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Understanding Disaster Literacy Level in Indonesia: How can students understand natural disasters?

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ABSTRACT

This study aims to determine the understanding of disaster literacy in preparing disaster-resilient students. This study used a quantitative descriptive method with a quasi-experimental design. The type of research used in this research is one group pretest-posttest. The research population is students of a public junior high school in Lembang, grade 7, for the odd semester of the 2022/2023 academic year. The research sample consisted of 33 students in class 7A. Data was collected through tests and documentation for two months, from November to December 2022. Then, the data were analyzed using descriptive statistics. Data analysis used paired t-test with the result that there was a significant difference between the pretest and posttest scores of 33 students with p <0.000. Based on these results, disaster literacy is very effective in improving disaster preparedness, especially in preparing aspects of disaster literacy knowledge, attitudes, and skills. The recommendations in this study are that only a few researchers apply disaster literacy in schools so that disaster literacy activities can become routine habits carried out by students and schools.

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1. INTRODUCTION

The Sustainable Development Goals (SDGs) aim to overcome global challenges and ensure everyone can enjoy a prosperous and equal life. One of the 2030 agenda consists of 17 sustainable development goals; point 13 emphasizes strengthening resilience and adaptive capacity to hazards from climate-related matters, including natural disasters in all countries (Fadilah et al., 2020). Goal 13 of Sustainable Development is essential to ensure the survival and well-being of current and future generations by taking action to prevent the worst impacts of climate change and disasters. This opinion is in line with the agenda of the Partnership for 21st Century Skills (P21), which classifies the 21st-century skills students must possess as learning and innovation skills, life and career skills, and media and information technology skills (Gutiérrez-Martín & Tyner, 2012; Makaramani, 2015; Paywala & Wulandari, 2021). Indonesia is an archipelago country located in the Southeast Asia region; Indonesia has a population of approximately 268 million people, has more than 17,508 islands, and is one of the largest archipelagic

countries in the world with a coastline length of up to 81,000 km. Indonesia's social and cultural life has been one of the most generous countries in the world for five consecutive years based on the 2022 World Giving Index (BPS, 2011; Charities Aid Foundation, 2022).

The geographical and geological location of Indonesia at the confluence of three major tectonic plates, namely the Indo-Australian plate, the Eurasian plate, and the Pacific plate causes earthquakes to occur frequently; Indonesia is also an active mountain route with 129 volcanoes, and 80 are dangerous, and Indonesia is in in the Pacific Ring of Fire area, namely a collection of active volcanoes surrounding the Pacific Ocean (Directorate of Disaster Development, 2022) and resulting in a high potential for natural disasters, especially in coastal and mountainous areas. Indonesia has a tropical climate, so it is prone to drought during the dry season. Disasters that often occur in Indonesia during the dry season are drought disasters which cause land fires and haze in Indonesia. During the rainy season, floods with high rainfall often cause landslides with many fatalities (Yanuar, 2018). Based on the research results above, it can be concluded that at least six factors make Indonesia the most disaster-prone country in the world. First, Indonesia is crossed by three confluences of large tectonic plates with the potential for earthquakes. Furthermore, makes Indonesia part of the ring of fire with the potential for volcanic eruptions and high slope areas prone to landslides; third, Indonesia has the second longest line in the world and has the potential for a tsunami; fourth, Indonesia has a tropical climate that triggers floods, drought, forest fires, and land and abrasion, fifth, most of the Indonesian population lives close to rivers, lakes, and the sea as well as in the foothills of mountains, sixth, the preparedness of the Indonesian people for disasters is very low.

Based on previous research, the diversity, and problems of disasters in Indonesia provide information as a combination of lack of capacity or steps to reduce or defend against the potential negative consequences of a hazard threat and conditions of disaster vulnerability (Amri, 2016; UNICEF, 2012). The impact of disasters that occur due to unpreparedness for disasters can result in injury, illness, and other harmful effects on humans' physical, mental, and social welfare, resulting in loss of life. Disasters also impact material losses, such as asset destruction, property damage, environmental degradation, and disruption to social and economic aspects. With various natural disasters in Indonesia, the Indonesian government has seriously handled disaster issues by issuing legal regulations in Indonesia. The publication of this regulation, preparedness for disaster mitigation, has become part of the government's work program through various ministries. International organizations such as the G-20, WHO, UNESCO, and UNISDR have also provided a lot of technical and financial assistance in implementing disaster mitigation programs in Indonesia.

