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Paper:

Effectiveness of Disaster-Based School Program on Students' Earthquake-Preparedness

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Given the importance of public disaster education, efforts have been made to integrate disaster risk reduction in the school system. Studies focusing on the effects of school disaster programs on actual preparedness and factors influencing preparedness behaviour, however, have been limited. The present study assesses the effectiveness of disaster risk education (DRR) in schools by comparing students in two junior high schools regarding action taken in earthquake preparedness and major factors of disaster preparedness such as risk knowledge, risk perception, critical awareness and attitude. Data on earthquake preparedness and other variables were collected from two junior high schools in Yogyakarta, Indonesia. Participants were 124 students from a school adopting disaster risk reduction education and 115 students from a school not adopting it. Multivariate Analysis of Variance (MANOVA) revealed that there was a significant difference in investigated variables among students although their level of actual preparedness was quite low. This study provided evidence that having a school adopting disaster risk reduction issues effectively enhanced knowledge, risk perception, critical awareness and attitude but limited in preparedness behaviour. Efforts should be taken by policy makers, teachers, and other stakeholders to develop public education in schools focusing on changes in preparedness behaviour.

Keywords: school, knowledge, risk perception, awareness, attitude, disaster preparedness, earthquake.

1. Introduction

Following the devastating tsunami of December 26, 2004, disaster management systems have been established in countries along the Indian Ocean, including Indonesia. Located where four tectonic plates – the Australian, Philippine, Eurasia and Pacific plates – meet, Indonesia is one of the countries most vulnerable to plate-related earthquakes in the world [1]. In terms of human exposure, for example, Indonesia ranks first in tsunami hazards out of 76 countries, first in landslides among 162 countries, third in earthquakes out of 153 countries, and sixth in floods among 162 countries. The development of public disaster education has become a top priority considering the absence of disaster awareness in the past that caused more than 165,708 lives to be lost due to the 2004 Sumatra Tsunami, 1,300 due to the 2005 Nias Earthquake, 5,778 due to the 2006 Yogyakarta Erthquake, 645 due to the 2006 South Java Tsunami and 1,117 due to the 2010 West Sumatra Earthquake [2]. Local, national and global institutions have developed disaster education programs in schools, focusing on both structural and non-structural measures [3, 4]. Studies focusing on the effects of school disaster programs in actual preparedness, however, have remained limited in developing countries except for Nepal [5] and Iran [6]. Because the characteristics of disasters and education systems in Indonesia are different from others, this study will valuable in enriching the different perspectives of DRR in the educational sector.

2. Theoretical Framework

Many resources have been expended to integrate disaster subject into school curriculums to improve the knowledge of school community members about disaster and how to respond to it. After the Kobe earthquake in 1995, some schools in Japan implemented disaster management issues into subjects such as geography, history, science, health and physical education, and the environment [7, 8]. The development of disaster topics in schools has recently been extended through different methods such as town watching, game simulation, hazard-map making, disaster drills, and disaster student paper competition [9, 10]. The advantage of integrating disaster education into schools is that doing so can maintain disaster knowledge among students because disaster knowledge decreases over time [11].

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The development of disaster education should not be limited only to improving knowledge [12], risk perception and awareness but should also address preparedness behaviour [13]. Murata et al., [14] were concerned about the importance of the process of translating knowledge into action by giving community education both in schools and the community so that those being educated will be prepared in encountering disasters.

Ronan et al. [13] argued that disaster education will be effective if it is connected to multiple systems such as schools, the community, the government, and business sectors. School has been acknowledged as an institution critical in contributing to disaster awareness in the wider community. UNCRD [13], for example, noted that more than half of the schools in Japan serve as evacuation shelters not only for the school community but also for the community living in surrounding areas. In the context of DRR, the school serves as a place for an evacuation shelter if a disaster occurs and also as a place to share information about hazards in times other than disaster [16, 17].

