

TSUNAMI DISASTER PREPAREDNESS AMONG SCHOOL COMMUNITY: NEW EVIDENCE FROM EMERGING COUNTRY

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ABSTRACT: This study evaluates the tsunami preparedness levels of six schools in Nagari Kataping, Padang Pariaman Regency, West Sumatra—one of the world's most vulnerable regions. A quantitative survey was conducted involving 160 respondents, including students, teachers, and principals. Preparedness was assessed based on five parameters: knowledge and attitudes, policies and guidelines, emergency response plans, early warning systems, and resource mobilization. Non-parametric tests (Kruskal–Wallis and Mann–Whitney U) were used to analyze significant variations in preparedness among the schools, with overall scores ranging from "not ready" to "ready." The results showed that teachers had higher preparedness scores compared to students and principals, while male students demonstrated slightly better preparedness than females. The parameters for knowledge and attitudes and emergency response plans were relatively strong, whereas early warning systems and resource mobilization were weak. Theoretically, this study extends the Disaster Risk Reduction (DRR) framework by introducing a preparedness index that captures intra-school variations based on roles, demographics, and institutional capacity. Practically, the findings provide recommendations for integrating DRR into curricula, strengthening school leadership, and increasing investment in early warning systems. Policy implications emphasize the importance of safe school programs and gender-sensitive disaster education in rural areas.

Keywords: *Tsunami, disaster preparedness, school community, disaster risk reduction, rural resilience*

1. INTRODUCTION

Indonesia, located along the Pacific Ring of Fire, is one of the most disaster-prone countries in the world, highly vulnerable to earthquakes, volcanic eruptions, and tsunami [1]. Historical records show that tsunami events in Indonesia have resulted in devastating impacts, such as the 2004 Indian Ocean tsunami that caused over 165,000 fatalities nationwide. West Sumatra, particularly Padang Pariaman Regency, has been identified as one of the most at-risk areas, with tsunami waves predicted to reach up to 11 meters in height and arrive within 35 minutes. These conditions underline the urgent need to strengthen preparedness, especially within school communities located in coastal and rural tsunami-prone areas. Some things that can affect disaster preparedness include gender, age, education level, frequency of beach visits, number of family members, and region of origin [2]. Schools play an important role in providing adequate preparation

for their students through disaster education to face the challenges of potential disasters. In this case, schools also need to become disaster-safe schools to prepare a generation that is more resilient and stronger in facing disaster threats.

[3] prior research has highlighted the importance of integrating disaster preparedness into curricula, simulation exercises, and community engagement [4]. However, most disaster preparedness studies in Indonesia and other developing contexts have focused on urban communities, households, or general population-level assessments [5].

Furthermore, while existing studies have examined knowledge, attitudes, and policy frameworks [6], they rarely provide comparative insights within school communities—such as between students, teachers, and principals, or across gender and age groups. The micro-level variations within school preparedness are therefore

underexplored. In addition, the weakest dimensions, such as resource mobilization and local disaster warning systems, have not been systematically measured in previous research, limiting the development of context-specific interventions for rural schools.

Moreover, existing studies tend to emphasize knowledge, attitudes, and policy instruments without sufficiently addressing the internal variations within school communities. Differences between students, teachers, and principals, as well as demographic factors such as age and gender, are often overlooked despite their potential influence on preparedness levels. Another underexplored dimension lies in the weakness of resource mobilization and disaster warning systems at the school level, which are critical components of effective disaster readiness. These gaps highlight the urgent need for more nuanced empirical evidence from rural schools located in high-risk areas, in order to strengthen both the conceptual grounding of DRR and the formulation of context-specific strategies.

Against this background, the present study seeks to evaluate the level of tsunami preparedness among school communities in Nagari Kataping, Padang Pariaman Regency, West Sumatra—one of the most tsunami-prone areas in Indonesia. Specifically, the study investigates the overall level of school preparedness, examines differences between students, teachers, and principals as well as across age and gender groups, and identifies the strongest and weakest preparedness dimensions across five key areas: knowledge and attitudes, policies and guidelines, emergency response plans, disaster warning systems, and resource mobilization.

Through this focus, the study contributes both theoretically and practically. Theoretically, it extends the DRR framework by incorporating intra-school comparative analysis that accounts for role-based, demographic, and inter-school differences in preparedness. Practically, it generates context-sensitive recommendations for enhancing safe school policies, integrating disaster preparedness into curricula, and strengthening resource mobilization and local early warning systems. In doing so, it provides new empirical evidence from an emerging country context, enriching the global discourse on school-based disaster resilience.

