Bubungan Tinggi: Jurnal Pengabdian Masyarakat
http://ppjp.ulm.ac.id/journals/index.php/btj/index
ISSN: 2722-3043 (online) ISSN: 2722-2934 (print)
Vol 4 No 4 2022
Hal 1280-1289

The Collaboration between the Lecturer's Community Service and Student's Community Service for Disaster-Resilient in Pondok Aren District, South Tangerang, Indonesia

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Abstract: This study investigated the effectiveness of the collaboration program between the Lecturer's Community Service (PKM) and Student's Community Service (KKN) of the State College of Meteorology Climatology and Geophysics (STMKG) for disaster-resilient in Pondok Aren District, South Tangerang, Indonesia. Community participatory methods have been applied during this program which elaborates the role of lecturers, students and the community in enhancing the disaster awareness community. Some activities have been done during this program, such as providing the spatial information maps, designing the earthquake's evacuation route, planting the bio pure absorption hole technology (LRB), installing the Automatic Rain Gauge (ARG), counselling to school and Forum Group Discussion (FGD). As the result, Pondok Aren district appreciated STMKG, which has chosen their office as the target of program. The improving knowledge about the disaster vulnerability in Pondok Aren district has formed during the program which the pre- and post-questioners of FGD can evaluate. The collaboration-community service program proved more effective in activities, funding and time consumption than the conventional program. Furthermore, the causes of floods disaster in the Pondok Aren district also can be listed during this program.

Keywords: FGD; Disaster; KKN; PKM; Pondok Aren; STMKG

***Received*:** 12 September 2022 ***Accepted*:** 22 November ***Published*:** 30 November 2022
DOI : https://doi.org/10.20527/btjpm.v4i4.6371

***How to cite*:** Darmawan, Y., Sagita, N., Suharni, S., & Gustono, S.T. (2022). The collaboration between the lecturer's community service and student's community service for disaster-resilient in pondok aren district, south tangerang, indonesia. *Bubungan Tinggi: Jurnal Pengabdian Masyarakat*, 4(4), 1280-1289.

INTRODUCTIONS

Pondok Aren District is one of the districts located in South Tangerang City, Banten Province. The total area is about 2,975.99 Ha, with an elevation of 29 meters above sea level (BPS, 2022). Pondok Aren district has a strategic location close to the Soekarno-Hatta Airport and adjacent to Pesanggrahan District, which is part of DKI Jakarta. Accessibility to the centre of DKI Jakarta and the lower price of properties are two keys to the increasing population in Pondok Aren. Badan Pusat Statistik (BPS) recorded that the population of Pondok Aren District has increased from 8.715 km^2 (2010) to 13.889 km^2 (2020) (BPS, 2022).

Currently, disasters often occur worldwide due to the impact of climate change (IPCC, 2007). Furthermore, Geo-Hydro-meteorological disasters are a new term commonly used to describe the complexity between geologic and Hydro-meteorological disasters (BMKG, 2022; Darmawan, Hsu, & Yu, 2021). In terms

of geological and hazard disasters, these disasters are caused mainly by volcanic eruptions, avalanches, natural explosions, earthquakes, and landslides. Furthermore, Hydro-meteorological disasters relate to extreme weather and meteorological and climate phenomena (i.e. flooding, hurricanes, drought, and tornado) (Darmawan et al., 2021; Wu, Huang, Tang, Kirschbaum, & Ward, 2016). *Badan Nasional Penanggulangan Bencana* (BNPB) noted that four districts have a higher hazard vulnerability in flooding disasters: Pamulang District, Pondok Aren District, Setu District and Serpong District.

According to the information from the local expert, flood disasters in Pondok Aren District frequently occur when extreme rainfall comes over several hours. The flooding appears in some places in Pondok Aren, such as Wadasari Village, Jurang Mangu Permai, and Pondok Safari. Overall, the height of floods is from 50 to 100 cm. Water will continuously disappear about 1-2 hours after the rainfall. Even though the floods have been steady over the years, the community and local government did not make significant efforts to reduce the hazard vulnerability of flooding in those places.

In the concept of adaptation and mitigation of disasters, there are 3 (three) concepts which have to be improved to reduce the impact of disasters Disaster risk reduction (DRR), resilience and community (Twigg, 2007). In principle, DRR can be used to identify, assess and reduce the degree of risk caused by disasters (Twigg, 2007). DRR's objective is to avoid the impact of disasters related to the socio-economic exposures and hazards as similar as an agreement to the environmental factors and other vulnerabilities that cause them. In conclusion, DRR only be established by improving community awareness about the disaster vulnerability around their regions (Karanci, Aksit, & Dirik, 2005).

