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# Disaster risk reduction efforts through education in Indonesia: A literature review

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**Abstract.** Indonesia is a country that is prone to natural disasters, such as earthquakes, floods, volcanic eruptions and tsunamis. To reduce the risk of disasters, efforts through education are important. This article aims to conduct a literature review regarding disaster risk reduction through education in Indonesia. Education has an important role in increasing public awareness, increasing knowledge, and developing the skills needed to reduce the impact of disasters and increase responsiveness in dealing with them. This research wants to find out other forms of approaches that have been implemented to reduce disaster risk in education in Indonesia and find out what the results are. A review of existing literature shows that there are 3 efforts to reduce disaster risk through education, namely formal education, informal education and non-formal education. The research results show that the three educational pathways are implemented quite well in Indonesia. Forms of disaster risk reduction through education include integration of learning in schools, local wisdom, training, outreach and disaster mitigation simulations from disaster awareness activist groups and from certain institutions/institutions to the community, as well as disaster mitigation programs from community groups themselves. To reduce disaster risk in Indonesia, sustainable and coordinated efforts are needed between the government, educational institutions and the community. Increasing the role of education in protecting and preparing people for disasters is important to minimize the negative impacts of disasters in the future.

## 1. Introduction

Indonesia is a country that has various potential natural resources but is also vulnerable to various disasters. Frequent disasters such as earthquakes, tsunamis, floods, landslides, volcanic eruptions, and extreme weather often cause losses both material and non-material. The following is a summary of data on the number of disaster events according to BNPB over the last five years.





Source : BNPB [1]

The latest data for August 2023, there were approximately 2,460 disaster incidents that resulted in 194 fatalities. 10 people were declared missing, 3,745,304 people suffered and fled and 5547 were injured. Meanwhile, as a result of the damage caused by the disaster, 23,816 houses were damaged, ranging from light to heavy damage, and 634 facilities were damaged, including health facilities, worship facilities, and educational facilities. A total of 79 office facilities were damaged and 183 bridges were also damaged [2]. Considering the magnitude of the impact caused by this disaster, if it is not addressed immediately it will cause even greater losses. So it is necessary to do disaster risk reduction. Disaster risk reduction itself is a series of efforts to reduce disaster risk carried out through awareness, increasing the ability to face disaster threats, and/or implementing physical and non-physical efforts carried out by community members in an active, participatory, and organized manner [3].

One way to reduce disaster risk is through education. Education has a key role to play in raising public awareness, increasing knowledge, and developing the skills needed to reduce the impact of disasters and increase responsiveness in dealing with them. By the description from UNICEF (2011) [4] DRR in education equips people with knowledge and skills so that they can minimize the dangers that cause death and damage, and only have minimal impact on the economy, society, and culture. Teaching and learning about DRR and climate change is key to increasing individual and community knowledge about hazards and what to do when disaster strikes. Amri (2015) [5] is even more emphatic in stating that education is the basic key for children to participate in disaster risk reduction. Education has always been a global priority in commitments to disaster risk reduction as in the Yokohama Strategy (United Nations, 1994), and Hyogo Framework for Action (HFA) 2005-2015. Disaster risk reduction activities involve education, as they aim to change a person's attitudes, perceptions, and emotions [6]. The Sendai Framework for DRR 2015-2030 places education as a cross-sectoral issue, integration of disaster risk knowledge can be carried out through formal and non-formal education channels [7]. According to Sejati et al. (2019) [8], Education is very strategic in DRR because it has a direct influence on the success of achieving educational goals.

According to Selby & Kagawa (2012) [9], there are several approaches used to integrate DRR into the curriculum, namely text-based approaches, centered competencies, centrally developed special subject approaches (special rooms), symbiotic approaches, and special events approaches. The integration of DRR into the curriculum is one example of efforts to reduce disaster risk in Indonesia. In

this study, we want to know other forms of approaches that have been implemented to reduce disaster risk in education in Indonesia and find out what the results are.

