

IMPROVING STUDENTS' HEALTH PREPAREDNESS THROUGH LOCAL WISDOM-BASED DISASTER RISK REDUCTION EDUCATION AT EMAUS ELEMENTARY SCHOOL

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ABSTRACT

Disaster Risk Reduction (DRR) needs to be introduced early to improve disaster mitigation, especially for special groups. Integration of local wisdom in learning becomes a contextual strategy to improve student preparedness for disasters. Aims to analyze the effect of local wisdom integration in DRR education on improving student preparedness at Emmaus Elementary School. The research method used a pre-experimental design with a pretest–posttest approach. The number of respondents was 33 students whose preparedness levels were measured before and after the intervention using a questionnaire instrument and an observation checklist based on eight preparedness indicators. The results showed that 27 respondents experienced an increase in preparedness after the intervention. Statistical analysis used the Wilcoxon test, that showed p value = 0.001 ($p < 0.05$) with $Z = -4.778$, which means there is a significant effect of local wisdom integration in DRR education on student preparedness. This study concludes that the integration of local wisdom is effective in increasing students' preparedness for disasters and can be an innovative approach in disaster education in elementary schools.

Keywords: *Disaster Risk Reduction (DRR), Local wisdom, Students' health preparedness, Emmaus Elementary School*

INTRODUCTION

Health Emergency and Disaster Risk Management (EDRM) is a substantial response in this challenge now. It emphasizes the critical importance of prevention, preparedness and readiness, together with response and recovery, to save lives and protect health. The framework also underscores the essential role of the entire health system in supporting and strengthening all phases of disaster management. It is essential to target key population groups through structured and context-specific interventions. In this regard, educational settings provide a critical platform for translating prevention, preparedness, and response strategies into practical knowledge and skills. (World Health Organization, 2019)

Students are a vulnerable group at high risk of being affected by disasters, but they also have great potential as agents of change in disaster risk reduction efforts. Disaster Risk Reduction (DRR) education is a crucial strategy for improving children's preparedness and capacity to face disasters from an early age. Schools, as formal learning environments, play a strategic role in integrating disaster education through the Disaster Safe Education Unit program, which emphasizes preparedness, mitigation, and emergency response (Fadilah & Prasetyo, 2020). However, the implementation of

Disaster Risk Reduction (DRR) in schools still tends to be theoretical and less contextualized to students' daily lives (Lestari & Suwanto, 2024). Integrating local wisdom into disaster learning can be an innovative approach that is more relevant and easier for children to understand (Suarmika et al., 2022). Local wisdom, such as folklore, nature observations, and social practices, has been shown to increase student's understanding and awareness of disaster risks. This culture-based approach also strengthens student engagement in the learning process. Therefore, integrating local wisdom into DRR education is important for building children's resilience in a sustainable manner of disaster (Astuti & Anandita, 2025; Keswick et al., 2025; Ratnaningsih et al., 2022)

Globally, natural disasters continue to increase and significantly impact the education sector, including school damage and disruption to teaching and learning (Huang et al., 2024). In Asia, the high frequency of earthquakes, floods, and volcanic eruptions makes schools one of the locations at high risk of disaster impacts (Zhang et al., 2025). Indonesia, as a country located in the Pacific Ring of Fire, has a very high level of disaster vulnerability. In East Java, various types of disasters, such as Mount Semeru eruptions, Mount Bromo volcanic activity, floods, and landslides, frequently occur and impact the school environment and in Kediri, such as Kelud Mountain. This situation indicates that schools in disaster-prone areas require more comprehensive mitigation efforts. However, children's involvement in preparedness activities is still limited and suboptimal. However, active participation of children in Disaster Resilience (DRR) has been shown to significantly improve individual and community preparedness (Fadilah & Prasetyo, 2020; Kurniawati & Triyoga, 2024). Based on the results, 60,6% of students at Emaus elementary school, before receiving disaster education, had sufficient knowledge of disaster risk reduction.