Education has a message in providing information about disaster mitigation, in education the contribution of disaster mitigation can be through counseling and publishing teaching materials to prepare communities and students in schools to face natural disasters, reading signs of impending natural disasters, saving themselves and family members or residents schools, preparing shelters or evacuating, dealing with post-disaster problems and restoring the recovery process have been socialized to the community and schools. This preparation was conveyed to the broader community and school members through social media and integrated into learning, especially social science subjects at the junior high school level and geography at senior high schools (Siriwardena et al., 2013). The research from UNICEF in 2018 stated that around 45% of Indonesia's population was still blind to disaster knowledge and attitudes, especially the victims most affected by disasters, namely children and the elderly (Directorate of Disaster Development, 2022).

One of the indicators in implementing disaster education and minimizing disasters in Indonesia is disaster education which is integrated into several subjects such as Social Sciences, Natural Sciences, Geography, and Language (Maryani, 2021). Disaster education is influential in changing the broad human mindset in responding to disasters (Juhadi, 2020). *Disaster education* is a way to create good knowledge, rigid attitudes, and safe situations in dealing with disasters (Nurwin et al., 2015). Disaster education is carried out by providing disaster education, both formal and informal, at all levels of education. At the current level of education, there are at least several essential literacies that must be

mastered, one of which is disaster literacy, which is related to the high potential for natural disasters to occur throughout Indonesia and the lack of knowledge, attitudes, and skills of the community and students regarding various disaster mitigation measures. Disaster literacy is an individual's capacity to read, understand, and use disaster information (Brown, Haun et al., 2014). The study's results (Noviana et al., 2021) define *disaster literacy* as a concept of reducing disaster risk through a systematic way of analyzing and reducing the factors that cause disasters. Disaster literacy is one of the efforts that teach individuals to read, understand, and use information, which helps make the right decisions and follow instructions in disaster mitigation, preparation, response, and recovery (Hoffmann & Blecha, 2020). Education is essential in an ongoing effort to socialize and promote disaster prevention. Individual mindsets need to be built through an educational process that can enhance disaster preparedness. The educational paradigm directs disaster knowledge in which knowledge is constructed through interactions with objects, experiences, phenomena, and the environment (Mujiburrahman et al., 2020).

Based on this, disaster literacy develops several components of individual skills; the first is a basic understanding of disasters. Second, functionally preparing individuals to have an attitude of preparedness, response, and disaster recovery (Sari et al., 2021). Finally, regarding individual capacity to analyze disaster-related information, empowerment to overcome obstacles, and recovery in overcoming disasters. Efforts to inculcate disaster literacy are further considered a process of forming mindsets and behaviors so that they care and are responsible for themselves, society, and the universe. The results of research on disaster literacy by Tsai et al. (2021) outline that disaster literacy can be applied to the family, school, and community environments. Disaster education and literacy in the family environment are emphasized on the attitude aspect, the school environment on the knowledge and skills aspect, and the community environment on the social aspect.

Meanwhile, according to Kanbara et al. (2016), disaster literacy in the community and school members can reduce disaster risk in their environment. Ashintya (2019) also revealed that with disaster literacy, Indonesian people could become a society that is ready to face natural disasters by mastering this literacy. The results of another study by Koike et al. (2018) Disaster information included in disaster literacy can be used as a consideration in making policies or decisions by following instructions in the context of mitigation, preparedness, response, and spreading false information that is detrimental and makes each panic. The purpose of disaster literacy is effort that people can filter, check, and reconsider the disaster information they receive to decide on appropriate and efficient actions.

