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Flash Flood Disaster Mitigation Through Environmental Education

Abstract: Flash flood disasters often hit many areas in Indonesia and can generate various losses. These conditions are exacerbated by people's low knowledge and interest in their environment. Therefore, if people's environmental education increases, especially their flood disaster mitigation knowledge, they can be prepared and better protect themselves from such disasters. People's environmental education must start from determining the reason of the flood disaster in their environment to discovering how to avoid the disaster. This research design is a one-group post-test design. The collected data in this research is a written test result about knowledge in flash flood disaster mitigation materials as an implementation in environmental education in the community. The research data results were analyzed by means of simple regression, logistics regression, and correlation. Based on this research, environmental education with disaster mitigation materials has a high understanding level. In the disaster step, the highest understanding is before it happens. The correlation between educational strata and gender on environmental education and disaster mitigation materials is low. Finally, the role of women in disaster mitigation needs to improve because they have a higher understanding than males of disaster mitigation materials.

Keywords: disaster, environmental education, flash flood, mitigation

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1. Introduction

Indonesia is known as a vulnerable disaster area. The Disaster Management National Agency notes that there were 24,969 disasters in their database with 5,060,778 fatalities, 4,400,809 houses affected, and 19,169 damaged public facilities from 2010 to 2020 [1]. The Indonesian government places the natural disaster issue as a priority to be handled. The government's actual role in disaster handling is to create regulations. They are National Research Master Plan 2017–2045, Presidential Regulation Number 38/2018 about National Research Priority 2020–2024, Disaster Mitigation Law Number 24 of 2007, and Law Number 26 of 2007 about Spatial Planning which is a revision of the previous law Number 24 of 1992 which indicates that disaster mitigation policy has been handled comprehensively and focused on preventive efforts which are not only when a disaster occurs but also before they happen [2].

Based on disaster frequency, it is known that hydro, meteorological, and geological disasters often occur in Indonesia. Floods are in first place with the highest frequency, followed by earthquakes [3]. Flood Mitigation Policy Study in Facilities and Infrastructure Deputy states that there are 5,590 main rivers, 600 of which have the potential to cause floods in Indonesia [4]. Floods are one of the broadest ranges and happen most often globally. They affect almost 70 million people on average every year. At the same time, another flood definition is a land sinking event by water. Floods are a natural phenomenon that often happen in various countries, including Indonesia. Floods are caused by the river water overflowing the surrounding environment and excessive surface runoff with high rainfall intensity and long duration [5]. Generally, floods are caused by high rainfall intensity above average, making the drainage system and artificial flood storage canals unable to accommodate rainwater, leading it to overflow [6].

There are two flood types based on duration, namely ordinary floods and flash floods. Based on the definition of the WMO (World Meteorological Organization), a flash flood is of a short duration with a relatively high-water discharge. According to the AMS (American Meteorological Society), a flash flood rises and falls quickly with little or even no warning before. A flash flood is usually the result of high rainfall in a relatively small area. A flash flood is distinguished from an ordinary flood because of its short duration, usually less than six hours [7]. Flash floods often occur in fluvial volcanic foot areas because of high rainfall intensity, leading to land cover loss in that area. The surface water flows as rain falls in the fluvial volcanic foot area, which should seep into the ground because of land cover loss and causing it to flow down hillsides.

The reasons for flash floods are not only natural but also human factors. Indeed, recent floods in Indonesia are mainly because of human factors. Human factors which can lead to flooding such as deforestation, large land use transformation in the rain catchment area, spatial violation, and other activities which do not preserve the environment.

The human factors which are considered to be largely responsible for triggering floods can be addressed or mitigated by education, especially environmental education. Law Number 23 of 1997 of the Republic of Indonesia mentions that environmental education is an effort to change attitudes and behaviors conducted by various parties or community elements to increase knowledge, skills, and community awareness about environmental values and environmental issues, which in turn can drive the community to play an active role in environmental conservation, safety, and the need of the future generation [8]. In facing and overcoming disaster, universities are one of the institutions that are able to play an active role in doing research or contributing to disaster mitigation and reduction in the community, improving emergency responses, and fostering rehabilitation, reconstruction, regulation, and a disaster awareness culture [9]. The materials in environmental education such as knowledge, attitude, and behavior during flood disasters in the community's surrounding area can be used to mitigate its impact, while at the same time functioning as a reserve in environmental conservation.

