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Disaster Risk Reduction (DRR) Model in Senior High School: A Comparison of Tsunami Affected and Unaffected Areas in Banda Aceh City

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A B S T R A C T

This study aims to analyze the implementation of the disaster Risk Reduction (DRR) model in Senior High School in Banda Aceh City in schools located in areas affected and unaffacted by the tsunami in 2024. This paper uses a qualitative approach with a comparative study design, the research was conducted through a group investigation method in four schools. The research explores students' knowledge of DRR, including disaster experience, disaster information, participation in disaster activities, and understanding when a disaster occurs. Through the group investigation model, the research addressed the differences between schools in tsunami-affected and unaffacted areas. The result show that tsunami-affected schools have higher understanding and preparedness related to disaster risk reduction than unaffected schools, with differences in training participation and information sources.

INTRODUCTION

The main tectonic plates that shape Indonesia consist of the Indo-Australian Plate, the Pacific Plate and the Eurasian Plate. In certain periods, these three plates can interact with each other tectonically, causing earthquakes, and even tsunamis. Indonesia, which has a very high disaster-prone potential, makes its people anticipate in various ways, especially living in areas that are vulnerable to disasters (Firdaus & Yuliani, 2022). According to the Banda Aceh City District Disaster Risk diagram table in 2023 compiled by BNPB on the Aceh Disaster Management Agency (BPBA) website, Banda Aceh City District is categorized as having a lower disaster risk level than in 2022, which recorded 269 events. However, the total loss increased from IDR 335 billion in 2022 to IDR 430 billion in 2023, this loss includes damage to infrastructure, property owned by residents and agricultural land (Juwita, 2024).

Schools as a source of knowledge, so that students will gain in-depth knowledge, practical skills, and proactive attitudes in dealing with disasters, which will help students in overcoming disasters, and teachers are able to support students in building psychological responses, including disaster response, so that schools play a strategic role in disaster management efforts. Therefore, disaster management efforts in schools are a reflection of overall disaster prevention efforts, both individuals, families and communities (Qurniawan, 2014). As an effort to reduce disaster risk, collective awareness from various parties and comprehensive actions are needed to reduce the impact of disaster losses.

Indonesia is one of 168 countries that ratified the Hyogo Framework for Action (HFA) and is committed to emphasizing the loss of life as well as social, economic, and environmental losses due to disasters (Rahma, 2018). Given the government's limitations in disaster mitigation efforts, one of the steps taken is to provide education to the community, especially school students as a preventive effort in dealing with potential disasters. The education sector is one of the government's focuses in increasing public awareness of disaster risk, efforts in supporting this, the Disaster Safe Education Unit (SPAB) program was designed as one of the options implemented by BPBD, this program is based on the Head of the National Disaster Management Agency Regulation No. 04 of 2012 concerning Guidelines for Implementing Disaster Safe Schools/Madrasah (Wicaksono & Sibuea, 2022). SPAB was implemented in response to the large number of schools located in disaster-prone areas.

Disaster education is not only about providing knowledge and information about disasters to the community, but also aims to encourage the community to take concrete actions in disaster prevention and mitigation efforts (Frankenberg *et al.,* 2013). The education sector and school communities are among the sectors most frequently affected by disasters. That is why many schools have established disaster preparedness programs to reduce disaster risk in their environment (Setiawan & Akbar, 2021).

At present, there is a need to anticipate when earthquake and tsunami events recur, at least anticipation has been done by implementing crisis management, which makes schools prepare to accommodate disaster risk reduction such as preparing a gathering point, as well as disaster risk reduction knowledge. Improving community and societal preparedness for earthquake and tsunami hazards can be achieved by increasing their understanding of the hazards around them, understanding early warning systems, such as evacuation routes and shelter plans, acquiring the ability to evaluate situations quickly, making disaster anticipation plans for their families, conducting exercises to reduce the impact of hazards, and participating in training (Haslinda, 2017).

