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Perception of Elementary School Students on the Tsunami Early Warning System (TEWS) in High-Risk Tsunami Zones in Padang City

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ABSTRACT

This study aims to understand students' perceptions of the Tsunami Early Warning System (TEWS) in tsunami-prone areas, focusing on SD Pertiwi 2 in Padang City. TEWS is crucial in disaster risk mitigation as it provides early warnings to reduce casualties during a tsunami. This research utilizes a quantitative descriptive approach, with a questionnaire distributed to 69 sixth-grade students. The findings reveal that 85.51% of students understand TEWS, 97% believe TEWS is essential for safety, yet only 63% are aware of a TEWS installation near their school. These results indicate a need for enhanced local education about TEWS, particularly by schools and relevant agencies.

Keywords: *Tsunami Early Warning System; Disaster Mitigation; Student Perception; Disaster Preparedness; Community Preparedness.*

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INTRODUCTION

Padang City, located along the western coast of Sumatra, is highly vulnerable to seismic and tsunami events due to its proximity to the Sunda megathrust fault line. According to recent data from the Indonesian Meteorological, Climatological, and Geophysical Agency (BMKG), Padang is among the most at-risk areas for tsunamis in Indonesia, with estimated potential wave heights reaching up to 12 meters in the event of a large undersea earthquake [1]. This high level of risk necessitates effective disaster preparedness and mitigation strategies, particularly in educating the community about the Tsunami Early Warning System (TEWS) [2]. The TEWS, consisting of a network of sensors, buoys, and sirens, aims to provide early alerts to minimize casualties during tsunami events [3]. This system is particularly crucial in coastal areas such as Padang City, which has experienced previous seismic activities with tsunami potential [4].

Schools play a critical role in raising awareness and preparing younger generations for disaster situations. Previous studies have shown that education and preparedness significantly impact how communities respond during emergencies [5]. However, there is a gap in understanding how effectively TEWS information is being disseminated within schools and how well students understand its functions. The Tsunami Early Warning System (TEWS) serves as a critical tool for mitigating disaster risks by providing early alerts to populations in vulnerable areas, thus enabling timely evacuation and reducing casualties. For students, especially those in coastal regions like Padang, understanding TEWS and being able to respond to warnings are essential components of disaster preparedness. Studies indicate that early disaster education, including training in TEWS, greatly enhances a community's ability to respond effectively to natural hazards [5]. Schools play an instrumental role in fostering this awareness among young people,

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which can subsequently enhance community-wide resilience [6].

Educational programs focused on disaster preparedness are critical for enhancing community resilience, particularly in regions at high risk for natural hazards like Padang. Introducing TEWS and similar preparedness concepts at the school level helps build a foundational understanding that can lead to improved safety outcomes during emergencies [7]. Therefore, this study investigates the perception of elementary school students in SD Pertiwi 2, located in a high-risk tsunami zone, regarding the TEWS. This study aims to explore the perceptions of sixth-grade students at SD Pertiwi 2 regarding TEWS, focusing on their knowledge, the perceived importance of TEWS for safety, and awareness of TEWS installations near their school. Specifically, this research addresses the following questions:

1. What is the level of students' general knowledge about TEWS?
2. How do students perceive the importance of TEWS in disaster preparedness?
3. Are students aware of local TEWS installations, and do they understand their role?

By investigating these aspects, this study seeks to contribute valuable insights into the role of educational institutions in disaster preparedness and the potential for enhancing TEWS awareness among students in high-risk areas like Padang.

METHOD

This study adopts a quantitative descriptive approach, focusing on analyzing the perception of sixth-grade students at SD Pertiwi 2 regarding the TEWS. The research was conducted in August 2024 in Padang City, which is classified as a high-risk tsunami zone [1]. Purposive sampling was used to select 69 students from sixth grade as the study sample. The selection of this age group was based on their cognitive maturity and readiness to understand disaster-related concepts, as students in this stage are transitioning to middle school.