One community that has experienced a flash flood disaster is Baureno Village, Jatirejo District, Mojokerto Regency. Based on the initial observation of this research, there was a flash flood disaster in 2020 in Baureno Village. The effect of that flash flood disaster was a broken bridge connecting to other villages, several damaged houses, and some injured residents. Baureno Village is 7°40′ – 7°36′ south latitude, and 112°24′ – 112°26′ east longitude [10]. The socio-economic condition of Baureno Village community can be seen from their religion and profession type. In detail, Baureno Village community's profession type is presented in Table 1.

Table 1. Baureno Village community's profession type

No.	Profession type	Total	
		amount	percentage [%]
1	Unemployed	1,058	28.95
2	Housewife/househusband	780	21.34
3	Student	327	8.95
4	Pensionary	10	0.27
5	Government officials	58	1.53
6	Army	8	0.22
7	Police	1	0.03
8	Trader	33	0.87
9	Farmer	205	5.61

Table 1. cont.

No.	Profession type	Total	
		amount	percentage [%]
10	Stock farmer	4	0.11
11	Online motorbike driver	2	0.06
12	General employee	895	23.01
13	State ownership entity employee	5	0.14
14	Government temporary employee	2	0.05
15	Freelancer	99	2.71
16	Farm worker	184	5.03
17	Housemaid	2	0.05
18	Bricklayer	4	0.11
19	Carpenter	2	0.05
20	Welder	1	0.03
21	Hair stylist/makeup artist	2	0.03
22	Mechanic	1	0.03
23	Muslim chaplain	1	0.03
24	Village officials	7	0.19

Source: Baureno Village official website [10]

Based on their religion, it is stated that 99.70% of Baureno Village community are Muslim and 0.30% are Christian. In detail, the number of people with the religion based on gender in Baureno Village is presented in Table 2.

Table 2. Baureno Village community religion based on gender

No.	Religion	Total		Man		Woman	
		amount	percentage [%]	amount	percentage [%]	amount	percentage [%]
1	Moslem	3,644	99.70	1,888	51.66	1,756	48.04
2	Christian	11	0.30	6	0.16	5	0.14
Total		3,655	100.00	1,894	51.82	1,761	48.18

Source: Baureno Village official website [10]

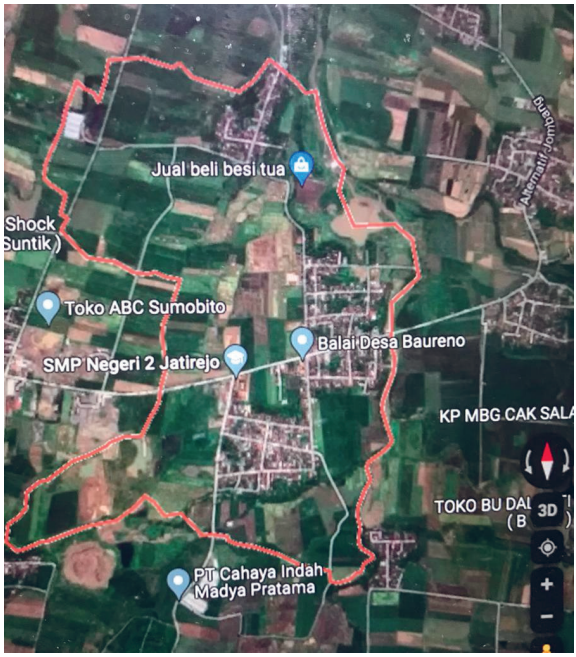

Fig. 1. Research location area in Baureno Village
Source: Baureno Village official website [10]

Geographically, Baureno Village is in the Welirang Mountain fluvial volcanic foot plain. Following the 2020 flash flood disaster, the Baureno Village community wanted to avoid future flood disasters and when our team offered environmental education with flash flood disaster mitigation materials, all of the Baureno Village community, including their village head, accepted with pleasure. Therefore, the research objective was to give environmental education especially about flash flood disaster mitigation in the research area, analyze environmental education material results especially about flash flood mitigation based on gender in the research area, and analyze environmental education material results, especially about flash flood mitigation based on educational strata in the research area.