According to [7], in general, UN-OCHA explains that preparedness is a pre-disaster activity carried out in the context of disaster risk management and based on sound risk analysis. These included disaster preparedness, immediate response, as well as rebuilding and recovery. Disaster-preparedness schools are very important in preparing for disasters that can occur suddenly at any time. The existence of such schools is very beneficial. Therefore, it is important to include

school in national and local disaster response strategies, serving as a curriculum resource and preparation for teachers and leaders in disaster crisis management. Disaster preparedness can be organised around a number of important factors, such as knowledge and attitude, policies and guidelines, emergency response planning, disaster warning system, and resource mobilisation. Some strategies that can be implemented in the field of education to reduce disaster risk in schools include developing emergency response plans, integrating disaster education into the curriculum, conducting disaster evacuation drills, providing disaster education, and forming disaster task forces involving teachers, students, and even parents [8]. According to research, having a positive outlook on disaster preparedness greatly increases one's ability to react appropriately in an emergency [9]. In several research, the relationship between attitudes and knowledge is quite clear. [10] stating that it is important to manage emotional responses during disasters and stating that psychological preparedness improves clear thinking (cognitive) abilities and behavioral responses in making the right decisions when disasters occur. Findings by [11], who claim that students who have greater understanding of natural catastrophes demonstrate higher levels of preparedness, further reinforce this relationship. Research findings by Rahmat et al state that disaster mitigation learning based on local wisdom can be interpreted as student learning based on local wisdom values as an effort to reduce disaster risk in order to decrease the vulnerability of a group and increase preparedness within that group [12].

The creation of thorough policies and standards based on best practices and research is a fundamental component of disaster preparedness [13]. According to research on the capacities of local governments, policies should also encourage the creation of specialised organisations in charge of disaster management [14]. Findings from the study [14-16] 75% of informants felt more prepared to face disasters after receiving education about disaster preparedness, which demonstrates the effectiveness of education and socialization programs in increasing the preparedness of individuals and communities.

An efficient Emergency Response Plan (ERP), which includes a methodical approach to risk mitigation, emergency response, and crisis recovery, is essential for disaster preparedness. Creating such a plan requires a number of essential elements, such as resource management, stakeholder coordination, and communication tactics. Efforts to develop preparedness are necessary to anticipate disasters and take appropriate action when disasters occur as part of disaster preparedness. These preparations should not only be carried out at home, but also at school

so that students are ready at any time when a natural disaster occurs. Preparations at school are carried out by students at school and are also expected to be applied at home, as school-age children are quick to respond to information [15]. In order to effectively manage crises, organisations must also continuously evaluate and enhance their plans, drawing lessons from the past to better their tactics. For the ERP to detect any risks and weaknesses, a thorough risk assessment must be incorporated. Evaluation of mitigation strategies and plans is necessary to assess whether the measures designed are effective in reducing disaster risks and impacts [16]. The study by Khan et al discusses the function of mitigation in disaster management and emphasizes the need for periodic evaluation of mitigation policies and plans to assess the effectiveness of risk reduction and to update interventions in line with evidence and changes in hazard exposure [17].

Early warning systems are an important part of preparedness. Early warning systems provide rapid notification when a disaster occurs, helping communities avoid disaster. Through these warnings, communities can take appropriate action to reduce the threat of danger [18]. This is especially true in educational settings, where integrating early warning systems and disaster management strategies is essential to guaranteeing

2. METHODS

The study was conducted in Nagari Kataping, Batang Anai Sub-district, Padang Pariaman Regency, West Sumatra, Indonesia. This area, located along the Indo-Australian and Eurasian plate boundary, is categorized as a high tsunami-prone zone, with previous studies estimating a potential wave height of up to 11 meters and an arrival time of 30–35 minutes. Nagari Kataping was selected as the case study site due to its combination of geographical vulnerability and the presence of fourteen educational institutions situated within tsunami hazard zones. These conditions provide a relevant empirical setting to examine school-based preparedness in rural coastal communities. The research area is a village in Batang Anai District, Padang Pariaman Regency, Indonesia. Kataping Village is considered a village with a high tsunami risk level.

1. Red Zone (High Tsunami Risk)

Schools located closest to the coast are categorized as highly vulnerable because they are directly exposed to the potential first tsunami wave. In the Simpang Katapiang area, there is the Darul Ikfli Quran Kindergarten and Batang Anai 08 Elementary School, both located within a short radius of the coastline. This makes these two schools highly vulnerable to the impact of high

student safety in an emergency. Wireless sensor networks have become an essential tool for tracking environmental conditions and forecasting natural disasters like earthquakes and floods. In addition to offering real-time data, these systems make visualization-based monitoring possible, which improves situational awareness and speeds up decision-making in emergency situations [19]. Research by Nurdiansyah et al found that many schools, especially in rural areas, lack disaster warning systems and structured drills, meaning that existing emergency response plans are not supported by effective warning/mobilization mechanisms.

A key element of disaster preparedness, which includes methodical attempts to lessen the risks and effects of disasters on communities, is resource mobilisation. In order to mobilise resources effectively, human resources, expertise, and community networks must be involved in addition to financial and material resources. Knowledge and attitudes, policies and guidelines, emergency response plans, early warning systems, and resource mobilisation are some of the crucial components of the disaster preparedness framework described by [20]. The participation of many community members and organisations in disaster preparedness initiatives is a crucial component of resource mobilisation.

waves. Meanwhile, in the western and southern Pauh-Olo Bangau-Talao Mundam area, there are Batang Anai 24 Elementary School, Batang Anai 22 Elementary School, and Indonesia Raya Vocational School, which are also included in the red zone.

From a mitigation perspective, schools in the red zone require rapid evacuation strategies because the wave travels from the coast to the mainland in just a few minutes. Therefore, providing emergency evacuation routes, evacuation signs, and vertical evacuation sites (VES) around schools is essential. Furthermore, regular evacuation simulation training for teachers and students is crucial for effective emergency response.