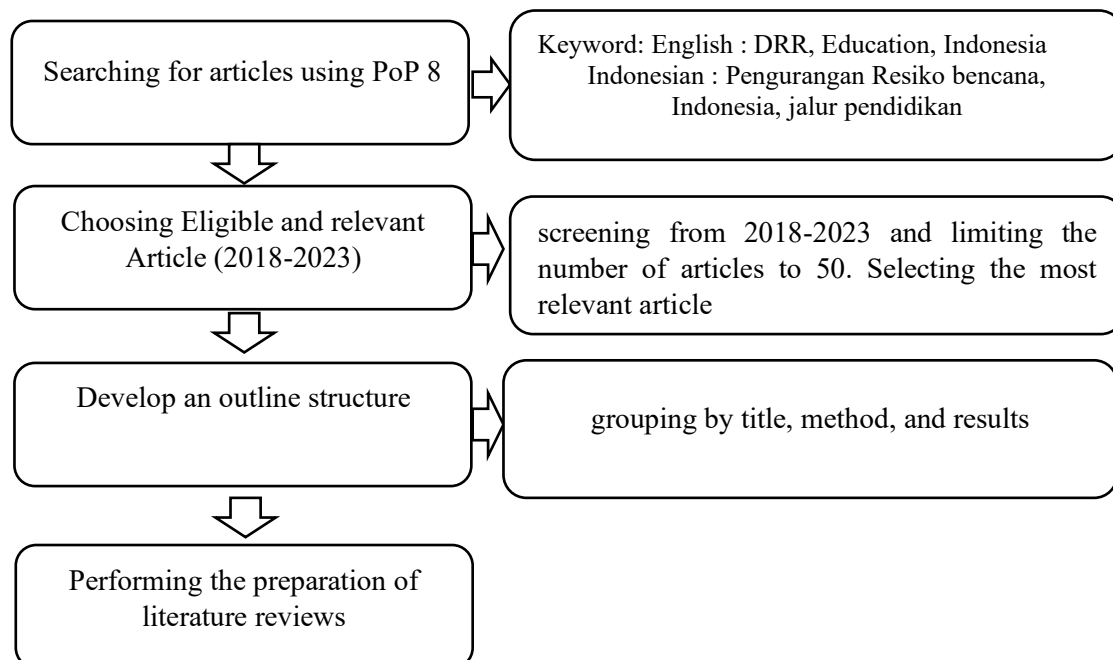
## 2. Methods

This study uses a qualitative approach and uses the SLR (Systematic Literature Review) method. According to Kitchenham, SLR is a research method that emphasizes the process of identifying, assessing, and interpreting all relevant research results to provide answers to certain research questions [10]. The aim of choosing this method is to present more comprehensive and balanced facts from various studies. Systematic selection of articles using the PoP 8 application. The data used is article data for the last 5 years from 2018-2023. Then selected articles that best fit the purpose of this study which describes disaster management efforts through education in Indonesia.

According to Fink (2014) [11], there are 7 stages of SLR, namely as follows.

- 1) Create a Research Question
- 2) Selecting a Database.
- 3) Determine the Search Strategy
- 4) Determine practical screening criteria
- 5) Determine methodological screening criteria
- 6) Conduct a review
- 7) Synthesize results

Guided by the literature review steps according to Fink (2014), the following is the flow of this research in a simpler form.



**Figure 1.** Research flowchart

## 3. Result and Discussions

### 3.1. Forms of efforts to reduce disaster risk through education in Indonesia

Based on the results of a review of the existing literature, it can be found that there are 3 efforts to reduce disaster risk through education in Indonesia, namely formal education, informal education, and non-formal education. The following is a description of each of these paths.

*3.1.1. Efforts to reduce disaster risk through formal education.* According to Law No. 20 of 2003 [12], formal education is a structured and tiered educational path consisting of basic education, secondary education, and higher education. So what is meant in this study is efforts to reduce disaster risk in formal education, namely efforts that have been made to reduce disaster risk at various levels, both primary, secondary, and tertiary education. Forms of disaster risk reduction through formal education can be carried out by integrating DRR into the learning curriculum itself as well as by selecting certain appropriate learning strategies, methods, and models for implementing DRR in formal education in schools. As was done by Kamil et al. (2020) [13], who carried out action research improving disaster knowledge among high school students through geographic literacy. the results of his research showed that there was an increased knowledge and understanding of class xi high school students in Banda Aceh by 91.6% regarding geographic literacy on related disaster material themes. so that with this good understanding, you can reduce the risk of disaster. Anggraeni, d (2019) [14] looked at the implementation of the basic environmental education and disaster mitigation curriculum in elementary schools. Putro, HPN, & Alviawati, E (2021) [15] developed a social studies learning model with scientific learning for DRR, the results of scientific learning with inquiry are effective for reducing student disaster risk, relevant for social studies learning relevant for increasing student activity, so the inquiry model is effective for improving process quality and social studies learning products in junior high schools. The findings of this research have positive implications for the development of social studies learning about natural disasters in junior high schools. The practical implications of the findings of this study are the improvement of social studies teachers' skills and the socialization of inquiry models for disaster risk reduction in junior high schools.