Earthquakes and volcanic eruptions have caused significant damage to school infrastructure and directly impacted students' physical and psychological well-being. Earthquakes can cause the collapse of school buildings, injuries, and even fatalities among students and educators (Zhang et al., 2025). Meanwhile, volcanic eruptions produce volcanic ash, lava, and toxic gases that disrupt learning activities and children's health. In addition to physical damage, disasters also cause psychological trauma such as anxiety, fear, and post-disaster stress in children (Keswick et al., 2025; Kurniawati et al., 2024). These disruptions can affect students' concentration and emotional development in the long term. Economic losses due to damage to educational facilities also slow the post-disaster recovery process. The impact of disasters is not only felt by schools but also extends to surrounding communities that lose access to education. Therefore, systematic efforts are needed to mitigate the impact of disasters through effective and sustainable education (Astuti & Anandita, 2025; Suarmika et al., 2022)

One possible solution is to develop a Disaster Risk Reduction (DRR) education model that integrates local wisdom into the learning process in elementary schools (Lestari & Suwanto, 2024). This approach can be implemented through evacuation simulations based on real-world conditions in rural East Java schools

(Suarmika et al., 2022). Local wisdom, such as *titen* (observation of natural signs), *pranata mangsa* (traditional seasonal calendar), and the value of mutual cooperation, can be used as contextual and applicable learning media (T. Handayani & Suryani, 2022). For example, students are taught to recognize natural signs as early warnings of disasters and conduct simulations of leveraging based on the school's geographical location. Activities such as community service, cleaning water channels, and joint evacuation drills can effectively improve student preparedness. The integration of local wisdom has also been shown to improve understanding and skills in disaster mitigation. Furthermore, this approach strengthens social and cultural values in building community resilience (Hanum et al., 2025). Therefore, combining DRR and local wisdom is an effective strategy in developing a generation that is resilient to disasters.

RESEARCH METHODS

The research design used in this study was a pre-experimental, using the one-group pre-test post-test design. The data analysis used the Wilcoxon. The population consisted of 33 students from Emaus Elementary School, Kediri Regency, selected using a purposive sampling technique. Inclusion criteria were children aged 8-9 years who attended school during data collection and were willing to participate. Education in this study included disaster simulations of preparedness. Ethical approval was granted No : 047/28/V/EC/KEPK-3/STIKES RSBK/2025. Data collection used a questionnaire instrument and an observation checklist based. Assessment components included knowledge, emergency response planning, early warning systems, training and simulations, infrastructure, coordination, participation, and local wisdom. Data collection began with instrument and module preparation, identification of local disaster risks in schools, and the development of local wisdom-based learning. Pretest instruments were compiled to measure initial preparedness. The local wisdom-based DRR intervention included implementation of disaster risk reduction learning, materials on disasters and local disaster risks, local cultural discussions, evacuation simulations, and storytelling on local wisdom. The process ended with post-test preparedness data collection, followed by scoring and statistical analysis. Respondents' preparedness was scored: 80-100 for very ready, 65-79 for ready, 55-64 for almost ready, 40-54 for less ready, and 0-39 for not ready, based on UNDRR (2020).

RESULTS AND DISCUSSION

The results of this study are presented in two stages. First, the demographic characteristics of the respondents are described to provide an overview of the study population. Second, changes in students' disaster preparedness before and after the local wisdom-based DRR education intervention are analyzed to determine the effectiveness of the program. The detailed findings are presented in Tables 1 and 2.

Table 1. Results of Characteristic of Respondent at Emaus Elementary School

Characteristic	Total	Percentage (5)
Gender		
Boy	14	42,4
Girl	19	57,6
Total	33	100
Disaster Information		
Not Yet	24	72,8
Done	7	21,2
Total	33	100

Based on table 1, it is known that more than 50% of respondents were female with a total of 19 respondents (57.6%), and the majority of respondents had never received disaster education, namely 24 respondents (72.8%).

