

Does Indonesia green school program affect students' disaster and mitigation literacy?

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Abstract. Adiwiyata is the green school program run by the Ministry of Environment and Forestry and the Ministry of Education of Indonesia since 2006. The impact of the program on the disaster and mitigation literacy of the students is questionable. This quantitative study aims to compare the disaster and mitigation literacy levels of students of Adiwiyata and non-Adiwiyata schools, as well as to identify several factors that may influence disaster and mitigation literacy among junior high school students. The respondents were students of Adiwiyata and non-Adiwiyata Schools (N=346). Data was collected through knowledge tests, attitude questionnaires, and interviews. The collected data was analysed using an independent t-test and Kruskal-Wallis. The findings show no significant difference in disaster literacy between students in Adiwiyata and non-Adiwiyata Schools. Based on the interviews, it was also found that the disaster literacy and mitigation program in the Adiwiyata School was not running properly. Additionally, it was found that the factors influencing disaster and mitigation literacy are gender, grade, disaster experience, and training experience. From this study, the Adiwiyata schools need to improve literacy and disaster mitigation training.

1 Introduction

The World Meteorological Organization (2023) reported an increase in natural disasters over the past 50 years due to human activities impacting climate change [1]. Indonesia is among the countries with a high disaster risk. This is due to its geographical position as an archipelago located at the convergence of three major tectonic plates: the Indo-Australian Plate, the Eurasian Plate, and the Pacific Plate [2]. This convergence places Indonesia along the Pacific Ring of Fire, making it highly susceptible to earthquakes, tsunamis, and volcanic eruptions [3]. Consequently, Indonesia's geographical location makes it one of the countries with a high and dangerous disaster risk [4].

The United Nations Office for Disaster Risk Reduction defines a disaster as a serious disruption to the functioning of a community or society, causing widespread impacts and

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resulting in significant losses, whether material, economic, or environmental [1]. Between 2015-2020, Indonesia experienced 8,422 disaster events, with 78% being hydrometeorological disasters and 22% geological disasters [5].

On other hand, the concept of green schools has emerged as a progressive educational approach that emphasize sustainability and environmental responsibility. In Indonesia, the green school is named as *Adiwiyata* school and is part of a program aimed to develop environmentally friendly schools focused on promoting the conservation and sustainable development for the present and future [6]. The *Adiwiyata* awards are given to schools that have created an ideal learning environment for nurturing a sense of responsibility to protect the environment among students and teachers [7]. According to the Regulation of the Minister of Environment Number 05 of 2013, which provides guidelines for the implementation of the *Adiwiyata* Program, an *Adiwiyata* School is excellent and ideal for acquiring knowledge, norms, and ethics that serve as a foundation for human welfare and sustainable development [8]. By instilling sustainability principles, *Adiwiyata* schools can offer an ideal platform for teaching disaster and mitigation literacy.

Disaster mitigation is essential to reduce disaster risks. One effective mitigation strategy is enhancing disaster literacy among all societal groups. Disaster literacy involves understanding, analyzing, synthesizing, and evaluating disaster-related issues in detail, and having the ability to decide on actions to take during a disaster [9]. It is a form of non-structural mitigation that focuses on skills and understanding related to disasters [10]. Knowledge and attitudes are crucial for personal safety during disasters, and a lack of disaster knowledge increases community vulnerability [11]. Previous studies have confirmed that low disaster literacy negatively impacts hazard warnings, self-protection actions, and recovery efforts [12].

Meanwhile, there are vulnerable groups to disasters, such as children, pregnant women, persons with disabilities, and the elderly [13]. This vulnerability stems from physical limitations, dependency on others, and limited access to information. Children are particularly susceptible to disasters due to their lack of knowledge. Their presence in schools not only affects their education but also their economic and psychological well-being, as well as that of their families. It has been found that children exhibit varying degrees of stress following disasters [14].

Disaster literacy among school-age children is crucial because without knowledge of natural disasters, students are vulnerable to misinformation online, which can induce fear and intimidation [15]. Moreover, disaster literacy enables them to understand appropriate actions to take during disasters, allowing them to respond and protect themselves effectively.

