

The Effectiveness of School-Based Disaster Preparedness Improvement Programs among School-Aged Students: A Systematic Literature Review

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Abstract: Children are among the most vulnerable populations during disasters due to their limited capacity to respond independently. Disaster preparedness education in schools is essential to improve students' readiness to respond to disasters. Although various school-based disaster preparedness programs have been implemented, evidence comparing the effectiveness of different intervention approaches remains limited. Therefore, this systematic literature review aimed to evaluate and compare the effectiveness of school-based disaster preparedness improvement programs for students. This research is based on the PRISMA guidelines registered in PROSPERO with ID number CRD420251271966. Literature searches were conducted in PubMed, Scopus, Nature, SAGE, ProQuest, and ScienceDirect for studies published between 2015 and 2025 using Boolean operators (AND/OR). A total of 15,551 records were identified. After duplicate removal, screening, eligibility assessment, and methodological quality appraisal using the JBI Critical Appraisal Checklist, 13 studies were included and synthesized using a narrative synthesis approach. The findings showed that school-based disaster preparedness programs consistently improved students' disaster preparedness. Simulation and experiential learning-based interventions demonstrated the most comprehensive improvements in disaster knowledge, emergency response skills, decision-making, self-efficacy, and practical preparedness. Technology-based interventions, curriculum-based programs, and local wisdom approaches also contributed to improving disaster preparedness through different learning mechanisms. Integrating simulation, technology-assisted learning, curriculum-based education, and local wisdom may provide the most comprehensive strategy for strengthening school disaster preparedness. These findings support the development of evidence-based disaster education and reinforce the roles of nurses, educators, and policymakers in implementing effective school-based disaster preparedness programs.

Keywords: Children, Disaster education, Disaster Preparedness, Nursing role

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INTRODUCTION

Natural disaster are abrupt ecological occurrences. The ecology, infrastructure, and the social and economic lives of towns can all suffer significant harm from natural disaster. Many natural calamities, such as earthquakes, tsunamis, floods, and volcanic eruptions, happen suddenly. These occurrences frequently have detrimental and extensive repercussions. Natural disaster impact millions of people worldwide each year, resulting in fatalities, significant material losses, and disruptions to social wellbeing ([Alper et al., 2025](#)). Indonesia is known for being highly susceptible to disasters. Geographically, Indonesia is situated in the ring of fire and located at the meeting point of tectonic, which makes disasters more common.

There were roughly 2,726 disasters in Indonesia, including 22 earthquakes, 529 forest and land fires, 199 landslides, 1,340 floods, 582 extreme weather events, 16 tidal waves, 33 droughts, 1 tsunami, and 4 volcanic eruptions, Based on data from the National Disaster Management Agency (BNPB). In

Central Java alone, there were 292 disasters ([BNPB, 2025](#)). This figure shows that Indonesia is risk at various disasters.

The nation of Indonesia is highly susceptible to a variety of natural calamities. Natural disasters have the potential to kill a large number of people, including adults and children. Because they rely on adults both parents and caregivers for their protection and security, children are seen to be the most vulnerable category ([Newnham et al., 2023](#)). Kids are a part of school, where they study from dawn till dusk. However, schools are also vulnerable to danger because that is where children generally gather, and most children are not trained in evacuation drills and often panic in emergency situations. Children are challenging to manage during a crisis, which increases their risk of harm and death, particularly because they are less able to act quickly. Thus, to guarantee their safety, a strong readiness system is crucial, particularly when handling emergency situations ([Widowati et al., 2023](#)).

For school children to be prepared in the case of a disaster, disaster preparedness programs and training are crucial. Due to their vulnerability, children require a thorough awareness of first aid, evacuation protocols, and emergency response techniques. The disaster preparedness program has proven effective in reducing the possibility of harm or death during a crisis, an effective disaster preparedness program can enhance students capacity to react promptly and effectively. Disaster preparedness programs are a key aspect of reducing the risks and impacts of catastrophe. In the context of health, preparedness refers to ability of health systems and medical personnel to respond quickly and effectively to emergencies caused by natural disasters. Health workers, especially health student, play a key role in supporting disaster preparedness in schools. In addition to being responsible for providing first aid, nurses also have an important role in trauma management, medical evacuation, and providing psychological support after a disaster. The involvement of health workers especially school nurses Students safety and well-being at school can be enhanced by participating in disaster preparedness programs, which will also increase their psychological and medical preparedness and enable them to react more effectively in emergency situations. There are different sorts of disaster preparedness programs, but there has been no systematic research determining which that programs are most helpful in enhancing student preparedness. Programs that not only improve readiness but also mold students attitudes and understanding to be more capable of handling emergencies are therefore required. To evaluate the different disaster preparedness initiatives that have been put in place in schools, a Systematic Literature Review (SLR) was carried out. This study aims to provide information about disaster preparedness programs and to identify the most effective interventions. This review is entitled "The Effectiveness of Disaster Preparedness Improvement Programs for School Students: A Systematic Literature Review." Natural disaster are abrupt ecological occurrences. The ecology, infrastructure, and the social and economic lives of towns can all suffer significant harm from natural disaster. Many natural calamities, such as earthquakes, tsunamis, floods, and volcanic eruptions, happen suddenly. These occurrences frequently have detrimental and extensive repercussions. Natural disaster impact millions of people worldwide each year, resulting in fatalities, significant material losses, and disruptions to social wellbeing ([Alper et al., 2025](#)). Indonesia is know for being highly susceptible to disasters. Geographically, Indonesia is situated in the ring of fire and located at the meeting point of tectonic, which makes disasters more common.

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are challenging to manage during a crisis, which increases their risk of harm and death, particularly because they are less able to act quickly. Thus, to guarantee their safety, a strong readiness system is crucial, particularly when handling emergency situations ([Widowati et al., 2023](#)).