Research Design

This study employs a quantitative descriptive research design to examine students' perceptions and understanding of the Tsunami Early Warning System (TEWS) in a high-risk tsunami zone. The quantitative descriptive approach allows for the systematic collection and analysis of numerical data, which is ideal for summarizing students' knowledge levels, attitudes, and awareness in a structured manner. This method is suitable because it provides insights into how widespread knowledge and perceptions about TEWS are among students, without seeking to establish causality [8], [9]. By describing trends within the responses, the study aims to highlight the educational needs concerning TEWS and disaster preparedness in schools.

Sample and Population

The research was conducted at SD Pertiwi 2 in Padang City, a high-risk tsunami zone. The population for this study consisted of all sixth-grade students at the school, with 69 students selected as the sample using a purposive sampling technique. This sampling method was chosen because sixth-grade students possess a higher cognitive ability compared to younger students, allowing for better understanding of disaster preparedness concepts [5]. The demographic information of the sample, including the number of male and female students and their respective ages, is summarized in Table 1 and Table 2 below

Table 1. Distribution of Respondents Based on Gender

Gender	No. of Students
Male	34
Female	35

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Table 2: Distribution of Respondents Based on Age

Age	No. of Students
11 years	25
12 years	40
13 years	4

Instrument

The primary data collection tool was a structured questionnaire developed based on indicators related to disaster preparedness and TEWS. The questionnaire contained 26 items designed to measure:

1. Student's knowledge of TEWS
2. Perception of the importance of TEWS for disaster mitigation
3. Awareness of TEWS installations around the school

Each question was rated on a 4-point Likert scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree), allowing for the quantification of students' responses. This approach is widely used in similar disaster preparedness studies to obtain measurable data on perception and awareness [6].

Prior to the main data collection, a pilot test was conducted at SD 26 Jati Utara with 48 students with the same criteria to assess the instrument's validity and reliability. The validity test employed a 5% significance level, requiring a minimum correlation coefficient of 0.279 for each item to be considered valid. Items that did not meet this threshold were excluded from the final version. The reliability was measured using Cronbach's Alpha, which yielded a value of 0.846, indicating a high level of internal consistency [10]. This ensures that the questionnaire items reliably measure students' knowledge, perceptions, and awareness regarding TEWS.

Validity and Reliability Testing

Before the main data collection, the questionnaire underwent validity and reliability testing at SD 26 Jati Utara, with 48 students participating in the pilot study. The validity test used a 5% significance level with a minimum correlation coefficient of 0.279. For reliability testing, Cronbach's Alpha was calculated, yielding a value of 0.846, indicating a high level of internal consistency [10]. Items that did not meet this threshold were excluded from the final version of the questionnaire [9]. Four questions were excluded due to failing the validity test:

1. Do you know how to communicate during an emergency?
2. Do you remember important phone numbers in case of an emergency?
3. Do you think students can play an active role in disseminating information about TEWS?
4. Do you think it is important to inform family members about TEWS?

Data Collection Procedure

The study was carried out in August 2024. Data collection was conducted in a classroom setting, with each student completing the questionnaire independently. Instructions were provided prior to the survey to clarify any questions and ensure accurate responses. Teachers were also present to facilitate the process and maintain a conducive environment for honest responses.

Data Analysis

Data were processed using SPSS, and descriptive statistics were used to analyze the collected data, with frequency distributions and percentages calculated to summarize responses. Percentages and frequencies were calculated to assess the distribution of responses across the sample. The analysis focused on understanding the general knowledge of TEWS, students'

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perception of the system's importance, and their awareness of TEWS installations around the school area [11]. The results were categorized based on three main indicators:

1. General knowledge of TEWS
2. Perception of the importance of TEWS
3. Awareness of local TEWS installations.

RESULTS AND DISCUSSION

The data collected from the 69 student respondents were organized according to three primary indicators: General Knowledge of TEWS, Perception of the Importance of TEWS, and Awareness of Local TEWS Installations.

