

Does Experiencing Fieldwork Strengthen or Dampen Indonesian Preservice Biology Teachers' Attitude and Self-Reported Behavior towards Environment?

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ABSTRACT

The current study examines the impact of fieldwork activities on Indonesian preservice biology teachers' attitudes towards the environment and self-reported conservation behavior. A total of 283 Indonesian preservice biology teachers (16% male and 84% female) participated in the study and four different instruments were used to explore the research questions. Validity and reliability of the research instruments were tested by performing Rasch model analysis. To explore the moderation effect of fieldwork on correlated variables, multiple-regressions test was conducted. The findings showed that fieldwork acted as a moderating factor in creating the relationships between Ecocentric Concern and Personal Conservation Behavior and between Human Utilization attitude and Personal Conservation Behavior. The correlation between findings and the Indonesian preservice biology teachers' curriculum are discussed.

Keywords: environmental attitudes, fieldwork, preservice biology teachers.

INTRODUCTION

Various environmental degradation such as air pollution, water pollution, forest fires, loss of biodiversity, and emergence of new diseases have occurred and have become one of the most fruitful topics in various fields including education and psychology (Chekima et al., 2016; Morag and Tal, 2012). Environmental degradation is not a new problem, but it is a problem that tellurians have faced for several decades, especially those living in developed-industrial countries. Today, environmental problems occur not only in industrial countries, but also in almost all corners of the world. Environmental problems influence humans' attitudes and behaviors towards the environment. Humans, who are nature-selfish, are always concerned with the quality of their own lives (Intergovernmental Panel on Climate Change [IPCC], 2014) without considering their impacts on the environment and/or environmental damages. Therefore, psychologists, educators and sociologists (e.g. Boeve-de Pauw and Van Petegem, 2013; Dunlap and Jones, 2002; Todd, 2016; Vining et al., 2002) have conducted



studies on human attitudes and behaviors towards the environment and attempted to develop programs to solve these problems.

Given the emergence of environmental degradation, most of humans have become aware of environmental problems, which are results of their attitudes and behaviors towards the environment. Hence, many communities have strived to change their environmental attitudes and perceptions. Changes in attitudes and perceptions of today's society have been led to pro-environmentalism (Leung and Rice, 2002). Pro-environmentalism is a pro-attitude or a kind of support to keep nature natural, balanced, and livable for future generations (Bratanova, Loughnan, and Gatersleben, 2012). Several studies have found that most of pro-environmentalists come from natural sciences-related communities, so their activities or even their works are directly related to nature or environment (Tal and Morag, 2013).

Several findings in environmental psychology have found that the relationship between attitudes or perception and behavior are close, whether it is actual behavior or intentional behavior in the theory of planned behavior (TPB) (Ajzen, 1991). Though, it is not entirely one's attitude can describe his behavior, but Kaiser et al. (1999) found that approximately 53% of one's intentional behavior towards the environment could be predicted from attitudes or perspectives towards the environment. Thus, their intentional behaviors could be reflected in many of their attitudes through the term 'perceived pro-environmentalism.' Behavior theory proposed by Ajzen (1991) claims that humans have control for their actual behaviors and always consider many things before they are about to behave or implement their attitudes in the form of actual activities.

There are several factors that increase the relationship between attitude and behavior towards the environment, though one's behavior towards the environment, for example conservation behavior, would be reflection and implementation of their own attitudes (Dunlap, 2008; Bechtel et al., 2006; Kollmuss and Agyeman, 2002). To improve the relation through an environmental program, using factors closely related to one's daily life can be one significant effort, because targeted society will easily implement and accept it. In the case of a biology education student or commonly referred to preservice biology teachers, before becoming a biology teacher, they most likely had done variety of outdoor learning activities in order to have better understanding of content to be learned (Bell et al., 2009; Anderson, Kisiel and Storksdieck, 2006). A study by Esra (2010) indicated that students' knowledge about environment significantly affected their attitudes toward environment by. Furthermore, Aslan (2017) also pointed that attitude toward subject content might affect their academic achievements, Güzel (2004) described attitude toward subject also could influence students' learning, for example, students' negative attitudes towards science lesson make learning difficult. Because biology is the branch of science, which its subject study is nature (Lederman, 1999), preservice biology teachers conducting outdoor learning activities, may be one of the possible factors that could stimulate their attitudes and behaviors towards the environment and nature (Morag and Tal, 2012).