In other words, the term resilience refers to giving more attention and emphasis to how the communities can do something useful for themselves. Furthermore, it focuses on enhancing their capacities rather than considering their exposure to disaster or their requirements during an emergency. Based on the fieldwork and discussion with the local government, most of the villagers in Pondok Aren have weak attention to the disaster hazard around their regions. In the Pondok Aren District office, the Standard of Operation (SoP) for disaster mitigation and adaptation cannot relate to geo-hydrometeorology disasters. In addition to the SoP, they need preparation equipment for Disaster Risk Reduction (DRR). They need more knowledge and technology to enhance the disaster-resilient community due to the lack of human resources and funding from the government.

Since the State College of Meteorology Climatology and Geophysics (STMKG) is located in Pondok Aren District, STMKG has arranged the collaboration between the students and lecturer is at community service (namely: KKN and PKM, respectively), which focused on the disaster-resilient in Pondok Aren District. Collaboration between students and lecturers was identified as one of the effective methods of the community service approach (Zalyaeva & Solodkova, 2014). The collaboration can elaborate on the idea of both students and lecturers (Zalyaeva & Solodkova, 2014). Participatory Action Research (PAR) has been applied during the collaboration-community service program (Kelman, Lewis, Gaillard, & Mercer, 2011). In the community service program, there was a collaboration among the students, lecturers and community where the community actively participated in the programs (Baum, MacDougall, & Smith,

2006). As the target, this community service program was focused on the community around the Pondok Aren district, especially Pondok Aren district officers, some heads of sub-district and staff.

Based on the collaboration program, this paper describes the whole process from the preparation to the evaluation stages. Overall, this study aims to investigate the effectiveness of the collaboration program between the Lecturer's Community Service (PKM) and Student's Community Service (KKN) for disaster-resilient in Pondok Aren district, South Tangerang, Indonesia.

METHODS

The collaboration program has done from 18 July 2022 to 12 August 2022 in Pondok Aren District, South Tangerang, Banten. The target of the participant is the officers in the central Pondok Aren district and the head of the sub-districts officers in the Pondok Aren district. The schematic flow of the program can be found in Figure 1.

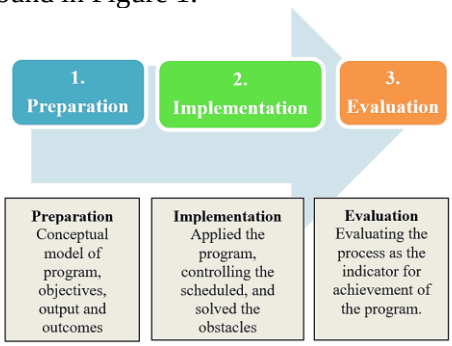

Figure 1 Problems and Output Identification by A Discussion with The Pondok Aren Officers

Basically, this collaboration-community service program is divided into three steps:

Preparation

For preparation steps, it included all the members of, students and lecturers. As the team, it consists of 19 (nineteen) students and 4 (four) lecturers. In the coordination meeting, the achievement has targeted for four weeks of schedule (Table 1). Identify the community's problems through interviews and dialogue with the local government officer (Figure 2). These crucial parts aim to ensure that our output benefits the community. Arranging for the schedule and letter of permission from the Pondok Aren district. They supported this program by preparing a working space for us.

Figure 2 Problems and Output Identification by Discussion with The Pondok Aren Officers

Implementation

The implementation of this program can be found in the Tabel 1.

Table 1 Schedule for The Program

No.	Activities	Week			
		1	2	3	4
1.	Providing the spatial map.				
2.	Earthquake's evacuation route				
3.	Biopore absorption hole technology (LRB)				
4.	Installation of Automatic Rain Gauge (ARG).				
5.	STMKG goes to School				
6.	Forum Group Discussions (FGD).				

Evaluation

As the last stage in the program, the evaluation of the program can be shown by some indicators such as: The program's outputs can be achieved and finished for the community. The outcomes of the program have reached which evaluated during the FGD. The pre-FGD and post-FGD questionnaires have been prepared and filled during the FGD. The questionnaire was filled by the participants of FGD, which represents the community in Pondok Aren Districts.

