



Enhancing Disaster Preparedness among Elementary School Students through Flood Preparedness Training: A Pre-Experimental Study

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Abstract

Children are a vulnerable group in disasters due to their limited physical strength, susceptibility to illness, and emotional instability. Reducing vulnerability is essential for protecting children during disasters, and one crucial factor in their preparedness is disaster education. This study aimed to evaluate the effect of flood disaster preparedness training on improving elementary school students' preparedness in dealing with flash floods. A pre-experimental design with a one-group pretest-posttest approach was employed, involving 50 students from SDN 23 Guguak Randah. The intervention consisted of a 60-minute training session using lectures, discussions, videos, and disaster simulations. Disaster education plays a significant role in raising children's awareness about disasters and their risk perception. Students' knowledge was assessed using a validated 10-item questionnaire before and after the intervention. The data were analyzed using the Wilcoxon test. The results showed an increase in the mean knowledge score from 69.20 (SD = 17.71) before training to 80.40 (SD = 15.53) after training ($z = 4.089$, $p < .0001$). These findings demonstrate that flood preparedness training significantly enhances students' knowledge and awareness of disaster preparedness. Disaster education programs for children have been considered an innovative approach to disaster risk reduction. The use of lecture-based methods, complemented by simulations, can significantly improve students' comprehension of the concepts and materials being taught. Routine implementation of disaster preparedness programs in schools, in collaboration with the Regional Disaster Management Agency (BPBD), is recommended to strengthen children's resilience and readiness for future disasters.

Keywords: Children, Disaster, Disaster Preparedness, Students, Elementary School

INTRODUCTION

Indonesia is one of the most disaster-prone countries in the world due to its geographical location within the Pacific Ring of Fire. In recent years, West Sumatra has been particularly vulnerable to flash floods, which are exacerbated by heavy rainfall and the sedimentation of volcanic material from Mount Merapi. These conditions have led to severe flooding in several districts, including Agam, Tanah Datar, and Padang Panjang. Such events have caused significant loss of life, infrastructure damage,



and disruption to education, underscoring the urgent need for disaster risk reduction initiatives. The flash floods in West Sumatra in May 2024 caused extensive damage to educational infrastructure, with 27 schools reported to have been affected. This highlights the vulnerability of the region's educational facilities to natural disasters and emphasizes the necessity for stronger disaster preparedness and mitigation strategies (<https://dibi.bnpp.go.id/>). Schools are the second place after home where students gather and spend approximately 7 hours learning. This makes schools highly vulnerable to significant casualties if disaster risk reduction efforts are not implemented (Evie et al., 2022).

Disasters that occur not only cause loss of life and damage to infrastructure but also to the social structure of society (PP RI, 2008). Disasters can also cause various health problems, especially vulnerable groups such as infants, children, pregnant or breastfeeding mothers, disabilities and the elderly. Therefore, this group is a priority regarding disaster management (PP RI, 2008). In addition, previous studies have identified that the incidence of stress, anxiety and depression also increases after a disaster (Sugianto et al., 2022). A systematic review found that although many children experience stress due to disasters, most will adapt to their environment and only a small number experience ongoing psychopathology. The development of psychological distress in children and adolescents is closely related to various risk and protective factors. Factors that place young people at risk of mental health distress can include high levels of disaster exposure, low parental support, social isolation, poverty, and pre-existing mental health symptoms such as anxiety and depression. In contrast, protective factors, such as peer social support, school connectedness, supportive parenting, problem-solving, self-regulation skills, self-confidence, and positive mother-child relationships, can buffer the psychological impact of sudden large-scale disaster (Powell et al., 2021). In addition to children and adolescents, disasters also impact educational units. Some of the impacts that may occur include learning not being able to be carried out due to damage to school facilities and infrastructure, schools being difficult to reach and the absence of playgrounds for children (Kementrian Pendidikan, 2023).