For school children to be prepared in the case of a disaster, disaster preparedness programs and training are crucial. Due to their vulnerability, children require a thorough awareness of first aid, evacuation protocols, and emergency response techniques. The disaster preparedness program has proven effective in reducing the possibility of harm or death during a crisis, an effective disaster preparedness program can enhance students capacity to react promptly and effectively. Disaster preparedness programs are a key aspect of reducing the risks and impacts of catastrophe. A previous study conducted by [Sibualamu et al. \(2024\)](#) on disaster preparedness among students identified three key factors that contribute to improving students' preparedness: students' knowledge and attitudes, the effectiveness of school-based programs, and school engagement. However, the study did not specify which school-based programs are the most effective in enhancing disaster preparedness. Therefore, a literature review is needed to examine, compare, and identify the most effective programs for improving disaster preparedness among students. There are different sorts of disaster preparedness programs, but there has been no systematic research determining which that programs are most helpful in enhancing student preparedness. Programs that not only improve readiness but also mold students attitudes and understanding to be more capable of handling emergencies are therefore required. To evaluate the different disaster preparedness initiatives that have been put in place in schools, a Systematic Literature Review (SLR) was carried out. This study aims to provide information, to examine, compare, and identify the most effective interventions. The research question in this systematic literature review focuses on the effectiveness of disaster preparedness intervention programs in improving school student preparedness. This review is titled "The Effectiveness of School-Based Disaster Preparedness Improvement Programs among School-Aged Students: A Systematic Literature Review"

METHODS

Study Design

This systematic literature review use Preferred Reporting Items for Systematic Reviews and Meta-Analyses or PRISMA 2020 Tools criteria served as the foundation. This SLR aims to find out which programs most effective for enhancing student readiness. A narrative synthesis was conducted to summarize, compare, and interpret the findings of the included studies. The interventions were categorized based on their types, and their effectiveness was compared based on the reported outcomes. This review registered in PROSPERO with Number ID CRD420251271966. Before searching the literature, a PICO framework was developed to guide this review. P (Population) : Students enrolled in programs to prepare for disasters, I (Intervention) : Disaster preparation intervention programs to enhance students' readiness, such as interactive learning, technology-based educational apps, training, and disaster simulations, C (Comparison) : The control group that either got no intervention at all or an intervention unrelated to disaster preparedness, O (Outcome) : including preparedness scores, disaster knowledge, attitudes, self-efficacy, and disaster response skills.

Eligibility

The article in this study following criteria were used for inclusion and exclusion : Criteria for Inclusion such as 1) Research that assesses disaster preparedness initiatives in school children using quasi-experimental or randomized controlled trials (RCT) methodologies, 2) Students enrolled in disaster preparedness programs from elementary to high school make up the population used, 3) Intervention programs for disaster preparedness, 4) Research with a control group that either receives a different intervention or does not receive the intervention at all, 5) Research that assesses students' practical skills in handling disasters, preparedness scores, attitudes, their self-efficacy, or their understanding of disaster preparedness, 5) English-language articles. Exclusion Criteria such as : 1) Research using non-experimental designs, including correlation, observational, cross-sectional, and survey studies, 2) Research that uses adults, teachers, or non-school communities as the population

instead than schoolchildren, 3) Research that does not concentrate on disaster preparedness.

The article search strategy was carried out in several electronic databases, including PubMed, Scopus, Nature, Sage, ProQuest, and ScienceDirect. The search strategy was developed using a combination of Medical Subject Headings (MeSH) terms and keywords related to disaster preparedness, schools, and students. Boolean operators (AND and OR) were used to combine search terms. The search strategy used the following Boolean operators such as ("Disaster Management" OR "Disaster Preparedness" OR "Disaster Readiness") AND ("School" OR "Schoolchildren" OR "Students") AND ("Preparedness" OR "Emergency Preparedness"). The literature search was limited to English-language articles published between 2015 and 2025.

Study Selection Process

The screening article process was summarized using the PRISMA 2020 diagrams to ensure transparency. The first author conducted the paper. This screening process was undertaken in three stages, namely Identification, Screening, and Eligibility. Articles were searched through several databases, including PubMed, Scopus, SciDirect, Nature, Sage, and ProQuest, using keywords developed with Boolean operators. After the review, a final screening was conducted, and articles that were less suitable, had high bias, were not relevant to the research question, had unclear data collection, and had unclear population selection were excluded. nine articles were excluded from this screening. Thirteen articles were considered eligible and data extraction was performed using a table. Each report will be evaluated by the first and second author in this study to minimize bias and ensure consistency. Any disagreement between reviewers at any stage can be resolved through discussion and consensus. However, if consensus cannot be reached the first and second authors will consult with a third review to make a decision.

Risk Of bias

The data was collected were appraised by applying the Joanna Briggs Institute tools checklist (JBI) criteria, with the aim of determining the quality of the methods used in the research. JBI is used for research involving randomized controlled trials and quasi-experimental studies. Selected articles are then assessed using the JBI. Articles using a Randomized Controlled Trial (RCT) design are evaluated based on 13 criteria, while articles using a Quasi-experimental design are evaluated based on 9 criteria. Each article was independently assessed by two reviewers (the first and second authors) to minimize bias and ensure consistency in the appraisal process. Any disagreements between the reviewers were resolved through discussion and consensus. If consensus could not be reached, a third reviewer was involved to make the final decision. The methodological quality of the included studies was interpreted based on the percentage of fulfilled JBI appraisal criteria. Studies achieving a score of $\geq 67\%$ were considered to have acceptable methodological quality and were eligible for inclusion, whereas studies with scores below 67% were excluded due to insufficient methodological rigor. This cut-off was established based on the principle that studies meeting at least two-thirds of the JBI appraisal criteria demonstrate adequate methodological quality and a lower risk of bias. The risk of bias assessment using the JBI critical appraisal checklist showed that all included studies met the minimum quality criteria for inclusion. The JBI appraisal score was calculated by dividing the number of "Yes" responses by the total number of applicable appraisal criteria, then multiplying the result by 100 to obtain a percentage score. Each criterion was scored as "Yes", "No", "Unclear", or "Not Applicable (NA)". The final percentage score represented the proportion of fulfilled methodological quality criteria for each study. The appraisal scores ranged from 67% to 77%, indicating acceptable methodological quality. The detailed results of the risk of bias assessment are presented in [Table 1](#) and [Table 2](#).