The outputs refer to the products given to the community after the program. Some outputs which planned to finish such as: Maps, Earthquake's Evacuation route map, Biopore absorption hole technology (LRB), Prototype Automatic Rain Gauge (ARG). The program's outcome was to enhance the community disaster-resilient in the Pondok Aren district. Questioners have used a quantitative approach as an indicator during FGD. FGD has attended the officers from Pondok Aren district and sub-district. The participant has filled Pre-FGD and Post-FDG to evaluate the effectiveness of the programs. FGD was held on 10 August 2022 as the community service program's final activities and 'unboxing' products.

RESULTS AND DISCUSSIONS

In the program implementation, some activities were applied during the community service. In this section, the program's implementation will be explained in more detail.

Maps

Spatial information is a crucial part of giving spatial information and detailed location for many applications that are possible to access by some typical software (word and spreadsheets processing, Web application, GIS desktop and GIS server databases) (Wallace, Williamson, Rajabifard, & Bennett, 2006). In the preparation steps, there needed to be more spatial information related to the Pondok Aren district. There were some spatial maps. However, the domain of the map is only for the Tangerang Selatan regency. In supporting the operation of Pondok Aren, the spatial maps need to be prepared as the baseline for decision support.

In addition to the administrative map, there were five maps left: elevation map, vegetation cover map, geological map, seismicity map and rainfall distribution map. The map has been given to the Pondok Aren district office in softcopy and printed out of the maps. The printed maps have been framed and displayed strategically in the Pondok Aren office. Based on the officer's response, they appreciated all the maps and asked for all the scratch datasets of maps for future improvement. One example of a map is an "*Peta Seismisitas*" (Seismicity map) which can describe the spatial profile and detailed location of the earthquake and fault at Pondok Aren district. The seismicity map includes the earthquake and faults. The map can be seen in Figure 3.

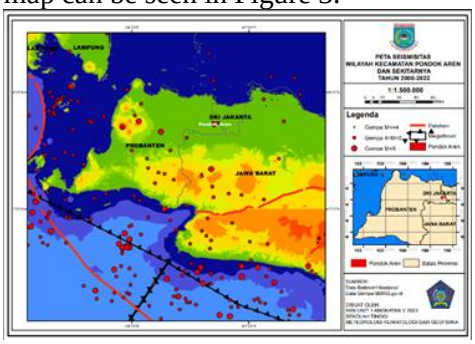

Figure 3 An example of Output Program is The Seismicity Maps For Pondok Aren District (Source Of Data : BMKG And BIG)

Earthquake's Evacuation route map

The evacuation route is one of the requirements for community disaster awareness. For both predictable and unpredictable events, the place for temporal sheltering based on disaster management can differ depending on the disaster context (Naghdi, Mansourian, Valadanzoej, & Saadatseresht, 2008).

For an unexpected disaster like an earthquake, sheltering injured people will be a significant issue post-disaster. In this situation, temporal sheltering for injured people should be known for rescue operations. For predictable disasters like floods, sheltering people can be described during preparation. In other words, an evacuation route can reduce the risk of earthquake disaster for the people in the building (Naghdi et al., 2008).

The students designed 2 (two) evacuation routes for the Pondok Aren district office. The first building was the main one used for operational service. The second building is the meeting room. For the first building, Figure 4 shows the evacuation route for the earthquake disaster at the main building. After designing the route, the students displayed and set up the sign to guide the people in the building to evacuate can be seen in Figure 4.

Figure 4 Installation of Earthquake's Evacuation Sign at Pondok Aren District Office

Biopore absorption hole (LSB)

Biopore absorption hole technology (LRB) can speed up water absorption using organic waste (Simanjuntak, Setiyadi, Mulyani, & Hutabarat, 2021). In practice, LRB is a cylindrical hole of 10 cm in diameter and a depth of about 100 cm from the surface to the soil. It is filled with organic waste as the primary accelerator for water absorption. Instead of improving the soil ecosystems, LRB can be used to prevent floods (Simanjuntak et al., 2021). The soil can be seen in Figure 5.

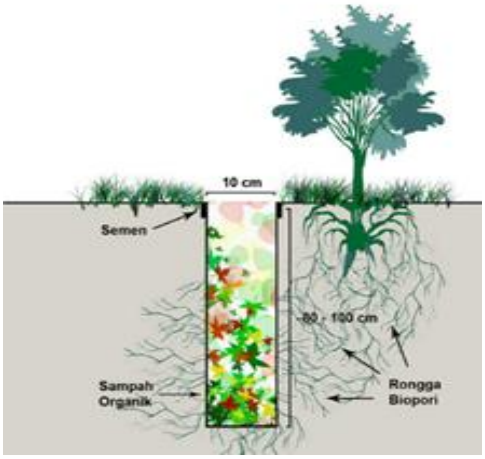

Figure 5 Design of LSB

There were ten (10) numbers of the Biopore planted around the locations. The criteria for establishing a biopore is the bare soils (open space) that puddle/ponds after the rain. The biopore expected can absorb the water and reduce the puddle. LSB was buried in the target area can be seen in Figure 6.