This research is fundamental considering that disaster literacy is basic literacy that must be owned by students and taught to students or children who are victims of the highest disaster risk in schools, especially with Indonesia's high level of disaster vulnerability. Many studies have been conducted on disaster and disaster education, but still need to be more comprehensive regarding research on disaster literacy in Indonesia. The limitations of research on disaster literacy are raised as a search for students or children to understand the disasters that occur around them.

2. METHODS

This study used a quantitative descriptive method with a quasi-experimental design, but the research subjects were not randomly selected. This research tries to find a causal relationship by manipulating the independent variables, controlling the influences that cause the experimental results to be invalid, and observing the impacts arising from the treatment or manipulation of the variables (Borg & Gall, 2007). The type of experimental research used is One Group Pretest Posttest Designs, namely a research design that contains a pretest before being given treatment and a posttest after being given treatment. The research population for junior high school students at SMPN 6 Lembang is 646 in grades 7-9 in the 2022/2023 semester. The stratified random sampling technique, the sample was 33 people in class 7A, consisting of 12 male and 21 female students. Data collection techniques were carried out through tests and documentation for two months, from November to December 2022, then data collection was analyzed using the quantitative description. Data analysis techniques by measuring students' disaster literacy, namely: disaster literacy knowledge, disaster literacy attitudes, and disaster

literacy skills. Based on the data analysis technique, the test instrument regarding disaster literacy knowledge consists of 20 items of multiple-choice questions. The validity test results were 17 valid item items and 3 invalid items. While the disaster literacy attitude and skills instrument use a non-test by filling out a questionnaire, the results of the validity test of disaster literacy attitudes consisting of 15 items are declared valid.

Moreover, the results of the validity test of disaster literacy skills consisting of 15 items were declared valid. Disaster literacy knowledge reliability test results were 0.956 with reliable conclusions, disaster literacy attitudes were 0.697 with reliable conclusions, and disaster literacy skills were 0.718 with reliable conclusions. As for location considerations, the research was carried out at SMPN 6 Lembang, West Java, considering that SMPN 6 Lembang is highly vulnerable to earthquakes, landslides, and volcanic eruptions. The disaster literacy level, knowledge, attitudes, and skills are divided into 5 categories: very good, good, currently, not enough, and very less (Table 1).

Table 1. Disaster literacy rate

No	Aspect	Category	Value
1	Disaster literacy knowledge	Very Good	80-100
		Good	65-79
		Currently	55-64
		Not enough	40-54
		Very less	< 40
2	Disaster literacy attitude	Very Good	55-75
		Good	40-54
		Currently	32-41
		Not enough	23-31
		Very less	< 22
3	Disaster literacy skills	Very Good	55-75
		Good	40-54
		Currently	32-41
		Not enough	23-31
		Very less	< 22

Source: LIPI-UNESCO/ISDR, 2006; Shaw & Takeuchi, 2009; Pangesti, 2016

3. FINDINGS AND DISCUSSION

The disaster literacy research at SMPN 6 Lembang, West Java, was implemented in four meetings in class 7A. The first meeting provided 20 items of disaster literacy knowledge pretest questions, 15 on disaster literacy attitudes, and 15 on disaster literacy skills. After being given a pretest by the teacher, the next activity is to start disaster literacy. Namely, students are given motivation and guidance to see, observe, find, read, and rewrite video shows related to geographical conditions in Indonesia that are linked to potential disasters in Indonesia. Based on the results of observations in class on the video shows, students were asked to discuss things they did not understand or did not know in advance. Students are also asked to observe the pictures regarding the map of Indonesia, followed by understanding the geographical conditions of Indonesia. Then, students were asked by the teacher to listen to the material explanation of Indonesia's geographical conditions. As a group, students were asked by the teacher to discuss the geographical conditions of Indonesia so that they could generate potential disasters and observe the school environment potential disasters could occur. After students search for answers and discuss in groups, the group representative presents the results of the discussion in the form of conclusions orally in front of the class. At the end of the lesson, students summarize the essential points that emerged.