2. Yellow Zone (Moderate Risk)

Schools located in the yellow zone are still at risk of tsunami impact, even though they are not on the front lines of the waves. In the central Batang Sariak –Olo Bangau–Talao Mundam area, there are several schools, such as SDN 27 Batang Anai, Sabbihisma Kindergarten, Pemina Kecamatan Kindergarten, and MIS Islam Bega Bestari. These schools are located relatively further from the coast, but still face the potential for significant inundation in the event of a strong tsunami.

The yellow zone is characterized by areas that may experience tsunami backwash or widespread inundation due to the sloping terrain. Therefore, the

mitigation strategy in this zone is to utilize the longer time available compared to the red zone for gradual evacuation to safe locations in the green zone. Schools in the yellow zone can serve as temporary evacuation transit points before students and the community are moved further to higher ground.

3. Green Zone (Relatively Safe/Low Risk)

Schools located in the green zone tend to be safer because they are located further from the coastline or on higher ground. In the Maranteah-Pilubang-Tabek area (northern and northeastern parts of Nagari Katapiang), there are several schools: SDN 25 Batang Anai, SDN 09 Batang Anai, SDN 26 Batang Anai, SMPN 2 Batang Anai, and SDN 23 Batang Anai. These schools' geographic locations are relatively better protected from the potential for direct waves.

From a disaster preparedness perspective, schools in the green zone can function as final evacuation sites or temporary refugee centers. The presence of junior high and elementary schools in the green zone is a strategic advantage because, in addition to being safer, these locations also have the classroom capacity and facilities to accommodate students from the red and yellow

zones. However, even in the safe zone, these schools still need to be equipped with emergency infrastructure such as clean water sources, logistics, and adequate road access to support their function as evacuation centers.

Overall, the spatial distribution of schools in Katapiang Village shows that the majority of elementary schools are located in the red and yellow zones, making early childhood and school-age children the most vulnerable populations to a tsunami. This suggests that mitigation policies need to be directed at improving the capacity of elementary schools, both in terms of disaster curriculum, evacuation infrastructure, and self-rescue simulations.

Meanwhile, schools in the green zone, dominated by junior high and elementary schools in the north, can function as evacuation concentration points. This situation requires clear evacuation route connectivity between the red zone and the yellow zone, and finally to the green zone, the tsunami-safe zone. Evacuation routes can utilize the primary and secondary collector road networks, as shown on the map. Thus, the road network serves not only as a daily mobility function but also as an official evacuation corridor in a disaster scenario.

Table 1. Distribution of Schools Based on Tsunami Prone Zones in Nagari Katapiang

Prone Zones	Korong/Location	Name of School
Red (High Risk)	Simpang Katapiang	TK Quran Darul Ikfli, SDN 08 Batang Anai
	Pauh	SDN 24 Batang Anai
	Olo Bangau	SDN 22 Batang Anai
	Talao Mundam	SMK Indonesia Raya, SDN 21 Batang Anai
Yellow (Medium Prone)	Batang Sariak	SDN 27 Batang Anai, TK Sabbihisma, TK Pemina Kecamatan, MIS Islam Bega Bestari
Green (Relatively Safe)	Maranteah	SDN 25 Batang Anai, SDN 23 Batang Anai
	Pilubang	SDN 26 Batang Anai, SDN 09 Batang Anai
	Tabek	SMPN 2 Batang Anai

The table above can be classified as follows: (1) Red Zone (High Risk): Six schools (primarily elementary and vocational schools) are highly vulnerable, with the majority located along the coast. This indicates a high risk for children and adolescents, (2) Yellow Zone (Moderate Risk):

Four schools, mostly elementary schools and kindergartens, serve as buffer zones and are still potentially affected by tsunami inundation, and (3) Green Zone (Relatively Safe): Five schools, mostly elementary schools and one junior high school, are relatively safer and have the potential to serve as final evacuation sites.

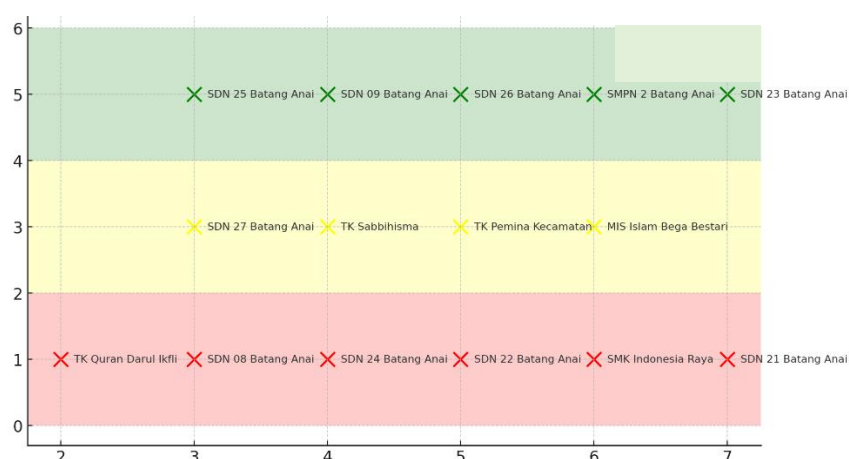


Fig 1. Distribution of schools and tsunami-prone zones in Nagari Katapiang

This is a conceptual map of school distribution based on tsunami-prone zones in Katapiang Village: (1) Red Zone (most vulnerable, near the coast): marked with a pink background and red dots, (2)

Yellow Zone (moderately vulnerable): marked with a yellow background and yellow dots, and (3) Green Zone (safe/relatively low risk): marked with a green background and green dots.