Children are included in the age group that is vulnerable to disasters because, at that age, children do not have sufficient physical strength, are susceptible to disease and are emotionally unstable (Qodir et al., 2023). Reducing vulnerability is one way to protect children in disasters. Children are more vulnerable to injury, and they depend on others for life-saving, livelihood, decision-making, and emotional support, and this makes them vulnerable. Attention to children before a disaster is part of the preparedness phase and will reduce their vulnerability.

Schools play a vital role in disaster risk education, as they can reach children systematically and teach them practical survival skills. The Sendai Framework for Disaster Risk Reduction (2015-2030) emphasizes the importance of education and awareness-raising as essential components of building a culture of safety and resilience. By increasing children's awareness of disasters, children can share their knowledge with adults, which can help improve adult preparedness (Seddighi et al., 2021). School-based disaster education should be an integral part of community-based disaster preparedness programs (Seddighi et al., 2021).

Several disaster preparedness education activities conducted previously have shown significant results, with improvements in students' knowledge and skills regarding disaster awareness (Arinata et al., 2023; Evie et al., 2022; Kharisna et al., 2023; Mas'ula et al., 2022; Pahleviannur, 2019). One of the previous community service activities used a method involving the provision of a video on disaster preparedness, followed by a simulation. The results indicated an increase in students' knowledge about disaster preparedness (Qodir et al., 2023).



Different methods in disaster education must be utilized, and the continuity of education is crucial for preparedness education for children. Lectures and textbook reading for disaster education are ineffective, and these methods must be combined with drills and disaster exercises. Using various tools and equipment is essential for disaster preparedness. Comprehensive and exclusive school-based disaster education textbooks are needed to achieve better outcomes. School-based disaster education should be an integral part of community-based disaster preparedness programs (Seddighi et al., 2021). Therefore, this study seeks to address this gap by examining the effectiveness of flood disaster preparedness training in improving students' knowledge and readiness to respond to flash floods in West Sumatra.

METHODS

Study Design, setting and sample

This study employed a pre-experimental design with a one-group pretest-posttest approach. A total of 50 students from grades 4 to 6 at SDN 23 Guguak Randah were recruited through total sampling. Inclusion criteria required that students were willing to participate and had parental consent. Exclusion criteria included students who were absent on the day of the study or who had previously received formal disaster preparedness training. Participants were invited by the class teachers, who informed them about the study and obtained parental consent. To ensure participation, students who met the inclusion criteria were asked to confirm their willingness to participate during the class briefing. SDN 23 Guguak Randah is a rural school located in the Guguak Randah district, with students primarily from low to middle-income families. The sample size of 50 was chosen based on prior studies in similar contexts (Evie et al., 2022; Mas'ula et al., 2022), where this number was found sufficient to detect meaningful differences while being feasible given the resources and time constraints of the study.

Variable, Measurement and Data Collection

The training intervention, lasting 60 minutes, was conducted by a research team in collaboration with Regional Disaster Management Agency (BPBD). The facilitators were experienced disaster preparedness trainers from BPBD Agam, with backgrounds in disaster management and education. The training session took place in a classroom setting at SDN 23 Guguak Randah, where students were seated in groups of 10 to encourage interaction and engagement during the activities. The session was structured to include lectures, discussions, video demonstrations, and practical simulations focusing on flood causes, evacuation routes, and self-protection strategies. To measure students' knowledge before and after the intervention, a knowledge questionnaire consisting of 10 questions was used. The questionnaire was adapted from previously validated instruments in disaster education and was reviewed for content accuracy by experts in disaster management. Each correct answer was scored 1 point, and incorrect answers received zero points. The higher the knowledge score, the better the students' knowledge of disaster preparedness. To maintain participant engagement throughout the 60-minute session, the facilitators used interactive techniques such as asking questions during the lecture, encouraging student participation in discussions, and conducting hands-on activities during the practical simulations. Frequent breaks and opportunities for student feedback were incorporated to ensure active involvement and retention of information.