The second meeting was continued by linking the previous material, namely the geographical conditions of Indonesia. In this activity, students were asked to carry out disaster literacy at school by carrying out interaction patterns with school residents in disaster-prone areas. The teacher motivates

students by providing guidelines for observing, reading, and rewriting the interaction patterns of school members in dealing with disasters. In groups, students discuss what to do before, during, and after a disaster occurs. After getting answers from students based on the results of group discussions, group representatives presented in front of the class the results of observations and readings regarding the interaction patterns of school members in disaster-prone areas. At the end of the meeting, the teacher scheduled the activities for the third meeting. In the third meeting, recalling the previous material, namely Indonesia's geographical conditions and the interaction patterns of disaster-prone school residents, literacy activities were shown as a map of Indonesia prone to earthquakes, landslides, and volcanic eruptions. Student activities at the third group meeting, students are asked to identify the factors that cause earthquakes, landslides, and volcanic eruptions by writing them on the discussion sheet. Afterward, together with groups of students, they were asked to convey orally the factors that cause earthquakes, landslides, and volcanic eruptions. At the end of the meeting, the teacher gave assignments to students to prepare for a disaster simulation at the fourth meeting.

The fourth meeting of the teachers gave directions for carrying out disaster simulation activities and dividing tasks among students in carrying out disaster simulations, both before, during, and after the disaster. The implementation of disaster simulation is carried out outside the classroom, namely in the school field; this is done to provide free mobility for students. The teacher explains the importance of disaster literacy and asks students to do disaster literacy in disaster simulation activities. After the teacher has arranged everything, the process of carrying out the disaster simulation begins by dividing each role. The disaster simulation process has been completed, and the teacher asks students to return to their classrooms. After that, the teacher and students concluded the experience of conducting disaster simulations with the events and difficulties of carrying out disaster simulations. At the end of the lesson, the teacher conducts post-test activities. Based on the implementation of the first to fourth meetings, the results of the pretest and post-test of students' disaster literacy knowledge, students' disaster literacy attitudes, and students' disaster literacy skills in class 7A SMPN 6 Lembang are presented below with the results of the pretest and post-test of students' disaster literacy knowledge.

Table 2. Differences in students' disaster literacy knowledge scores pretest and posttest

No	Score Range	Criteria	pretest		postets	
			f	%	f	%
1.	$x \geq 85$	Very Good	0	0	17	52
2.	$72 \leq x \leq 84$	Good	4	12	10	30
3.	$70 \leq x \leq 71$	Currently	7	21	4	12
4.	$48 \leq x \leq 69$	Not enough	15	45,5	0	0
5.	$x \leq 47$	Very less	7	21	0	0

Source: Data Analysis, 2023

Table 1 above regarding students' disaster literacy pretest data on the aspect of disaster literacy knowledge, it appears that the initial condition of students' disaster literacy knowledge is included in the less dominating category at 45.5%, the currently category is at 7%, and significantly lacking at 40-55 is at category 21%. After experiencing the treatment of disaster literacy learning, the posttest results obtained students' disaster literacy knowledge was spread very good in the 52%, good 30% and currently 12% categories. From the data on students' disaster literacy knowledge, it can be obtained that the conditions at the time of the disaster literacy pretest were in the moderate, poor, and very lacking categories. Meanwhile, after the posttest, learning experienced an increase in students' disaster literacy knowledge in the currently, good, and very good.

Table 3. Differences in disaster literacy values before and after in students' disaster literacy knowledge

		Mean	N	Std. Deviation	t	p
Pair 1	Postest_knowledge	87.2121	33	9.27280	17.492	.000
	Pretest_knowledge	55.0303	33	8.65478		

Source: Data Analysis, 2023

Based on the table. 3 results of descriptive data and using the paired t-test, pretest, and posttest values of disaster literacy knowledge on 33 students obtained a significant difference with a p-value <0.005. This shows that each student already has good knowledge of student disaster literacy in applying social studies learning to the material of Indonesia's geographical conditions. Table 3 also shows the average value of students' disaster literacy knowledge before participating in disaster literacy learning activities of 55.03, meaning that students' disaster literacy knowledge is in the less category. In the posttest results, the average value of disaster literacy knowledge rose to 87.21, which means it is included in the excellent category. Furthermore, the results of the pretest and posttest of students' disaster literacy attitudes can be presented in Table 4 below.