Shaw et al. [18] examined the effect of different types of education such as community, school, family and self-education on school student knowledge, perception, preparedness and dissemination of earthquake information and experience. Research has shown that school disaster education affects student knowledge and perception about earthquake disasters but is limited in earthquake preparedness [18].

Shiwaku et al., [5] replicated Shaw et al.'s [18] research about the effect of a school disaster education approach on student perception and disaster preparedness in Nepal. Consistent with previous findings, they found that school disaster education was effective in risk perception, searching for information and intention to prepare for disaster but not for taking actual preparedness measures. This study recommended making a link between the school and community to build disaster resilience in both the community and among individuals.

The link between a disaster education program on risk perception, i.e., the awareness of protecting against disaster and emotional coping with disaster in a sample of 440 students from Aucklcand, New Zealand, was examined by Ronan et al. [19]. Results showed that schoolchildren participating in the disaster education program were better prepared in risk perception, fear factors, and awareness than children who were not involved in a disaster risk reduction program. Ronan et al. [20] conducted a similar study on the role of

disaster education programs in promoting community preparedness involving 560 schoolchildren in Auckland, New Zealand. In general, findings supported the contention that the disaster education program was effective in increasing community resilience.

Disaster preparedness issues have been a concern of many scholars as a consequence of the increase in unpredictable natural disaster events for the last decade. Even though a number of resources have been expended in an effort to promote behavioural preparedness, a common finding in research on natural disaster is that potentially vulnerable populations fail to prepare for such disaster events [18, 21]. This value of preparation is apparent especially when a community encounters an unpredictable disaster such as an earthquake or landslide.

The ways in which persons attempt to prevent, adjust to, react to and recover from natural disasters have been studied for many years. Disaster preparedness behaviour has been influenced by different factors and complex variables such as risk perception [22–24], hazard experience [25], the disaster information received [22], critical awareness [26], knowledge of disasters [22], attitude [26], social and economic characteristics [27], outcome expectations [24, 26], and demographic factors [28].

A number of recent studies have examined the influence of disaster knowledge on disaster preparedness. The U.S. Indian Ocean Tsunami Warning System Program [29] found that risk knowledge is an essential factor in building disaster preparedness behaviour. Acquiring risk knowledge assumes that individuals understand potential hazards. Knowing the correct response to a disaster will guide individuals in taking appropriate action when a disaster occurs to limit injuries and other potentially fatal impact. Paton et al. [24] reported that despite efforts to mitigate disaster impact onthose living in regions at high risk for earthquakes, such persons people still hold the fatalistic view that human beings can do nothing to limit the impact of a disaster. In developing countries, residents tend to perceive disaster based on culture and religious beliefs instead of based on science, according to Lavigne et al. [30]. Study conducted in three different communities after the December 26, 2004, tsunami revealed that around 25% on the average [12] and 37% [31] of people believed that a tsunami was caused by God as a punishment.

Another factor that facilitates disaster preparedness behaviour is risk perception. Risk perception refers to a person's perception of the possibility that a disaster would occur and the level of severity of its impact [22, 23]. Research found that an increase in risk perception leads those potentially affected to adopt preparedness measures [13, 32]. The higher the level of risk perception is, the more it can motivate people to take action for preparedness, and vice versa.

Paton et al., [24] emphasized that adopting disaster adjustments should not be isolated from the economic and social issues concerning individuals in daily life such as crime, poverty, health and education. If individuals pay more attention to such social problems instead of to salient hazards, it is less likely that such persons will adopt preparedness behaviour. Disaster awareness is therefore a crucial factor in inhibiting or facilitating individuals to take protective measures [25, 28]. Critical awareness refers to how much individuals think about and discuss a certain hazard [33].

Attitude as a predictor of behaviour has been widely discussed in psychological studies in attempts at understanding human behaviour. The Theory of Planned Behavior (TPB) explaining human behaviour has stated that attitude is one of the crucial factors in influencing indi-

viduals to undertake behaviour [34]. Persons who believe that taking preparedness action will result in a positive outcome will voluntarily adopt disaster preparedness and vice versa.