However, the question arises whether *Adiwiyata* School only contributes to environmental awareness, but also plays a role in enhancing student's literacy in disaster preparedness and mitigation. Based on this case, we aim to investigate the influence of *Adiwiyata* school on students' disaster literacy and mitigation levels. Additionally, we intend to identify factors that may affect disaster literacy, such as gender, grade level, disaster experience, and disaster training experience. The target sample consists of junior high school students, a vulnerable group to disasters due to their school-age status. The research site criteria include areas with high disaster potential. For this study, Karanganyar Regency was selected because it meets these criteria and is located in a highland area. According to the disaster vulnerability map created by the Karanganyar Regional Disaster Management Agency [16], several disasters occurred in Karanganyar, including landslides, tornadoes, and floods (Figure 1).

Adiwiyata and non-*Adiwiyata* programs, as well as to compare literacy levels based on gender, disaster experience, and disaster training experience.

2.2 Population and Sample

The study population includes all junior high school students in Karanganyar Regency from grades 7, 8, and 9, totalling 31.963. Samples were selected using purposive random sampling, ensuring representation from *Adiwiyata* and non-*Adiwiyata* School. There are 16,899 *Adiwiyata* students and 14.958 non-*Adiwiyata* students. The sample was determined using the Slovin formula with a 95% confidence level. According to this formula, the minimum required respondents were calculated to be 395. The number of participants in this research was 416 students from three *Adiwiyata* schools and one non-*Adiwiyata* school across grades 7,8, and 9.

In addition to students, we also require participation from teachers in each school to further explore the implementation of literacy programs in *Adiwiyata* and non-*Adiwiyata* schools through interviews. The criteria for interviewing teachers are those who have a good understanding of disaster literacy activities in schools and are involved in the *Adiwiyata* team (specifically for *Adiwiyata* School).

2.3 Data Collection

Data collection was conducted by measuring disaster literacy in cognitive aspects and attitude questionnaires, which were modified from Chung & Yen's (2016) instrument and adapted to Indonesian conditions based on the guidelines in the book "Tanggap Tangkas Tangguh Menghadapi Bencana" (Resilient Agile Response to Disaster) by National Disaster Management Agency [18,19]. The types of disasters covered in the instrument are those frequently occurring in the Karanganyar region, i.e. landslides, floods, tornadoes, and forest and land fires. Additionally, unstructured interviews were conducted to delve deeper into information regarding disaster literacy programs in each school and with teachers as the sample.

The cognitive test consisted of 22 multiple-choice items to assess students' knowledge about disasters and mitigation. Furthermore, the attitude questionnaire comprised 24 items of positive and negative statements, each with 4 options: strongly disagree (1), disagree (2), agree (3), and strongly agree (4). The attitude questionnaire was to measure students' attitudes and awareness towards disasters (Table 1).

Table 1. The Instrument for Disaster and Mitigation Literacy

Aspect	Category	Description
<i>Knowledge Aspect</i>	<i>Disaster Knowledge</i>	Synthesize and analyze the definitions and causes of various disaster Explain the impacts and harms of disasters to humans and their environment
	<i>Preparedness Knowledge</i>	Develop the disaster mitigation procedures Make the action plan of disaster mitigation and preparedness
	<i>Response Knowledge</i>	Decide the response procedures in the event of a disaster Design the measures of post-disaster rescue and medical cares

<i>Attitude Aspect</i>	<i>Prevention Awareness</i>	Evaluate the environment comprehensively and recognize the potential hazards
	<i>Prevention Values</i>	Synthesize and analyze the disaster related information proactively Promote the importance of disaster prevention, disaster relief, and evacuation plan
	<i>Prevention Sense of Responsibility</i>	Explain the relation between disaster prevention and social cost Organize the promotion of campus and community disaster prevention

The literacy levels were categorized into four categories: insufficient, mediocre, sufficient, and excellent [20]. The distribution of literacy scales is presented in Table 2.

Table 2. Disaster Literacy and Mitigation Scale

Category	Scores
<i>Insufficient</i>	0 – 29
<i>Mediocre</i>	30 – 35
<i>Sufficient</i>	36 – 41
<i>Excellent</i>	40– 50

2.4 Data Analysis

Data were analyzed using IBM version 26 and Microsoft Excel which contained mean, percentage, standard deviation, minimum value, maximum value, and p-value. An Independent t-test was used to compare students' disaster and mitigation literacy levels based on *Adiwiyata* and non-*Adiwiyata*, as well as several factors such as gender, disaster experience, and disaster training. To compare disaster and mitigation literacy levels based on grade level, the Kruskal Wallis test was used because the groups were not homogeneous.

