
Disaster mitigation education: Efforts to improve school community disaster preparedness

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Abstract: Indonesia is one of the countries frequently affected by natural disasters, including land, air, and sea disasters. Government efforts to socialize disaster mitigation education have been extensive across various sectors of society. However, the results have not yet met the expected targets. In Japan, a country frequently hit by numerous disasters, disaster mitigation education is integrated into the curriculum. At least twice a year, students undergo disaster preparedness drills. This aims to make students responsive when disasters strike suddenly. A trial of disaster mitigation education was conducted, focusing on understanding the surrounding environment by identifying hazardous and safe areas and interviewing residents to gather information about past disasters in their area. Subsequently, students were taught to prepare emergency kits, create eating utensils, and develop learning materials like story cards, similar to practices in Japanese elementary schools. Data was collected from 500 questionnaires distributed to elementary school teachers in Mataram. The trial materials were tested in each class, and teachers were interviewed afterward. The results showed that some teachers taught disaster mitigation to students, resulting in increased understanding among students about what to do when facing disasters. Classroom teachers stated that disaster preparedness drills were meaningful activities for students because they needed to be trained not to panic during disasters.

Keywords: disaster education; drill trials; mitigation drills

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Introduction

Indonesia, like Japan, is known as a disaster-prone country, and according to a UNEP report (Raharja, 2016), the total amount of damage from such disasters is said to be the fourth largest in the world. The impact of global warming due to climate change, such as landslides caused by heavy rains in Aceh in 2017 and flooding in West Lombok in 2021, has resulted in unprecedentedly high rainfall and large-scale damage (Fikriani, 2014). In addition to weather disasters, there have also been a number of damages due to geological disasters, such as the Lombok earthquake in 2018, the Java earthquake that struck West Java in November last year, and the eruption of Mount Sumeru in December. Under these conditions, the Indonesian government has not officially provided practical disaster education such as providing basic knowledge about natural disasters and evacuation drills in the compulsory learning process in schools. In fact, disaster education is very much needed for the people in Indonesia.

In this context, in previous research activities, the researchers of this present study conducted research related to environmental and disaster education, with the material of observing the environment around schools and homes in the event of natural disasters, this research developed environmental education in model elementary schools in Lombok Indonesia, in collaboration with Mataram University and the Education Management Board. In previous research, the researchers piloted disaster mitigation learning media in three elementary schools. So far in Indonesia, the researchers have conducted classes in elementary schools by adapting traditional Japanese education methods such as "neighborhood walks, commonly called Machitanken (Niwayama & Nambu, 2013) and "picture story shows" to suit Indonesian tastes. In addition, the researchers have also held workshops in Indonesia to teach necessary teaching methods to teachers. Teachers also received drills on disaster mitigation, directly in Kitakyushu Japan. That is learning how to research the surrounding environment and make learning media, to support the success of environmental education and disaster prevention education. These two materials are inseparably linked. The first step in preventing disasters that suddenly occur in our daily lives is to recognize the natural environment around us (Carvalho & Leitão, 2015). It is important not to separate the environment and disaster prevention, but to learn about the nature that sometimes threatens us (Marchezini, 2020) as we learn about the nature around us. In addition, to stop the damage caused by these disasters in the long run, it is necessary to realize a sustainable society (Lopez et al, 2012).

In this further research, this trial introduces Japanese-style evacuation drills to elementary schools in Mataram city. In addition to the methods of "strolling around the city (Machitanken)" and "picture-story shows (Kamishibai)", we want to understand the results of these drills. For geological disasters, evacuation drills like this are expected to be effective to a certain extent and are much needed in the area.

One of the disaster preparedness drills conducted in schools in Japan is evacuation drills in the event of disasters, such as earthquakes, tsunamis and fires (Okada et al., 2023). Instructions are given to school members, what to do in the event of a disaster, and how to follow instructions during a disaster. All are simulated to students at school. So that they do not panic when facing the actual event. Signs were sounded to indicate that a disaster was occurring. Students are invited to recognize some instructions when evacuating. Therefore, for this habituation, disaster education is needed with one of the activities being a simulation when an earthquake occurs.

The frequent occurrence of land and air disasters in Mataram city makes disaster education increasingly important, considering the increasing and diverse risks and threats faced by the community. Historically, DE has been studied in various disciplines including disaster risk management, environmental studies, and civil engineering, covering various diverse teaching and learning activities.