Research Design and Respondent

A quantitative research design was employed to measure the preparedness of school communities. Data were collected using a structured questionnaire distributed to 160 respondents across six schools. The respondents comprised 94 students, 58 teachers, and 8 school principals. Sampling was

determined using the Slovin formula with a 10% margin of error, ensuring representation across different roles within the school community. The inclusion of multiple respondent categories allowed for comparative analysis of preparedness levels among different school stakeholders.

Table 2. School Preparedness Indicators

Variable/Parameter	Indicators	Respondents
Knowledge and Attitude (KA)	Explain the types, sources, causes, and intensity of disaster	Teacher and Student
	Mention the types of disasters that occur after an earthquake	
	Explain the vulnerability of the environment and physical buildings of school	
	The motivation of school for preparedness in anticipation of natural disaster	
Policies and Guidelines (PG)	The existence of educational policies and guidelines for preparedness for disaster	Head/Deputy Head of School
	Availability of data on the implementation of disaster preparedness education policies	
	Understand the education regulations related to disaster preparedness	
Emergency Response Plan (ERP)	Availability of school plans for emergencies	Head/Deputy Head of School, Teacher and Students
	Availability of school procedures for disaster emergencies	
	Availability of places, maps, and evacuation routes	
	Availability of a first aid plan	
	Availability of rescue, safety, and security plans for school	
	Availability of documents, important school equipment, and safe storage places	
	Understand the addresses and telephone numbers of important facilities	
	There is access to important facilities	

Disaster Warning System (DWS)	There is access to disaster preparedness education	Head/Deputy Head of School, Teacher and Students
	There are exercises and simulations/rehearsals (students, teachers, and head schools)	
	Understand sources of national and local disaster warning information	
	There is access to Tsunami warning system	
	There is equipment that can capture disaster warning information	
	Availability of disaster warning information distribution procedures	
	Number of teachers and students who have been trained/trained	
	Understand the frequency of training and simulations	
	Availability of a team on duty for emergencies	
	Availability of procedures for disaster emergencies	
Resource Mobilization (RM)	There is school involvement in the disaster preparedness network	Head/Deputy Head of School, Teacher and Students
	Number of teachers and students trained/trained for disaster emergency preparedness and response management	
	Availability of disaster preparedness materials and supplies	
	There is mobilization of funds for preparedness	
	Availability of plans to integrate disaster preparedness material into the curriculum of relevant subjects, local or extracurricular content	

Source: Authors' compilation based and related studies [3].

Preparedness index analysis is calculated based on scoring, where the score is obtained using the percentage of questionnaire answers. The yes answers are scored 1, and no answers are scored 0,

with the scores received from the literature sources, as shown in Table 3.

Table 3. Preparedness Parameter Score

School Community	Parameter					Total
	KA	PG	ERP	DWS	RM	
Head School (S1)	-	10	14	4	6	34
Teacher (S2)	30	-	7	2	3	42
Student (S3)	20	-	2	1	1	24
Total	50	10	23	7	10	100

Source: [3].

After obtaining the index for each community, preparedness index was calculated based on the sum of all parameters. As shown in Table 3, higher and lower index value shows an elevated and reduced level of preparedness, respectively.

Instrument Development and Indicators

The questionnaire was developed based on established disaster preparedness frameworks and adapted from previous studies [3]. Five key dimensions of preparedness were operationalized: (1) knowledge and attitude, (2) policies and guidelines, (3) emergency response plans, (4) disaster warning systems, and (5) resource mobilization. Each dimension was represented by multiple indicators (see Table 1), covering aspects

such as awareness of disaster risks, existence of emergency protocols, access to early warning systems, and availability of preparedness resources. Responses were dichotomous (Yes = 1, No = 0), enabling standardized scoring. Content validity of the instrument was established through expert review by three disaster management specialists and two education practitioners. Reliability was assessed using Cronbach's alpha, with all dimensions achieving coefficients above 0.70, indicating acceptable internal consistency for social science research.

Data Analysis

Preparedness indices were calculated by summing indicator scores and converting them into percentages. Based on these percentages, schools

and respondents were classified into five categories: very ready, ready, almost ready, less ready, and not ready (Table 3). To test for statistically significant differences in preparedness across demographic and role-based groups, non-parametric tests were applied. The Kruskal–Wallis test was used for

comparisons across more than two groups (age and school type), while the Mann–Whitney U test was applied for two-group comparisons (gender). These tests were selected due to the ordinal nature of the preparedness scores and the non-normal distribution of the data.

Table 4. Category Level of Preparedness

No.	Index Score	Category
1.	80-100	Very Ready (VR)
2.	65-79	Ready (R)
3.	55-64	Almost Ready (AR)
4.	40-54	Less Ready (LR)
5.	0-39	Not Ready (NR)

Source: [4].