2. Analysis (State) of The Problems

A disaster is a series of events that threatens and disturbs a community's life and livelihood caused by a natural, non-natural, or human factor, resulting in human fatalities, environmental damage, property losses, and psychological impacts. Indonesia is one of the most disaster-vulnerable countries in the world. Based on the various disasters found in Indonesia, one disaster that always threatens the community in Indonesia is flood. Indonesia is vulnerable to flood disasters because it

is located in a tropical area and is an archipelago country between two oceans. This leads to a high air humidity level, and, as a result, makes Indonesia have a high rainfall level. Furthermore, flood disasters will happen if a high rainfall level and bad environmental governance implementation occur. Based on the flood type, a flash flood is a flood type leading to many disasters or victims. A flash flood usually occurs because of high rainfall level, and their duration is shorter than an ordinary flood, especially when it happens on a mountain slope area. Baureno Village is a part of the Mojokerto Regency in East Java Province, Indonesia, with a high rainfall level. Furthmore, Baureno Village is located on Welirang and Anjasmoro Mountain slope. Baureno Village is located in a river-flowed valley. Therefore, physically Baureno Village has very high flash flood potential. Baureno Village is presented in Figure 2.

Fig. 2. Baureno Village
Source: Baureno Village official website [10]

The flash flood which occurred in Baureno Village only happened once in 2020. The source of the flash flood disaster problem in Baureno Village did not come from their environment but from outside. Fortunately, the Baureno Village community survived the disaster but they need environmental education to prevent or mitigate their need to be rescued from the flash flood disasters that always threaten them, and especially lack disaster mitigation knowledge. The environmental education implementation which contains flood disaster mitigation materials are expected to provide knowledge about the reasons for flooding, ways to overcome them or actions to be taken when a flood occurs, and any action taken afterwards.

Associated with knowledge provision, the educational strata can be used as a benchmark for improving human knowledge capacity. If it is low, the effort to improve human knowledge will encounter problems. The Baureno Village community educational strata condition is presented in the Table 3.

Table 3. The sample educational strata

No.	Education level	Total		Man		Woman	
		amount	percentage [%]	amount	percentage [%]	amount	percentage [%]
1	Junior high school	4	13.34	4	15.38	0	0.00
2	Senior high school	21	70.00	19	73.07	2	50.00
3	Bachelor	5	16.66	3	11.55	2	50.00
Total		30	100.00	26	100.00	4	100.00

Source: primary data processing result

Based on table above, the research samples of educational strata are 13.34% in junior high school, 70.00% in senior high school, and 16.66% bachelor's degree. Based on the respondents' information on flood disaster mitigation knowledge, they claimed that they had never received training, education, or socialization about flood disaster mitigation. Furthermore, according to respondents, the flash flood disaster in Baureno Village was the first time it had happened there. Therefore, the community needs environmental education on flash flood disaster mitigation materials so that they can mitigate the impact of any future disaster.

3. Material and Methods

The selected research design in this research was a one-group post-test design. The treatment in the experiment is by supplying environmental education to the Baureno Village community through contextual learning, especially by providing knowledge that their living environment was vulnerable to flash flood hazards. In detail, it consists of supplying knowledge before, during and after flash floods. The mitigation variables and instrument items used in this research for examination after environmental education implementation for flash flood disaster mitigation materials are presented in Table 4.

Environmental education implementation was done by giving a lecture, film playback, PowerPoint material playback via an LCD (liquid crystal display) projector, discussion, and a question-and-answer activity. The environmental education implementation for flash flood disaster mitigation was held on September 17th, 2020, in the Baureno Village meeting hall. It did not involve all of the Baureno Village community, but they were chosen by sampling. The sampling techniques used in this research were purposive random sampling or specific random sampling. The Baureno Village community that became samples in this research were 75 people.

They consisted of 8 village officials and 67 people from other community groups such as hamlet heads, village officials, environmental cadres, health cadres, and youth groups. The 67 people from other community groups represented 10% of the total population of Baureno Village community.