Table 2. Results of Disaster Preparedness of Respondent at Emaus Elementary School

No	Disaster Preparedness	Frekuensi		Persentase (%)	
		Before	After	Before	After
1	Not Prepared yet	0	0	0	0
2	Less Prepared	3	0	9.1	0
3	Almost Prepared	21	0	63.6	0
4	Prepared	5	3	15.2	9.1
5	Very Prepared	4	30	12.1	90.9
	Total	33	33	100	100
Statistic Test		<i>Wilcoxon Signed Rank Test</i> p = 0,001 Z = -4,778			

Table 2 showed an increase in preparedness, from very prepared by 12.1% to 90.9%. The Wilcoxon statistical test results show that there was a positive change before and after the intervention in 27 people, and preparedness remained the same in 6 people.

DISCUSSION

The results of the study indicate that the integration of local wisdom into Disaster Risk Reduction (DRR) education significantly improved student preparedness at Emaus Elementary School (0,001). This improvement was evident across eight preparedness categories, including knowledge, emergency response planning, early warning systems, training and simulations, infrastructure, coordination, local wisdom-based participation, and response readiness. Overall, all indicators improved after the intervention, confirming the effectiveness of the local wisdom-based approach in strengthening student capacity. However, the lowest initial scores were found for emergency response planning (70%) and capacity building through training and simulations (67%), requiring special attention in program implementation. These findings are supported by research showing that contextual and participatory

approaches, such as storytelling and active student involvement, can significantly improve preparedness (Amri et al., 2022; Keswick et al., 2025; Lu et al., 2021). However, the limited sample size and short duration of the intervention mean that the results of this study do not fully reflect the long-term impact.

The concept of disaster occurrence in this study emphasizes that, the integration of local wisdom in Disaster Risk Reduction (DRR) education must be supported by a health and mortality approach as the main foundation in disaster preparedness (World Health Organization, 2019). Nurses have a strategic role in providing health education, improving disaster literacy, and building student preparedness through promotive and preventive approaches (Veenema, 2019). In the context of the Disaster Safe Education Unit (SPAB) program, nurses can act as facilitators in training, evacuation simulations, and strengthening emergency response systems in school environments (Kemendikbud, 2017). In addition, the occurrence of emergency disasters, the importance of individual physical, mental, and social preparedness in facing disasters through community-based interventions (International Council of Nurses, 2019). The implementation of DRR by nurses also includes providing student capacity in first aid, stress management, and understanding health risks due to disasters (World Health Organization, 2019). Thus, the integration aspect of poverty in disaster education based on local wisdom becomes a holistic approach in building a disaster-resilient generation.

This approach aligns with the global concept that health workers, particularly nurses, play a critical role in all phases of disaster management, from mitigation to rehabilitation (International Council of Nurses, 2019). Nurses' involvement in SPAB strengthens cross-sector collaboration in creating safe and disaster-ready school environments (Amri et al., 2022; Kemendikbud, 2017). Nurses function not only as clinical staff but also as educators and advocates in disaster risk reduction at the community level (Veenema, 2019). Research shows that integrating health education into DRR can significantly improve individual preparedness and resilience (World Health Organization, 2019). However, optimizing the role of nurses still requires policy support, ongoing training, and integration into disaster education curricula (International Council of Nurses, 2019). Therefore, strengthening the role of nursing in SPAB and DRR is a crucial strategy for sustainably improving school-based preparedness.

Furthermore, active student involvement in disaster preparedness learning has been shown to increase the effectiveness of disaster education. Studies in Indonesia also show that integrating DRR through disaster-safe school programs effectively increases preparedness, although challenges remain in implementing simulations and planning. Therefore, the results of this study strengthen the evidence that integrating local wisdom is a relevant strategy in disaster education, although it is not yet fully optimized in practice. The limitations of this study lie in the limited sample size and relatively short intervention duration, which prevent comprehensive answers regarding the sustainability of long-term impacts (Amri et al., 2017; Li, 2024; Society for Research in Child Development, 2020).