Ethical Consideration

Ethical approval was obtained from the Research Ethics Committee of Universitas Bung Hatta. Participation in the study was voluntary, and informed consent was obtained from all respondents. For student participants under the age of 18, consent was additionally secured from parents and school authorities. Anonymity and confidentiality were maintained throughout the data collection and analysis processes, ensuring that no personal identifiers were disclosed.

3. RESULT AND DISCUSSION

Respondent Characteristic

The study involved 160 respondents, consisting of students (58.7%), teachers (36.2%), and principals (5.1%). The majority were aged 10–20 years (56.1%), and female students represented 64.2% of the total sample. This demographic profile reflects the school population in Nagari Kataping and provides a solid basis for examining differences in preparedness across roles, age groups, and gender. Table 5 presents the demographic distribution of respondents.

Table 5. Demography data of respondent

Demography Data	Category	Frequency	Percent
Position of Respondent	Student	73.00	59.35
	Teacher	44.00	35.77
	Head	6.00	4.88
	Total	123.00	100.00
Age of Respondent	10-20 year old	69.00	56.10
	21-30 year old	18.00	14.63
	31-40 year old	15.00	12.20
	41-50 year old	6.00	4.88
	> 50 year old	11.00	8.94
	no respond	4.00	3.25
	Total	123.00	100.00
Sex of Respondent	Female	79.00	64.23
	Male	44.00	35.77
	Total	123.00	100.00
Type of Respondent's School	school 1	15.00	12.20
	school 2	13.00	10.57
	school 3	19.00	15.45
	school 4	13.00	10.57
	school 5	39.00	31.71
	school 6	23.00	18.70
	No respond	1.00	0.81
	Total	123.00	100.00

Source: Authors survey data (2025)

The dominance of student respondents mirrors the school environment, yet this also means that their lower preparedness (as shown later) heavily influences the overall preparedness index.

Preparedness Across Dimensions

Preparedness was assessed across five key factors: knowledge and attitudes, policies and

guidelines, emergency response plans, disaster warning systems, and resource mobilization. The overall results indicate that knowledge and attitudes scored relatively high, while resource mobilization and warning systems scored the lowest. Table 6 summarizes the descriptive statistics of preparedness factors.

Table 6. Statistic of the disaster preparedness factors

Factor	Code	Indicator	Mean	Category	Group Mean	Group Category
Knowledge And Attitude	ka1		0.84	high	0,75	moderate
	ka2		0.70	moderate		
	ka3		0.78	moderate		
	ka4		0.67	moderate		
Policy And Guideline	pg1		0.66	moderate	0,66	moderate
	pg2		0.67	moderate		
	pg3		0.67	moderate		
	erp1		0.86	high		
Emergency Respond Plan	erp2		0.61	low	0,78	moderate
	erp3		0.47	very low		
	erp4		0.77	moderate		
	erp5		0.92	high		
	erp6		0.96	high		
	erp7		0.88	high		
	erp8		0.85	high		
	erp9		0.87	high		
	erp10		0.59	low		
	dws1		0.77	moderate		
Disaster Warning System	dws2		0.63	low	0,66	moderate
	dws3		0.92	high		
	dws4		0.72	moderate		
	dws5		0.60	low		
	dws6		0.47	very low		
	dws7		0.63	low		
	dws8		0.52	very low		
	rm1		0.59	low		
Resources Mobilization	rm2		0.64	Low	0,54	low
	rm3		0.63	Low		
	rm4		0.76	Moderate		
	rm5		0.50	Low		
	rm6		0.00	very low		
	rm7		0.67	Moderate		

Source: Authors survey data (2025)

These findings suggest that while schools and respondents understand disaster risks and possess basic response plans, they remain constrained by limited resources and insufficient warning system infrastructure. This echoes findings from [21-24]. found that building awareness within schools must be accompanied by school policies, training programs, and resource support in order for mitigation education to have a real impact; knowledge without policy and implementation results in insufficient preparedness.

Variations by Demographic Factors

Respondent age

Age significantly influenced preparedness in certain dimensions. Older respondents (>50 years) had the highest mean scores in knowledge and attitude, reflecting the role of experience in disaster awareness. Younger respondents, however, scored lower, particularly in resource mobilization. Table 7 shows the preparedness scores by age group.

Table 7. Respondent age

Preparedness Factor	Age	Mean	Std. Deviation	Std. Error	Kruskal Wallis (Asym. Sig)
Knowledge And Attitude	10-20 year old	0.71	0.08	0.01	22.04 (0.00)***
	21-30 year old	0.79	0.10	0.03	
	31-40 year old	0.78	0.12	0.03	
	41-50 year old	0.79	0.04	0.02	
	> 50 year old	0.88	0.12	0.04	
Policy And Guideline	10-20 year old	0.65	0.48	0.06	2.87 (0.58)
	21-30 year old	0.61	0.50	0.12	
	31-40 year old	0.80	0.41	0.11	
	41-50 year old	0.80	0.45	0.20	
Emergency Respond Plan	> 50 year old	0.56	0.50	0.14	10.17 (0.038)**
	10-20 year old	0.74	0.16	0.02	
	21-30 year old	0.84	0.16	0.04	
	31-40 year old	0.85	0.15	0.04	
	41-50 year old	0.82	0.18	0.08	
Disaster Warning System	> 50 year old	0.77	0.28	0.08	1.61 (0.81)
	10-20 year old	0.66	0.23	0.03	
	21-30 year old	0.74	0.22	0.05	
	31-40 year old	0.67	0.22	0.06	
	41-50 year old	0.65	0.16	0.07	
Disaster Warning System	> 50 year old	0.65	0.14	0.04	10.24 (0.04)**
	10-20 year old	0.58	0.23	0.03	
	21-30 year old	0.50	0.32	0.08	
	31-40 year old	0.64	0.23	0.06	
	41-50 year old	0.54	0.38	0.17	
	> 50 year old	0.30	0.31	0.09	

Source: Authors survey data (2025)

These results indicate that preparedness education must particularly target younger groups to ensure long-term community resilience.