Data Analysis

Data were analyzed using SPSS 27 software. The unit of analysis in this study was at the individual level, with each student's knowledge score treated as a separate data point. To determine the



frequency distribution and characteristics of the students, univariate analysis was used. To assess the effect of the training intervention on students' knowledge, bivariate analysis was conducted. Given that the results of the analysis showed that the data were not normally distributed, the non-parametric Wilcoxon signed-rank test was used to compare pretest and posttest knowledge scores. Statistical significance was set at $p < .05$. Regarding missing data, any incomplete responses were handled by exclusion, meaning that only students who completed the entire questionnaire were included in the analysis. Effect size was calculated using the r -value from the Wilcoxon test to provide a measure of the magnitude of the training's effect. Additionally, 95% confidence intervals were reported for the pretest and posttest scores to convey the precision of the estimated effects.

RESULTS

A total of 50 students from grades 4 to 6 at SDN 23 Guguak Randah were initially assessed. All 50 students were invited to participate in both the pretest and posttest assessments. No participants were excluded from the study, and all 50 students completed both the pretest and posttest. As a result, there were no missing data points, and the full sample of 50 students was analyzed.

Respondent characteristics

The following explains the characteristics of students who were respondents in this study, including: gender, age, and class. The recruitment process was carried out in September 2024, during which teachers informed students about the study and obtained parental consent. The disaster preparedness training was implemented in October 2024 and lasted for 60 minutes. Students completed a pretest assessing their knowledge of flood preparedness immediately before the intervention, while the posttest was administered directly after the training. Because the pretest and posttest were conducted within a short time frame, it is unlikely that seasonal variations or contextual factors such as changes in school activities or external events affected the study outcomes.

Based on Table 1, it is known that most of the respondents are female. The age distribution of respondents was mostly 12 years old.

Table 1. Respondent Characteristics		
Characteristics	f	%
Sex		
Girl	37	74.0
Boy	13	26.0
Age		
9 years	12	24.0
10 years	6	12.0
11 years	19	38.0
12 years	11	22.0
13 years	2	4.0
Grade		
4	19	38.0
5	14	28.0
6	17	34.0



In this study, all participants were treated as a single cohort, and no control or comparison group was used. This design is based on a pre-experimental approach with a one-group pretest-posttest structure, where all students received the same training intervention. As such, there was no intention to compare outcomes between different groups, and the results should be interpreted within the context of this design.

Regarding the participant characteristics presented in Table 1, it is evident that more than half of the respondents were girls, comprising 74.0% of the total sample. Approximately 38.0% of the participants were 11 years old, and nearly half of the respondents were in grade 4 of elementary school.

Student's knowledge before and after intervention

Table 2 provides information about students' knowledge before and after the training. It can be seen that the average score of students' knowledge increased after the training, from 69.20 before the training to 80.40 after the training. The average score of students' knowledge before training was 69.20, with a standard deviation of 17.71, the lowest value of 30, and the highest value of 100. The results of the analysis showed that the 95% confidence interval for the average score of students' knowledge before training was between 64.17 and 74.23. The average score of knowledge after training was 80.40, with a standard deviation of 15.53, the lowest value of 40, and the highest value of 100. The 95% confidence interval for the average score of students' knowledge after training was between 75.70 and 85.10.

Table 2. The average of student's knowledge before and after intervention

Variable	Mean	SD	n	Min-Max	95% CI
Knowledge					
<i>Pretest</i>	69.20	17,71	50	30-100	64.17 - 74.23
<i>Posttest</i>	80.40	15.53	50	40-100	75.70 - 85.10

The effect of disaster preparedness training on student's knowledge

Table 3 presents the students' knowledge scores before and after the training. The average score increased from 69.20 (SD = 17.71) before the training to 80.40 (SD = 15.53) after the intervention, reflecting an improvement of 11.2 points (or 16.2%) This significant improvement in knowledge, supported by a Wilcoxon Signed-Rank test ($z = 4.089$, $p < .0001$), suggests that the training effectively enhanced students' disaster preparedness knowledge. The effect size, calculated using the r -value, was 0.58, indicating a medium to large effect. The results indicate that despite some students showing little or no improvement, the majority of participants demonstrated better understanding and awareness of disaster preparedness after the intervention. These findings emphasize the effectiveness of the training in increasing students' knowledge, as reflected in the overall improvement in posttest scores.