Fajar et al. (2022) [16] in their research tested the Effectiveness of Social Science Learning on the Socialization of Earthquake Disaster Potential and its Mitigation to Students of Junior High Schools in the City of Bandung, the results of which were The social curriculum studies for junior high schools made a fairly high contribution to disaster education and disaster mitigation. Furthermore, Setyaningrum et al. (2020) [17], Indriasari, FN (2018) [18], and Sukanto et al. (2021) [19] used simulation methods to reduce disaster risk for students and the results significantly increased students' understanding of disaster mitigation. Meanwhile, Salsabila, WS, & Dinda, RR (2021) [20] chose to use the demonstration method in learning disaster mitigation in elementary schools. His findings also show that the demonstration method can increase students' understanding of disaster mitigation. The findings of Sudharmono, U (2023) [21] show that the use of disaster content songs is quite effective as an earthquake DRR effort for PAUD RA students. Al Munnawaroh Lembang.

The various approaches, models, strategies, and methods of integrating DRR into the formal education learning curriculum are quite effective in increasing knowledge and understanding of disaster mitigation in the context of disaster risk reduction. In addition, DRR efforts in formal education in Indonesia can also be carried out in the form of the Development of Learning Resources related to Disaster in learning (modules, reading books, etc.). Gamification of Disaster Education. Utilization of IT to develop applications and disaster learning media. As stated by Winarni, E. W., & Purwandari, E. P. (2018) [22] with their quantitative pre-experiment design with one group pretest-posttest design research. Their research results in disaster risk reduction for earthquakes using mobile learning applications to improve students' understanding in elementary school there is an influence of educational mobile applications to students for earthquake disaster mitigation. Sukmawati, et al. (2019) [23] Android Mobile Learning Application Based on Earthquake Mitigation for Junior High School Students. Prawesti, DA, & Irfansyah, I (2023) [24] tested the Effectiveness of Learning Media for Disaster Preparedness Bags (TSB) in Increasing the Retention of Elementary School Students. Sapparwati, M, & Trimawati, WF (2020) [25] uses animated videos for school-age children to increase knowledge of disaster preparedness. Rifai, MH (2018) [26] tested the effect of using audio-visual media on

understanding the concept of disaster mitigation in geography education students. Purwani, A., Fridani, L., & Fahrurrozi, F. (2019) [27] developed audiovisual media for early childhood disasters. Wulandari, F. (2018) [28] tested the use of video on student preparedness for disasters. Pambudi, DI (2019) [29], developed pop-up book media as disaster mitigation education for elementary school students. The development of various IT-based disaster learning media has proven to be able to increase disaster knowledge, the concept of disaster mitigation and preparedness for their research subjects.

Disaster learning media is also packaged in the form of games, such as Winarni's (2018) [30] development of a Mobile Educational Game for Earthquake Disaster Preparedness in Elementary Schools. Putri, WML, & Suparti, S (2020) [31] also developed a disaster puzzle educational game while testing its effect on knowledge of volcanic eruption mitigation at Karangsalam State Elementary School. Similar to Aswadi et al (2016) [32], they also tested the application of puzzles for the earthquake and tsunami disaster in class V students at SD Negeri 15 Banda Aceh. Raayuni et al. (2022) [33] used a crossword puzzle game about earthquakes and tsunamis, and Ardini (2022) used a PowerPoint-based monopoly game to introduce the concept of earthquake disaster mitigation at the kindergarten level. The findings from the researchers are that the use of IT-based media or gamification in existing learning has quite an influence on increasing a person's knowledge and understanding about disasters so that this becomes one of the effective disaster risk reduction (PRB) efforts.