Table 4. Mitigation variables and items of environmental knowledge test instrument regarding flash flood mitigation material

No.	Disaster mitigation stage variables	Items of the environmental knowledge test instrument regarding flash flood mitigation materials
1	Knowledge before flash flood disaster	– Knowing the causes of flash flood – Knowing the flash flood disaster management cycle – Knowing the media that drives the flash flood – Knowing the main causes that the environment has a high potential for flash flood – Knowing the signs in the field that need to be watched out for in the event of a flash flood in their environment. – Knowing the main reasons that their environment is vulnerable to flash flood disaster
2	Knowledge about activities during a flash flood	– Knowing the main activities carried out during a flash flood – Knowing the priority scale of family members who need to be rescued/evacuated – Knowing the priority scale of the goods that are the main / first to be taken away – Knowing the priority scale of documents that need to be saved – Knowing the priority scale of types of food to be brought into the refugee camps – Knowing the priority scale of the target to report in the event of a flash flood
3	Knowing activities after flash flood	– Knowing non-physical activities after flash food – Knowing physical activities after flash flood – Knowing what to do in case of aftershocks in the village environment

Source: primary data processing

The research data was taken from the post-test results of the participants who participated in the environmental education implementation to learn about flash flood disaster mitigation. Then, this research used logistic regression statistical analysis to analyze the learning results based on gender and educational strata. The materials and tools for this research were an LCD projector, a flood animation movie, a laptop for presentations and activity step explanations, and test instruments.

This research had three environmental education activity steps: preparation, main activity, processing, analysis, and evaluation. The preparation environmental education step was preparing the socialization room, screening and socializing the information on preparation, and reading rules and regulations by participants.

The main environmental education activity was divided into three parts: screening, question and answer discussion, and post-test mitigation materials. The first part was screening and material explanation via an LCD projector. The second part was a question-and-answer activity led by the source person. The third part was explaining the test activity about disaster mitigation to the socialization participants. The test instrument form was a written test. The last environmental education activity step was analyzing environmental education activity for flood disaster mitigation materials through categorizing a range of test results in Table 5.

Table 5. Environmental education test evaluation result criteria on flash flood disaster mitigation material

No.	Range of test result	Category
1	>60 until 75	very high
2	45 until 60	high
3	30 until <45	low
4	<30	very low

Source: primary data processing results

The environmental education test results in the total range were determined by counting the correctly answered items. Every correct answer gave a score of 1. The number of the question items for every mitigation step was 25. If there were 3 mitigation steps (before the disaster, during the disaster, after the disaster), there were 75 question items. Because there were 75 question items, the maximum test score was 75, and the minimum was 0.

4. Results and Discussion

4.1. Results

After the environmental education implementation in disaster mitigation materials was conducted, it was determined that the test average value is 60.13, and the median value is 60. Based on the criteria score in Table 5, the environmental education implementation test value in flash flood disaster mitigation materials was higher than the average. In detail, the result is presented in the Table 6.

In detail, the environmental education test results about flash flood disaster mitigation were divided into three mitigation steps. They were before the flash flood occurred, when it occurred, and the last after it occurred, which is described based on gender and education level in Table 7.

Table 6. Environmental education test evaluation result criteria on flash flood disaster mitigation material

No.	Category	Amount	Percentage [%]
1	Very high	13	17.33
2	High	62	82.67
3	Low	0	0.00
4	Very low	0	0.00
Total		75	100.00

Source: primary data processing

Table 7. Environmental education test result on flash flood disaster mitigation material

No.	Mitigation step	Test score	Gender		Educational level		
			man	woman	junior high school	senior high school	graduate
1	Before flash flood	21.9	20.4	23.4	22.4	21.3	22.3
2	During flash flood	22.6	23.3	22.0	23.3	22.2	22.2
3	After flash flood	23.2	23.2	23.4	22.1	22.4	23.3
Total		67.7	66.9	68.8	67.8	67.9	67.8

Source: primary data processing results

As seen in Table 7, the highest to lowest scores of the participants of this environmental education based on the mitigation steps is as follows: before the flash flood (21.9), during the flash flood (22.6), and after the flash flood (23.2). Based on gender, the total score for all steps in the disaster mitigation materials in the women's group (68.8) was higher than that in the men's group (66.9). Finally, based on education level, the test score in senior high school (67.9) is higher than the one in junior high school (67.8) and graduate level (67.8). The correlation between gender and the test results, and the correlation between educational levels and the test results of environmental education are presented in Table 8.