Table 3. Wilcoxon test of disaster preparedness training on student's knowledge

Knowledge	N	Mean Rank	Rank Sum	z	p
Pretest	Negative Rank	8	14.94	4.089*	< .0001
Posttest	Positive Rank	33	22.47		
	Equal	9			
	Total	50			

*Base on negative rank

* $p < .05$

DISCUSSION

In this study, the average knowledge score of students before the training intervention was 69.20, which increased to 80.40 after the intervention. Further analysis revealed a significant difference in students' knowledge scores between the pretest and posttest ($z = 4.089$; $p < .0001$), demonstrating the effectiveness of the training in improving students' knowledge and preparedness for dealing with disasters. The improvement can be attributed to the **interactive learning methods** used during the training, including **experiential learning** through simulations. Engaging students in realistic scenarios likely enhanced their memory retention and active participation, which are crucial for reinforcing disaster preparedness knowledge. Additionally, the use of multiple learning approaches such as lectures, discussions, and hands-on simulations may have contributed to better engagement and a deeper understanding of the concepts (Gualtieri & Finn, 2022; Martinez & Gomez, 2025).

Similar research in Konawe Regency tested the effect of module-based disaster response training and simulations on community preparedness knowledge. The results showed an increase in respondents' preparedness after receiving training with modules and simulations. This finding aligns with the conclusion that module-based emergency response training and simulations significantly impact preparedness knowledge (Iqra & Tahir, 2022). A similar study conducted in Pekanbaru also demonstrated that after educating students, there was a notable increase in their knowledge, response, and understanding of preparedness during earthquakes and fires (Kharisna et al., 2023). These studies align with the present study's findings, confirming that interactive and simulation-based disaster education is effective in enhancing knowledge and preparedness.

In this study, students were trained in flood disaster preparedness through the provision of materials, discussions, and disaster prevention simulations. A similar approach was employed in research involving students from SD Negeri Ngijo 01 Gunungpati, Semarang City, where the results revealed significant improvements in students' knowledge and response skills, particularly regarding landslides (Arinata et al., 2023). The increase in students' knowledge and awareness of disaster preparedness can likely be attributed to the intervention methods employed. Active participation, particularly in the discussion sessions and practical activities, played a key role in shaping students' awareness and responsiveness to potential disasters in their environment.

Education through early socialization in the school sector is essential in minimizing disaster risks within the community. Such efforts not only enhance public understanding of disaster preparedness but also contribute to overall community resilience (Pahleviannur, 2019). The combination of lecture-based methods with simulations, a form of active and engaging learning, facilitates the development of attitudes, behaviors, and responses to simulated disaster scenarios, thereby deepening students' understanding of disaster risks and preparedness (Salsabila & Dinda, 2021).

Over the past few decades, disaster education programs for children have been recognized as a vital approach to disaster risk reduction. Many theories, including those related to **Social Learning Theory**, support the benefits of these programs. Education improves children's risk perception and prepares them for disaster situations. International consensus emphasizes that disaster education for children strengthens both their preparedness and resilience, with the most critical aspect of training focusing on preparedness (Torani et al., 2019). Schools, therefore, play a pivotal role in strengthening community resilience by delivering education on disaster risk reduction. Integrating disaster education into school programs, particularly in disaster-prone areas, is increasingly important (Yusuf et al., 2022).



