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1 **Students Environmental Attitude and Pro-Environmental Behavior in Engineering**

2 **Faculty: Analysis for Develop DIFMOL Model**

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12

13 **ABSTRACT**

14 Environmental education for university level, especially in Engineering faculty, is an important
15 issue. One of environmental issue that becomes a concern is related to flood disaster mitigation.

16 21

16 The purpose of this study is to describe environmental attitudes (EA) and Pro-Environmental

17 Behavior (PEB) among Engineering faculty students. The description will be used to develop

18 16

18 a Disaster Mitigation of Flood based on Online Learning (DIFMOL) model. The research

19 method used is a descriptive survey technique. Instruments are distributed online using Google

20 form with a sample size of 139 students taken using simple random sampling. The results show

21 that the students' EA scores are in a very high category (89.68) and the students' PEB are in a

22 moderate category (60.53). It indicates that the Engineering faculty students still require an

23 educational model development to cope with flooding. One that can be developed is a DIFMOL

24 model. In general, aspects need to be emphasized in the DIFMOL model are those related to

25 flood disaster mitigation efforts in urban areas. The study concludes that EA is very high and

26 PEB is still in the medium category. The DIFMOL model innovation requires further

27 development in the next research.

28

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

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32 Introduction

33 21st-century environmental education triggers the need for technology-based learning.
34 Technology-based learning creates innovations in various learning devices and media. It needs
35 to be developed because educational innovation functions to improve various competencies and
36 community behavior. One thing that needs to be implemented after learning using technology-
37 based learning is Environmental Attitude (EA) that students must acquire (Buchanan &
38 Mathews, 2013; Ogunbode & Arnold, 2012; Sigit et al., 2020; Sugandini et al., 2018). In
39 addition, it also needs to be further developed ²⁶ in the form of Pro-Environmental Behavior (PEB)
40 which is a behavior to protect the environment (Ahmad & Nordin, 2014; Digby, 2013).

41 Students, in this regard, require EA and PEB to overcome various environmental
42 problems that occur. Technology-based education is needed to promote a variety of human
43 knowledge and behavior. It is due to the technology-based education facilities that facilitate the
44 delivery of various messages to the community. The message can be conveyed through social
45 media and other information technology means (Miarsyah, Rusdi, et al., 2019; Saltan & Divarci,
46 2017; Sigit, Azrai, Heryanti, et al., 2019; Zhou et al., 2017). It will require technology-based
47 educational model development to facilitate this. This education model should focus on one
48 environmental problem. In this case, flood problem can be raised for further study.

49 One of the educational models that can be developed is ¹⁶ Disaster Mitigation of Flood
50 based on Online Learning (DIFMOL) model in the 21st century (Rahmayanti et al., 2020). The
51 model development is a necessity for, among others, groups of Engineering faculty students.
52 Engineering students play a role in building various environmentally-friendly buildings.
53 Therefore, it is necessary to measure EA and PEB of the Engineering students and describe
54 their various attitudes and behaviors. It aims to depict the DIFMOL model for environmental
55 education in the Engineering faculty.

56 Previous research has been carried out regarding various profiles of environmental
 57 knowledge, attitudes, and behavior (Azrai ⁴ et al., 2019; Ichsan et al., 2019; Ichsan &
 58 Rahmayanti, 2020; Sigit et al., 2020). This description also forms a basis for developing various
 59 learning tools and media. Moreover, a description of the DIFMOL model has been carried out
 60 on students in general (Rahmayanti et al., 2020). However, it has not been done on Engineering
 61 student group. The EA and PEB measurements for Engineering students is thus necessary to
 62 analyze the suitability of the DIFMOL for Engineering faculty students. The purpose is for
 63 Engineering students to have EA and PEB that can be improved related to flood disaster
 64 mitigation efforts. Based on the aforementioned, it is necessary to do a study to describe the EA
 65 and PEB of Engineering students in overcoming floods. ³ The purpose of this study was to
 66 describe the EA and PEB of engineering students.

67

68 **Materials and Methods**

69 The study used a ⁸ descriptive method with a survey technique approach. The study was
 70 conducted in July 2020. The samples involved were 139 respondents. The instruments used in
 71 the study were EA and PEB instruments related to contextual daily life (Sigit et al., 2020).
 72 Indicators made in the EA instrument consisted of 10 items. The research instruments were
 73 distributed online using Google Form. The EA indicators are described in Table 1.

74 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

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

78 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

79

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

85 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	$X \leq 38,72$

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

87 Result and Discussion

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

92

93

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

94 Note: Item adapted from Rahmayanti et al (2020)

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

99 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

100

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

105 ¹³ Table 6. Average PEB score for each item

No	Item	Average
1	I along 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 flows smoothly thus avoid flooding and prevent Covid-19	3.50
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

106

107 The PEB score related to flooding based on each indicator indicated ¹³ that the indicator
 108 with the lowest score was the 5th indicator, which was inviting other students to campaign for
 109 flood mitigation efforts. The PEB score describes in Table 7.

110 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 ¹³ 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

111

112 ¹³ The results showed that the students' EA score was already in the very high category.
113 It suggested that the Engineering students will be able to protect their environment in terms of
114 supporting various policies related to flooding. The attitude of caring for the environment is an
115 important thing because for a sustainable development program to occur it must start from this
116 attitude. Engineering students play a role in supporting various environmentally-friendly
117 policies in terms of infrastructures as well as environmentally-friendly development programs.
118 This infrastructure development is essential to support sustainable development goals programs
119 (Blanco & Lozano, 2015; Goldman ²² et al., 2014; Lazaridou et al., 2018; Rahmayanti et al.,
120 2019).

121 The next aspect was related to PEB which was the implementation of EA. The
122 implementation of PEB in preventing flooding is also important for engineering students. This
123 is because these students can build an infrastructure that allows people or communities to carry
124 out environmentally-friendly activities. PEB is a more concrete form of community attitudes
125 implementation to apply PEB, in this case, related to flooding (Krettenauer, 2017; Storr ²⁵ et al.,
126 2017).

127 The results of the study also indicated the necessity to improve the Engineering
128 students' EA and PEB scores. The DIFMOL became an innovation to improve the Engineering
129 students' EA and PEB. It was due to the DIFMOL that is an online-based learning tool that can
130 be used remotely. The long distance learning has resulted in an innovation where learning is no
131 longer limited by time and space(²²Grosch et al., 2014; Reyna et al., 2018; So et al., 2019).
132 DIFMOL is a form of an idea that can be developed in subsequent research. The results of the
133 EA and PEB analysis in this study were sufficient to show that DIFMOL had the potential to
134 be developed in environmental education in the Faculty of Engineering.

135 The Engineering faculty students, in this regard, had the potential to develop various
136 knowledge related to the environment. The DIFMOL model that will be developed will have

137 the potential to improve the Engineering students' ability to become a support group for the
138 environmental movement. Additionally, the potential possessed by the Engineering faculty
139 students are essential in building various infrastructures that support environmentally-friendly
140 programs (Choudri et al., 2016; Dangelico et al., 2017). This is because the infrastructure
141 demanded in environmental education is related to buildings that adhere to the 4.0 industrial
142 revolution which currently is focused on being built.

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

158 **3** 159 **Conclusion**

160 Based on the results of the study, it can be concluded that the EA score is already in the
161 very high category, whereas the PEB is still in the moderate category. This showed that the
162 DIFMOL Education model can be developed to improve the learning environment among

163 Engineering Faculty students. The DIFMOL model innovation is also required by Engineering
 164 students as they have the potential to build various buildings that support environmentally-
 165 friendly programs.

166

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