Table 1. JBI Appraisal tool for Randomized Controlled Trial (RCT)

Author and Year	Questions													Score
	1	2	3	4	5	6	7	8	9	10	11	12	13	
(Setioputro et al., 2025)	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	69%

Table 2. JBI Appraisal tool for Quasi-Experimental

Author and Year	Questions									Score
	1	2	3	4	5	6	7	8	9	
(Thangarajath, 2022)	Y	N	N	Y	Y	Y	Y	Y	Y	77 %
(Yulfiwanti et al., 2025)	Y	N	N	Y	Y	Y	Y	Y	Y	77 %
(Nurlaili et al., 2024)	Y	Y	NA	Y	Y	Y	N	NA	Y	67 %
(Abdillah et al., 2020)	Y	N	NA	Y	Y	Y	Y	NA	Y	67 %
(Rahmawati et al., 2020)	Y	N	Y	Y	Y	NA	Y	NA	N	67 %
(Irdayasa et al., 2019)	Y	N	N	Y	Y	Y	Y	NA	Y	67 %
(Nopembri et al., 2021)	Y	N	N	Y	Y	Y	Y	N	Y	67 %
(Amri et al., 2021)	Y	N	N	Y	Y	Y	Y	NA	Y	67 %
(Intaramuean et al., 2025)	Y	Y	Y	Y	Y	Y	NA	Y	Y	88 %
(Yildiz et al., 2024)	Y	Y	Y	Y	Y	Y	Y	Y	Y	100 %
(Zuhriyah et al, 2025)	Y	Y	NA	Y	Y	Y	NA	Y	Y	77 %
(Lestari et al., 2025)	Y	Y	Y	Y	Y	Y	Y	Y	Y	100 %
(Saprudin et al., 2025)	Y	Y	Y	Y	Y	Y	Y	Y	Y	100 %

Table 3. RoB 2 Tools for RCT

Author and Year	D1	D2	D3	D4	D5	Overall
(Setioputro et al., 2025)						

Table 4. ROBINS-I Tools for Quasi-experimental

Author and Year	D1	D2	D3	D4	D5	D6	D7	Overall
(Thangarajath, 2022)								
(Yulfiwanti et al., 2025)								
(Nurlaili et al., 2024)								
(Abdillah et al., 2020)								
(Irdayasa et al., 2019)								
(Nopembri et al., 2021)								
(Amri et al., 2021)								
(Intaramuean et al., 2025)								
(Yildiz et al., 2024)								
(Zuhriyah et al, 2025)								
(Lestari et al., 2025)								
(Saprudin et al., 2025)								

To provide a more comprehensive evaluation of internal validity, an additional risk of bias assessment was conducted. The randomized controlled trial was evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool, whereas the quasi-experimental studies were assessed using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool. Overall, the included studies demonstrated a

low to moderate risk of bias. The randomized controlled trial was judged as having some concerns, primarily due to potential bias arising from deviations from the intended intervention. Among the quasi-experimental studies, most were rated as having low or moderate risk of bias, whereas one study was judged as having a serious risk of bias, mainly because of potential confounding and bias in outcome measurement. No study was classified as having a critical risk of bias. The detailed results of the risk of bias assessment are presented in [Table 3](#).

RESULTS

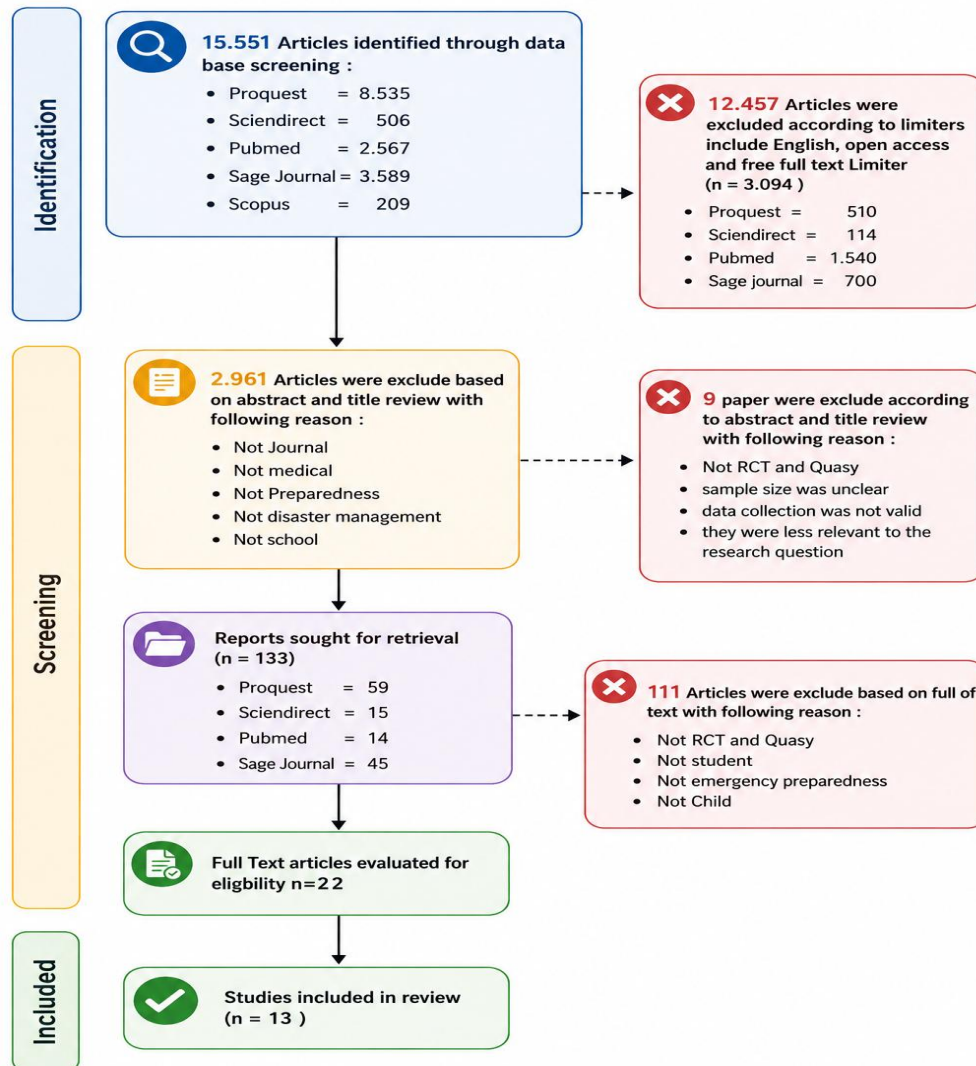


Figure 1. PRISMA Flowgram

This study selection using a PRISMA flow diagram. A total of 2,961 articles that did not address preparedness, were not journals, or had nothing to do with disaster management were disqualified from screening. Thirteen papers were chosen from six databases utilizing the PRISMA design and JBI tools for RCT and quasi-experimental designs. The results of data extraction show that preparedness intervention programs have been proven effective in improving student learning outcomes, perception, and skill performance during catastrophes. The various programs tested in these articles include several preparedness improvement programs as described in [Table 5](#):