Integrating local wisdom not only enhances cognitive aspects but also strengthens students' attitudes and practical skills in disaster situations. This is evident in the improvement in knowledge indicators, early warning systems, and response readiness, as demonstrated through evacuation simulations following the intervention. These findings align with research emphasizing the importance of interdisciplinary and community-based approaches in increasing disaster resilience (Palma et al., 2025). Furthermore, the use of traditional knowledge has been shown to effectively strengthen locally based mitigation systems (Hao & Lun, 2024). However, the results of this study also reveal similarities with findings that indicate the integration of local wisdom is often suboptimal if not supported by a structured and sustainable learning system (Sakic et al., 2022). Other research also shows that the integration of local wisdom in disaster mitigation education can significantly increase students' understanding and awareness (Astuti, 2025). An approach based on the integration of science, environment, technology, and Societe combined with local wisdom, has also been shown to increase students' resilience to disasters (Hanum, 2025). However, the low scores for the training and simulation aspects indicate the need to continuously increase the frequency and quality of training. Therefore, further research is needed to develop a more comprehensive learning model involving various parties and extending the duration of the intervention. Therefore, the results of this study provide an important contribution to the development of more effective, contextual, and sustainable local wisdom-based DRR education.

Indonesia is a country with a high level of disaster risk due to its geological and climatological conditions, including East Java, which is vulnerable to floods, landslides, earthquakes, and volcanic eruptions (UNDP, 2012) Within the UNDRR framework, Disaster Risk Reduction (DRR) emphasizes the importance of strengthening community capacity through an inclusive approach, including the integration of local wisdom as part of a sustainable mitigation strategy. Local wisdom is seen as a form of knowledge that develops from community experience in adapting to the environment and disaster threats (Hiwasaki et al., 2014) In East Java, practices such as *titen*, *pranata mangsa*, and *gotong royong* are highly relevant in supporting community-based disaster preparedness and risk reduction.

The concept of *titen* or remember (*adhedhasar pangling-eling tanda-tanda alam sing wis kedadeyan*) refers to a community's ability to empirically observe and interpret natural signs as a form of prediction of environmental change (Rafii et al., 2023). In the context of disasters, *titen* is used to recognize early indications such as changes in animal behavior, cloud patterns, and unusual environmental conditions. This practice aligns with the concept of an early warning system in Disaster Risk Reduction (DRR), where early detection is a key factor in mitigating the impact of disasters. Javanese people, including those in East Java, recognize several natural phenomena such as animals leaving their nests (ants, rats, snakes), birds flying erratically, livestock becoming restless, the ground feels warm in several places, rumbling sounds coming from the ground, the air feels hotter/more uncomfortable, rain/rumbling, the smoke

from the crater becomes thicker and higher, the smell of sulfur is pungent, rumbling sounds are heard, ash begins to fall thinly, wild animals descend from the mountain, livestock becoming restless or trying to move away, small tremors/earthquakes. Meanwhile, *pranata mangsa* is a traditional calendar system used by Javanese people to understand seasonal patterns based on natural phenomena (Handayani et al., 2023). This system serves as a guideline for agricultural activities and helps communities anticipate potential disasters such as droughts and floods. From a DRR perspective, *pranata mangsa* is a form of non-structural mitigation that supports risk-informed planning (Hiwasaki et al., 2018).