Table 8. Environmental education data correlation result

No.	Correlation	Result
1	Gender with test result of mitigation material	0.02250235
2	Educational strata with test result of mitigation material	0.43522839

Source: primary data processing results

The research result in Table 8 indicated that the correlation between gender and environmental education test score was 0.02250235. The correlation between educational strata and environmental education test scores was 0.43522839. The statistical logistic correlation analysis score showed that the environmental education knowledge test score variable in disaster mitigation materials had a positive correlation with educational strata. It also showed that the environmental education knowledge test score variables in disaster mitigation materials were correlated with gender.

4.2. Discussion

The flash flood disaster mitigation materials provided results of environmental education before, during, and after the flash flood that are in the high category. This result is interesting because the Baureno Village community had no prior teaching, training, or similar activities. However, a flash flood disaster has been experienced by the Baureno Village community. The high average on flash flood disaster mitigation environmental education post-test results comes from the participants' education level. Although the Baureno Village community's education level is relatively low, the selected participants attending environmental education on average are at senior high school level and thus the participants' education level correlates with the test results.

Another element contributes to the environmental education test result, i.e., a given educational learning resource that comes from local environmental phenomena. This method is called contextual teaching and learning (CTL). According to Ria Claudia Welerubun et al. [11], CTL impacts students and results in score improvement in environmental contamination materials during pandemics. Thus, related to the environmental education experimental application, using CTL in flash flood disaster mitigation materials has an impact on the high post-test result. It can be generalized from the test result that if done in the same environment and same community conditions, the model in this research can be used as a reference in other research locations.

The purpose of environmental education is to develop a global population that is aware and cares about the environment and its related problems; and also has knowledge, skills, behavior, motivation, and commitment to work in groups or individually to solve recent environmental problems [12]. The purpose of grassroots

environmental education is to make individuals and the community as a whole understand complex behavior from both the natural and artificial environment. Environmental management knowledge and the role of environmental awareness synergize together [13]. Environmental knowledge also has an impact on environmentally friendly behavior [14]. Furthermore, one should obtain knowledge, value, behavior, and practical skills to participate responsibly and effectively in anticipating and solving social problems and environmental quality management. Therefore, we can conclude that environmental education is an environmental management approach based on the statement above.

Baureno Village community has recognized the natural signs if flash flood occurs in their environment. Therefore, it can become a beginning knowledge for them to deal with flash flood disaster based on their local culture. The environmental education understanding of post-test results in flash flood disaster mitigation materials was very high. This condition implied that if such a disaster occurred again, the Baureno Village community would be ready and would hope to reduce the relevant risks. The research results indicated that environmental education post-test results in disaster mitigation materials could reduce disaster risks. Areas that have never had a disaster before usually have relatively more victims when they occur [15]. This condition happens because there is no community experience and knowledge in facing a disaster. The first disaster experience can be used as a source of knowledge when facing the next one [16].

These research results are strengthened by Roman Hoffmann and Daniela Blecha's research in Southeast Asia, specifically Indonesia, Thailand, and the Philippines. Through education and learning, individuals can obtain the requisite knowledge, abilities, skills, and perceptions, which allow them to prepare effectively and overcome disaster shock consequences [17]. Indirectly, education can provide access to materials, information, and social sources for an individual and household, and help reduce disaster vulnerability. Mitigation is the most effective action to minimize disaster impacts [18]. The mitigation action consists of both structural and nonstructural mitigation. Structural mitigation are actions to reduce or avoid a probable physical impact of a disaster. At the same time, nonstructural mitigation is intended to reduce disaster risk through policies, knowledge development, regulation, and dangerous object security. So, based on the mitigation in this research conducted in Baureno Village, it was classified as nonstructural mitigation through socialization given in a knowledge development effort to prepare the community for when a flash flood disaster occurs in their environment in the future [19].