It is therefore important that communities, especially educational communities, know how to deal with and cope with disasters. In every disaster, children are always the worst victims, whether it is an earthquake, fire, flood or tsunami (Kitagawa, 2021). In the event of an earthquake disaster, many people often die or are seriously affected by the earthquake disaster, for example, being hit by collapsed buildings, being hit by landslides due to the earthquake. This will have an impact on children. To reduce trauma or injury as earthquake victims, children should be equipped with disaster mitigation education, so that they are mentally and physically prepared, if an earthquake suddenly occurs in their environment. Therefore, the cooperation of teachers and students is needed to conduct drills to deal with disasters (Kitagawa, 2021). Drill and simulation, which is an effort in disaster education activities, is felt to be very important, so it was tested in 3 elementary schools with the themes of analyzing the surrounding environment, disaster drills, emergency bags, making cutlery, and kamishibai. The purpose of this study is to measure whether students and teachers can conduct disaster mitigation education trials related to the above themes.

Method

This research trial tested a disaster preparedness drill (Okada et al., 2023), the research object being students, with the activity diagram of disaster education as shown in Figure 1. Overview of the mitigation education programs and workshop goals. The stages of this activity are:

1. Before the disaster occurs: Students engage in activities walking around the school surroundings, then create a disaster prevention map. By walking around, students can identify hazardous areas around the school and places where they can take shelter. Students understand their location beforehand and create a map.

2. When the disaster occurs: Students conduct evacuation drills, where students must take immediate action to protect themselves in the event of a disaster. For this, students undergo evacuation drills. In this drill, students learn to understand what to do when a disaster occurs.

3. During sheltering after the disaster: Students assemble emergency bags, preparing necessary items for emergency conditions that will be required in case of evacuation.

4. Life in evacuation: Students make plates from banana leaves. The content revolves around making something useful by replacing familiar items during their stay in evacuation centers.

5. Everyday life/Before the disaster: Creating picture-story shows for disaster prevention. To think about disaster prevention and daily disasters. As motivation, we decided to create picture-story shows for disaster prevention.

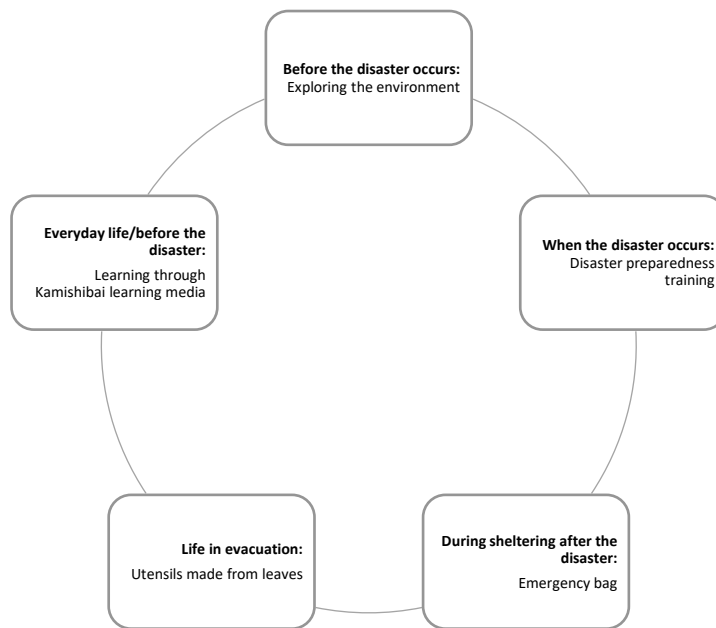


Figure 1. Diagram of Disaster Education Trial Activities

This activity involved fifth-grade students from three schools located upstream, middle, and downstream of the Jangkok River. Each school had two teachers, as shown in Table 1.

Table 1. Number of Participants in Disaster Education Trial

School Position	Students	Teachers
Upstream	60	2
Middle	55	2
Downstream	57	2
School Position	Students	Teachers

In this study, data collection was carried out by distributing questionnaires with eight multiple-choice questions and four open-ended essay questions, randomly distributed to 500 elementary school teachers in Mataram City. The questionnaire theme related to the teacher's profile, teacher's habits in

preparing lessons, and disaster education. The questionnaire results counted the number of teachers conducting disaster mitigation education and determine if teacher habits in lesson preparation are related to disaster education.