Through initiative and care and more attention (for example, protecting oneself from tsunamis and earthquakes by escaping to safer places) and increasing preparedness on an ongoing basis in the face of disasters. Integrating disaster mitigation education in schools can provide students with an interpretation of natural disasters, form a wise attitude in dealing with them, instill awareness of the importance of protecting the environment to prevent, and explore alternative mitigation solutions. Therefore, providing disaster mitigation knowledge that aims to improve the ability to deal with emergency situations needs to be done early, both in the home and school environment so that students understand the steps to protect themselves when a disaster occurs. This paper examines the role of schools in DRR in tsunami-affected and tsunami unaffected schools that will help students understand disaster knowledge and deal with disasters to minimize the occurrence of disaster victims. Thus, this research discusses the comparison of DRR in tsunami-affected and tsunami-unaffected schools in terms of students' knowledge.

METHODOLOGY

This study used a descriptive qualitative design with an Investigation Group approach, which was conducted in four high schools in Banda Aceh, consisting of two tsunami-affected schools (SMAN 1 Banda Aceh and SMAN 3 Banda Aceh) and two tsunami-unaffected schools (SMAN 9 Banda Aceh and SMAN 10 Fajar Harapan Banda Aceh). Data collection was conducted through group discussions involving 5-6 groups of students from each school. A semi-structured interview guide was used to explore students' knowledge on disaster risk reduction. The research took into account research ethics by obtaining informed consent, ensuring voluntary participation, and maintaining the confidentiality of participants' identities. The main objective was to obtain a comprehensive picture of disaster mitigation knowledge among high school students, taking into account the different experiences with tsunami disasters.

RESEARCH RESULT

Education is a strategic means to introduce potential disasters and their risks to every learner, so that one day they become disaster-aware citizens. Disaster education plays an important role for individuals in overcoming the impact of disasters, both in the short and longer term (Frankenberg *et al.,* 2013). Prevention and Disaster Risk Reduction (DRR) education is an ongoing initiative that is an integral part of the sustainable development process, by involving this education it is hoped that disaster risk reduction efforts can reach more people and be introduced to learners from an early age. Shaw (1976) explains that understanding small group dynamics in an educational context is very important, because interactions between peers can have a significant impact on student learning outcomes. In disaster education, group activities allow the simulation of real situations that can help children learn and internalize disaster self-rescue procedures through an interactive approach and involve active participation. This is expected to contribute to the improvement of individual preparedness against potential disasters. The results of the group investigations conducted at high schools in Banda Aceh, both affected and unaffected by the tsunami, are presented in a Group Investigation (GI) conducted in groups, where students in groups conduct group discussion learning and then answer the questions provided.

1. Disaster Risk Reduction (DRR)

Tsunami-affected school students understood DRR as a series of efforts aimed at reducing the adverse impacts of disasters through mitigation, preparedness and recovery measures, moreover, some groups pointed out the importance of active community roles and direct actions to reduce the risk of vulnerability to disasters. In addition, school students recognize the importance of community roles and direct actions in reducing the risk of vulnerability. However, as seen in SMAN 3 Banda Aceh, Amri *et al.,* (2017) emphasized the importance of thorough and continuous simulation implementation to ensure its effectiveness.

Schools that were not affected by the tsunami provided important insights into their approach to disaster risk reduction. Although these schools were not directly affected by the 2004 tsunami, efforts to improve disaster preparedness remain a priority. Schools that were not affected by the tsunami provided important insights into their approach to disaster risk reduction. Although these schools did not experience the direct impact of the 2004 tsunami, efforts to improve disaster preparedness remain a priority. These schools, such as SMAN 9 and SMAN 10 Fajar Harapan in Banda Aceh, have started integrating disaster education into the curriculum, although in some schools implementation is still limited. Students from these schools have an understanding of the importance of disaster risk reduction, such as the importance of evacuation routes and simulation exercises, but they report that formal disaster risk reduction (DRR) education or training activities in schools are still rare. Students in schools not affected by the tsunami understand the concept of DRR as a series of systematic efforts aimed at reducing disaster risks through preventive measures mitigation and environmental management. Their understanding tends to emphasize the importance of proactive measures taken before a disaster occurs, as part of a strategic approach in DRR. This understanding of DRR is the concept and practice of reducing disaster risk through systematically analyzing and managing the factors that cause disasters (UNISDR, 2009).