The interesting thing in this paper is on disaster mitigation material can be delivered by environmental education. The environmental education which has a disaster mitigation material has done by Awaliyah. According from Awaliyah, the community's knowledge on flood disaster mitigation was in medium category based on flood disaster mitigation knowledge, flood management aspect, facilities and infrastructure system aspect, and participation behavior aspect [5]. The community's knowledge

on disaster mitigation before flood occurred was in medium category, their knowledge on disaster mitigation when flood occurred was in medium category, and their knowledge on disaster mitigation after flood occurred was in high category. Penolih Village which become a research location by Awaliyah has a same characteristic with Bauerno Village which become a research location of this research. They are both rural areas, new to flood disasters, and experienced for the first time. There are similarities in the research which aim to measure flood mitigation starting before, during, and after a flood disaster occurs. However, the results are different in terms of the level of knowledge of the population at Baureno and Penoleh Village. The population of Baureno Village received training in this study, while the Penoleh Village had no such treatment. Thus, the results of the analysis show that environmental education plays a role in providing knowledge on flood disaster mitigation, especially for the population of rural areas experiencing flash flood disasters for the first time.

What is also interesting to discuss is the correlation between the participants' educational level and the results of the environmental education post-test because based on the level of education, it is hypothesized that it should be correlated with the level of knowledge. Based on the research results, it is known that there is a strong and positive correlation between the educational level of environmental education participants and the post-test results. This condition indicates that a high level of education of the participants leads to high post-test results. This condition occurred in the Baureno Village community, among those who had a senior high school or vocational school background, and their flash flood disaster mitigation test result was higher than the graduates of junior high school. The results of this study have similarities to that of Hartini, who conducted research in Salo Village, Kendari Regency. According to Hartini's research, it is known that the higher the level of educational background a person has, the higher the understanding and knowledge of disaster mitigation [20].

In disaster mitigation, gender also becomes an interesting issue. It is indicated in the research results that the post-test score in the female group was 68.8, and the male group was 66.69 which meant that women had higher disaster mitigation test results than men. This means that women in Baureno Village are strategically positioned to empower flash flood disaster mitigation. Based on these research results, women in Baureno Village could be more closely involved in flash flood disaster mitigation. Activities that seem particularly appropriate included post management, supplying first aid kits, operating shared kitchens, and post-disaster psychological recovery. However, women had a high vulnerability level on disaster because their capacity to face such disasters was still low and not comprehensive [21].

The variables behind the reasons for flash floods between one area to another are different. Therefore, the flash flood reason factors and elements in Baureno Village cannot be implemented in other areas [22]. The very high understanding of flash flood disaster mitigation for the Baureno Village community does not guarantee that they will avoid flash flood disasters in the subsequent years. The main cause of flash flooding in Baureno Village does not stem from its environment as it affects the river or

watershed area, not the village administration border. Therefore, handling flash flood disasters in Baureno Village needs a cross-sectoral, comprehensive, and integrated approach. Giving an assertive sanction for someone who violated the law intentionally or unintentionally, and constructing a collaboration between community and government for preserving nature and growing a self-awareness for preserving nature are one example of a cross-sectoral, comprehensive, and integrated approach [23].

5. Conclusion and Reference

5.1. Conclusion

The research results indicate that the flood disaster mitigation knowledge test results score is 67.85 (range 0–75), which is good. It can be concluded that the environmental education with flood disaster mitigation materials was successful. Therefore, the environmental education test can give knowledge to the community so that they can avoid a flood disaster if it occurs in their environment someday.

Based on the variable selection which focuses on educational strata and gender with environmental education test score correlation with mitigation materials, it can be concluded that the variable which has a higher correlation with environmental education test score is educational strata, namely 0.43522839 in correlation score. This was higher than the correlation between environmental education test score and gender which was 0.02250235. Therefore, it can be concluded that educational strata is more influential than gender in environmental education test score through mitigation materials.