The trial of disaster mitigation education materials includes exploring the surrounding environment, emergency bags, creating story cards, and making utensils from leaves. These materials are commonly practiced in elementary schools in Kitakyushu City. This trial was conducted in 3 elementary schools located near the Jangkok River. The data collected are the results of observations regarding student activities during the learning process.

The next trial involved training students in movement during evacuation. Data was collected on the speed of students' movement without running during evacuation. This training was accompanied by teachers who have received disaster mitigation education drill in Kitakyushu City, Japan. After accompanying the students, the teachers were interviewed about this trial activity.

Results and Discussion

The questionnaire was distributed to 500 teachers as respondents scattered across elementary schools in Mataram, yielding the following results:

Teacher Profile

Female respondents comprised 70% of the total, with a distribution not significantly different from other grade levels. However, the highest proportion, 18%, was found among grade 2 teachers. Additionally, 272 respondents were in the age range of 41-50 years old, as shown in Table 2.

Table 2. Profile of Disaster Education Questionnaire Respondents

Demographic Information	Item	Frequensy/Persentasi
Gender	Male	30%
	Female	70%
Affiliation	Guru Kelas 1	16.40%
	Guru Kelas 2	18%
	Guru Kelas 3	16.20%
	Guru Kelas 4	17.60%
	Guru Kelas 5	15.90%
	Guru Kelas 6	15.90%
Umur	21-30	137
	31-40	136
	41-50	272
	51-60	162
Teaching subject	Agama	174
	Bahasa Indonesia	183
	Bahasa Inggris	473
	IPA	141
	IPS	148
	Matematika	147
	Pend Jasmani dan Kesehatar	218
	PPKN (Pancasila)	176
	Tematik	230

Teacher Contribution to Disaster Mitigation Education

The questionnaire results indicate that respondents participate in teaching disaster mitigation, as evidenced by their responses. It is noted that 95% of respondents answered "Yes" when asked if

teaching disaster education is very important. Despite only 48% having experienced floods themselves, 96% stated that it is important to teach about floods. This information is detailed in Table 3.

Table 3. Teacher Contribution to Disaster Mitigation Education

Questioner	Yes, I know	I don't know	Maybe
Do you know why earthquakes occur?	89%	7%	4%
	Yes	No	Maybe
Do you have earthquake experience?	97%	3%	0%
Did you learn about earthquakes from school?	82%	4%	13%
Did you learn about earthquakes from your parents?	78%	7%	15%
Do you teach about earthquakes?	88%	4%	8%
Is it necessary to teach about disasters in schools?	95%	1%	4%
Do you have experience with flooding?	48%	51%	1%
Have you ever taught about floods at school?	83%	1%	17%
Is it necessary to teach about floods in schools?	96%	1%	3%

The survey distribution yielded findings that 414 respondents had experienced earthquakes and believed it necessary to teach about disasters and floods in schools. For the 4 open-ended essay questions, respondents' answers are listed in Table 4. The term "self-rescue" appeared 94 times among 5% of the total words.

Table 4. Respondents' Answers on What to Do During an Earthquake

What do you do when an earthquake occurs?	Number of words that appear (A)	Total number of words (B)	Percentage of A to B
Save	94	1729	5%
Which	64	1729	4%
Self	64	1729	4%
place	56	1729	3%
tall	53	1729	3%
evacuate	39	1729	2%
goods	35	1729	2%
more	35	1729	2%
stuff	24	1729	1%
Flood	22	1729	1%
Valuable	21	1729	1%

Regarding earthquake knowledge, Table 5 shows that earthquakes occur due to the shifting of Earth's plates, a response provided by respondents comprising 276 words out of 3367 total words. Besides the term "earthquake," words like "plate," "slab," and "shift" appeared in their answers, indicating some understanding of earthquake occurrence.

Table 5. Respondents' Knowledge About Earthquakes

If you answered that you can understand in (5), please tell me the reason why the earthquake occurred. (please write a free description)	Number of words that appear (A)	Total number of words (B)	Percentage of A to B
Earth	276	3367	8%
Earthquake	148	3367	4%
Plate	139	3367	4%
Slab	128	3367	4%
Shift	113	3367	3%
Pressure	91	3367	3%
Plate shift	79	3367	2%
Move	52	3367	2%

In Table 6 responses, regarding the causes of floods, respondents answered that they are caused by garbage blockages, overflowing rivers, and continuous rainfall.