Table 3. Summary of Student Responses by Indicator

Indicator	Agree (%)	Disagree (%)
General Knowledge of TEWS	85.51	14.49
Importance of TEWS for Safety	97	3
Awareness of Local TEWS Installations	63	37

General Knowledge of TEWS

A significant proportion of students (85.51%) reported knowing about TEWS, confirming that the majority of students are aware of its existence and purpose [6]. However, 14.49% of the respondents indicated that they were unfamiliar with the system. This gap suggests that although the TEWS has been widely introduced, there remains a segment of students who require additional education [12]. Previous research supports the need for sustained education efforts in disaster-prone regions to ensure that students remain informed and prepared [5].

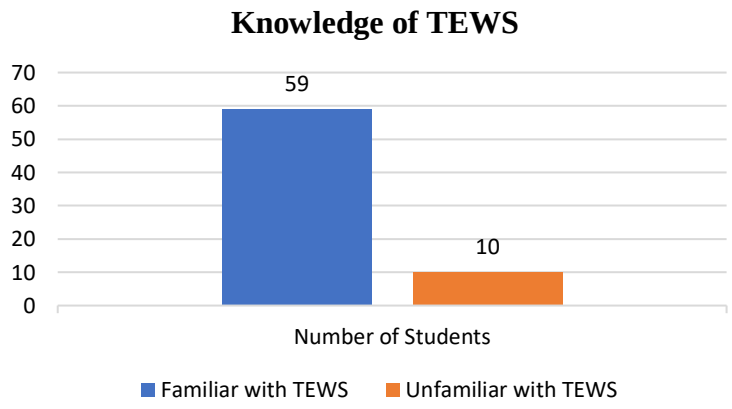

Figure 1. Student Knowledge of the Tsunami Early Warning System (TEWS)

Perception of TEWS Importance

Nearly all respondents (97%) acknowledged that TEWS is crucial for ensuring safety during a tsunami. This high level of agreement indicates that students understand the life-saving role of TEWS in disaster preparedness and response [13]. This aligns with findings from other studies on disaster education, which emphasize that early exposure to disaster-related concepts increases children's awareness and promotes preparedness behavior [14].

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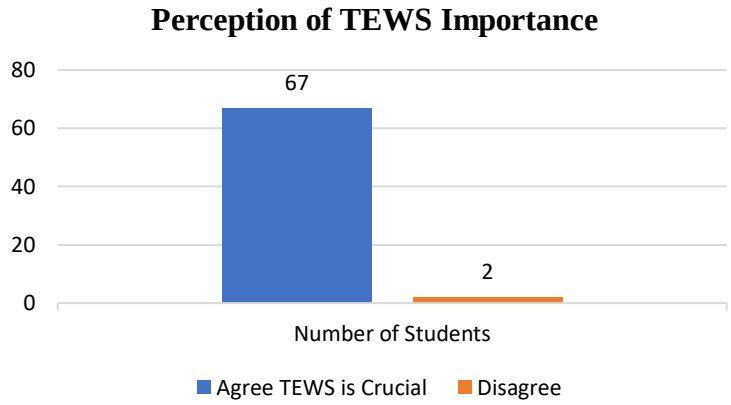

Figure 2. Student Perception of the Importance of the Tsunami Early Warning System (TEWS)

Awareness of Local TEWS Installations

While students generally understand the significance of TEWS, only 63% were aware of the TEWS installation located near their school at the BPBD office. This finding is concerning, as awareness of the physical presence of TEWS installations is crucial for effective disaster response [1]. The lack of awareness points to a need for improved local information dissemination. Educators and local disaster management agencies, such as BPBD, play a pivotal role in ensuring that students are well-informed about nearby warning systems [11].