In this study, eight students experienced a decrease in knowledge scores, while nine students showed no improvement after the intervention. This outcome suggests that several factors could influence the effectiveness of disaster preparedness training. One key factor is the level of children's acceptance of information during the training sessions. Children's ability to absorb and retain information varies significantly based on their cognitive development, attention span, and interest in the material being presented (Gualtieri & Finn, 2022). Environmental factors, such as students' home life, prior experiences, and family support, may also influence their engagement with the training content. These factors can either enhance or hinder students' ability to internalize disaster preparedness knowledge, as seen in the diverse outcomes of this study (Javornik & Klemenčič Mirazchiyski, 2023).

Despite the mixed results, the overall benefit of the training in enhancing students' disaster preparedness is evident. Research shows that training programs can significantly improve children's awareness and readiness for disasters by fostering a sense of responsibility and preparedness (Seddighi et al., 2021; Torani et al., 2019). Active learning activities, such as discussions and hands-on simulations, contribute to a more engaging and memorable learning experience, which is crucial for long-term retention (Martinez & Gomez, 2025). This engagement allows students to better apply the knowledge in real-life scenarios, such as spreading the information to their families and taking appropriate action during emergencies. By training elementary school students, it is expected that they will serve as agents of change, helping to raise disaster awareness within their households, thus contributing to broader community resilience.

Furthermore, the findings align with previous research highlighting the importance of tailored and interactive disaster education programs for children. Such programs are essential for improving individual preparedness and fostering a culture of safety and resilience within families and communities (Seddighi et al., 2021; Torani et al., 2019). Although some setbacks in knowledge retention were observed for certain students, the overall positive impact of the training suggests that schools should continue to invest in comprehensive disaster preparedness programs. Future interventions may benefit from incorporating feedback mechanisms to identify and address barriers to knowledge retention, such as varying levels of understanding among students or external factors affecting engagement (Seddighi et al., 2021). Ultimately, equipping children with the skills and knowledge to manage disasters enhances their resilience and contributes to the broader goal of community-wide disaster preparedness.

Limitation

However, it is important to acknowledge potential **biases** in the study. The absence of a **control group** limits the ability to definitively attribute the improvements in knowledge solely to the intervention, as other factors (e.g., prior exposure to disaster education) may have influenced the results. Furthermore, the study's **limited follow-up duration** means that the long-term retention of the learned material was not assessed, leaving open the question of whether the increased knowledge will be sustained over time.

While the findings of this study suggest that disaster preparedness training can be effective in improving students' knowledge and readiness, it is important to consider the generalizability of these results. The intervention in this study was conducted at SDN 23 Guguak Randah, a rural school in West Sumatra, and the effectiveness of the training may vary when applied to other schools, especially those in urban areas or with different socio-economic characteristics.



Differences in student demographics, such as age, cognitive development, and prior exposure to disaster education, could influence the outcomes of similar interventions. Furthermore, variations in school facilities and resources such as the availability of training materials, the ability to conduct simulations, and the level of teacher expertise may impact the effectiveness of disaster preparedness programs. Schools in regions with fewer resources or more limited access to qualified instructors may face challenges in implementing such training with the same level of success.

However, with appropriate adaptations to fit local contexts, the intervention could potentially be applied to other schools in West Sumatra or in other disaster-prone areas. Tailoring the program to meet the specific needs of different student populations, integrating local disaster risks, and ensuring access to necessary resources would help maximize the effectiveness of such programs in diverse settings.

CONCLUSION

This study demonstrates that disaster preparedness training can significantly improve students' knowledge. On average, students' knowledge scores increased by **11.2 points**, from **69.20** before the intervention to **80.40** after the training, indicating a measurable improvement in preparedness awareness. These findings highlight the effectiveness of the training and the positive impact of disaster prevention simulations on students' understanding of disaster risks.

It is recommended that disaster preparedness training, along with simulations, be routinely implemented in schools, with the involvement of local disaster management agencies (BPBD). Additionally, incorporating such programs into extracurricular activities could further enhance students' awareness and preparedness for disasters, ensuring long-term resilience in disaster-prone areas.

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