3 Result

The total number of students involved in the research was 416, but the data that researchers were able to analyze was 346 because 70 students did not answer the questions completely. The distribution and frequency of respondents are presented in Table 3.

Table 3. Distribution and Frequency of Respondents

	Frequency	%
School Type		
<i>Adiwiyata</i>	187	54
Non- <i>Adiwiyata</i>	159	46
Gender		
Female	166	48
Male	180	52
Grade Level		
7th	116	33.5
8th	110	31.8
9th	120	34.7

Disaster Experienced		
Yes	147	42.5
No	199	57.5
Training Experience		
Yes	256	74
No	90	26

The research results indicate that the majority of students in junior high schools in Karanganyar are at a sufficient level of literacy, totaling 178 students with a percentage of 51.45% of the total sample. The distribution of frequency and percentage of disaster literacy and mitigation levels is presented in Table 4.

Table 4. Frequency and Percentage of Disaster Literacy and Mitigation Levels of Students

Scores	Category	Frequency	%
0 – 29	<i>Insufficient</i>	15	4.33
30 – 35	<i>Mediocre</i>	60	17.34
36 – 45	<i>Sufficient</i>	184	53.18
42 – 50	<i>Excellent</i>	87	25.15

Based on the research findings, it was found that the majority of junior high school students in Karanganyar are at the sufficient literacy level, with 184 students (53.18%), followed by excellent level with 87 students (25.15%), mediocre level with 60 students (17.34%), and insufficient level with 15 students (4.33%).

Furthermore, comparative tests were conducted to determine the influence of *Adiwiyata* and non-*Adiwiyata* schools on the disaster literacy and mitigation levels of junior high school students in Karanganyar. Additionally, we compared the involvement of gender, grade level, disaster experience, and disaster training experience on the disaster literacy and mitigation levels of students. The results of the comparative tests are presented in Table 5.

Table 5. Comparisons by Disaster and Mitigation Literacy Scale Scores

	Min.	Max.	Mean	Std. Deviation	<i>p-value</i>
School Type					
<i>Adiwiyata</i>	23	48	38.50	4.646	0.553
Non- <i>Adiwiyata</i>	28	49	38.33	4.017	
Gender					
Female	24	49	39.51	4.061	<0.001
Male	23	47	37.42	4.400	
Grade Level					
7th	23	47	36.83	5.229	<0.001
8th	30	46	38.25	3.344	
9th	29	49	40.08	3.652	
Disaster Experienced					
Yes	23	49	38.82	4.146	0.001
No	24	46	37.04	4.672	
Training Experience					
Yes	29	47	37.99	4.432	0.001
No	23	49	39.64	3.930	

**p-value* < 0.05

The comparison results in Table 4 show that *Adiwiyata* and non-*Adiwiyata* programs do not have a significant effect because they have a significance value of 0.553. In addition, there are differences in the level of disaster and mitigation literacy based on gender (*p-value*

<0.001), grade level (p-value <0.001), disaster experienced (p-value = 0.001), and training experienced (p-value = 0.001).

4 Discussion

Disaster literacy involves knowledge and skills in accessing, reading, understanding, and using information for preparedness, mitigation actions, and recovery following disasters, as well as following instructions and coping during disasters [15]. Disaster literacy is crucial for preparing for disasters to reduce the risks associated with them. In our study, most of junior high school students in Karanganyar have a sufficient level of disaster literacy (53.18%).

Genc et al. (2022) investigated disaster literacy levels in Turkey and found that a significant portion of respondents were at the insufficient level (28.4%), followed by sufficient (24.5%), mediocre (24.3%), and excellent (22.8%) levels [20]. Cvetković et al. (2015) assessed the perceptions of secondary school students in Belgrade and found that less than half of the respondents, 45.05%, knew how to respond to earthquakes [21]. The level of disaster knowledge among students in Solo Raya, including Sukoharjo, Surakarta, and Klaten, indicated a level of understanding and readiness categorized as "almost ready" [13]. Yusuf et al. (2022) conducted research aimed at measuring disaster knowledge and found that 45.50% of respondents had high disaster knowledge [22]. In our study, disaster literacy was measured among junior high school students in Karanganyar, revealing that 53.18% were at a sufficient level, followed by excellent (25.15%), mediocre (17.34%), and insufficient (4.33%) levels.