Table 6. Respondents' Answers on the Causes of Floods

If you answer that you know about floods, please tell us briefly the reasons why floods occur.	Number of words that appear (A)	Total number of words (B)	Percentage of A to B
Water	242	4811	5%
Rubbish	221	4811	5%
River	153	4811	3%
Flood	149	4811	3%
Rain	106	4811	2%
Overflow	104	4811	2%
Throw away	72	4811	1%
Genre	63	4811	1%
Tall	57	4811	1%
Bulk	54	4811	1%
Haphazard	51	4811	1%
Public	47	4811	1%
Absorption	34	4811	1%
Mainland	26	4811	1%
Blocked	25	4811	1%
Tree	22	4811	0%
Awareness	21	4811	0%

Out of 1729 total words, "self" was found, indicating self-rescue actions, along with words like "place" and "save." The word "run" ranked fourth, with many responses mentioning running to safety during earthquakes or disasters. There were numerous instances of the word "place," alongside terms like "safe place," "open space," and "low-lying area." Respondents' answers on what to do during an earthquake are detailed in Table 7.

Table 7. Respondents' Answers on What to Do During an Earthquake

What do you do when an earthquake occurs?	Number of words that appear (A)	Total number of words (B)	Percentage of A to B
Self	130	1760	7%
Place	104	1760	6%
Save	92	1760	5%
Run	80	1760	5%
Safe	77	1760	4%
Take cover	72	1760	4%
Building	60	1760	3%
Look for	59	1760	3%
Go out	44	1760	3%
Avoid	36	1760	2%
House	26	1760	1%

Analyze the surrounding environment

In Japan, school arrangements use zoning systems, where the government determines where students will attend school (except for private schools). For example, for students in area A, they will attend school in area A. To become more familiar with their surroundings, there's a material called "exploring the environment," commonly known as Machitanken, conducted by first and second-grade students. Lower-grade students aren't very aware of the conditions around their school and home environment. Through this activity, students can get to know their surroundings better. For instance, when disasters occur, first and second-grade elementary school students don't know what they should do, where to evacuate, who to ask, where police stations are, where community activities take place, where public facilities are, etc.

The Machitanken activity was tested with fifth-grade students, who were previously instructed on how to carry out the Machitanken activity. Students also made a list of questions to ask the community members they encountered. They could analyze hazardous areas, safe places to evacuate, and inquire about previous disasters in the area near the school. The result of this Machitanken activity was the students creating a mapped area of their exploration. Figure 2 shows the students' observation results, while Figure 3 shows students completing the map.



Figure 2. Students drawing on environmental exploration



Figure 3. The students are working on their drawing

This activity is believed to be very effective in introducing lower-grade students to their environment, not only about disasters but also about community activities. After completing the mapping, students presented it in front of the class, able to recount everything they observed during their walk. Guided by accompanying teachers, students could analyze hazardous and safe areas. They also received information from the community members they encountered during their exploration. An interesting discovery was that students could notice things close to them that may have gone unnoticed before, such as disaster evacuation signs (Figure 4).



Figure 4. Evacuation signs in the school environment

Disaster Preparedness Drills

We do not know when disasters will strike, what we are doing, where we are, or who we're with. Disasters cause panic and make us anxious. Therefore, providing evacuation drills at least offers guidance on how to move when disasters occur.

In Japanese schools, there are typically two disaster preparedness drills. Students are trained on what to do when they are in class and hear the disaster alarm (Figure 5). They must remember the steps to take (Segawa, 2023). For example, during an earthquake, they must automatically take cover under their desks (Figure 6), then listen to the teacher's instructions to leave the classroom slowly without running, pushing, or rushing out, and gather on the field, lining up according to their positions.

The results of this disaster preparedness trial initially showed that students ran and scattered out of the classroom, with some falling. Even though the teacher had explained that this was a trial and they should follow the instructions. In the second trial, the teacher reiterated the rules that needed to be followed. In the second phase, students were slightly more disciplined and quicker to line up on the field. For the third trial, the teacher didn't explain, but students were asked to discuss in groups. How to be orderly, avoid injuries, but it took a little longer. The result was that the students became more disciplined and could do it faster than before (Figure 7 and Figure 8).



