knowledge had a significant effect on earthquake preparedness behaviour.

Based on the results of the analysis, the regression equation in this research is as follows:

$$Y = -10{,}072 + 0.407X_1 - 0{,}238X_2 + 0.870X_3$$

The equation above shows the effect of the independent variables (Self-Efficacy (X1), Experience (X2) and Knowledge (X3)) on the dependent variable (Earthquake Preparedness Behavior). The coefficients of the variables that have a significant effect (self-efficacy and knowledge) are positive. This indicates that the self-efficacy and knowledge variables havd a positive effect on the earthquake preparedness behavior variable. Students with good self-efficacy and high knowledge will have good earthquake preparedness behavior.

4 Results and Discussion

This research was divided into two parts. The first aimed at examining earthquake preparedness behavior among students from Padang and Surakarta Cities. Based on this research, it was found that most of the 51 respondents had good category on earthquake preparedness behaviour (80,39%), 19,61% respondents had moderate and low score on earthquake preparedness behavior. Generally, the students tended to have good earthquake preparedness. Student's earthquake behavior consisted of two indicators, namely behavior before earthquake, and behavior during earthquake. The results show that both of these indicators had good category with average score 4,17 and 4,20. Respondents had low average score on behavior to protect themselveswhen an earthquake occured, such as protecting their heads with their hands. On the second indicator, respondents had low average score on observing evacuation routes in the surrounding area. In line with results of this research, the results of a survey [15] in Dulegauda-Tanahun District, Nepal, showed that only 58% of those surveyed had sufficient knowledge about earthquake prevention, and 42% had inadequate knowledge on earthquake preparedness.

Preparing for an earthquake can require significant resources. The financial costs of strengthening structures against seismic shaking are obviously high. However, some measures can be implemented with relatively little effort. Prepare an emergency kit, stock up on supplies, and attach heavy items to the wall. These preparations assume that peoples are aware of risk mitigation measures, guidelines for behavior during the event, and have the ability to take self-defense measures prior to the event [2].

From the results of multiple linear regression analyses, it is known that earthquake preparedness behavior is significantly influenced by self-efficacy and knowledge. The knowledge variable was measured with two indicators, namely Knowledge of Earthquake Causes and Risks, and Knowledge of Disaster Risk Reduction Measures. The results of this research show that both of the indicators average scores were classified into good knowledge. Most of respondents (94,12%) had good knowledge, and 5,88% was classified into moderate knowledge. The knowledge variable had a significant effect on earthquake preparedness behavior. This is in line with the research [16] and [17] which found that earthquake knowledge was one of the variables which had an effect on disaster preparedness. Knowledge had a significant impact on earthquake preparedness in Kuta Rayat sub district of Regency Karo, Naman Teran, with a contribution of 23% [17]. Low knowledge of respondents was associated with low level of disaster preparedness [18]. Knowledge management practices also had an effect on the increasing community capacity regarding disaster knowledge, but it is still necessary to improve

knowledge transfer methods to motivate people to take preparedness actions [19]. Students' knowledge of earthquake disasters in this research had an average score of 4.41, which was included in the high category. The knowledge variables used included the causes of earthquake disasters, individual responses when an earthquake occurred, as well as preparedness actions that needed to be taken to reduce the risk of earthquake disasters.

Another factor that has a significant effect on earthquake preparedness behavior is the self-efficacy factor. People with high self-efficacy have positive expectations of themselves, which manifest as a strong belief that they can overcome difficulties and take the initiative to overcome obstacles. High self-efficacy can have a positive effect on disaster preparedness behaviour. This is in accordance with the results of the research [20] that self-efficacy interventions can be effective in dealing with unexpected disasters such as earthquakes. The effect of self-efficacy on behaviour was also investigated by[21], the results of the research [21]showed that self-efficacy affected controlling human behaviour. Individuals with high self-efficacy have positive expectations of themselves which are manifested in high beliefs that they can overcome difficulties and take the initiative to overcome obstacles[22]. Self-efficacy consists of four indicators, namely Confidence in Self-Ability, Enthusiasm, Ability to Face Obstacles, and Self-Control Ability. Indicator that has moderate classes is Confidence in Self-Ability. Improving students' earthquake preparedness can be done by improving student's Confidence in Self-Ability. This can be done by encouraging students to increase their optimism in achieving challenging goals and assignments, also encouraging students to improve their skills and perform good time management.

5 Conclusion

Self-efficacy and knowledge partially have a significant effect on earthquake preparedness behaviour. Experience does not have a significant effect on earthquake preparedness behaviour. As much as 62.8% of the preparedness behaviour variables can be explained by the experience, knowledge and self-efficacy variables. These results indicate that enhancing student's self-efficacy and knowledge are required to improve their earthquake disaster preparedness.

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