Many external factors influence students' disaster literacy, one of which is family and school. The family serves as the initial foundation for children to learn about disaster information before they receive it at school. Previous research found that children whose both parents work and do not have time to educate them are unaware of earthquakes [20]. Additionally, Sözcü & Türker (2021) found that respondents whose mothers are educated have higher disaster knowledge scores compared to respondents whose mothers are illiterate [23]. Another supporting factor is the location of students' schools relative to disaster events. Students attending schools in disaster-prone areas are more aware of disasters and tend to think critically about disaster issues [24].

In today's digital age, it is undeniable that information disseminated through various social media platforms plays a positive role in society by accelerating the spread of information in a short time [25]. Social media serves as a bridge to connect information to users without limitations. There are indeed many factors that can influence disaster literacy, but these unlimited factors make it impossible for researchers to list them one by one. In addition to the factors mentioned above, there are other factors such as disaster experience [20], sources/media of information [21], and even age [26].

4.1 The Influence of Adiwiyata Program on Disaster and Mitigation Literacy Levels

Based on the *Adiwiyata* and non-*Adiwiyata* programs, this study shows that the type of school does not significantly affect disaster literacy scores, with a significance value of 0.553. These findings contradict previous research findings. Research conducted by Aprilianti (2023) and Ashar (2018) found differences in literacy levels between *Adiwiyata* and non-*Adiwiyata* [27,28]. However, there are also studies with similar results, where *Adiwiyata* and non-*Adiwiyata* do not influence students' literacy levels [29].

The difference in disaster literacy and mitigation scores obtained between *Adiwiyata* and non-*Adiwiyata* Schools is relatively small, at 0.16 points. Despite being known for its environmental concern, *Adiwiyata* does not specifically have disaster literacy programs. Interviews with teachers at each *Adiwiyata* revealed that these schools focus more on teaching environmental safety and conservation practices, such as proper waste disposal, reforestation on deforested lands, and not damaging plants. However, environmental safety topics are not consistently taught, resulting in suboptimal knowledge acquisition among students at *Adiwiyata*. This indicates that the *Adiwiyata* program is not fully implemented and requires evaluation to ensure its effectiveness.

In contrast, non-*Adiwiyata* also engage in similar environmental education practices, albeit not regularly. The similarity in treatment between these two types of school results in no significant difference in disaster literacy scores. Internal student factors also play a role in determining students' knowledge and attitudes toward disaster preparedness. Even if schools implement disaster mitigation programs, if students lack awareness and understanding of the importance of disaster preparedness, literacy outcomes will remain unchanged. However, it is also possible that students from both types of schools have similar levels of awareness, leading to most of students having good knowledge and attitudes towards disaster preparedness, as indicated by the study's findings.

4.2 Disaster and Mitigation Literacy Based on Gender

When disaster literacy is examined based on gender, this study shows a significant difference between female and male students with a p-value of less than 0.001. This finding aligns with research by Vu et al. (2023), which found that female students scored higher than male students [26].

Yusuf et al. (2022) found that the disaster knowledge level among males was higher compared to female respondents. However, differing results have been found in previous studies [22]. Tuladhar et al. (2014) indicated that disaster risk reduction knowledge in Nepal did not significantly differ by gender [30]. Other studies also found no significant difference in disaster literacy scores overall based on gender [20]. Sözcü & Türker (2021), in their study on natural disaster literacy among teachers, found no significant differences based on gender, but noted that female literacy scores were higher than males [23].

The influence of gender on disaster literacy levels may be attributed to differences in knowledge acquisition between males and females. Females are perceived to be more diligent, thorough, and meticulous in tasks [31]. From the researcher's observations, when answering questions, female students exert more effort to comprehend and respond to the provided questions, utilizing all their capabilities. Conversely, males show less interest and seriousness in answering questions, opting to play with friends and occasionally joke around.

Gender differences influence female students to be more sensitive to environmental issues. Females often experience anxiety; thus they value disaster preparedness more than males [26]. Consequently, they are more diligent in equipping themselves with disaster prevention knowledge and skills to ensure their safety and security. From careful observation, female students approach tests more seriously, whereas male students often lack focus and joke around with their friends.