Although the correlation between gender and environmental education test score through mitigation materials is low, the environmental education test score based on gender has a relatively significant difference. It was discovered that the flood disaster mitigation test on the female group was 68.8 which is higher than flood disaster mitigation test in the male group. The flood disaster mitigation test on the male group was 66.9. It can be concluded that the potential female role in flood disaster mitigation cannot be ignored.

Reference

[1] Badan Nasional Penanggulangan Bencana (BNPB): *Kejadian Per Provinsi Tahun 2022*. Geoportal Data Bencana Indonesia. https://gis.bnpb.go.id/ [access: 19.02.2022].

[2] Murdiyanto, Gutomo T.: *Bencana Alam Banjir dan Tanah Longsor dan Upaya Masyarakat dalam Penanggulangan* [*Flood and Landslide Natural Disasters and Its People Prevention Effort*]. Jurnal Penelitian Kesejahteraan Sosial, vol. 14, no. 4, 2017, pp. 437–452.

[3] Azizah M., Khoirudin Apriadi R., Tri Januarti R., Winugroho T., Yulianto S., Kurniawan W., Dewa Ketut Kerta Widana I.: *Kajian Risiko Bencana Berdasarkan Jumlah Kejadian dan Dampak Bencana di Indonesia Periode Tahun 2010–2020* [*Study of the Disaster Hazard Risk Based on the Disaster Events and the Impact in Indonesia for the 2010–2020 Period*]. PENDIPA Journal of Science Education, vol. 6, no. 1, 2021, pp. 35–40. https://doi.org/10.33369/pendipa.6.1.35-40.

[4] Wigati R., Maddeppungeng A., Pratiwi B.D.: *Kajian Alternatif Penanggulangan Banjir (Studi Kasus DAS Ciujung Bagian Hulu, Banten)*. Konstruksia, vol. 8, no. 2, 2017, pp. 9–22.

[5] Awaliyah N., Sarjanti E., Suwarno: *Pengetahuan Masyarakat dalam Mitigasi Bencana Banjir di Desa Penolih Kecamatan Kaligondang Kabupaten Purbalingga*. Geo Edukasi, vol. 3, no. 2, 2014, pp. 92–95.

[6] Riyandari R.: *'Water Front City' Mitigasi Bencana Banjir Di Kelurahan Dendengan Luar, Kota Manado* [*Waterfront City Disaster Mitigation of Flood in Dendengan Luar Village, Manado City*]. Jurnal Sains dan Teknologi Mitigasi Bencana, vol. 13, no. 1, Juni 2018, pp. 57–64. https://doi.org/10.29122/jstmb.v13i1.3361.

[7] Sanit M.S., Poerwati T., Hamidah A.*: Strategi Mitigasi Bencana Banjir Bandang Berdasarkan Nilai Ketangguhan di Kabupaten Malaka, Nusa Tenggara Timur*. Jurnal Program Studi Perencanaan Wilayah dan Kota Institut Teknologi Nasional Malang, 2018, pp. 1–13.

[8] Pemerintah Republik Indonesia: *Undang-Undang Republik Indonesia Nomor 23 Tahun 1997 tentang Pengelolaan Lingkungan Hidup*. Lembaran-Negara Republik Indonesia, no. 23, 1997. http://ciptakarya.pu.go.id/dok/hukum/uu/uu_23_1997.pdf [access: 17.09.2022].

[9] Tukino, Mariany A., Koesuma S.: *Panduan Pembentukan Pusat Studi Bencana di Perguruan Tinggi.* Forum Perguruan Tinggi untuk Pengurangan Risiko Bencana, Bandung 2019.

[10] Desa Baureno official website: *Profil Desa*. 2013. https://www.baureno.desa.id/artikel/2013/7/29/profil-desa [access: 20.02.2022].

[11] Welerubun R.C., Wambrauw H.L., Jeni J., Wolo D., Damopolii I.: *Contextual Teaching and Learning in Learning Environmental Pollution: The Effect on Student Learning Outcomes*. Prima Magistra: Jurnal Ilmiah Kependidikan, vol. 3, no. 1, 2022, pp. 106–115. https://doi.org/10.37478/jpm.v3i1.1487.

[12] UNESCO: *The Belgrade Charter*. 1975. https://eric.ed.gov/?id=ED179406 [access 17.09.2022].