Building on previous discussions, this study hypothesizes that students in schools that have implemented disaster education (SSB) are better prepared than school that have not done so (Non-SSB) in earthquake risk knowledge, risk perception, critical awareness, attitude toward preparedness and actual preparedness behavior.

3. Overview of Study Case

The 2006 6.3 SR earthquake that hit Central Java and the Special Region of Yogyakarta Province left 5,778 people dead, 1,649,420 displaced, and more than 50,000 injured [2]. The earthquake also severely damaged 190,025 houses and cost about US$3.1 billion in total. While natural disasters do not discriminate demographically, children are the most vulnerable group compared to other age groups [10, 35]. The educational sector was one seriously impacted on by the 2006 earthquake, damaging a total of 1,116 school building in the Bantul Regency of Yogyakarta Province alone [36].

Both government and nongovernment organizations have made efforts in incorporating disaster risk reduction in schools. One such project was School-Based Disaster Preparedness, called *Sekolah Siaga Bencana* (SSB) in Indonesian and organized by the Safer Communities through Disaster Risk Reduction (SC-DRR) Project funded by UNDP starting in 2007 and lasting until 2011. SSB was one among project components addressing public-awareness-based disaster activities [37].

SSB focused on developing structural and nonstructural measures in school. Structural activities included the development of earthquake-proof school buildings, improving school facilities in areas such as sanitation and cooking, laboratory equipment, disaster campaigns, evacuation signs and shelter facilities. Nonstructral measures covered the development of school emergency planning, establishing standard operating procedures (SOP) for use during disasters, training for teachers, the development of details of disaster topics into school subjects, and school resources mobilization capacity during disasters [37]. Although processes for teaching and learning were mostly conducted using lectures, other methods were also used, such as workshops, field trips, disaster drills and laboratory-based activities. Other important activities were integrated as disaster themes into school extracurricular activities.

The disaster topic was incorporated into a range of school subjects such as science, social studies, language, physical education, and local content/subject. The Ministry of Education provided guidelines in the form of textbooks (modules) about disaster that were recommended to be taught in school such as about tsunamis, earthquakes, landslides, floods, typhoons, fire and social conflict [35]. Contents ranged in topics from types of disaster to causes and impacts of disaster, and how to mitigate, prepare for and respond to disaster events.

While the mechanism of the disaster topic tends to address disaster knowledge that should be acquired by students, in earthquake preparedness subjects, modules consist of recommendations on how to appropriately prepare for earthquakes, such as fastening furniture to walls at home, preparing disaster kits, conducting disaster drills and establishing emergence plans. Global earthquake-standard preparedness in responding to earthquakes such as "duck, drop and hold" is one of the actions suggested in the module on earthquakes [35].

4. Methods

4.1. Participants

Participants were 124 students from a school implementing SSB and 115 students from a school termed "Non-SSB." In general there was no difference in student characteristic between the two schools. The median student age was the same at 17 year old. In terms of religion, the majority of students were Moslem, with 98% in SSB and 96% in Non-SSB. Students from both schools were predominantly in grade 12, i.e., 77% SSB and 72% Non-SSB, and among those over grade 11, 23% SSB and 28% Non-SSB. The proportion of females in both schools was higher than that of males. In SSB, females accounted for 70% and Non SSB 66%, while males accounted for 30% SSB and 32% Non-SSB, respectively. Related to the length of living in the area, more than half of students in both schools had lived in the area more than 15 years, i.e., 69% SSB and 56% Non-SSB.

4.2. Measures

Questionnaires used in this study consisted of demographic characteristics, experience in the 2006 earthquake, student knowledge, level of risk perception, critical awareness, attitude toward preparedness behaviour and the level of earthquake preparedness.