4.3 Disaster and Mitigation Literacy Based on Grade Levels

When considering grade levels (7th, 8th, and 9th), the highest disaster mitigation literacy scores were achieved by 9th graders with an average of 40.08, followed by 8th graders with

an average of 38.25, and lastly 7th graders with an average of 36.83. The Kruskal-Wallis test results indicated a significant difference among the literacy levels of grades 7, 8, and 9, with a computed significance value of <0.001 . This conclusion was drawn from the comparative test results, which demonstrated that 9th-grade students have better disaster mitigation literacy compared to 7th and 8th graders. Vu et al. (2023) researched to assess the awareness, knowledge, and attitudes of high school students toward Natural Disaster Prevention (NDP), finding significant differences across grades 10, 11, and 12 [26].

According to the curriculum, 8th and 9th graders receive disaster mitigation materials in the second semester of 7th grade. This has also been confirmed through interviews with teachers at each school. Based on these interviews, every teacher affirmed the presence of disaster mitigation content in the Science subject in the second semester of 7th grade. At the time of this study, 7th graders had not yet received disaster mitigation materials at the junior high school level, hence it is understandable that 7th graders obtained the lowest literacy scores because they lacked initial knowledge about disasters compared to 8th and 9th graders.

Furthermore, internal factors within students also influenced disaster literacy scores. During test-taking, 9th graders showed more seriousness in independently understanding readings and questions. Conversely, 7th and 8th graders, despite receiving warnings, still joked and chatted with friends. Not all 7th and 8th graders considered disaster literacy tests unimportant, but a significant number of them were less serious in their approach. This behaviour resulted in lower disaster literacy scores for 7th and 8th graders compared to 9th graders.

4.4 Disaster and Mitigation Literacy Based on Disaster Experience

When disaster literacy is examined based on disaster experience, this study reveals significant differences in disaster literacy scores with a p-value of 0.001. Similar findings were demonstrated by Cvetković et al. (2015), who emphasized that personal experience is the most effective form of learning [21]. Chung & Yen (2016) found through their research that students who have experienced disasters have better knowledge, attitudes, and skills compared to those who have not [18].

Experience has a significant influence on literacy [32]. Personal experience is a valuable source of knowledge [33]. Personal experiences can affect students' sensitivity to environmental stimuli. Students who have experienced disasters are more responsive and sensitive to changes in their environment, and able to recognize signs of impending disasters more effectively.

One respondent who experienced the eruption of Mount Merapi while in a "cautious" status mentioned that there was no need to panic because they followed authorities' instructions [34]. Individual responses form the basis for attitudes towards disaster response. Someone who has experienced a disaster will know safe places to take shelter, recognize signs of an impending disaster, and be better prepared to face it.

4.5 Disaster and Mitigation Literacy Based on Disaster Training Experience

The Disaster Training Experience referred to in this study is the offline dissemination received by students from the National Disaster Management Agency (BNPB), Regional Disaster Management Agency (BPBD), also humanitarian and environmental organizations. The research findings indicate that there is a significant difference between students who have attended disaster training and those who have not, with a p-value of 0.001.

Disaster training is considered one of the strategies to cultivate a culture of disaster mitigation before, during, and after disasters [35]. Training has the potential to enhance disaster mitigation literacy by involving efforts in knowledge, skills, and understanding related to disasters. Dissemination and internalization are deemed effective in increasing knowledge about the environment [22]. Through this effort, students gain preparation and skills in facing disasters, thereby enhancing their understanding of disasters—conversely, the lack of disaster dissemination results in lower disaster understanding among students [36].

Based on interview results, sample schools with disaster training programs conduct earthquake and COVID-19, while the disaster topics in this study include landslides, tornadoes, floods, and forest fires prevalent in Karanganyar. This leads to minimal score differences in disaster literacy between students who have received dissemination and those who have not. This occurrence proves that despite some students receiving disaster dissemination, differences in the content delivered during dissemination and in the literacy test result in similar average scores between groups with and without disaster experience. This event also demonstrates that each disaster requires different handling and skills. Some students mentioned receiving dissemination during their elementary school years, indicating that they may not specifically remember the dissemination content they received.

5 Conclusion

The study reveals that the majority of students' disaster and mitigation literacy falls into sufficient and excellent categories. However, some students have low literacy. Several factors contribute to differences in disaster literacy scores, such as gender, grade level, disaster experience, and disaster training experience. Meanwhile, the *Adiwiyata* school does not influence the disaster and mitigation literacy of the students. One of the reasons is because of the absence of a disaster and mitigation literacy program at those schools. It was revealed that schools in Karanganyar have not provided disaster and mitigation training for students. Therefore, it is recommended that schools, particularly those located in the disaster regions, should provide effective disaster mitigation programs, such as integrating disaster and mitigation content into school curricula and activities, conducting weekly disaster and mitigation literacy programs, and regularly organizing disaster simulations at schools. Further research should also be conducted on other *Adiwiyata* schools in other provinces of the country, as it is challenging to develop an effective module of learning disaster and mitigation to be shared with the schools.