Figure 6 Planting the LSB in Pondok Aren district office

Automatic Rain Gauge (ARG)

Automatic Rain Gauge (ARG) is usually used to monitor a region's rainfall intensity (Arifin & Rahadian, 2017). ARG operated based on the microcontroller as a processing unit and embedded system (a stand-alone system). Prototype Automatic Rain Gauge (ARG) was installed for monitoring the rainfall in location due to the floods hazard in the Pondok Aren district. The ARG can record the rainfall per minute and display it on the monitor (Figure 7). The ARG is installed in the back of the Pondok Aren district office meeting room. ARG works using electricity, and it needs an internet connection to share the data to the smartphone or pc.

Figure 7 Output Display of ARG

STMKG goes to school

Education about disasters is not only for adults but also should be done for children. Then, this program also did the counselling time for the student in Elementary School and Senior High School. At this time, we choose Elementary School Islam Amelia and SMAN 11 Tangerang Selatan as the place for our activities. The students in those schools were pleased and curious to listen to our explanation. We focused our presentation on the disaster around their region. Figure 8 shows the activity during the class. All the students look curious and interested in getting information about disasters around their regions. As documentation, we took a picture together after the class can be seen in Figure 8.

Figure 8 STMKG goes to school

Forum Group Discussion (FGD)

Forum Group Discussions (FGD) is the peak of all the community service programs in Pondok Aren district. FGD was held on August 10th, 2022, and invited 40 participants from 11 (eleven) sub-district officers in the Pondok Aren district. The discussion method used was a group of experts. It means that all the participations have a role as the experts and the lecturer is the moderator for handling the discussions (Kelman et al., 2011). Documentation can be seen in Figure 9.

Figure 9 Opening Ceremony of FGD

In the FGD, there are three topics discussed with the participant. The first topic was the Hydrometeorological disasters in the Pondok Aren district. The second topic was related to the geology disasters in the Pondok Aren district. The last topic was the instrumentation support in BMKG, as seen in Figure 10.

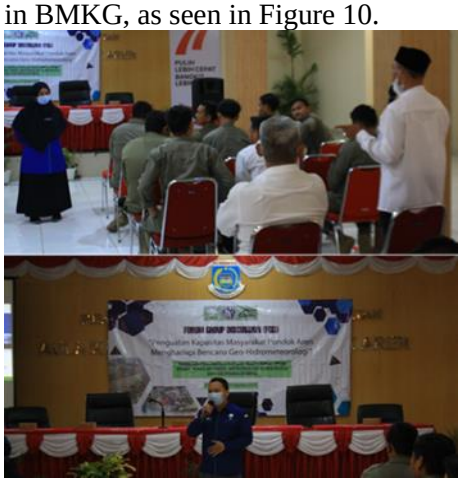

Figure 10 Discussion by the Lecturers

Between those sections, the students also presented their outputs (products) during this program. After the discussion, the participant also went to the field to learn about ARG instruments (Figure 11). The students actively explained the instruments. Collaboration between lecturers and students proved to encourage the students to be more active and confident in guiding the discussions.

Figure 11 Discussion by the Students

For evaluation of the program, a questionnaire has given to the participants before and after the program. The questions for the pre-FGD and post-FGD are similar, so the program's effectiveness can be evaluated by the quantitative approach. Here is the list of questions for the questionnaire can be seen in Table 2.