Table 4. Differences in scores of students' disaster literacy attitudes pretest and posttest

No	Score Range	Criteria	pretest		postets	
			f	%	f	%
1.	x ≥ 55	Very Good	5	15,15	6	18
2.	40 ≤ x ≤ 54	Good	10	30,30	27	82
3.	32 ≤ x ≤ 41	Currently	18	55	0	0
4.	23 ≤ x ≤ 31	Not enough	0	0	0	0
5.	x ≤ 22	Very less	0	0	0	0

Source: Data Analysis, 2023

The results of Table 4 show that the differences in pretest students' disaster literacy attitudes are in the current (55%), good (30.30%), and very good (15.15%) categories. After experiencing the treatment of disaster literacy learning, the posttest results obtained that students' disaster literacy attitudes were very well distributed in the 18% and 82% good categories. Data on students' disaster literacy attitudes shows that the conditions during the disaster literacy pretest were in the medium, good, and very good categories. Meanwhile, after the posttest, the learning experienced an increase in students' disaster literacy attitudes in the very good and good categories.

Table 5. Differences in disaster literacy scores before and after in students' disaster literacy attitudes

		Mean	N	Std. Deviation	t	p
Pair 1	Postest attitudes	61.42	33	3.62311	7.013	.000
	Pretest attitudes	38.21	33	5.20671		

Source: Data Analysis, 2023

Based on the table. 5 descriptive data results and using the paired t-test, the pretest and posttest values of disaster literacy knowledge on 33 students obtained a significant difference with a p-value <0.005. This shows that each student already has a good student disaster literacy attitude in applying social studies learning to the material of Indonesia's geographical conditions. Table 5 also shows the average value of students' disaster literacy knowledge before participating in disaster literacy learning activities of 38.21, meaning that students' disaster literacy attitudes are in the less category. In the posttest results, the average value of disaster literacy attitudes rose to mean it was

included in the very good category. Furthermore, the results of the pretest and posttest tests of students' disaster literacy skills can be presented in Table 6 below.

Table 6. Differences in scores of students' disaster literacy skills pretest and posttest

No	Score Range	Criteria	pretest		postets	
			f	%	f	%
1.	x ≥ 55	Very Good	0	0	6	18,2
2.	40 ≤ x ≤ 54	Good	8	24	27	81,2
3.	32 ≤ x ≤ 41	Currently	16	48	0	0
4.	23 ≤ x ≤ 31	Not enough	9	27	0	0
5.	x ≤ 22	Very less	0	0	0	0

Source: Data Analysis, 2023

Table 6. The differences in the pretest students' disaster literacy skill scores are in the good (24%), moderate (48%), and poor (27%) categories. After experiencing the treatment of disaster literacy learning, the posttest results obtained showed that students' disaster literacy skills were spread very well in the 18.2% and 81.2% good categories. Data on students' disaster literacy skills show that the conditions during the disaster literacy pretest were in the moderate, reasonable, and poor categories. Meanwhile, after the posttest, the learning experienced an increase in students' disaster literacy skills in the very good and good categories.

Table 7. Differences in disaster literacy scores before and after in students' disaster literacy skills

		Mean	N	Std. Deviation	t	p
Pair 1	Postest skills	55.45	33	4.3738	11.644	.000
	Pretest skills	39.90	33	3.7279		

Source: Data Analysis, 2023

Based on the table. 7 descriptive data results and using the paired t-test, the pretest and posttest values of disaster literacy knowledge on 33 students obtained a significant difference with a p-value <0.005. This shows that each student has good disaster literacy skills in applying social studies learning to the material of Indonesia's geographical conditions. Table 7 also shows the average value of students' disaster literacy skills before participating in disaster literacy learning activities of 39.90, meaning that students' disaster literacy skills are in the less category. In the posttest results, the average value of disaster literacy knowledge rises, which means it is included in the very good category. At the same time, the effectiveness test in disaster literacy knowledge, disaster literacy attitudes, and students' disaster literacy skills can be presented in the following table.