*3.1.2. Efforts to reduce natural disaster risks through non-formal education.* Informal education is a pathway to family and environmental education. (National Education System Law no 20 of 2003). What is meant here is disaster risk reduction that occurs in the scope of one's family or environment. Forms of disaster risk reduction through informal education can be in the form of local wisdom, folklore, and regional thrust. As in Aceh, especially the Simeulue people have local wisdom. "Nandong Smong" is an oral art or speech in the form of reciprocating poetry/rhymes by several penandung, at least two penandung, led by a penandung called "penghulu gandang" who is chosen based on his expertise in chanting, how many poems/rhymes are memorized and melodious the sound in nandong, as well as excellent endurance in nandong, because nandong is usually performed all night long. The most famous is the nandong about the 1907 earthquake and tsunami [34]. Furthermore, Putri (2022) [35] explains that "smong" means a blow Sea water from the Devayan language (the native language of Simeulue) is passed down from generation to generation through nafi-nafi (storytelling of life advice or advice). "Smong" is delivered in between busy schedules and also acts as a lullaby for children at night. So nandong smong contains life advice telling about the characteristics of a tsunami that is going to happen and an appeal to find high ground if a tsunami does happen. According to Sutton et al. (2021) [36], songs and music from Simeulue were utilized to integrate information about tsunami risk and tsunami avoidance into the Simeulu people's sense of coherence ("SOC"). Simeulue residents apply techniques that are now mastered to optimize learning. This is very effective in reducing disaster risk

*3.1.3. Efforts to reduce disaster risk through non-formal education.* According to the National Education System Law No. 20 of 2003, non-formal education is an educational pathway outside formal education that can be implemented in a structured and tiered manner. In article 26 it is states that non-formal education complements formal education which functions to develop the potential of students with an emphasis on mastering knowledge and functional skills as well as developing attitudes and personalities with educational units in the form of course institutions, training institutions, study groups, community learning activity centers, and other similar things. So non-formal education can be carried out inside or outside the institution. The target is not only for the school-age community but can be for all age levels. The non-formal education referred to here takes the form of disaster mitigation education outside of the formal education that has been provided to the community in Indonesia.

The form of disaster risk reduction efforts through non-formal education in Indonesian society is in the form of training, outreach, and disaster mitigation simulations from groups of disaster-aware activists as well as from certain institutions/agencies to the community, disaster risk reduction programs from community groups. For example, the research by Iin Marlina & Erni Suharini (2019) [37] looked at the implementation of the Boyolali River School program as an effort to reduce disaster risk by BPBD Boyolali Regency. The Boyolali River School itself is a place for awareness and increasing knowledge, ability, and community concern in managing rivers and reducing the risk of flood disasters. Considering that several areas in Boyolali are prone to flooding. The results of this study indicate that after the implementation of the Boyolali River School there is known community knowledge about flood disaster risk reduction is an average of 74 in the high category. Society's awareness about disaster risk reduction is an average of 70.6 in the high category. Similar to Fiadesi, AE, & Satlita, L (2018) [38], the river school program is also implemented in Klaten Regency, which is one of the innovative programs to reduce the risk of flood disasters. This is proven by: (1) having a positive impact, (2) creating good partnerships, (3) having sustainability, (4) creating innovative leadership and community empowerment, (5) realizing gender equality and social exclusion, (6) innovation in the local context produced by the river school program can be transferred to other areas

In the research of Widyasari, N, & Setyoningsih, W (2020) [39] disaster education in Kebon Dalem Village, Kendal City District, Kendal Regency is carried out in several activities. Disaster education efforts in the disaster resilient village program are carried out through Destana Socialization, Working Group Meetings, Volunteer Training, Flood Simulation, and Village Development. There are at least 2 things that result from disaster education in the Kebon Dalem Village, namely people who are aware of flood disasters, have skills related to disaster, and produce supporting products in the form of evacuation route maps, threat risk maps, evacuation route signs, and disaster documents.

Rohaendi et al (2023) [40] reviewed disaster education for adults related to the land movement in PPSDM Geominerba. The preparation of training at PPSDM Geominerba involves all stakeholders, especially the Geological Agency, KESDM as the unit responsible for geological disasters [41]. There is a separate curriculum related to ground movement mitigation in PPSDM geominerba. Land Movement Mitigation Extension Instructor Training for the people of West Java was carried out to prepare instructors who can provide community education in disaster-prone areas before a disaster occurs, during a disaster, and after a disaster occurs.