Respondent position

Teachers demonstrated higher preparedness levels than students and principals, especially in

knowledge and emergency response plans. Surprisingly, principals showed lower preparedness than expected, highlighting institutional leadership gaps. Table 8 illustrates preparedness by respondent position.

Table 8. Respondent position

Preparedness factor	Respondent position	Mean	Std. Deviation	Std. Error Mean	Kruskal Wallis (asym. Sig)
Knowledge And Attitude	student	0.71	0.08	0.01	25.28 (0.00)***
	teacher	0.81	0.11	0.02	
	head	1.00	na	na	
Policy And Guideline	student	0.66	0.48	0.06	0.01 (0.99)
	teacher	0.67	0.47	0.07	
	head	0.67	0.52	0.21	
Emergency Respond Plan	student	0.74	0.16	0.02	10.22 (0.006)***
	teacher	0.84	0.16	0.02	
	head	0.75	0.34	0.14	
Disaster Warning System	student	0.66	0.23	0.03	0.56 (0.75)
	teacher	0.68	0.21	0.03	
	head	0.75	0.18	0.13	
Resources Mobilization	student	0.58	0.23	0.03	2.83 (0.24)
	teacher	0.48	0.31	0.05	
	head	0.60	0.37	0.15	

Source: Authors survey data (2025)

This suggests that disaster leadership training for school heads is urgently required to align institutional responsibilities with actual preparedness capacity.

Respondent Gender

Differences were also observed between male and female students. Male respondents displayed slightly higher preparedness, particularly in warning system knowledge. **Table 9** details preparedness scores by gender.

Table 9. Respondent Gender

Preparedness factor	Sex	Mean	Std. Deviation	Std. Error Mean	Mann-Whitney (asym. Sig)
Knowledge And Attitude	Female	0.75	0.11	0.01	15115.50 (0.65)
	Male	0.75	0.10	0.02	
Policy And Guideline	Female	0.65	0.48	0.05	1682.00 (0.72)
	Male	0.68	0.47	0.07	
Emergency Respond Plan	Female	0.79	0.18	0.02	1551.00 (0.42)
	Male	0.77	0.18	0.03	
Disaster Warning System	Female	0.65	0.22	0.03	1436.00 (0.31)
	Male	0.70	0.22	0.03	
Disaster Warning System	Female	0.52	0.29	0.03	1560.00 (0.34)
	Male	0.58	0.22	0.03	

Source: Authors survey data (2025)

While this difference may reflect gendered participation in drills and physical activities, it also highlights the need for inclusive preparedness education that ensures equal engagement for female students.

School to School Comparison

There were significant disparities across the six schools. School 1 scored highest and achieved “ready” status across most dimensions, while School 2 had the lowest preparedness, particularly in resource mobilization. Table 10 presents the comparison of preparedness levels across schools.

Table 10. Respondent school

Preparedness factor	Respondent school	Mean	Std. Deviation	Std. Error	Kruskal Wallis (asym. Sig)
Knowledge And Attitude	school 1	0.78	0.06	0.02	12.46 (0.05)*
	school 2	0.78	0.05	0.01	
	school 3	0.76	0.12	0.03	
	school 4	0.71	0.05	0.01	
	school 5	0.76	0.13	0.02	
	school 6	0.70	0.08	0.02	
Policy And Guideline	school 1	0.73	0.46	0.12	30.62 (0.00)***
	school 2	0.05	0.18	0.05	
	school 3	0.68	0.48	0.11	
	school 4	0.92	0.28	0.08	
	school 5	0.77	0.43	0.07	

	school 6	0.61	0.50	0.10	
	school 1	0.94	0.09	0.02	
	school 2	0.62	0.21	0.06	
Emergency Respond Plan	school 3	0.80	0.16	0.04	32.93 (0.00)***
	school 4	0.77	0.13	0.04	
	school 5	0.81	0.17	0.03	
	school 6	0.70	0.15	0.03	
	school 1	0.77	0.23	0.06	
	school 2	0.69	0.19	0.05	
Disaster Warning System	school 3	0.73	0.21	0.05	24.62 (0.00)***
	school 4	0.50	0.12	0.03	
	school 5	0.73	0.21	0.03	
	school 6	0.53	0.22	0.05	
	school 1	0.78	0.13	0.03	
	school 2	0.29	0.25	0.07	
Resources Mobilization	school 3	0.55	0.26	0.06	39.50 (0.00)***
	school 4	0.73	0.22	0.06	
	school 5	0.56	0.18	0.03	
	school 6	0.38	0.30	0.06	

Source: Authors survey data (2025)

These differences point to unequal institutional support and access to resources within the same sub-district. This finding support. Organizational factors such as leadership commitment, regular training, and cross-institutional knowledge sharing are more significant determinants of preparedness than geographical factors.