Knowledge about earthquake hazards. Knowledge about earthquake hazards consisted of six subvariables with correct answers ranging from 0 to 16 related to "scientific facts" about earthquake among 37 optional answers. These items were adopted from the Module on Earthquakes used as a guideline taught in schools and including such items as (1) causes of earthquake (e.g., tectonic movement or volcano activity), (2) when earthquakes might occur, (3) the impact of earthquakes, (4) what human beings could do to prevent earthquakes, (5) what can be done before earthquakes occur (making emergency plans, preparing food, drink and tools, securing furniture so that it does not move, keeping emergency phone numbers handy, searching for information related to earthquakes), (6) responses to earthquakes (Drop, cover, and hold, run outside, go to evacuation shelters). Only correct answers were assessed (Cronbach's alpha=0.625).

Risk perception. The statement on risk perception consisted of four items, namely, (1) likelihood of earthquake occurrence, (2) possibility to harm, (3) cause of damage to property, and (4) disturbance of economic and social activities (e.g., praying at mosques or earning a livelihood). Answers were rated on a 5-point scale ranging from very unlikely (1) to very likely (5) (Cronbach's alpha=0.860).

Critical awareness. Critical awareness was measured using 3 items (Cronbach's alpha=0.841) using the work of Paton et al. [38], that is, (1) thinking about earthquakes, (2) talking about earthquakes with members of the family, and (3) discussing earthquake with friends and neighbors. Answers were assessed using a 5-point scale from "never" to "always."

Attitude toward earthquake preparedness behaviour. Attitude items were developed from the work of Ajzen et al. on components of TPB [34], consisting of 6 items (Cronbach's alpha=0.848) by asking students about (1) preparing emergency plans in the family, (2) keeping emergency phone numbers handy, (3) preparing disaster kits at home (e.g., food, water, flashlights), (4) securing furniture in place, (5) searching for information from different sources, and (6) participating in disaster drills. Answers were assessed using 5-point scale from "useless" to "useful."

Earthquake preparedness behaviour. Then items on earthquake preparedness measures were adopted from the Mulilis-Lipa Earthquake Preparedness Scale [39]. Only 10 items were involved in this study to ensure that adjustment was easily and reasonably made by students individually at home (Cronbach's alpha=0.768). Items included (1) preparing medicine, (2) preparing food and water, (3) preparing flashlights, (4) preparing communication means, (5) keeping phone number of family members and emergency units handy, (6) confirming how to evacuate, (7) securing furniture in place, (8) searching for information related to earthquakes in printed media, (9) searching for information on the radio, TV, and CD/DVDs about earthquakes, and (10) participating in disaster drills conducted in the community (not school),. Answers were evaluated using a 3-point scale of "no," "not sure," and "yes." Only "yes" answers were included to the preparedness index. The total of preparedness activities ranged from 0 to 10. Each preparedness item was treated as having the same important as others.

5. Results

5.1. Experience in 2006 Earthquake

In terms of experience with the 2006 earthquake, the majority of students in both schools had experienced it, i.e., % SSB and 90% Non-SSB. Similiarly, more than half of both school's students stated that the earthquake felt "extremely strong," i.e., 56% SSB and 55% Non-SSB. More than two-thirds of students (77% SSB and 75% Non-SSB) were inside their homes when the earthquake struck. The majority of students in both schools responded by "running outside" in response to the earthquake, i.e., 79% SSB and 71% Non-SSB. Only 2% SSB and 4% Non-SSB did "drop, cover and hold." In terms of damage to houses, the number of students whose houses were "totally damage" was higher in Non-SSB at 15% than in SSB at 10%. In contrast, 42% of student in SSB and 31% in Non-SSB said that there had been "no damage" as a result of the 2006 earthquake. Students in SSB who "lost family members" numbered 10% compared to 11% in School-Non SSB.

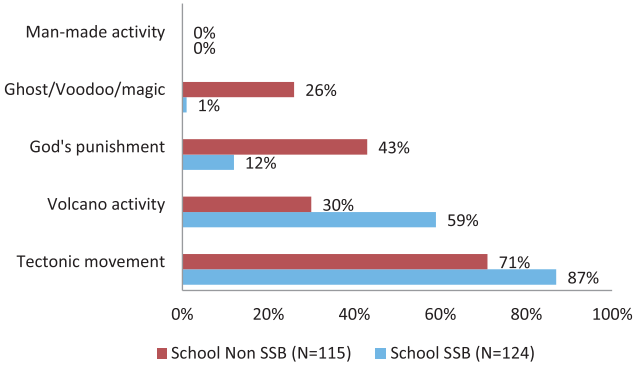

Fig. 1. Student's knowledge on cause of earthquake (multiple answers).