Table 5. Article Reviewed

Article Title and Author	(Country and Year)	Study Design, population	Intervention	Comparison	Outcomes
"School Based Program for Improving Disaster Preparedness among Indonesian Adolescents in Earthquake Risk Area: A Randomized Control Trial." Askoro Setioputro, et al.	2025 Indonesia	Randomized control trial (RCT) 140 students	School-based program for improving disaster preparedness (SBIPDP)	The control group and the intervention group with the provision of school-based programs on increasing disaster preparedness	The study shows that SBIPDP program effective improved independence it also improves knowledge of adolescents with the result p-value = 0,01 in experimental class (from 18,21 ±3,41 to 24,51±4,48), and general self-efficacy (from 28,81±4,51 to 39,81±3,92, P<0,001). Control class found that minor transformation in students outcomes learning (p:0,089, 18,33 ±3,02 to 17,89 ± 3,44) and personal efficacy (from 27,93±3,99 to 29,46±5,67, P=0,052). Population in this study include 140 students
"Effectiveness of Intractive Multimedia Package on Disaster Management Learning Activities for School Students." S. Thanarajah	2022 India	Quasi-experimental design 62 students	Interactive Multimedia Package on Disaster Management	The group of pre-test and post-test after intervention of an Interactive Multimedia Package on Disaster Management	The program disaster management-based learning activities in interactive multimedia package showed a significant influence. This program can increase in student preparedness with a pretest score of 21,95 increasing to 52,58 at the time of the posttest with a p value <0,05.
"Influence of junior high school students' knowledge, attitudes, and practices on earthquake and tsunami preparedness simulations in Padang." Yulfiwanti, I., et al.	2025 Indonesia	Quasi-experimental design one group pretest post-test. 87 students	Earthquake and Tsunami Preparedness Simulation	Comparison of one pre-test and post-test group after intervention in the form of earthquake and tsunami preparedness simulation.	The research assessment tool was design by author. This assessment tool adapted from LIPI preparedness questionnaire. The study include with a sample of 87 students. The earthquake and tsunami preparedness simulation showed a significant effect on attitude, behavior and students knowledge p< 0,005 with connection value = 0,646. In this study the relationship is classified as moderate
"Effectiveness of landslide mitigation education on disaster knowledge and preparedness of students in class VIII SMPN 1 Jenawi." Nurlaili, T., et al.	2023 Indonesia	Quasy-experimental 63 students	Implementation of landslide disaster mitigation education,	Comparison between the control group and the intervention group that received landslide disaster mitigation education, measured by pre and post tests in each group.	The program of mitigation education using a researcher-designed questionnaire. The results showed that score outcomes of N-Gain Score test for catastrophe learning outcomes was categorized high quality, with mean= 63,6159 (63,6%) for the intervention group and mean of 60,5658 (60,5%) for the non intervention group. The Normalized Gain Score assessment for preparedness showed an mean = 66,6883 (66,6%) for the intervention group and mean 69,2830 (69,2%) for the control class, categorized as quite effective. Based on outcomes score of N-Gain Score test results show that program mitigation education for children between experimental group and control group is a right step to increase knowledge and preparedness.

5	"Implementation of physics learning media based on android integrated earthquake disaster education to enhance problem solving abilities and natural disaster preparedness." Abdullah, et al.	2020	Quasy Experimental 29 students	Learning using media based learning, Android-based physics learning integrated with earthquake disaster education	There is one group that is measured in the pre-test and post-test, the group is given intervention in the form of learning using Android-based media integrated with earthquake disaster education.	After conducting an intervention using media-based learning for integrated application with earthquake, this study showed that this program can increase students' analytical thinking with a p value <0.005, categorized as quite good, but the level of preparedness was still quite low.
6	"The effectiveness of integrated science textbook using networked model with example problem based learning to enhance students' smog preparedness." Irdayasa, Fauzi and Usmeldi.	2019	Quasy experimental 38 students	An integrated science textbook on the theme of landslides with a nested model	One group underwent pre-test and post-test with the intervention of providing an integrated science textbook on the theme of landslide disasters using a nested model.	Application learning media based on Android integrated with landslide catastrophe learning. The study show that disaster preparedness increased during before and after test, with an increase of 0.66.
7	"Constructing Student's Physical Preparedness through Game-Based Activities in Disaster Safe School." Nopembri, S., et al.	2021	Quasi-experimental 74 students	Game-based physical activity.	Comparison in one group that was carried out with pre-test and post-test with intervention of providing game-based physical activity.	The results of the study showed a significant increase in students' physical fitness between the pre-test and post-test, or after engaging in game-based physical activity in 12 sessions ($t = 4.224$, $p = 0.000$), an increase of 12.03% ($M_{pre} = 12.80 < M_{post} = 14.34$). This increase in physical fitness will influence physical activity and increase children's physical preparedness in the face of disasters. There was no control or comparison group, and no randomization.
8	"Effectiveness of an educational intervention for disaster preparedness for elementary school students in Central Sulawesi." Amri, et al.	2021	Quasi-experimental 40 students	Animated videos and PowerPoint presentations (PPT) on earthquake disaster preparedness as learning media	Comparison in one group that conducted pre-test and post-test with audiovisual and visual interventions, namely providing counseling and providing learning models through ppt and animated videos	The results of the study showed that a significant influence on increasing preparedness in the audiovisual and visual media groups obtained a p value = 0.004 ($p < 0.05$) and the average value in the audiovisual group had a higher value than the visual group with an average result of 90.25 ($SD = 7.159$). There was no control group, the number of samples was small