2. Sources of Information about Tsunami

Tsunami-affected school students mostly obtained this information through various sources such as social media, BMKG, television and direct experience from the surrounding community. This shows that both modern and traditional sources of information play an important role in providing disaster knowledge to students. Although they did not directly experience the tsunami disaster, students at schools that were not affected by the tsunami obtained information about the tsunami through various sources, such as mass media, Geography lessons, and official websites such as BMKG.

3. Participation in DRR Education and Training Activities

Most students at SMAN 1 Banda Aceh have participated in DRR education or training activities, indicating a high level of student participation. SMAN 1 Banda Aceh, which involved students in disaster simulations at the Tsunami Museum. The aspect of student participation in disaster simulations, such as the one conducted by SMAN 1 Banda Aceh at the Tsunami Museum, is supported by Adiyoso and Kanegae's (2013) research, which found that participatory approaches in disaster education can significantly improve students' understanding and preparedness. Nevertheless, there are still some weaknesses that need to be considered, such as the limited evacuation infrastructure, where there are no clear evacuation route sign boards, and the implementation of simulations that have not covered all students. In addition, teaching about disaster mitigation is often only integrated in certain subjects, such as geography, which means not all students gain sufficient knowledge on this topic. The implementation of disaster education can also improve the quality of education during disasters, reduce risks, and support the fourth goal of sustainable development, which is quality education (Hoelman & Michael, 2016). In contrast, at SMAN 3 Banda Aceh there were students who did not have gaps in the implementation of DRR education at the school However, as seen at SMAN 3 Banda Aceh, Amri *et al*., (2017) emphasized the importance of thorough and continuous simulation implementation to ensure its effectiveness. Differences in access to DRR training can affect the level of preparedness between one school and another (Sakurai *et al.,* 2018).

Students in schools that were not affected by the tsunami had never participated in DRR education or training activities at school. Disaster education and simulation has not been a common practice in the school environment, thus indicating a gap in the implementation of disaster mitigation programs in schools that do not have direct experience of disasters. In study Oktari *et al.,* (2018) found a gap in the implementation of DRR training between schools in tsunami-affected and unaffected areas, where schools in affected areas tended to have more structured DRR programs.

4. Actions to Take When a Tsunami Disaster Occurs

Tsunami-affected school students tend to focus on evacuating to high ground, staying away from vulnerable areas and following designated evacuation routes, and they also understand the importance of staying calm during a disaster, such as a tsunami. In addition, they understand the importance of maintaining calm during emergency situations to support the safety of themselves and others.

In dealing with disaster situations such as tsunamis, schools that are not affected by tsunamis take various mitigation actions including finding a safe place, following

designated evacuation routes, and avoiding disaster-prone areas, as a form of response to emergencies. However, their level of preparedness is lower than that of students from tsunami-affected schools, as Adiyoso and Kanegae's (2017) study showed that students in unaffected areas had lower levels of preparedness than affected areas, despite having basic knowledge of evacuation procedures. In line with the findings of Rafliana (2021) who identified the needs for DRR program development, the needs of DRR programs in schools include evacuation infrastructure, routine simulations, and integration with the community.