Theoretical and Practical Implications

The results enrich the DRR literature by extending preparedness analysis into rural school contexts and incorporating intra-school variations based on role, age, and gender. The proposed preparedness index provides a multi-dimensional approach that captures both strengths (knowledge and emergency response) and weaknesses (resource mobilization and warning systems). Practically, the findings emphasize the need to integrate disaster preparedness into school curricula, expand training

for teachers and principals, and prioritize investments in resource mobilization and disaster warning systems. Schools should function as community resilience hubs, bridging formal education and disaster risk reduction at the grassroots level.

Limitations and Future Research

The study is limited by its reliance on dichotomous (yes/no) responses, which may oversimplify preparedness perceptions. Future studies could employ Likert-scale instruments and qualitative approaches to capture more nuanced preparedness behaviors. Additionally, the cross-sectional design provides only a snapshot; longitudinal research could examine how preparedness evolves following policy interventions or training programs.

4. CONCLUSION

This study assessed the level of tsunami preparedness among six rural schools in Nagari Kataping, Padang Pariaman Regency, one of the most tsunami-prone areas in Indonesia. The findings reveal that preparedness levels ranged from “not ready” to “ready,” with significant disparities across schools. Teachers consistently demonstrated higher levels of preparedness

compared to students and principals, while male students showed slightly higher readiness than females. Among the five preparedness dimensions, knowledge and attitudes as well as emergency response plans performed relatively well, whereas disaster warning systems and resource mobilization were identified as the weakest components. These results highlight that although awareness exists, the institutional and material capacities of schools remain limited. Theoretically, the study extends the

Disaster Risk Reduction (DRR) framework by developing a preparedness index tailored to school communities, which incorporates variations by role, demographic characteristics, and school type. This multi-layered approach offers a more nuanced understanding of school-based resilience, particularly in rural and emerging country contexts.

5. REFERENCES

- [1] Khairul Rahmat, H., Frinaldi, A., Rembrandt, R., & Lanin, D. (2024). Model Kesiapsiagaan Bencana Berbasis Sekolah Melalui Program Satuan Pendidikan Aman Bencana Di Kota Tangerang Disaster Management Policy: School Based Disaster Preparedness Model Through Disaster Safe School Program in Tangerang City. *Al-Isyraq: Jurnal Bimbingan, Penyuluhan, Dan Konseling Islam*, 7(3), 655–668.
- [2] Alfianto, A. G., Wijayanti, D. P., Sulaksono, A. D., & Choirullah, A. H. (2024). Disaster-Safe-School Based Program for the Psychological Preparedness of Elementary School Students. *Nurse and Health: Jurnal Keperawatan*, 13(1), 148–155. <https://doi.org/10.36720/nhjk.v13i1.657>
- [3] Husna, C., Firdaus, R., Wardani, E., & Jannah, S. R. (2021). Disaster Preparedness Among Disaster Management Agency Officers: A Study From Rural and Urban Areas in Aceh, Indonesia. *International Journal of Disaster Resilience in the Built Environment*, 13(4), 484–497. <https://doi.org/10.1108/ijdrbe-02-2021-0015>
- [4] Benardi, A. I., Sumarmi, S., Budijanto, Bachri, S., Rahman, A., & Wulandari, F. (2023). Disaster Preparedness in Proximity of Merapi Volcano, Indonesia: Is There Any Relationship in Knowledge and Attitude of Senior High School Students? *International Journal of Safety and Security Engineering*, 13(2), 245–254. <https://doi.org/10.18280/ijss.130207>
- [5] Emaliyawati, E., Satiadi, D., Sutini, T., Jamaludin, H. N. N., Khofifah, I. N., Manika, L. R., Fauziyah, S. M., & Siagian, E. T. (2022). The Effect of Disaster Education of Increasing Earthquake Disaster Preparedness : A Narrative Review. *Jurnal Keperawatan Komprehensif*, 8(4).
- [6] Munawir, A. (2023). Capability of Local Government Organizations in Handling Natural Disasters in Maros Regency. *Kne Social Sciences*. Faisal, R. (2022). Pengembangan Model Pengurangan Risiko Bencana Melalui Kesiapsiagaan Berbasis Sekolah Di Sma Negeri 24 Bandung. *Jurnal Ilmiah Kebijakan Dan Pelayanan Pekerjaan Sosial (Biyana)*, 3(02), 130–150
- [7] Fidiana Kurniawati, Desi Natalia Trijayanti Idris, Dinar Yuni A. A. C., & Srinalesti Mahanani. (2025). Edukasi Pengurangan Risiko Bencana Berbasis Sekolah Di Sd Emaus Kabupaten Kediri. *Indonesian Health Literacy Journal*, 2(2), 82–89. <https://doi.org/10.70574>
- [8] Hargono, A. (2023). Relationship Between Disaster Awareness and Disaster Preparedness: Online Survey of the Community in Indonesia. *Journal of Public Health in Africa*, 14(9), 8. <https://doi.org/10.4081/jphia.2023.2376>
- [9] Hariyanto, T., Abubakar, Y., & Zainun, I. (2022). The Impact of Disaster Knowledge and Attitudes on Community Preparedness in Facing Earthquakes. *Kne Social Sciences*. <https://doi.org/10.18502/kss.v7i16.12154>
- [10] Haryani, Rini Asmariati, I. F. M. (2023). Preparedness Study of Ketaping Beach Tourism Object Visitors Against Earthquake and Tsunami. 7 (1), 71–80.
- [11] Khan, S. M., Shafi, I., Butt, W. H., Diez, I. de la T., Flores, M. A. L., Galán, J. C., & Ashraf, I. (2023). A Systematic Review of Disaster Management Systems: Approaches, Challenges, and Future Directions. *Land*, 12(8), 1–37. <https://doi.org/10.3390/land12>
- [12] Khusnani, A. (2023). Identification of Understanding of Disaster Preparedness in the School Environment. *Indonesian Journal on Learning and Advanced Education (Ijolae)*, 5(3), 233–248. <https://doi.org/10.23917/ijolae>
- [13] Mishra, K. G., Patnaik, N., Pradhan, N. R., Mohapatra, A., & Saleem, S. M. (2025). Comparative descriptive analysis of hospital disaster preparedness using WHO safety index: a multi-center study from Eastern India. *BMC Emergency Medicine*, 25(1), 201. <https://doi.org/10.1186/s12873-025-01248-2> <https://doi.org/10.18502/kss.v8i17.14107>
- [14] Muzani, M., Fatimah, A. N., Imsa, M. A., & Casmana, A. R. (2022). The obstacles hierarchy of school disaster preparedness implementation in Mount Sinabung area, Indonesia. *Frontiers in Education*, 7(August), 1–17. <https://doi.org/10.3389/educ.2022.8429>
- [15] Nasution, R. F., & Lestari, E. B. (2025). The Role of Disaster Preparedness Education in Raising Awareness in Adolescents (Peran Pendidikan Kesiapsiagaan Bencana dalam Meningkatkan Kesadaran pada Remaja). *Jurnal Bintang Pendidikan Indonesia*, 3(1),