Table 8. Results of the Disaster Literacy Effectiveness Test

No	Aspect	Pretest	Postest	Enhancement	N-gain(g)
1.	Knowledge	55,00	87,00	32,00	0,602
2.	Attitudes	38,00	61,00	23,00	0, 745
3.	Skills	39,00	55,00	16,00	0, 761

Source: Data Analysis, 2023

Table 8. The results of the disaster literacy effectiveness test have very high criteria based on the n-gain results, so that disaster literacy knowledge, disaster literacy attitudes, and disaster literacy skills can be an effort to someone's capacity to read, understand, use the information to make decisions and follow instructions in disaster mitigation efforts. Low disaster literacy can lead to errors in interpreting natural disasters. Errors in interpreting natural disasters can be categorized into two major groups (Ru Gwee et al., 2011) disasters resulting from human negligence and disasters coming from God's power. The interpretation of the first group is everything that can be accounted for by humans,

starting from human error as the cause of various disasters to bad post-disaster management. The second interpretation relates to all disasters that come from God because, seeing the condition of the Indonesian people, who are very religious, that disaster is a punishment from God, explain various things that humans cannot explain, such as the causes of natural disasters and the reasons for a disaster to occur. The achievement of students who master disaster literacy is essential for compiling it through various educational programs. One example implemented in developed countries prone to natural disasters, such as Japan and Taiwan, is disaster mitigation education. One of the disaster mitigations is by implementing disaster literacy. Disaster literacy is one of the efforts to reduce disaster risk. Emily (Brown, Alto, et al., 2014) states disaster literacy is identifying, understanding, interpreting, and communicating disaster-related information.

Implementation of disaster literacy consists of three stages (Brown, Haun, et al., 2014), which need to be implemented sequentially. The first stage is the essential knowledge stage, followed by the functional stage, and the last is the interactive stage. First, basic knowledge about natural disasters that may occur in a community is conveyed to students. Various techniques include counseling, posting posters in class bulletins, WAG discussions, debriefing through social media, and so on. The purpose of this stage is that students can understand the potential for natural disasters in their environment and ways to save themselves that need to be done in the event of a natural disaster. At this stage, the need for appropriate learning media is very high; learning media must be arranged concisely, accurately, and easily understood. Refrain from letting the learning media confuse students and interfere with the disaster mitigation process. Second, in the functional stage, students are expected to be able to carry out various disaster literacy programs independently. Understand what to do in the event of a disaster. For example, in the event of a disaster, students can provide emergency assistance to the medical team or other functional skills needed during a natural disaster.

In the three interactive stages, students creatively and independently are expected to be able to independently compose various rescue steps when a natural disaster occurs or afterward. Students have been directed to no longer be passive victims of natural disasters but to independently become part of the disaster response team (Zavar & Nelan, 2020). In this third stage, students are expected to be able to independently organize disaster mitigation measures following the characteristics of disasters in their area. One of the focuses of implementing disaster prevention in schools is to make school members understand the warning signs of disasters and know the steps that must be taken to reduce risk and prevent disasters. With this stage of disaster literacy, at least every individual, namely students, can save themselves, their families, and the surrounding community from disasters; saving themselves dramatically contributes to reducing the number of disaster victims in Indonesia.

4. CONCLUSION

Based on the results of research and discussion, disaster literacy is a form of basic literacy that must be possessed by school students, especially in disaster-prone schools. Data analysis using the paired t-test of disaster literacy scores pretest and posttest on 33 students found a significant difference, with a p-value <0.005. The result shows that each student has good disaster literacy in the applied social studies learning activities. Data analysis using paired t-test, pretest, and posttest disaster literacy scores of 33 students found significant differences with p-values <0.005; these results indicate that each student has understood disaster literacy very well. The effectiveness test states that disaster literacy is in the very effective category. Of course, the effectiveness of disaster literacy is a benchmark for students in disaster preparedness. Therefore, it is necessary to have a habit of disaster simulation so that students are more responsive in dealing with disasters.

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