[13] Permatasari R., Suarsini E., Maslikah S.I.: *Pengaruh pengetahuan pengelolaan lingkungan hidup dan kesadaran lingkungan terhadap partisipasi siswa SMA Negeri di Kota Malang*. Jurnal MIPA dan Pembelajarannya, vol. 1, no. 1, 2021, pp. 25–32. https://doi.org/10.17977/um067v1i1p25-32.

[14] Nastuti R., Lelfita: *Hubungan Pengetahuan Lingkungan terhadap Perilaku Ramah Lingkungan Mahasiswa STKIP YDB*. Jurnal Kepemimpinan dan Pengurusan Sekolah, vol. 5, no. 2, 2020, pp. 155–162. https://doi.org/10.34125/kp.v5i2.541.

[15] Havwina T., Maryani E., Nandi: *Pengaruh Pengalaman Bencana terhadap Kesiapsiagaan Peserta Didik dalam Menghadapi Ancaman Gempabumi dan Tsunami (Studi kasus pada SMA Negeri Siaga Bencana Kota Banda Aceh)*. Gea: Jurnal Pendidikan Geografi, vol. 16, no. 2, 2016, pp. 124–131. https://doi.org/10.17509/gea.v16i2.4041.

[16] Makahaghi Y.B., Surudani C.J.: *Pengalaman Keluarga Menghadapi Trauma Pasca Bencana Alam Di Kampung Lebo Kecamatan Manganitu* [*Family Experience to Face Trauma after Natural Disaster in Lebo Village Manganitu District*]. Jurnal Ilmiah Sesebanua, vol. 5, no. 1, 2021, pp. 23–30. https://doi.org/10.54484/jis.v5i1.367.

[17] Hoffmann R., Blecha D.: *Education and Disaster Vulnerability in Southeast Asia: Evidence and Policy Implications*. Sustainability, vol. 12, no. 4, 2020, 1401. https://doi.org/10.3390/su12041401.

[18] Dewi E.L.: *Mitigasi Bencana Banjir di Kelurahan Nusukan Kecamatan Banjarsari Kota Surakarta*. Universitas Muhammadiyah Surakarta, 2014.

[19] Dewi I.K., Istiadi Y.: *Mitigasi Bencana pada Masyarakat Tradisional dalam Menghadapi Perubahan Iklim di Kampung Naga Kecamatan Salawu Kabpuaten Tasikmalaya* [*Disaster Mitigation on Traditional Community Against Climate Change in Kampong Naga Subdistrict Salawu Tasikmalaya*]. Jurnal Manusia dan Lingkungan, vol. 23, no. 1, 2016, pp. 129–135. https://doi.org/10.22146/jml.18782.

[20] Hartini: *Hubungan Tingkat Pendidikan dengan Pengetahuan Masyarakat tentang Mitigasi Bencana Banjir di Kampung Selo Kabupaten Kendari*. Jurnal Penelitian Pendidikan Geografi, vol. 3, no. 2, 2018, pp. 194–202, https://doi.org/10.36709/jppg.v3i2.9163.

[21] Nastiti N.N., Firawati T., Prabandari E.H.A.: *Pengarusutamaan Gender dalam Sistem Penanggulangan Bencana di Indonesia : Studi Kasus Analisis Implementasi Renstra BPBD Kabupaten Sleman di Desa Kepuharjo Kecamatan Cangkringan*. Dinamika Global, vol. 01, no. 1, 2016, pp. 43–70.

[22] Ka'u A.A., Takumansang E.D., Sembel A.: *Analisis Tingkat Kerawanana Banjir di Kecamatan Sangtombolang Kabupaten Bolaang Mongondow*. SPASIAL: Perencanaan Wilayah dan Kota, vol. 8, no. 3, 2021, pp. 291–302.

[23] Sholihah Q., Kuncoro W., Wahyuni S., Suwandi S.P., Feditasari E.D.: *The Analysis of the Causes of Flood Disasters and Their Impacts in the Perspective of Environmental Law*. IOP Conference Series: Earth and Environmental Science, vol. 437, 2020, 012056. https://doi.org/10.1088/1755-1315/437/1/012056.