- 119–128.
- [16] Nguyen, M. T., Nguyen, C. T., & Nguyen, H. (2023). Visualization-Based Monitoring in Early Warning Systems With Wireless Sensor Networks. *Indonesian Journal of Electrical Engineering and Computer Science*, 31(1), 281. <https://doi.org/10.11591/ijeecs.v31.i1>
 - [17] Nurdiansyah, M. I., & Nurwati, D. (2025). Evaluating school disaster preparedness: A comparative study between urban and rural areas in Indonesia. *Priviet Social Sciences Journal*, 5(8), 302–316. <https://doi.org/10.559>
 - [18] Nurdiawati, E., Jubaedi, A., & Holila, R. A. (2024). Kesiapsiagaan Siswa dalam Menghadapi Bencana Gempa Bumi dan Tsunami. *Faletehan Health Journal*, 11(02), 227–233. <https://doi.org/10.33746/fhj>
 - [19] Parlina, I., Prasetya, J. D., Cahyadi, T. A., & Maharani, Y. N. (2025). *Jurnal basicedu*. 9(5), 1466–1479.
 - [20] Rahmat, H. K., Haris Achadi, A., Akbar, A. A., Said, A., Basri, H., Yurika, R. E., Luhur, U. B., & Pencarian Dan Pertolongan, B. N. (2024). Pembelajaran Mitigasi Bencana Berbasis Kearifan Lokal: Sebuah Inovasi dalam Membangun Resiliensi Sekolah. *Prosiding Konseling Kearifan Nusantara (KKN)*, 3, 444–453. <https://proceeding.unpkediri.ac.id/index>.
 - [21] Rahmat, H. K., Hasrian, H., & Bimantara, M. A. (2023). Preparedness in Students through BLU-DISCARE as an Innovation in Disaster Education in Schools to Realize a Disaster Resilient Generation (Membangun Kesiapsiagaan Building Disaster Bencana pada Siswa Melalui BLU-DISCARE sebagai Inovasi Pendidikan Kebenca. *Jagratara: Journal of Disaster Research*, 1(2), 49–58. <https://doi.org/10.35719/ijdr.v1i2.120>
 - [22] Rahmawati, D. N. (2023). The Description of Knowledge and Attitude of Flood Disaster Preparedness of Residents in Kwarasan Sub-District. *Jkmi*, 2(1), 115–129. <https://doi.org/>
 - [23] Salmawati, L., Pertiwi, P., Syahril, M. S., Satria, M. A., Radhiah, S., & Rahman, A. (2024). Preparedness of Lab School Middle School Students Towards Earthquakes for Disaster Risk Reduction. *Journal of Health and Nutrition Research*, 3(2), 128–132. <https://doi.org/10.56303/jhnresearch.v3i2.209>
 - [24] Samuel, G., Mulalu, M. I., Moalafhi, D. B., & Stephens, M. (2022). Evaluation of national disaster management strategy and planning for flood management and impact reduction in Gaborone, Botswana. *International Journal of Disaster Risk Reduction*, 74, 102939. <https://doi.org/10.1016/j.ijdr.2022.102939>