9	"Empowering flood preparedness: Enhancing flood knowledge, risk perception, and preparedness among primary school learners in flood-affected southern Thailand." Intarameuan, et al.	2025 Thailand	Quasi-experimental 50 students	A flood education combined discussions, workshops, slide presentations, and interactive teaching methods	Comparison between the control group and the intervention group that received the flood education program	The flood learning program significant increased children readiness with a p-value <0.05, although insignificant differences were found in flood risk awareness between control and intervention groups.
10	"Effects of disaster education on children's risk perception and preparedness: A quasi-experimental longitudinal study." Yildiz, A., et al.	2023 Turki	Quasi-experimental 815 students	Disaster education includes discussions, visual materials, and interactive teaching	Comparison between the control group and the intervention group that received disaster education, including discussions, visual materials, and interactive teaching	This study suggest that were differences preception between control and intervention class in viewing natural hazards.
11	"Utilising Disaster Mitigation Educational Videos To Improve The Understanding Of Students In Reducing Environmental Problem Solving." Zuriyah and Rokhman	2024 Indonesia	Quasi-experimental 40 students	The learning process used a combination of contextual, inquiry, and problem-solving approaches both indoors and outdoors	The intervention group received additional InaRisk knowledge containing videos, while the control group received a BNPB disaster pocketbook.	. There was a significant difference between the control and intervention groups with a p-value of 0.000 (p<0.05), and there was an increase in knowledge with an average score of 17.30. This increase was supported by the gain test results of 0.64. There was a difference in students' understanding of reducing environmental problems between those who learned disaster mitigation through videos in the intervention group and those who learned about disaster mitigation through textbooks in the control group.
12	"Evaluating the effectiveness of local wisdom-based disaster mitigation education in primary schools." Lestari, W., et al.	2025 Indonesia	Quasi-experimental 346 students	Local wisdom-based mitigation program of students' understanding, preparedness for disasters	Comparison between the control group and the intervention group regarding the effectiveness of the local wisdom-based mitigation program	There was a significant difference between the control group and the intervention group with a p-value of 0.001 (p<0.05). The wisdom-based mitigation program proved effective in improving students' understanding and preparedness, with an average post-test score of 78.4 for the experimental group, significantly higher than the control group, which only achieved an average score of 52.3
13	"The Use Of Gamalama App To Improve Earthquake Disaster Mitigation Awareness In Islamic Junior High Schools." Saprudin et al	2025 Indonesia	Quasi-experimental 55 students	The earthquake learning program, science textbooks and the GaMALaMA application	The groups compared in this study were the control group and the intervention group through the earthquake learning program	The results showed that the use of the GaMALaMA application and the earthquake learning program was effective in increasing awareness of earthquake disaster mitigation (EDMA) with a p=0.000 (p<0.05) and an increase in scores in the intervention group (0.74) compared to a moderate increase (0.64)

Table 6. Outcomes of Reviewed Articles

No	Outcomes
1	The study show that SBIPDP program effective improved independence it also improve knowledge of adolescents with the result p-value = 0,01 in experimental class (from 18.21 $\pm$ 3.41 to 24.51 $\pm$ 4.48), and general self-efficacy (from 28.81 $\pm$ 4.51 to 39.81 $\pm$ 3.92, $P < 0.001$). Control class found that minor transformation in students outcomes learning (p:0,089, 18,33 $\pm$ 3,02 to 17.89 $\pm$ 3.44) and personal efficacy (from 27.93 $\pm$ 3.99 to 29.46 $\pm$ 5.67, $P = 0.052$).
2	The disaster management based learning program delivered through an interactive multimedia package demonstrated a significant positive effect on students' disaster preparedness. The mean preparedness score increased from 21.95 at the pretest to 52.58 at the posttest, with a standard deviation of 3.490. The paired-samples t-test revealed a statistically significant improvement in preparedness scores ($t = -37.950$, $p < 0.001$).
3	The research assessment tool was design by author. This assessment tool adapted from LIPI preparedness questionnaire. The study include with a sample of 87 students. The earthquake and tsunami preparedness simulation showed a significant effect on attitude, behavior and students knowledge $p < 0,005$ with connection value = 0.646. In this study the relationship is classified as moderate.
4	The program of mitigation education using a researcher-designed questionnaire. The results showed that score outcomes of N-Gain Score test for catastrophe learning outcomes was categorized high quality, with mean= 63.6159 (63.6%) for the intervention group and mean of 60.5658 (60.5%) for the non intervention group. The Normalized Gain Score assessment for preparedness showed an mean = 66.6883 (66.6%) for the intervention group and mean 69.2830 (69.2%) for the control class, categorized as quite effective. Based on outcomes score of N-Gain Score test results show that program mitigation education for children between experimental group and control group is a right step to increase knowledge and preparedness.
5	After conducting an intervention using media-based learning for integrated application with earthquake, this study showed that this program can increase students' analytical thinking with a p value < 0.005 , categorized as quite good, but the level of preparedness was still quite low. Furthermore, disaster preparedness scores increased from a mean pretest score of 55.0% to a mean posttest score of 77.3%, indicating a substantial improvement in preparedness following the intervention
6	The implementation of Android-based learning media integrated with landslide disaster education significantly improved students' disaster preparedness and problem-solving skills. Disaster preparedness increased from the pretest to the posttest, with a normalized gain (N-gain) score of 0.66, indicating a moderate improvement. Furthermore, significant improvements were observed in both the attitude and knowledge domains. The paired-samples t-test showed statistically significant differences for attitudes ($t = -7.143$, $df = 37$) and knowledge ($t = -16.679$, $df = 37$). The effect size values were 0.77 for attitudes and 0.94 for knowledge, indicating moderate to large effects of the intervention. These findings suggest that the Android-based learning media effectively enhanced students' disaster preparedness, knowledge, attitudes, and problem-solving skills.
7	The results of the study showed a significant increase in students' physical fitness between the pre-test and post-test, or after engaging in game-based physical activity in 12 sessions ($t = 4.224$, $p = 0.000$), an increase of 12.03% ($M_{pre} = 12.80 < M_{post} = 14.34$). This increase in physical fitness will influence physical activity and increase children's physical preparedness in the face of disasters. There was no control or comparison group, and no randomization.
8	Animated videos and presentations (PPT) on catastrophe readiness with topic earthquake are used as education media. The results found that application can enhance preparedness in the audiovisual and visual media groups $p : 0,004$ with mean score was increase in group of audiovisual rather than non audiovisual group, with mean 90,25, SD : 7,159.
9	The flood learning program significant increased children readiness with a p-value < 0.05 , although insignificant differences were found in flood risk awareness between control and intervention groups. The flood education program significantly improved children's flood preparedness ($p < 0.05$). However, no statistically significant differences were observed between the intervention and control groups in flood risk perception ($Z = 1.868$, $p = 0.062$) or flood preparedness ($t = -1.366$, $p = 0.714$). These findings suggest that, although the intervention improved preparedness within the intervention group, it did not produce statistically significant differences in flood risk perception or preparedness compared with the control group.
10	The study demonstrated significant differences between the intervention and control groups in their perceptions of natural hazards following the disaster education intervention. The intervention significantly improved children's perceptions of disaster preparedness in the intervention groups. In the Mobile Van group, statistically significant improvements were observed in emergency preparedness behaviors, including knowing what to do during a household emergency ($t = 10.54$, $p < 0.001$), identifying a family meeting place ($t = 7.96$, $p < 0.001$), having a first-aid kit ($t = 6.67$, $p < 0.001$), owning a flashlight ($t = 6.71$, $p < 0.001$), and preparing a three-day supply of food and water ($t = 8.95$, $p < 0.001$). Similarly, significant improvements were observed in the Kocaeli intervention group for knowing what to do during a household emergency ($t = 7.34$, $p < 0.001$), identifying a family meeting place ($t = 2.97$, $p < 0.05$), having a first-aid kit ($t = 2.91$, $p < 0.05$), owning a flashlight ($t = 3.76$, $p < 0.001$), and preparing a three-day supply of food and water ($t = 3.10$, $p < 0.01$). No significant changes were observed in fire extinguisher ownership in either intervention group
11	The learning process used a combination of contextual, inquiry, and problem-solving approaches both indoors and outdoors. Based on the independent-samples t-test (equal variances assumed), the intervention group had a

