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Students' Environmental Attitudes and Pro-Environmental Behavior in Engineering Faculty: An Analysis to Develop a DIFMOL Model

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Abstract- Environmental education for university level, especially in Engineering faculty, is an important issue. One of environmental issue that becomes a concern is related to flood disaster mitigation. The purpose of this study is to describe environmental attitudes (EA) and Pro-Environmental Behavior (PEB) among Engineering faculty students. The description will be used to develop a Disaster Mitigation of Flood based onOnline Learning (DIFMOL) model. The research method used is a descriptive survey technique. Instrumentsare distributed online using Google form with a sample size of 139 students taken using simple random sampling. The results show that the students' EA scores are in a very high category (89.68) and the students' PEB are in a moderate category (60.53). It indicates that the Engineering faculty students still require an educational model development to cope with flooding. One that can be developed is a DIFMOL model. In general, aspects need to be emphasized in the DIFMOL model are those related to flood disaster mitigation efforts in urban areas. The study concludes that EA is very high and PEB is still in the medium category. The DIFMOL model innovation requires further development in the next research.

Keywords: DIFMOL, Engineering Faculty, Environmental Attitude, Pro-Environmental Behavior

I. INTRODUCTION

21st-century environmental education triggers the need for technology-based learning. Technology-based learning creates innovations in various learning devices and media. It needs to be developed because educational innovation functions to improve various competencies and community behavior. One thing that needs to be implemented after learning using technology-based learning is Environmental Attitude (EA) that students must acquire (Buchanan & Mathews, 2013; Ogunbode & Arnold, 2012; Sigit et al., 2020; Sugandini et al., 2018). In addition, it also needs to be further developed in the form of Pro-Environmental Behavior (PEB) which is a behavior to protect the environment(Ahmad & Nordin, 2014; Digby, 2013).

Students, in this regard, require EA and PEB to overcome various environmental problems that occur. Technology-based education is needed to promote a variety of human knowledge and behavior. It is due to the technology-based education facilities that facilitate the delivery of various messages to the community. The message can be conveyed through social media and other information technology means (Miarsyah, Rusdi, et al., 2019; Saltan & Divarci, 2017; Sigit, Azrai, Heryanti, et al., 2019; Zhou et al., 2017). It will require technology-based educational model development to facilitate this. This education model should focus on one environmental problem.In this case, flood problem can be raised for further study.

One of the educational models that can be developed is Disaster Mitigation of Flood based on Online Learning (DIFMOL) model in the 21st century(Rahmayanti et al., 2020). The model development is a necessity for, among others, groups of Engineering faculty students. Engineering students play a role in

building various environmentally-friendly buildings. Therefore,it is necessary to measure EA and PEB of the Engineering students and describe their various attitudes and behaviors. It aims to depict the DIFMOL model for environmental education in the Engineering faculty.

Previous research has been carried outregarding various profiles of environmental knowledge, attitudes, and behavior(Azrai et al., 2019; Ichsan et al., 2019; Ichsan & Rahmayanti, 2020; Sigit et al., 2020). This description also forms a basis for developing various learning tools and media. Moreover, a description of the DIFMOL model has been carried out on students in general(Rahmayanti et al., 2020). However, it has not been done on Engineering student group. The EA and PEB measurements for Engineering students is thus necessary to analyze the suitability of the DIFMOL for Engineering faculty students. The purpose is for Engineering students to have EA and PEB that can be improved related to flood disaster mitigation efforts. Based on the aforementioned, it is necessary to do a study to describe the EA and PEB of Engineering students in overcoming floods. The purpose of this study was to describe the EA and PEB of engineering students.

II. METHOD

The study used a descriptive method with a survey technique approach. The study was conducted in July 2020. The samples involved were 139 respondents. The instruments used in the study were EA and PEB instruments related to contextual daily life (Sigit et al., 2020). Indicators made in the EA instrument consisted of10 items. The research instrumentswere distributed online using Google Form. The EA indicators are described in Table 1.

Table 1. EA instrument indicators for engineering faculty students

No	Indicator	Item
1	Support river widening/normalization efforts to accommodate more water	1,2
2	Invite the community to improve drainage channels	3,4
3	Perform flood prevention efforts by continuously monitoring the water level	5,6
4	Support flood prevention efforts during COVID-19	7,8
5	Clean the environment regularly according to health protocols to avoid flooding and in turn, the COVID-19	9,10

As for the indicators of the PEB instrument, theywere prepared with a contextual situation regarding flood during the COVID-19 pandemic. In more detail, the indicators of the PEB instrument are indicated in Table 2.