References

1. UNDDR, *Global Assessment Report on Disaster Risk Reduction 2023: Mapping Resilience for the Sustainable Development Goals*, (United Nations Office For Disaster Risk Reduction, Switzerland, 2023).
2. M. Fuady, R. Munadi, and M. A. K. Fuady, *Disaster Mitigation in Indonesia: Between Plans and Reality*, in Proceedings of the IOP Conference Series: Materials Science and Engineering, 1087, 12011, (2021).
3. M. Masum and M. A. Akbar, The Pacific Ring of Fire is Working as a Home Country of Geothermal Resources in the World The Pacific Ring of Fire is Working as a Home Country of Geothermal Resources in the World. IOP Conference Series: Earth and Environmental Science. **1**, 249 (2019).
4. L. De Priester, An approach to the profile of disaster risk of Indonesia. Emergency and Disaster Reports. **3**, 2 (2016).

5. F. J. Rumambi, A. G. Tangkudung, A. F. Assa, and D. N. Sari, The Habituation Of Landslide Disaster Mitigation Literacy To Elementary School Students On Slopes Of Mount Salak, Indonesia. *Journal of Positive School Psychology*. **6**, 8 (2022).
6. D. Astuti and T. Aminatun, Student's environmental literacy based on Adiwiyata and non-Adiwiyata at senior high school in Sleman, Yogyakarta. *JPBI (Jurnal Pendidikan Biologi Indonesia)*. **6**, 3 (2020).
7. H. Setyawati and W. Maisyaroh, Comparison of Environmental Care Attitude of Adiwiyata and Non Adiwiyata School Students in Jember. *Indonesian Journal of Mathematics and Natural Science Education*. **4**, 1 (2023).
8. Kementerian Lingkungan Hidup, *Permen LHK RI No. P.53/MENLHK/SETJEN/KUM.1/9/2019 Tentang Penghargaan Adiwiyata*, (2019).
9. A. Karabey and N. Aygun, Disaster Nursing Perspective: Disaster Literacy. *Austin Journal of Nursing & Health Care*. **9**, 2 (2022).
10. D. S. Logayah, E. Maryani, M. Ruhimat, and E. Wiyanarti, The importance of disaster mitigation literacy in social studies learning. *IOP Conference Series: Earth and Environmental Science*. **986**, 1 (2022).
11. L. Marinda, Teori Perkembangan Kognitif Jean Piaget Dan Problematikanya Pada Anak Usia Sekolah Dasar. *An-Nisa' : Jurnal Kajian Perempuan dan Keislaman*. **13**, 1 (2020).
12. B. Wisner, *Let Our Children Teach Us! A Review of the Role of Education and Knowledge in Disaster Risk Reduction*, (International Strategy for Disaster Reduction, Bangalore, 2006).
13. N. Khoirunisa, *Disaster Knowledge Of Student For Disaster Preparedness*, in *Proceedings of the The First International Conference on Child - Friendly Education* 219–222, (2016).
14. M. Annisa, A. Asrani, S. Serlinda, S. Kasih, and S. Maulana, Analysis of Students' Knowledge About Natural Disaster Mitigation in Wetland Areas. *Journal of Innovation in Educational and Cultural Research*. **3**, 1 (2022).
15. L. M. Brown, J. N. Haun, and L. Peterson, A proposed disaster literacy model. *Disaster Medicine and Public Health Preparedness*. **8**, 3 (2014).
16. BPBD Karanganyar, *Peta Rawan Bencana*. Open Data Karanganyar. (2019).
17. BNPB, *Data Informasi Bencana (DIBI)*. Badan Nasional Penanggulangan Bencana. (2023).
18. S. C. Chung and C.-J. Yen, Disaster Prevention Literacy among School Administrators and Teachers: A Study on the Plan for Disaster Prevention and Campus Network Deployment and Experiment in Taiwan. *Journal of Life Sciences*. **10**, 4 (2016).
19. T. Yanuarto, S. Pinuji, A. C. Utomo, and I. T. Satrio, *Buku Saku : Tanggap Tangkas Tangguh Menghadapi Bencana*, (Badan Nasional Penanggulangan Bencana, East Jakarta, 2019).
20. F. Z. Genc, S. Yildiz, E. Kaya, and N. Bilgili, Disaster literacy levels of individuals aged 18–60 years and factors affecting these levels: A web-based cross-sectional study. *International Journal of Disaster Risk Reduction*. **76**, 102991 (2022).
21. V. M. Cvetković, S. Dragičević, M. Petrović, S. Mijalković, V. Jakovljević, and J. Gačić, Knowledge and perception of secondary school students in belgrade about earthquakes as natural disasters. *Polish Journal of Environmental Studies*. **24**, 4 (2015).
22. R. Yusuf, M. Yunus, M. Maimun, and I. Fajri, Environmental education: A correlational study among environmental literacy, disaster knowledge, environmental sensitivity, and clean-living behavior of post tsunami disaster in aceh