	significantly higher mean score than the control group, with a mean difference of 2.20 ($t = 3.821$, $SE = 0.76$, $p < 0.001$). These findings indicate that the intervention effectively improved students' perceptions of natural hazards. There was a difference in students' understanding of environmental problem reduction between those who learned disaster mitigation through video media in the intervention group and those who learned about disaster mitigation through textbooks in the control group.
12	The local wisdom-based disaster mitigation program was effective in enhancing students' disaster awareness and preparedness. A statistically significant difference in preparedness was observed between the intervention and control groups ($p < 0.05$). The experimental group demonstrated a significantly higher mean post-test preparedness score (78.4) than the control group (52.3). In addition, regression analysis showed that students' understanding of local wisdom accounted for 42% of the variance in disaster preparedness ($R^2 = 0.42$, $p < 0.001$), suggesting that a greater understanding of local wisdom was significantly associated with higher preparedness levels.
13	This study explained that use the GaMALaMA application, integrated with an earthquake disaster learning program, effectively improved earthquake disaster mitigation awareness (EDMA). The intervention group achieved a higher mean gain score (0.74) than the control group (0.64), with a statistically significant difference ($p = 0.001$). The homogeneity test indicated that the assumption of equal variances was satisfied ($p = 0.093$). In addition, the intervention yielded a statistically significant effect ($t = 57.115$, $p < 0.001$). However, the effect size was 0.300, indicating a small practical effect despite the strong statistical significance

DISCUSSION

This systematic literature review found that school-based disaster preparedness improvement programs were consistently effective in enhancing disaster preparedness among students. Although the magnitude of the effects varied across intervention types, most studies reported significant improvements in disaster knowledge, preparedness, emergency response skills, disaster awareness, self-efficacy, and decision-making. These findings suggest that schools provide an effective setting for implementing disaster preparedness interventions and promoting students' readiness to respond to disasters. The included studies demonstrated that different school-based intervention approaches improved disaster preparedness through different learning mechanisms. Simulation- and experiential learning-based interventions produced the broadest improvements because they simultaneously strengthened students' cognitive, affective, and psychomotor competencies. In contrast, technology-based interventions primarily enhanced disaster knowledge, preparedness, and learning engagement through interactive and self-directed learning. The findings in this review were interpreted through consideration of the methodological quality and risk of bias of all screened studies. The results of this literature review based on the JBI Critical Appraisal Checklist, all studies have met the quality threshold ($\geq 67\%$), thus eligible for inclusion in this review. In addition, the risk of bias assessment using Risk of Bias 2 (RoB 2) for randomized controlled trials (RCTs) and Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) for non-randomized studies showed that most studies had a low to moderate risk of bias. Only one quasi-experimental study had a serious risk of bias based on the ROBINS-I assessment, while no studies were classified as having a critical risk of bias. These findings indicate that the overall strength of evidence supporting the effectiveness of disaster education interventions is moderate to high.

Disaster is a sequence of events brought on by either natural or artificial causes. Disasters can happen at any time or place, resulting in losses and possibly endangering community life ([Khairul Rahmat et al., 2024](#)). Preparedness is a set of actions taken to foresee calamities through well-organized strategies or tactics. In order to lower the risk of disaster and foster a culture of safety among the community, particularly among vulnerable groups, preparedness is essential ([Cahyo et al., 2023](#)). Children often experience heightened vulnerability impacted by disaster compared to adults, because they depend heavily on adults for decision making and protection. Children have limited coping capacity, emotional immaturity and dependence on caregivers. Children's or students' comprehension and abilities might be enhanced by the education sector's requirement to become more prepared. Students are the ones that take in information the quickest and can impart it to their families and the community. As a result, early planning is essential. The findings of [Nada et al \(2023\)](#), showed that a community is aware of and comprehends disasters can also be created by empowering young children to enhance their comprehension of disaster preparedness ([Nada et al., 2023](#)).

Understanding, behavior, crisis response plans, catastrophe alert systems, and resource allocation are some of the aspects that affect disaster preparedness. The findings of the included studies

suggest that different types of disaster education interventions improve students' disaster preparedness through distinct learning mechanisms. However, the magnitude and breadth of the outcomes varied according to the intervention approach. Experiential learning and simulation-based interventions demonstrated the most comprehensive improvements in disaster preparedness because they targeted cognitive, affective, and psychomotor domains simultaneously. School-based preparedness programs, disaster simulations, and game-based activities consistently enhanced students' preparedness, emergency response skills, decision-making, and disaster awareness. These interventions provided direct learning experiences that enabled students to practice appropriate responses in realistic disaster scenarios, thereby strengthening both knowledge retention and practical preparedness.