Figure 5. The teacher explained to students before evacuation trial drills



Figure 6. Students save themselves under the tables



Figure 7. Students scattered out of the classroom to school yard and line up



Figure 8. The teacher counts the number of students who lined up

In this trial, evacuation drills were conducted three times, and the results are as follows, as shown in Figure 8.

Table 8. Results of evacuation drill measurements in minutes

School	1 st Drill	2 nd Drill	3 rd Drill
SD Hulu kelas A	11,8	9,7	5,1
SD Hulu kelas B	14,2	8,5	5,4
SD Tengah kelas A	9,9	8,6	4,1
SD Tengah kelas B	7,2	7,0	4,2
SD Hilir kelas A	13,9	7,4	5,8
SD Hilir kelas B	8,3	7,9	6,2

Emergency Bag

The next step is to think about the emergency bag. In Japan, every family has an emergency bag prepared, stored in an easily accessible place. So, in the event of a disaster and the need to evacuate, the emergency bag can be grabbed immediately. In this trial, students considered what items should be brought to the evacuation site. In groups, students discussed and made a list of items.

Initially, they mentioned many items that should be brought when evacuating. Then, the supervising teacher directed that these items should fit into a medium-sized backpack. As a result, students could conclude what items should be brought. Examples of items in the emergency bag can be seen in Figure 9.

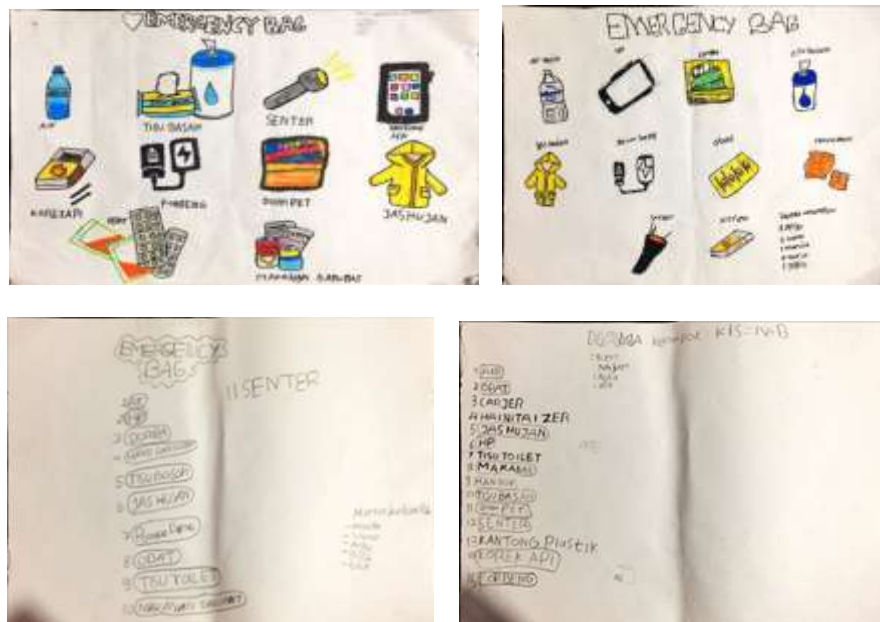


Figure 9. Example of items in the emergency bag

Making utensils from banana leaves

In Japan, for evacuation drills, students are taught to make plates, cups from paper, sandals from newspaper, and sleeping mats from old newspapers, as Japan is a country that extensively uses paper. One of the local wisdoms in Mataram city is the use of banana leaves to wrap food (Figure 10). In this trial, students were taught how to make bowls, plates, and cups from banana leaves (Rianti, 2016). As a result, some students were already skilled at making bowls, but many could not do it. On average, students only knew that banana leaves could be used as bowls. Some said they often saw bowls made from banana leaves, and some said they were taught by their parents to make bowls from banana leaves. However, in Mataram city, the role of banana leaves as utensils is diminishing, with the community predominantly using plastic for food packaging.



Figure 10. Photo of students making utensils from banana leaves

Making Kamishibai

Then, in groups, students created illustrated cards, commonly known as Kamishibai. Kamishibai is a Japanese theater paper often used as a learning tool. In this trial, students created Kamishibai with the theme of disaster avoidance. The students are able to create pictures with a storyline, depicting how to evacuate during disasters. Figure 11 is one of the works of students from the downstream class B group.