- communities, Indonesia. *Polish Journal of Environmental Studies*. **31**, 1 (2022).
23. U. Sözcü and A. Türker, Examining natural disaster literacy levels of pre-service geography teachers. *Journal of Pedagogical Research*. **5**, 2 (2021).
 24. D. P. Meliana, E. Suharini, and T. B. S. Sanjoto, The Profile Of Disaster Mitigation Literacy Ability By Students In The School Prone To Tidal Floods. (2020).
 25. E. I. Goma, A. Rahman, D. A. Kusumawati, E. Choirun Nisak, L. Suriani, N. Purba, and N. Awaliyah, *The Importance Media Literacy of Natural Disaster for the General Public Pentingnya Literasi Media Bencana Alam Bagi Masyarakat Umum*, 2, 141–144, (2021).
 26. B. D. Vu, H. T. Nguyen, H. V. T. Dinh, Q. A. N. Nguyen, and X. Van Ha, Natural Disaster Prevention Literacy Education among Vietnamese High School Students. *Education Sciences*. **13**, 3 (2023).
 27. A. N. M. Aprilianti, Pengaruh implementasi program Adiwiyata terhadap literasi lingkungan peserta didik SMA Negeri 10 Yogyakarta. *Jurnal Edukasi Biologi*. **9**, 1 (2023).
 28. J. Ashar, Studi Komparasi Hasil Belajar Lingkungan Hidup Kelas Xi Sma Pada Sekolah Adiwiyata Dengan Sekolah Non Adiwiyata Di Kabupaten Bulukumba. *Jurnal Nalar Pendidikan*. **6**, 1 (2018).
 29. R. Wulandari and E. Sulistiyowati, Environmental Literacy (Sikap dan Tindakan) Pengelolaan Sampah dan Penghijauan Siswa SMA Adiwiyata dan Non-Adiwiyata. (2017).
 30. G. Tuladhar, R. Yatabe, R. K. Dahal, and N. P. Bhandary, Knowledge of disaster risk reduction among school students in Nepal. *Geomatics, Natural Hazards and Risk*. **5**, 3 (2014).
 31. P. A. W. Suwaryo and P. Yuwono, Faktor-faktor yang mempengaruhi tingkat pengetahuan masyarakat dalam mitigasi bencana alam tanah longsor. *Urecol 6th*. (2017).
 32. C. Pathirage and K. Seneviratne, Managing disaster knowledge : identification of knowledge factors and challenges. *International Journal of Disaster Resilience in the Built Environment*. **3**, 3 (2012).
 33. S. B. Ajar and L. Ronggowulan, Disaster literacy level of teachers and students in secondary school case study in Surakarta City, Indonesia. *IOP Conference Series: Earth and Environmental Science*. **986**, 1 (2022).
 34. A. S. Arifina, J. G. Pembayun, and M. Amanda, Understanding Disaster Prevention Literacy of Villagers in Magelang Regency. *Bricolage : Jurnal Magister Ilmu Komunikasi*. **7**, 1 (2021).
 35. I. Lusmianingtyas and S. Suwarno, Peran Sekolah dalam Pendidikan Migitasi Bencana. *Proceedings Series on Social Sciences & Humanities*. (2022).
 36. H. E. N. Dianti, P. Febrisari, A. A. Ridho, and K. Septaria, The Disaster Box Mystery as a Media for Growing Disaster Preparedness and Literacy among Junior High School Students. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*. **10**, 2 (2022).