5. Understanding and Expectations of DRR Efforts in Schools

The understanding and expectations of students of SMAN 1 Banda Aceh and SMAN 3 Banda Aceh regarding efforts regarding the understanding of DRR in schools include environmental mitigation, such as reforestation and proper waste management. Meanwhile, students' expectations focused on increasing the frequency of disaster simulations, providing clear evacuation routes, and integrating disaster education in the school curriculum. Related to students' risk perceptions and expectations for stronger disaster mitigation programs, as found in SMAN 3 Banda Aceh, a study by Bordán and Petal (2021) showed that active involvement of students in the planning and evaluation of disaster programs in schools can increase the effectiveness and sustainability of such programs. This confirms the importance of listening to students' voices in the development of disaster mitigation strategies in schools.

The understanding and expectations of students at schools not affected by the tsunami for DRR efforts in schools include the need for clear evacuation routes, the regular implementation of disaster simulations, the provision of more comprehensive disaster teaching materials, and strengthening collaboration with local communities to improve disaster preparedness. Schools not affected by the tsunami show a pattern that is in line with the findings of previous studies on disaster education in Indonesian schools. Mardiah *et al.,* (2019) observed that although many schools have started to integrate disaster education into the curriculum, its implementation is often uneven and less comprehensive. This is reflected in the situation in both schools, where disaster materials have been introduced but not fully integrated into all subjects. Students' expectations for increased counseling, simulations, and more comprehensive disaster information reflect the findings of Amri *et al.,* (2017). Their study showed that active involvement of students in the planning and evaluation of disaster programs can increase the effectiveness and relevance of such programs.

DISCUSSION

From the tsunami-affected schools, it can be concluded that previous studies on school disaster preparedness in Indonesia show similar patterns to the findings in tsunami_affected schools. In a study conducted by Sakurai *et al*., (2018) in Aceh, it was found that although there was an increased awareness of the importance of disaster education after the 2004 tsunami, its implementation still faced challenges. Schools have generally started to integrate disaster material into the curriculum, but it is often limited to certain subjects, similar to the situation at SMAN 1 Banda Aceh. The two schools not affected by the tsunami showed awareness of the importance of disaster mitigation, but implementation was not optimal. SMAN 3 Banda Aceh has a solid building structure and budget allocation for maintenance, while SMAN 1 Banda Aceh has involved students in simulations at the Tsunami Museum. However, both schools still face obstacles

such as simulations that have not been thorough, limited evacuation infrastructure, and teaching disaster mitigation that has not been evenly integrated. This indicates the need for improvement in terms of training, simulation and cooperation with relevant agencies to strengthen disaster risk reduction programs in both schools. These improvements are important to ensure better preparedness in the face of potential disasters in the future.

SMAN 9 Banda Aceh, although not directly affected by the 2004 tsunami, has started to integrate disaster education into the school curriculum. Students at this school have a basic understanding of disaster risk reduction, such as the importance of evacuation routes and the importance of disaster simulation exercises. However, most students noted that they had never participated in any formal disaster risk reduction (DRR) education or training activities at school. Despite the presence of safety facilities such as evacuation routes, the school still faces challenges in terms of regular training and comprehensive coaching for all students. Students' expectations for disaster risk reduction efforts in schools are an increase in counseling, disaster simulations, and the provision of more complete information on disasters, so that they are better prepared to face potential disasters in the future.

At SMAN 10 Fajar Harapan Banda Aceh, disaster risk reduction is also an important concern, even though the school was not affected by the 2004 tsunami. The school has taught materials related to disaster risk reduction in grade 10, but the implementation has not been fully spread across all subjects. Students at SMAN 10 have a fairly good understanding of disaster risks and mitigation measures to be taken, such as following evacuation routes and avoiding dangerous areas during a disaster. Some students reported having participated in disaster education or training activities outside of school, but these programs have not been conducted at school. Students' expectations include improved safety equipment, more intensive disaster coaching, as well as more structured and comprehensive implementation of disaster risk reduction programs in schools. These efforts are expected to improve their preparedness for future disasters.