5.2. Knowledge

This section presents descriptive data about student knowledge on topics related to earthquakes divided into six "knowledge" subvariables.

Knowledge 1: Cause of earthquake. Generally, students from SSB had a better understanding of earthquake hazards such as the nature of earthquakes, impacts of earthquakes, and how to prepare for and respond to earthquake occurrence. In terms of causes of earthquakes, the number of SSB choosing correct answers was slightly higher than among Non-SSB. Students in both schools answered "tectonic movement" and "volcano activity" as factors that trigger earthquakes and none responded that they were due to "man-made activity." Although the number of SSB was lower than Non-SSB, fatalistic view (God's punishment and voodoo) on the nature of earthquakes was held by students in both schools (**Fig. 1**).

Knowledge 2: Earthquake Occurrence. In relation to questions about "when do you think the next earthquake will happened in this area?" quoted from the Module on Earthquakes, the majority answered correctly with 96% SSB and 92% Non-SSB answering "at any time." Only a small number of Non-SSB responded incorrectly, with 6% responding "every 50 years" and 1% "every 25 years."

Knowledge 3: Impact of Earthquakes. In terms of response on the impact of earthquakes, the understanding that earthquakes "could destroy anything" was highest in both schools at 95% in SSB and 88% in Non-SSB. Students from both schools ranked "lanslides" as secondary impacts of earthquakes at 45% SSB and 24% Non-SSB. Only a smaller percentage of Non-SSB incorrectly an-

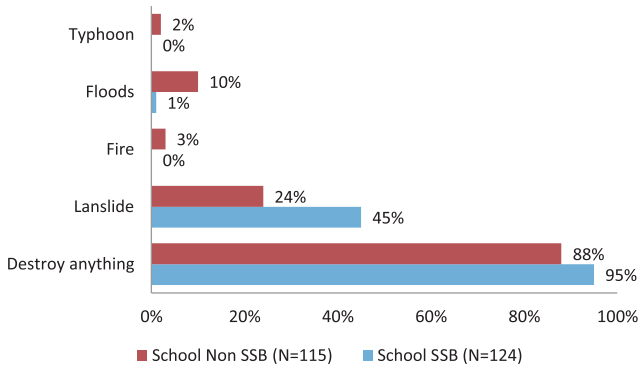

Fig. 2. Student's knowledge on impact of earthquake (multiple answers).

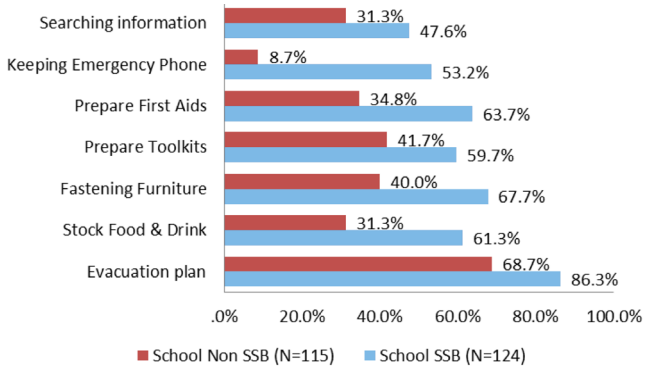

Fig. 3. Student's knowledge on earthquake preparedness (multiple answers).

swered that "flood" and "typhoon" were caused by earthquakes with 10% "flood" and 2% "typhoon." Surprisingly, only a few students chose "fire" as an impact of earthquakes, with 3% Non-SSB and no students in SSB chose "fire" (**Fig. 2**).