In contrast, technology-based interventions, including mobile applications (e.g., GaMALaMA and InaRisk), interactive multimedia, animated videos, and Android-based learning media, primarily improved students' knowledge, disaster awareness, and preparedness through interactive and self-directed learning. Their effectiveness appears to be associated with their accessibility, engaging visual content, and flexibility, allowing students to repeatedly access educational materials at any time and place. Several studies also reported improvements in analytical thinking and problem-solving skills following technology-assisted learning. Curriculum-based interventions improved disaster preparedness by integrating disaster education into formal classroom instruction through textbooks, thematic learning modules, and structured instructional models. Compared with technology- and simulation-based approaches, curriculum-based interventions produced more gradual improvements but were considered more sustainable because disaster education became part of routine learning activities. These interventions consistently enhanced disaster literacy, knowledge, and preparedness while supporting long-term educational implementation.

Meanwhile, local wisdom-based interventions uniquely combined scientific disaster education with indigenous knowledge, cultural values, and community experiences. These programs not only improved preparedness but also strengthened students' disaster awareness, environmental responsibility, and cultural relevance. Several studies demonstrated that integrating local knowledge into disaster education significantly enhanced preparedness and learning outcomes by making disaster concepts more meaningful and contextually relevant to students' daily lives.

Overall, simulation and experiential learning-based interventions appeared to produce the broadest improvements across multiple preparedness domains, whereas technology-based interventions were particularly effective in enhancing disaster knowledge, preparedness, and learning engagement. Curriculum-based approaches offered greater sustainability through integration into formal education, while local wisdom-based interventions strengthened preparedness by connecting disaster education with local culture and community practices. These findings suggest that combining experiential activities with technology-supported learning and culturally relevant educational content may provide the most comprehensive strategy for improving disaster preparedness among school-aged children. Implementing successful and interesting activities for kids can help address some of these concerns. The findings of the study suggest that programs can enhance students' knowledge, attitude, self-efficacy, and skills.

Several studies suggest that technology-based treatments can increase students' readiness. This demonstrates the substantial and useful effects of technology. The technology can increase students' readiness, including the Gamalama app, Inarisk, educational apps, and animated films, which were discovered by the investigation. According to research by [Saprudin et al \(2025\)](#) show that the Gamalama feature's flexibility makes it easier for students to comprehend the subject matter. Until they comprehend and become proficient in the material, it can be repeated at any time and from any location. There is an assessment in the form of quiz questions in addition to the content.

This program can enhance participation and students' motivation and participation in disaster preparedness. Students' readiness increased following an interactive multimedia intervention, according to another study by [Thangarajath \(2022\)](#). This interactive multimedia includes manuals, electronic encyclopedias, video games, and training programs. [Zuhriyah & Rokhman \(2025\)](#) found that students

can better understand the content by using this electronic media method. The Inarisk application, which was created by the government and other organizations with expertise in Indonesian disasters. This application contains information on the level of danger in an area and is equipped with recommendations for participatory anticipatory actions. In addition, there are also videos about disasters that are used to provide understanding to students. This application has been proven to increase students' understanding and preparedness compared to students who only receive learning using pocket books.

This study found that technology or electronic media can improve comprehension in disaster preparedness. The types of interactive media used in education include learning modules, animated movies, 3D simulations, interactive graphics, tests, animated PowerPoints, group debates, and disaster counseling. According to a study by [Aini & Daniah \(2020\)](#) show that youngsters are more likely to comprehend engaging and visually appealing media, and the usage of electronic media or technology can aid pupils in understanding the content being provided. This study is consistent with studies by [Teguh et al. \(2025\)](#) findings demonstrate that usage of digital media can improve student readiness because of its accessibility and kid-friendly content. Additionally, the use of technology-based apps enhances students' comprehension of disaster preparedness because the knowledge acquired is readily applicable in daily life and can be accessible at any time and from any location.

Students' readiness can be enhanced through curriculum-based learning. Numerous curriculum-based teaching strategies have been shown to be successful in literature reviews. The combination of catastrophe learning resources within the academic syllabus through textbooks and learning approach models is the focus of curriculum-based learning. To increase student understanding, learning modules will be created holistically (Fadhila et al., 2019). Students can learn about disaster mitigation in a more structured and scientific way thanks to these curricular intervention modules. Thematic textbooks encourage students to gain a thorough understanding of disasters by using case studies, images, and analytical questions. Strengthening disaster education in schools or educational units is necessary, according to research by [Kurniawan \(2025\)](#). One tool that can be used to convey educational messages is learning media. Learning media can support mitigation efforts by providing disaster mitigation material in the form of picture storybooks. Learning media equipped with pictures is considered effective in early childhood education. This is because visual media can illustrate or provide an overview of abstract material in the form of images or photos. Engaging and interactive learning media will improve students' attitudes toward learning and enhance the quality of study [Kartika et al. \(2023\)](#). By offering picture storybooks with disaster mitigation content, learning media can aid in mitigation efforts. Learning materials that include a variety of content and visual elements are often more effectiveness supporting children's knowledge in primary education. Learning materials featuring visuals are thought to be beneficial because abstract content can be illustrated or summarized through visual media in the form of pictures or photographs. This strategy can increase learning outcomes and children's attitudes toward learning through student-centered learning materials.

The comprehensive learning approach of disaster education can help children develop critical thinking abilities, emergency decision-making skills, and character development that aligns with Pancasila values. According to a study by [Hidayat \(2020\)](#) suggest that preparation books are essential for classroom instruction. Disaster books can enhance students' attitudes and knowledge toward establishing stability in disaster preparedness. Disaster literacy is a mitigation strategy or endeavor to increase pupils' understanding of disasters. Students' knowledge, attitudes, and skills will all increase as a result of disaster literacy. Several studies show that curriculum-based learning is successful in strengthening preparedness attitudes and enhancing long-term disaster literacy. This intervention has the potential to have a long-lasting and fair effect on all schools since it is incorporated into regular sessions ([Labudasari & Rochmah, 2020](#)).