Table 2. Indicators of PEB instrument for engineering faculty students

No	Indicator	
1	Clean waterways to avoid floods and Covid-19	1,2
2	Keep the environment clean by disposing garbage to its place to prevent flooding and the spread of Covid-19	3,4
3	Carry out a recycling process to minimize waste to avoid flooding	5,6
4	Advice the community to protect the environment to avoid flooding	7,8
5	Invite other fellow students to participate in campaigning for flood prevention	9,10

Data analysis used in the research was descriptive analysis using Microsoft Excel and SPSS. The scores analyzed were for each instrument item and each indicator. The analysis aimed to observe the score of each indicator and item in more detail. After the analysis completed, the categorization will be carried out according to the categories as presented in Table 3.

Table 3. Categories of PEB students

Category	Interval Score
Very High	$X > 81,28$
High	$70,64 < X \leq 81,28$
Moderate	$49,36 < X \leq 70,64$
Low	$38,72 < X \leq 49,36$
Very low	$X \leq 38,72$

Source: Category and score intervals adapted from Sigit et al (2020)

III. RESULT AND DISCUSSION

The results showed that the EA score of the Engineering faculty students was already in the very high category. It indicated that Engineering students as a whole had an understandingon the impacts and dangers of floods. Score with the lowest item was in item 5, which is monitoring the water level in the river upstream.

Table 4. The average score for each item of the EA instrument

No	Item	Average
1	River widening/normalization should be carried out to accommodate more water	4.31
2	The community must participate in helping the government to realize the river widening/normalization program	4.37
3	Fellow communities should remind each other to work together to clean waterways to prevent flooding	4.83
4	People who do not want to participate in preventing flooding by cleaning drainage channels should be given sanctions	4.18
5	The community should monitor the water level upstream of the river to overcome flooding	3.90
6	It is necessary to develop an application to be able to quickly and precisely monitor water levels	4.60
7	Flood disasters must be anticipated, especially during the Covid-19 outbreak, because it will increase the risk of transmission	4.70
8	Unanticipated floods will worsen the situation of the community during the Covid-19 outbreak	4.69
9	To avoid flooding, cleaning efforts must be conducted thoroughly in the environment and certainly using safety gears to avoid Covid-19	4.57
10	Environmental cleanliness is necessary as an effort to prevent flooding to prevent the spread of Covid-19	4.69
	Raw Score	44.84
	Average score (interval 0-100)	89.68
	Category	Very high

As regards EA on each indicator, the lowest score was in point 3 related to efforts to prevent flooding by monitoring water levels. This corresponded to the lowest score in the EA category for each item. It implied that Engineering faculty students must be able to innovate in environmental education related to flood prevention efforts.

Table 5. Average EA score for each indicator

No	Indicator	Average
1	Support river widening/normalization efforts to accommodate more water	4.34
2	Invite the community to improve drainage channels	4.50
3	Perform flood prevention efforts by continuously monitoring the water level	4.25
4	Support flood prevention efforts during Covid-19	4.69
5	Clean the environment regularly according to health protocols to avoid flooding and in turn, the Covid-19	4.63

The PEB scores of the Engineering faculty students were in the moderate category. It showed that the PEB score of the Engineering faculty students related to flood prevention efforts must be increased. The lowest score was related to recycling behavior to make a more useful good. The average PEB score for each item is indicated in Table 6.

Table 6. Average PEB score for each item

No	Item	Average
1	Ialong with the surrounding community clean the waterways in front of each house with safety to avoid flooding to minimize Covid-19	2.94
2	Waterways around the house are continuously monitored so that the water	3.50

	flows smoothly thus avoid flooding and prevent Covid-19	
3	I throw garbage according to its type in the trash bin so it doesn't cause flooding and the spread of Covid-19 gets worse	3.71
4	I clean the surrounding environment to avoid floods and Covid-19	3.96
5	The recycling process is carried out to reduce waste to avoid flooding	2.98
6	I recycle plastic bottles and turn them into works of art with economic value to prevent flooding	2.30
7	I invite the public through social media to protect the environment from flooding	2.87
8	I provide various information related to flooding to the general public	2.99
9	I invite other fellow students to campaign for flood prevention	2.56
10	Me and colleagues conducted an online flood prevention campaign	2.47
	Raw Score	30.27
	Average score (interval 0-100)	60.53
	Category	Moderate

The PEB score related to flooding based on each indicator indicated that the indicator with the lowest score was the 5th indicator, which was inviting other students to campaign for flood mitigation efforts. The PEB score describes in Table 7.