Knowledge 4: What human beings can do. When students asked, "What human beings can do to protect from earthquake hazard," students in both schools reported that human beings "can do nothing," with 50% in school SSB and 60% in Non-SSB. Similarly, 41% SSB and 20% Non-SSB said that the impact of earthquakes "can be reduced". While 29% SSB and 28% Non-SSB responded that they had "no idea," a small percentage answered that earthquake "can be prevented."

Knowledge 5: Earthquake Preparedness Action. In terms of knowledge of important action to be taken before an earthquake happened, there was a significant difference between SSB and Non-SSB, namely, in general, the percentage of SSB giving a correct action was higher than that of Non-SSB. The highest priority of earthquake preparedness chose by both was "establishing emergency plans" followed by "preparing tool kits," e.g., flashlights and radios, "fastening furniture" in place and "place heavy objects on lower shelves" from earthquake shaking. In contrast, the number of students choosing "depending on the government" (an "incorrect" answer) as one of earthquake preparedness measures was higher for SSB than Non-SSB (**Fig. 3**).

Knowledge 6: Responses to earthquakes. In relation to student understanding of responding to earthquake occurrence, 89% of SSB gave "drop, cover and hold" as the first choice among earthquake responses, compared to 51% of Non-SSB. Suprisingly, students in both schools said that "running outside" (not recommended) was their second choice of action go take in an earthquake – 35% SSB and 56% Non-SSB. Less than 5% in both schools answered that if conditions allowed, going to evacuation shelter would be a choice.

5.3. Risk Perception, Critical Awareness, Attitude and Preparedness

Differences in means and average scores in students knowledge, risk perception, critical awareness, attitude

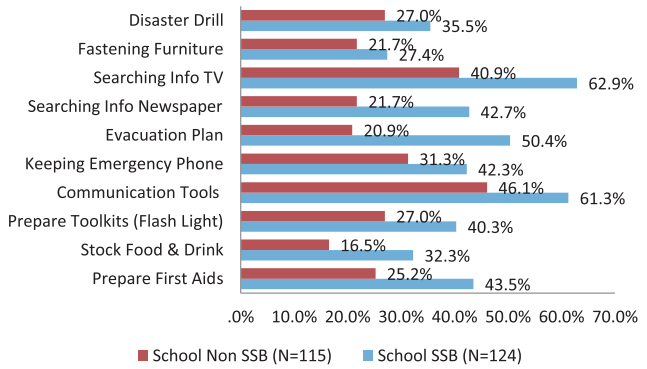

Fig. 4. Actual earthquake preparedness items reported done at home.

toward earthquake preparedness and actual preparedness are reported in **Table 1**. In general, means of all variables in SSB were higher than in Non-SSB. In terms of total knowledge (0-16 correct answers), SSB averaged 11 compared to 8.9 of Non-SSB. Similarly, in the case of risk perception, Non-SSB showed a lower mean (1-5) with 2.903 compared to 3.299 in SSB. Despitethis, in terms of critical awareness, the mean of SSB at 2.6 was slightly higher than that of Non-SSB at 2.4.Differences in mean are also evidence of student attitudes toward earthquake preparedness in both schools. As presented in **Table 1**, student attitude toward earthquake preparedness had a mean of 4.3 for SSV compared to 3.5 for Non-SSB, meaning that student views that preparing earthquake is useful is better in SSB than in Non-SSB. In terms of actual preparedness reported by students from both schools, data showed again that the mean (from 0-10) of SSB was higher at 4.8 than the 3.2 for Non-SSB (**Fig. 4**)

A comparison between **Figs. 3** and **4** shows that, in general, the percentage of students who has done earthquake preparedness items was not equal compared to student knowledge of earthquake preparedness except in searching for communication (newspaper and TV). Interestingly, students in Non-SSB had a higher score for "keeping emergency phones" in actual preparedness than in knowledge. The question of "knowledge of earthquake preparedness" allowed students to freely add any activities related to earthquake preparedness, yet no students

Table 1. MANOVA results for student knowledge, risk perception, critical awareness, attitude and preparedness scores for school groups.