The value of cooperation as a form of social solidarity in Javanese called *goyong royong*. It means *andang gawe bebarengan, tulung-tinulung kanggo nggayuh tujuan, lan meringanake beban*, also a crucial role in disaster preparedness and response. Cooperation reflects active community participation in prevention, emergency response, and post-disaster recovery (Aldrich & Meyer, 2015). In the context of disaster management (DRR), community involvement is a key factor in enhancing community resilience to disasters, as emphasized by the UNDRR, which recognizes that a community-based approach (community-based DRR) is an effective and sustainable strategy. The integration of local wisdom, such as *titen*, *pranata mangsa*, and *gotong royong* (cooperation), into disaster education in elementary schools adds value to the learning process. This approach not only enhances students' understanding of disaster concepts but also strengthens the cultural context and local relevance, making learning more applicable and meaningful (Syuryansyah & Habibi, 2024). Thus, local wisdom significantly contributes to supporting the implementation of disaster risk reduction (DRR). Integrating these values into the education system is an innovative strategy that can enhance disaster preparedness and build a sustainable, disaster-resilient generation.

The novelty of this study lies in the integration of indigenous local wisdom into school-based Disaster Risk Reduction (DRR) education to strengthen students' health preparedness and disaster resilience. While previous studies have demonstrated the effectiveness of participatory and innovative learning approaches such as youth-centered engagement, disaster games, and disaster education programs in improving preparedness, few studies have incorporated culturally embedded local wisdom as the core learning framework for elementary school students. Haynes and Tanner (2015) highlighted that empowering children through participatory approaches enhances their capacity to communicate risks, advocate for community safety, and actively contribute to disaster risk reduction. Similarly, Wang et al. (2023) reported that disaster education mediates the relationship between school preparedness and students' protective behaviors, emphasizing the importance of educational interventions in strengthening preparedness. More recently, Marahatta et al. (2024) demonstrated that interactive and contextual learning methods effectively improve disaster awareness and response skills among school children. Building upon these findings, the present study contributes a culturally grounded approach by integrating *titen*, *pranata mangsa*, and *gotong royong* into DRR education, thereby connecting scientific preparedness concepts with local

knowledge systems that are familiar and meaningful to students. This integration offers a novel pathway for promoting both disaster preparedness and health-related protective behaviors among children.

The global significance of this study lies in its potential to provide a sustainable, low-cost, and culturally adaptable model for strengthening disaster and health preparedness among school-aged children in disaster-prone regions worldwide. Current global frameworks for disaster risk reduction emphasize the importance of inclusive, community-based, and context-sensitive approaches that actively engage children as agents of resilience rather than passive recipients of information. Evidence suggests that youth participation enhances community resilience and supports more effective risk communication and preparedness actions (Haynes & Tanner, 2015). Furthermore, school preparedness initiatives are more effective when combined with disaster education that promotes individual protective actions and behavioral change (Wang et al., 2023). Community-based preparedness models rooted in local culture have also demonstrated positive outcomes in strengthening disaster readiness and resilience (Sofyana et al., 2021). Therefore, the findings of this study extend beyond the Indonesian context by demonstrating how indigenous knowledge can be systematically integrated into school-based DRR education to improve preparedness, resilience, and health protection among children. This approach may serve as a transferable model for other disaster-prone countries seeking to strengthen child-centered preparedness programs while preserving local cultural values and community participation.

CONCLUSION

This study found that integrating local wisdom into Disaster Risk Reduction (DRR) education at Emaus Elementary School effectively improved the disaster preparedness of students. The intervention enhanced eight key preparedness components, including knowledge, emergency planning, early warning systems, training and simulations, infrastructure, coordination, participation, and response readiness. These results indicate that culturally contextual learning strengthens student's cognitive understanding, attitudes, and practical skills in disaster situations. However, initial findings revealed that emergency planning (70%) and capacity building through training and simulations (67%) were relatively low, highlighting the need for greater emphasis on practical exercises. The study confirms that preparedness depends not only on theoretical knowledge but also on repeated practice, structured systems, and adequate resources. While the findings are consistent with previous research supporting local wisdom-based and participatory approaches, limitations such as a small sample size and short intervention period restrict the generalization of long-term impacts. Future research should expand the sample, extend intervention duration, and integrate supportive school policies to ensure sustainability. Overall, this study contributes to developing adaptive, participatory, and sustainable DRR education to foster disaster-resilient students.

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