Table 2 The List of Quetion

No.	Question
1	**The general understanding concept of disasters.**
	a. Do you know the causes of geo-Hydrometeorological disasters?
	b. Do you understand the definition of geo-Hydrometeorological disaster?
	c. Do you understand areas that are prone to geo-Hydrometeorological disasters around you
	d. Do you understand the concept of disaster adaptation and mitigation?
	e. Do you know what actions to take “before, during, or after” a disaster?
2	**The understanding of disaster institution: BMKG.**
	a. Do you understand the duties and functions of BMKG?
	b. Have you ever asked for information/collaborated with BMKG related to a disaster?
	c. Do you know what information BMKG can provide?
	d. Do you know how to get BMKG information?
	e. Do you understand how BMKG can produce disaster information?
3	**Understanding of disaster in Pondok Aren.**
	a. Do you understand the factors that support the occurrence of Hydrometeorological disasters such as floods in Pondok Aren District?

b. Do you understand the potential for geological disasters such as earthquakes in Pondok Aren District?
c. Do you understand how to reduce vulnerability to floods in Pondok Aren District?
d. Do you know the principles for making disaster evacuation routes, such as earthquake?
e. Do you understand how to use the information from BMKG related to disasters in Pondok Aren District?
f. Do you understand how rainfall monitoring works?
g. Do you understand how to carry out regular maintenance for rainfall monitoring tools?
h. Do you understand how to use of rainfall information from ARG in Pondok Aren District

Where the ***Q*** represents the questions, ***Pr*** is Pre-FGD or before the FGD (white column), and ***Po*** is Post-FGD or after the FGD (grey column). The result of questioner can be found in the table below. The questionnaires filled by 40 participants in before and after FGD so that the outcomes of FGD can be evaluated quantitatively. The Result can be seen in Table 3.

Table 3 Questioner's Result of FGD

Q	Very Poor		Poor		Mod		Good		Very Good	
	Pr	*Po*	*Pr*	*Po*	*Pr*	*Po*	*Pr*	*Po*	*Pr*	*Po*
I. Understanding general concept of disasters										
a	6	0	12	2	12	24	10	6	0	4
b	6	0	15	4	9	16	10	12	0	8
c	6	0	12	4	12	20	10	8	0	8
d	3	0	24	4	6	12	7	12	0	12
e	3	0	12	4	12	12	10	16	3	8
II.Understanding of disaster institution : BMKG										
a	0	0	3	0	24	20	7	20	6	0
b	6	0	18	8	9	12	4	20	3	0
c	0	0	3	0	21	24	10	8	6	8
d	3	0	9	0	12	24	10	8	6	8
e	3	0	3	4	24	20	7	8	3	8
III.Disaster vulnerabilities in Pondok Aren district										
a	0	0	12	0	18	24	10	16	0	0
b	3	0	15	4	15	12	7	24	0	0
c	3	0	15	4	15	16	4	20	3	0
d	0	0	15	0	21	20	4	12	0	4
e	0	0	12	0	12	16	16	24	0	0
f	3	0	27	0	3	16	7	20	0	4
g	6	0	21	0	9	20	4	16	0	4
h	6	0	24	0	6	16	4	20	0	4

Based on the questionnaire results, the knowledge of the community was enhanced about the three issues mentioned. At the beginning of FGD, most participants on the scale from "very poor" to "Moderate" understand the

general concept of disasters. Surprisingly, there was an improvement in knowledge about disaster concepts after FGD, where most participants increased the scale from "Moderate" to "Very Good" understanding of the disasters. This pattern also can be found in other issues. In the composition of participants, the education level of participants was senior high school (52 %). For gender, around 95 % of participants were male. Overall, the discussion was active and productive. The participants gave us some ideas based on their experiences as field experts about the causes of floods in the Pondok Aren district. The most factors which causes the floods at Pondok Aren are unconnected and bad management of drainage facilities, especially around the residences. When the rainfall increase, the drainage cannot accommodate all the water and triggers run-off as floods (Husein, Tjahjono, & Nurwajedi, 2017).

CONCLUSIONS

Based on the interviews with the Pondok Aren district officer and community, the community service STMKG was accepted and successfully gave some benefits for the Pondok Aren district office. Questioner during the FGD also shows the improvement of knowledge about the disasters, which supports the community disaster-resilient in Pondok Aren district. The collaboration program between lecturers and students proved effective regarding funding and time. It can save financing because there is budget sharing between lecturers and students to cover all the activities. In terms of student capacity, this program was robust to gain the confidence and creativity of students. They can directly discuss with the lecturers during the program. Communication between the lecturers and students was more often than in the conventional community service program.

According to the information from the participants of FGD, the flood disaster in Pondok Aren district is mainly caused by the ineffective drainage systems in some housing areas because the property developers do not pay more attention to the flood hazard when extreme rainfall comes. The people's bad habits support shallow drainage systems and rivers. Many people throw garbage into the drainage system. The local government needs to be aware of reducing water catchment areas in the Pondok Aren district. Vegetation cover maps show that most of Pondok Aren district is covered by buildings and urban regions.

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