Dependent Variables/School Groups	(Min-Max) Mean Score	Standard Error	df	F	Sig (p)	Partial Eta Squared
Knowledge	**(0 - 16)**	-	1, 209	30.609	.000	.128
SSB	12.229	.295	-	-	-	-
Non-SSB	9.882	.305	-	-	-	-
Risk perception	**(1 - 5)**	-	1, 209	9.233	.003	.042
SSB	3.299	.091	-	-	-	-
Non-SSB	2.903	.094	-	-	-	-
Critical awareness	**(1 - 5)**	-	1, 209	12.754	.000	.058
SSB	2.648	.070	-	-	-	-
Non-SSB	2.427	.072	-	-	-	-
Attitude	**(1 - 5)**	-	1, 209	53.193	.000	.203
SSB	4.309	.069	-	-	-	-
Non-SSB	3.590	.071	-	-	-	-
Preparedness	**(0 - 10)**	-	1,209	19.078	.000	.084
SSB	4.404	.248	-	-	-	-
Non-SSB	2.843	.257	-	-	-	-

answered "disaster drill" or "preparing communication means (having mobile phones or transistor radios" as an important thing in earthquake preparedness although they had done so in actual preparedness.

5.4. Statistical Analyisis

Given our focus on the effects of different school disaster educations, two factors were analysed using Multivariate Analysis of Variance (MANOVA)regarding SSB and Non-SSB on knowledge, risk perception, critical awareness, attitude and preparedness. MANOVA results revealed that Box's M did not meet the homogeneity of variance assumption ($F_{(15,174197)} = 5.068$, sig = .000). Results of Levene's test showed that knowledge ($F_{(1,209)} = 4.395$, sig = .037), critical awareness ($F_{(1,209)} = 12.342$, sig = .001) and preparedness ($F_{(1,209)} = 56.964$, sig = .000) variables did not meet the homogeneity of variance assumption compared to risk perception ($F_{(1,209)} = 1.866$, sig = .173) and attitude ($F_{(1,209)} = .3052$, sig = .582). Because samples were nearly equal in size, however, results of the MANOVA procedure were generally robust [40].

Our findings provide support for the effective different effects of disaster education programs in school. There was a significant effect of the disaster education program on combined dependent variables such as student knowledge, risk perception, critical awareness, attitude and preparedness ($F_{(5,205)} = 20.376$, sig = .000; Hotelling's Trace = .497; Partial Eta Squared = .332).

As shown in **Table 1**, implementation of curriculum-based disaster topics on school affected all student knowledge ($F_{(1,209)} = 28.464$, sig = .000), risk perception ($F_{(1,209)} = 9.233$, sig = .003), critical awareness ($F_{(1,209)} = 12.754$, sig = 000), attitude ($F_{(1,209)} = 53.193$, sig = 000) and preparedness ($F_{(1,209)} = 19.078$, sig = 000).

6. Discussion

The purpose of this study was to examine whether hazard education programs in school are effective in influencing students to take earthquake preparedness measures and other major factors linked to disaster preparedness behaviour. The effectiveness of disaster education programs in relation to knowledge is seen from the higher number of students giving correct answers such as "any time" in response to the occurrence of earthquakes. There was also a greater number of students responding correctly when they were asked how to prepare for earthquake hazards such as establishing emergency plans, preparing toolkits, preparing food and water, keeping emergency phone numbers handy, fastening furniture to keep it from moving and placing heavy objects on lower shelves.

Although disaster education programs in school have led to an increase in correct knowledge of earthquake hazards among students, it should be noted that a number of students in both schools said that earthquakes were caused by "God's punishment" and "voodoo". This finding is consistent with the idea that although persons may be given knowledge about disasters, they may still judge disasters differently based on social background factors such as religion, traditional beliefs and other cultural features [30]. This implies that in developing DRR materials in a country like Indonesia where the majority of the population belongs to a major religion such as Islam, it is important to take into consideration religious factors that facilitate the effectiveness of DRR. Although the dominant view in Islamic teachings in Indonesia is that natural disasters are God's punishment, some Moslem leaders believe that natural disasters are an environmental phenomenon and some Qur'an verses encourage people to prepare for disasters [41].