Table 7. Average PEB score for each indicator

No	Indicator	Average
1	Clean waterways to avoid floods and Covid-19	3.22
2	Keep the environment clean by disposing garbage to its place to prevent flooding and the spread of Covid-19	3.83
3	Carry out a recycling process to minimize waste to avoid flooding	2.64
4	Advice the community to protect the environment to avoid flooding	2.93
5	Invite other fellow students to participate in campaigning for flood prevention	2.51

The results showed that the students' EA score was already in the very high category. It suggested that the Engineering students will be able to protect their environment in terms of supporting various policies related to flooding. The attitude of caring for the environment is an important thing because for a sustainable development program to occur it must start from this attitude. Engineering students play a role in supporting various environmentally-friendly policies in terms of infrastructuresas well as environmentally-friendly development programs. This infrastructure development is essential to support sustainable development goals programs (Blanco & Lozano, 2015; Goldman et al., 2014; Lazaridou et al., 2018; Rahmayanti et al., 2019).

The next aspect was related to PEB which was the implementation of EA. The implementation of PEB in preventing flooding is also important for engineering students. This is because these students can build an infrastructure that allows people or communities to carry out environmentally-friendly activities. PEB is a more concrete form of community attitudes implementation to apply PEB, in this case, related to flooding(Krettenauer, 2017; Storr et al., 2017).

The results of the study also indicatedthe necessity to improve the Engineering students' EA and PEB scores. The DIFMOL became an innovation to improve the Engineering students' EA and PEB. It was due to the DIFMOL that is an online-based learning tool that can be used remotely. The long distance learning has resulted in an innovation where learning is no longer limited by time and space(Grosch et al., 2014; Reyna et al., 2018; So et al., 2019). DIFMOL is a form of an idea that can be developed in subsequent research. The results of the EA and PEB analysis in this study were sufficient to show that DIFMOL had the potential to be developed in environmental education in the Faculty of Engineering.

The Engineering faculty students, in this regard, hadthe potential to develop various knowledge related to the environment. The DIFMOL model that will be developed will have the potential to improve the Engineering students' ability to become a support group for the environmental movement. Additionally, the potential possessed by the Engineering faculty students areessential in building various infrastructures that support environmentally-friendly programs(Choudri et al., 2016; Dangelico et al.,

2017). This is because the infrastructure demanded in environmental education is related to buildings that adhere to the 4.0 industrial revolution which currently is focused on being built.

It is very crucial to educate students to possess and have positive mind set to embrace environmentally accountable and responsible behavior (Paristiowati et al., 2019; Sahronih et al., 2019; Wihardjo et al., 2020; Zerinou et al., 2020). The question raised here is to create an individual who can think critically that will create ways for environmental knowledge and cognizance to understand his or her role in environmental protection. Students or individuals can possess vast environmental familiarity, this does not mean that they will yield or show positive environmentally accountable behavior(Arthur et al., 2019; Harahap et al., 2018; Miarsyah, Sigit, et al., 2019; Rahmayanti et al., 2018; Sigit, Miarsyah, Komala, et al., 2019; Sipahutar et al., 2019). Schools do not provide sufficient environmental knowledge and this knowledge need to be improve(Ichsan et al., 2020; Miarsyah, Rusdi, et al., 2019; Sigit, Azrai, Heryanti, et al., 2019; Sigit, Azrai, Setyawati, et al., 2019; Sigit, Miarsyah, & Ichsan, 2019). However, further actions are needed to promote and develop critical thinking among citizens as to cultivate their responsibilities and practice their privileges that will make them responsible consumersas well as citizens (Azrai et al., 2019; Chander & Muthukrishnan, 2015; Ichsan et al., 2019).

IV. CONCLUSION

Based on the results of the study, it can be concluded that the EA score is already in the very high category, whereasthe PEB is still in the moderate category. This showed that the DIFMOL Education model can be developed to improve the learning environment among Engineering Faculty students. The DIFMOL model innovation is also required by Engineering students as they have the potential to build various buildings that support environmentally-friendly programs.

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