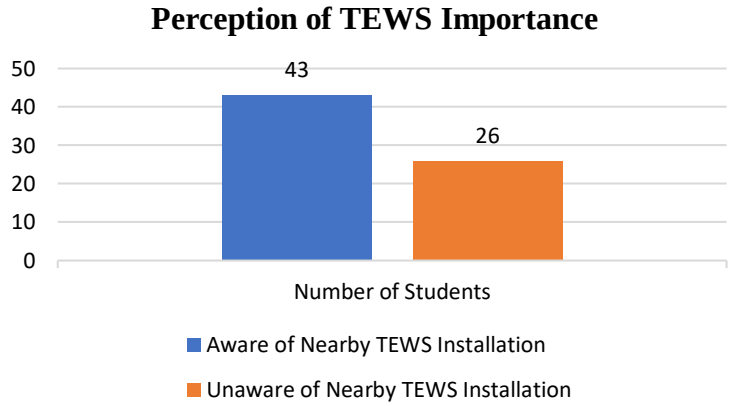

Figure 3. Student Awareness of Local TEWS Installations near the School

Role of Schools in Disaster Preparedness

The results reveal that schools are instrumental in disseminating information about TEWS. Students who received information through school programs showed a significantly better understanding of TEWS operations compared to those who did not. However, some students indicated that information regarding TEWS was provided infrequently, highlighting the need for more consistent educational efforts. Increasing the frequency of tsunami preparedness drills and integrating disaster education into the regular curriculum would likely improve overall student preparedness [5].

Perception of Preparedness and Active Participation

A notable 88% of respondents expressed a desire for more disaster simulations and preparedness drills at school. This finding reflects the students' proactive attitude toward disaster readiness, indicating that they recognize the value of hands-on experience in disaster response [3]. Schools have a unique opportunity to capitalize on this enthusiasm by organizing

more frequent evacuation drills and simulations in collaboration with local disaster management authorities.

Analysis

The results indicate that a significant majority (85.51%) of students possess general knowledge of TEWS, which aligns with other studies emphasizing the effectiveness of early disaster education in improving awareness [5], [6]. However, the 14.49% unfamiliar with TEWS highlights a need for continued educational efforts, especially for younger demographics who may lack exposure to disaster preparedness information.

The high percentage (97%) of students who believe TEWS is critical for safety during a tsunami suggests strong support for the system's role in disaster preparedness. This finding is consistent with research showing that early exposure to disaster concepts fosters a proactive approach to safety and emergency responses among students [12], [13]. Such positive perceptions could be leveraged by schools and local agencies to reinforce TEWS-related education in school curricula.

Regarding awareness of local TEWS installations, only 63% of students reported knowing about the TEWS location near their school, which is concerning given the importance of familiarity with nearby warning systems for effective evacuation during emergencies. This result underscores the importance of targeted local information dissemination efforts, particularly by BPBD and other disaster management agencies. Enhancing awareness of TEWS installations around schools can help ensure that students understand evacuation protocols and response actions, which are essential for minimizing casualties during a tsunami event.

Limitations

This study has some limitations that may affect the generalizability of its findings. First, the research was conducted in a single school, SD Pertiwi 2, which may not fully represent the broader student population in Padang or other tsunami-prone areas. Future studies could expand the sample size and include multiple schools to provide a more comprehensive view. Additionally, while this study focused on students' self-reported perceptions, observational data on their actual preparedness actions during drills could provide further insights into the effectiveness of TEWS education in practice.

CONCLUSION

This study highlights the critical importance of the Tsunami Early Warning System (TEWS) in enhancing student awareness and preparedness in tsunami-prone areas like Padang City. The main findings indicate that while the majority of students (85.51%) are knowledgeable about TEWS, and nearly all (97%) recognize its importance for safety, only 63% are aware of TEWS installations near their school. This awareness gap points to the need for schools and local disaster management agencies, such as BPBD, to enhance TEWS-related education. Practical recommendations include incorporating regular disaster preparedness drills, increasing the visibility of TEWS installations, and integrating TEWS knowledge into school curricula to foster a culture of preparedness.

Future research could explore the long-term impact of TEWS education on students' actual preparedness behaviors and investigate strategies to increase awareness in younger students and other school populations. Expanding the study across multiple schools and using observational data during drills could provide a deeper understanding of TEWS's role in student preparedness and contribute to more effective disaster education programs.

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