The effect of disaster education on other major factors correlates with disaster preparedness such as risk perception, but critical awareness, attitude toward preparedness

behaviour were other important findings. High risk perception, for example, is an important factor influencing people to take preparedness action as demonstrated by SSB students. This finding was consistent with previous research that disaster education in school affected risk perception [21, 24].

Previous studies failed to test the effect of hazard education on the critical awareness of students [8], yet the present study found that critical awareness among SSB students was higher than among Non-SSB. As discussed by McIvor and Paton [33], critical awareness is an important variable for making it easier for people to take protective action against earthquakes.

This study has also proven that the attitude toward earthquake preparedness SSB students was better than that of Non-SSB. Disaster education induced SSB students to believe that taking earthquake preparedness measures would reduce loss of life and injuries. Consistent with the idea of Ajzen et al., [34], these beliefs possibly came from information (knowledge) about the benefits of taking earthquake preparedness taught in school and past disaster experience into account.

The present study provides empirical findings on issues regarding the role of school hazard education in promoting disaster preparedness behaviour at home as done by Ronan et al., [20] despite only a limited 10-item earthquake preparedness scale. These findings met the general expectation that disaster education focus both on transferring knowledge of disaster to the students and on how to take preparedness action for disaster in school and at home [8]. Transferring knowledge about disasters in disaster education programs is just one step toward building safer schools. The next steps should be to encourage school teachers and students to update information, to increase the level of risk perception, to keep awareness fresh, and to increase the level of preparedness both at school and in the home.

Another factor that may contribute to the effectiveness of DRR education in SSB is that a mixed approach is used in teaching learning process. SSB teaches, for example, disaster subjects not limited only to lectures but also develops different methods such as extracurricular activities, experiments and disaster drills. SSB also built disaster evacuation facilities in school areas such as disaster public kitchen, disaster public sanitary, evacuation centre, and signboards showing ways to evacuation centers. In relation to risk communication, students and teachers created murals and disaster education on school walls. These activities helped maintain student awareness of disasters in daily living.

Findings showed that having schools implement DRR education effectively increased student knowledge, risk perception, critical awareness, and attitude toward preparedness behaviour despite limited earthquake preparedness. A comparison of student knowledge and actual behavior in earthquake preparedness measures supports previous research findings that better knowledge of disasters is not always followed by real action [18]. Policy makers should address factors contributing to an increase in student preparedness behaviour such as knowledge, risk perception, critical awareness and attitude toward disaster preparedness behaviour. Disaster preparedness behaviour, if assumed to be the ultimate goal of disaster education programs, should reflect change in student preparedness behaviour at school and at home. Therefore school can serve as safer places and knowledge centre for disaster for the wider community.

Use of the self-reporting method might be expected to result in an overestimate of the actual preparedness of the students since respondents might consider that reporting more (rather than less) preparedness behavior would make them look good, or at least diminish any feeling of inadequacy or guilt they might have for not doing more. However, possible concern about this is lessened because of the finding that the level of actual preparedness is quite low in both schools. Further study should focus on different effects of disaster education programs in school and the wider community in influencing the level of household earthquake preparedness.

7. Conclusions

This study involving students in two junior high schools, SSB and Non-SSB, has demonstrated that the SSB program was effective in enhancing disaster knowledge and in increasing the level of risk perception and critical awareness, attitude toward earthquake preparedness and actual preparedness after the 2006 Yogyakarta Earthquake. Although SSB is better than Non-SSB in variables of knowledge, risk perception, critical awareness, and attitude, the level of actual preparedness was quite low. This implies that increasing the number of major factors in earthquake preparedness has not been transferred to actual preparedness behaviour, which was one of the expected goals of disaster education program. Effort should be made by local government officials, teachers, and other stakeholders to evaluate and develop public education in school focusing on increasing preparedness behaviour.

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