Based on the description of the results of the discussion above, the forms of efforts to reduce disaster risk through education can be summarized in the following table.

**Table 1.** Forms of efforts to reduce disaster risk in the education sector

Formal Education	Informal Education	Nonformal education
<ul style="list-style-type: none"> <li>• Integration of DRR in the Learning Curriculum</li> <li>• Selection of specific learning strategies, methods, and models that are appropriate for the application of DRR in formal education in schools</li> <li>• Development of Learning Resources related to Disaster in learning (modules, reading books, etc)</li> <li>• Gamification of Disaster Education</li> <li>• Utilization of IT to develop applications, disaster learning media</li> </ul>	<ul style="list-style-type: none"> <li>• Local Wisdom</li> <li>• Folklore</li> <li>• Regional trust</li> </ul>	<ul style="list-style-type: none"> <li>• socialization and simulation in the community</li> <li>• workshop</li> <li>• Community group disaster reduction programs</li> </ul>

Source: research result 2023

### 3.2. Optimizing Disaster Risk Reduction through Education in Indonesia

Based on the presentation of the results of efforts to reduce disaster risk through education in Indonesia, it can be seen that the three channels of formal, informal, and non-formal education are quite well

implemented in Indonesia. However, it is not evenly applied in all regions of Indonesia. According to Tahmidien and Krismanto (2019) [42], the government has enacted a law on disaster-safe education but there is no clear derivative yet so not all schools in Indonesia implement disaster-safe schools. Only certain priority areas that often experience disasters become disaster-safe schools. The formal education route is the most appropriate route for implementing DRR. According to Nashr (2018) [43], the integration of disaster preparedness education into the basic formal education curriculum can be carried out by linking each disaster preparedness material and providing simple, concrete, and close examples of children's lives so that it will foster disaster preparedness attitudes and behavior. Disaster education should not only be applied to schools in certain areas that often experience disasters, but can be implemented nationally. All students have the right to receive early knowledge about disasters. When faced with a disaster at any time they are ready and skilled in dealing with disasters.

Meanwhile, the informal education path is very good when there are certain beliefs or habits in society that are local wisdom in dealing with disasters. As an example of Nandong Smong [36], the knowledge of ancestral heritage in the construction of Gadang houses for the Padang community which proved minimal damage during the earthquake, and the local wisdom values of the Minangkabau people's "bekulindan" teachings about togetherness, loyalty, social responsibility, independence and participation for facing natural disasters [44]. However, this does not necessarily exist in all regions of Indonesia.

In non-formal channels, socialization, simulation or training activities have often been carried out by community groups, institutions, government, BNPB, and BPBD, there is even a destana (disaster resilient village) program in Indonesia. However, various problems are still found in disaster management in Indonesia. As Muryani (2020) [45] expressed, there are at least three main problems: overlapping organizations, government agencies, and organizations or agencies whose programs are essentially the same but have different programs and names. different sponsorships. It confuses society. Sustainability of operations is of little concern, often only during disasters, recovery and reconstruction. In addition, there are funding problems, organizations, agencies and even the government sometimes have difficulty in funding day-to-day activities, which puts an end to the operation. business continuity. According to Taslim and Akbar (2019) [46], for the implementation of disaster management to run well, coordination from various parties is needed to reduce disaster risks and requires the role of multisectoral and multi-stakeholders. So that in this way parties who have the same vision regarding disaster management can create a program that applies nationally evenly and sustainably.

#### 4. Conclusions

Implementation of Disaster Risk Reduction (DRR) in Indonesia through education has been carried out in various forms and is effective in providing an understanding of disasters, making people ready to face them, and thereby reducing disaster risk. However, it is necessary to create a national curriculum on disaster education at all levels of education. It could also be included as a local content curriculum that teaches disaster preparedness according to the characteristics of each region. In informal education, the existence of local wisdom, regional trust or folklore that can minimize the impact of disasters can continue to be preserved. Non-formal education requires synergy and coordination between interrelated institutions in providing disaster education to the community so that it remains sustainable and effective.

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