Figure 11. Student's work creating Kamishibai for learning media

Evaluation of the drill programs

During the trial, the class teacher acted as a facilitator and analyzes the progress of the trial. To obtain data about this trial, teachers were interviewed directly after the trial series is completed. The interview results are summarized in Table 9.

Table 9. Results of interviews with accompanying teachers of disaster education trials

Activity	Teacher's Opinion
<i>Machitanken</i>	<p>In my opinion, the Machitanken activity conducted with students is very beneficial in drilling how to create a good map. Additionally, when making Machitanken, students not only draw the paths they traveled but also write down important things they encountered along the way. This activity also helps students better understand how to read maps and identify dangerous areas during disasters, as well as safe places to evacuate.</p>
	<p>Among several other activities, Machitanken is one of the most favored activities by students because they learn directly outside the school environment. In this Machitanken activity, students explore the surroundings of the school about dangerous areas or places to avoid during disasters, safe places to evacuate, and students learn to interview local residents about previous disasters. This activity enhances students'</p>

Activity	Teacher's Opinion
	<p>identification skills and their ability to communicate with the surrounding community. However, it is important to remember to supervise and monitor students during the journey to avoid dangers from passing vehicles.</p>
<p>Making bowls from banana leaves</p>	<p>The activity of making bowls from leaves is very beneficial to be taught to students because this activity aims to provide knowledge on how to utilize plants in the surrounding environment as useful tools during disasters.</p> <p>This activity trains students' hand skills in making a useful object from easily obtainable materials. In this activity, students make bowls from banana leaves to practice if a disaster occurs, students can use leaves as bowls for consuming food. In the process, some students still found it difficult because the leaves used were not good enough, resulting in many torn and scattered leaves. However, some other students succeeded because they had previously heated the leaves properly, thus successfully making bowls from banana leaves that can be used during disasters.</p>
<p>Emergency Bag</p>	<p>In my opinion, the emergency bag activity is very beneficial, so it's important to teach it to students considering Indonesia is one of the countries prone to disasters, especially earthquakes. During this activity, students were very enthusiastic about mentioning important items to be included in the bag but still according to their needs. Additionally, this activity also needs to be socialized to the surrounding community to make them understand and care about the importance of preparing an emergency bag before a disaster occurs.</p> <p>The Emergency Bag activity is a new activity for students to get to know the emergency bag that needs to be prepared before a disaster occurs. This activity broadens the knowledge of teachers and students in selecting the most important items to be included in the emergency bag and brought during earthquakes. Initially, the students wanted to write and draw as many items as possible to bring. However, after learning more about the usefulness of the emergency bag, students can choose the most important items more wisely by discussing with their friends. Suggestions for this activity include ensuring that students can immediately practice by trying to put their belongings in the emergency bag to be prepared before an earthquake occurs.</p>
<p><i>Kamishibai</i></p>	<p>During the Kamishibai activity, students were very enthusiastic because, on average, they enjoy drawing. Not only that, with the Kamishibai activity, students gain new knowledge and improve their skills in drawing events and turning them into interesting stories. So, in my opinion, this activity is important to be taught to students to train and provide knowledge that delivering an interesting message can be done by making Kamishibai.</p> <p>Among several other activities, the Kamishibai activity is quite challenging for students. In this regard, there are some difficulties, especially in the class I taught, namely in terms of creating a story concept and illustrating the continuous story they want to convey. Additionally, students' ability to write the story content is still lacking, so they need more guidance from the teacher. However, this activity also helps improve students' drawing and writing skills better than before.</p>

Conclusion

Children are the most vulnerable group in the context of disasters. This paper analyzes the importance of student and teacher participation in implementing disaster education trials adopted from disaster education in Japan. This trial program aims to reduce disaster risks and what can be done to enhance children's resilience. Students successfully analyzed the environment and made notes about dangerous areas, safe areas, and managed to gather information about the history of disasters around the school. Students also thought about emergency bags, with discussions and presenting

opinions, students could analyze the need for items when evacuating. Students also created a local wisdom heritage in groups, namely making utensils from leaves. Students also understand the function of leaves and the role of leaves as bowls and cups for eating utensils in evacuation centers. Lastly, students were able to practice evacuation drills in a very short time. From the teacher's opinions, disaster education with the materials conducted in three schools is very helpful and makes students understand what to do when experiencing disasters. In this trial activity, students from three schools in Mataram were able to conduct disaster education activities as done in Japan.

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