In relation to students' understanding of disaster risks and mitigation measures, Oktari *et al.,* (2018) found that students in disaster-prone areas generally have good basic knowledge. However, as seen in SMAN 9 and SMAN 10, there is still a gap between theoretical knowledge and practical experience in the form of training or simulation. This is in line with the findings of Hayudityas (2020) who emphasized the importance of active and participatory learning approaches in disaster education.

The challenges in implementing routine training and disaster simulations faced by the two tsunami-unaffected schools were also highlighted in Sakurai *et al.,* (2018) study. They identified that limited resources and lack of systematic support are often barriers to the implementation of effective disaster risk reduction programs in Indonesian schools.

Overall, the situation of the tsunami-unaffected schools illustrates positive developments in the integration of disaster education in schools, but also underlines the need for a more systematic and holistic approach to its implementation. While there are minor differences in the approach of each school, both face similar challenges in terms of regular training and comprehensive coaching for all students. In conclusion, despite awareness and initial efforts, significant improvements are still needed in the implementation of more structured and comprehensive DRR programs in both schools to ensure preparedness.

From the group investigation between tsunami-affected and tsunami-unaffected schools, it can be concluded that schools have started to use disaster materials, but they still face some problems. These include a lack of evacuation infrastructure, simulations that do not cover all students, and a lack of regular training. Adiyoso and Kanegae (2013) and Hayudityas (2020) emphasize the importance of participatory approaches and active learning in disaster education. This is in line with the expectations of students in the schools studied for more training, simulations and comprehensive information on disaster mitigation. Bordan and Petal (2021) and Amri *et al.,* (2017) underline the importance of student involvement in planning and evaluating disaster programs to improve their effectiveness and sustainability. This is in line with students' perceptions and expectations expressed in the study in Banda Aceh schools.

Overall, these studies show that despite progress in disaster education in schools particularly in Aceh, more systematic and comprehensive efforts are still needed to improve disaster preparedness. This includes infrastructure improvements, regular training, integration of materials across the curriculum, and active involvement of students in the planning and implementation process of disaster risk reduction programs. better cope with potential disasters in the future.

CONCLUSIONS AND RECOMMENDATIONS

Tsunami-affected schools tend to have better implementation of Disaster Risk Reduction (DRR) programs, both in terms of structural and unstructural aspects, compared to unaffected schools. First-hand experience of disasters seems to contribute to these schools' increased awareness and preparedness in disaster risk management. Disaster education is a strategic tool to introduce disaster potential and risk to students, aiming to form disaster-aware citizens. Through participatory and interactive approaches, no such as simulations and group activities, this education aims to improve individual preparedness in facing disasters. However, its implementation at SMAN 1 and SMAN 3 Banda Aceh still faces a number of challenges, including limited evacuation infrastructure, simulations that have not been thorough, and disaster mitigation teaching that has not been evenly integrated in the curriculum. based on research at SMAN 9 and SMAN 10 Fajar Harapan Banda Aceh, schools that were not

affected by the tsunami have shown initial efforts in disaster risk reduction (DRR) education, but still face significant challenges in its implementation. Although they have started to integrate disaster materials into the curriculum, implementation is still limited and uneven across subjects. This research emphasizes the importance of direct experience of natural disasters and school management in improving DRR preparedness and implementation in schools.

ADVANCED RESEARCH

Every research has limitations, including in this study which focuses on students' understanding of the concept of Disaster Risk Reduction (DRR). One limitation is that the data obtained only reflects the perceptions of students from two schools in Banda Aceh, so the results cannot be generalized to other areas with different geographical conditions and disaster experiences. In addition, an in-depth analysis of the influence of students' backgrounds, such as personal experience of disasters or level of access to information, has not been fully explored. Therefore, further research is recommended to involve a wider sample, including schools from different regions, as well as adding other variables such as parents' education level or school resources in supporting disaster education. A more in-depth qualitative approach could also be used to understand the motivations and factors that influence students' perceptions of DRR.

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