This study found that experiential learning is the best intervention to increase disaster preparedness. The intervention prioritizes psychomotor skills and real-world application. The experiential learning includes disaster simulations, games, and school-based preparedness initiatives like the School-Based Curriculum for Improving Disaster Preparedness (SBPIDP). This method gives a

chance to put their knowledge to use in scenarios that simulate real-world emergency circumstances. A simulation program can enhance comprehension in disaster preparedness. Students can develop a proactive and cautious approach to catastrophe management through simulation, which also serves to reinforce theoretical knowledge ([Yulfiwanti et al., 2025](#)).

A study by [Yustisia et al \(2019\)](#) found that simulation is a method of presenting learning experiences using situations that are made similar to real-life situations in order to understand certain concepts, principles, or skills. The findings of this study indicate that simulation through role-play methods has an impact on students' learning outcomes and awareness of disaster preparedness. Students' direct experiences will influence their knowledge and shape their learning attitudes and can help them prepare for future disasters. Experience has an influence on student preparedness. Students who have direct experience will respond favorably to material and instruction ([Setiadi et al., 2025](#)).

The existence of game-based activity programs is also demonstrated by the literature study's findings. Physical games can be an engaging and involved way to learn. This idea will encourage kids to participate actively and learn in an enjoyable way. Students practical mitigation skills may be enhanced by this program [Nopembri et al \(2021\)](#). The study by [Safitri et al., \(2025\)](#) reported that traditional teaching strategies like lectures and textbooks are thought to be poor at grabbing kids' attention. With a p-value <0.05, it has been demonstrated that the game "ant experience" enhances pupils' comprehension of disaster preparedness. Students' understanding of disasters, emergency procedures, making decisions under duress, and developing positive attitudes are all enhanced by ant adventure games. A method that incorporates psychomotor training, affective management, and cognitive management is necessary to improve readiness. Engaging in play activities is one method of cognitive regulation.

Playing while learning is a popular teaching strategy can help students to comprehend academic content. Educational toys may be used in a variety of activities, particularly disaster education. Educational toys are best suited to pique children's curiosity and help them develop different kinds of potential. According to other study show that therapeutic-based play strategies can also lessen kids' anxiety. Play-based therapy can help kids express their feelings, feel protected, and develop social skills. Additionally, play therapy is a successful program for enhancing children's emotional regulation abilities, lowering stress and anxiety, and developing coping mechanisms ([Topal et al., 2025](#)).

Local Wisdom Approach

The intervention can increase disaster preparedness through a local wisdom strategy. Local wisdom including populations cultural values with education about disaster mitigation. The local population has in dept knowledge of natural indicators, disaster history, and rescue tactics. Local wisdom-based mitigation learning programs are significant. Students can learn about disaster principles from a scientific perspective; students also comprehend how these concepts relate to the local community's actual experiences, culture, and environment. In practice, local wisdom is customary to raise community knowledge of early detection and anticipation of dangers in disaster-prone locations. Songs, symbols, and idioms are examples of local wisdom ([Mustofa, 2020](#)).

A study by Nugroho et al. (2025) suggests that folktales, local folklore concerning disasters, or customs of interpreting natural indications can be used to implement local wisdom-based learning. This program can raise awareness of risks, the environment, and a sense of ownership. Folktales can promote mitigation efforts and increase public knowledge of disasters. We can reduce disaster risk more effectively by including local stories in disaster communication campaigns. A local wisdom-based approach can enhance students' emotional and cognitive involvement. This can be a creative way to improve students' readiness and health literacy ([Ekaprasetya et al., 2025](#)).

Local knowledge has a significant influence in lowering the risk of disaster and can take the form of environmentally adapted attitudes and behaviors. Local wisdom values that come from a system of knowledge and management of traditional communities themselves are found in local knowledge that spreads and grows within the community. According to a study by [Pambudi \(2025\)](#) found that local knowledge fosters the development of life skills and attitudes, increases understanding of the

significance of disaster mitigation, and helps pupils comprehend the risk effects of disasters. Local knowledge that is generated and integrated into curriculum development can help improve disaster preparedness in a more pertinent and efficient way. This program shows significant improvement in students' learning outcomes and preparedness when the intervention ([Lestari et al., 2025](#)).

CONCLUSION

Disaster preparedness is the readiness of individuals or groups to face and reduce the impact of potential disasters. Preparedness includes knowledge, attitudes, and emergency skills to act quickly when a disaster occurs. Based on the results of a literature study show that several programs were found to be effective in improving student preparedness in schools, including technology-based interventions such as Android applications and interactive multimedia, which have been proven effective in improving students' knowledge and cognitive abilities. These programs allow students to access disaster-related material in an interactive, flexible, and enjoyable way. Other programs such as disaster simulations, game-based physical activities, and educational games have proven effective in improving student preparedness. While physical activities improve students' physical preparation by boosting their endurance and physical capabilities in the face of disasters. The simulation can help refine knowledge, attitudes, and practical skills in handling emergencies. This program can increase students' interest and engagement with disaster-related content. Rather than educational games can enhance learning enjoyably and interactively. Long-term learning is seen to benefit from curriculum-based learning combined with local wisdom-based initiatives and catastrophe avoidance. While a local wisdom-based approach helps enhance students' comprehension with the cultural context and experiences of the local community, making the information more accessible and relevant, textbooks coupled with catastrophe material offer a foundation of knowledge. All things considered, these programs demonstrate that a mix of technology, simulation, and context-based learning is the most successful strategy. Every program has its unique advantages when it comes to enhancing the cognitive, emotive, and psychomotor facets of student readiness. In this initiative, nurses play a crucial role. In order to make sure that disaster preparedness programs in schools function properly and are integrated with more general school policies, nurses can serve as instructors, facilitators, creators of educational media, and coordinators. In addition to ensuring that students have the ability and information about disasters with greater preparedness and composure, nurses can take a role in implementing disaster preparedness programs more comprehensively and sustainably.

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AUTHOR CONTRIBUTIONS

FPR: Conducted the literature search, study selection, designed the methodology, and drafted the manuscript. RK: Verified the data extraction, critically reviewed and supervised the review process.

ETHICAL CONSIDERATION

This study is a systematic literature review that does not require ethical clearance.

DECLARATION OF CONFLICTING INTEREST

The authors declare that this study has no potential conflicts of interest.

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