In Indonesia, most of preservice biology teachers must take courses using outdoor activities in the curriculum. Besides outdoor activities, to gain deeper understanding of science concepts also improves their conservation attitudes and behaviors. Mudilarto and Pamulasari (2017), who examined outdoor learning model in middle school level in Indonesia, found that it could improve core competencies of student's learning, which includes 78% of physics knowledge competencies and 92,5% skill competencies. The most well-known and widely implemented outdoor activity as a program or an activity to improve attitude and behavior towards the environment is fieldwork (Kisiel, 2006). Fieldwork activities are often used either as direct-planned activities (field trips) or as indirect-unplanned activities conducted at daily university classes. As noted earlier, people engaged in the science community (Harraway et al., 2012) would form attitudes to protect the environment

through fieldwork, whereas preservice biology teachers obtain values that make them more caring and willing to maintain the environment (Knapp and Barrie, 2001; Tal and Morag, 2013; Ballantyne et al. 2007). Therefore, some researchers (e.g. Morag and Tal, 2012) mention that fieldwork is one form of environmental education.

There has been no evaluation on impact of fieldwork activities, commonly used by most Indonesian universities affiliated with educational fields on their preservice biology teachers' curriculum, on preservice biology teacher's attitude and behavior towards the environment, especially conservation behavior. Conservation behavior and attitude related-conservation are two key factors for Indonesian citizens, given that Indonesia is the richest country in natural biodiversity and known as a mega biodiverse country. Indonesia has the largest tropical forests contributing oxygen on Earth. Thus, Indonesians should preserve biodiversity to keep national balanced nature and sustainability of the Earth. In this case, preservice biology teachers will be future environmental teachers in Indonesian schools and therefore, play a key role in maintaining conservation attitudes and behaviors of Indonesian students that will be future Indonesian citizens. Therefore, the curriculum implemented by preservice biology teachers is crucial in preparing future biology and environment teachers. This study explores the impact of fieldwork activities on the Indonesian preservice biology teachers' curriculum of the relationship between conservation behavior and conservation-related attitude. For more details about fieldwork activities and courses related to fieldwork studied by Indonesian preservice biology teachers, a brief description about Indonesian pre-service biology teacher's curriculum is described below.

Indonesian Pre-service Biology Teachers' Curriculum (Environmental Related Courses)

Prior to becoming middle school or high school biology teachers, Indonesian university students have to engage in four-year university life affiliated with the departments of biology and biology education. Those that graduate in biology and biology education in Indonesia hold a B.S or B.Ed as academic titles, and may apply for jobs as biology teachers. To prepare professional and competent biology teachers, most public universities that focus on educational fields have a curriculum not much different with others. In the first year, most preservice biology teachers will take introductory science courses divided into four introductory courses: biology, physics, chemistry and fundamental mathematics. Besides, they will enroll in basic educational related courses such as educational psychology, and a mandatory environmental science class for preservice biology education. In this environmental science course, they will be introduced to common and known environmental problems, cause of those problems, and ways to manage problems.

In the second year, they will enroll to more biology and educational classes, either mandatory classes such as biochemistry, curriculum and learning, or additional classes such as nutritional science and parasitology. In the second year, they have to enroll to plant anatomy class, animal structure class, botanical class, and entomology class. They have to engage in small fieldwork to collect plant or animal samples before they attend class and investigate samples. Like the second year, in the third year they have to enroll to courses that require outdoor learning activities, such as botanical science class and ecology class. Remaining classes are related to educational disciplines such as research and seminars in biology education and biology learning evaluation. The fourth year of the Indonesian preservice biology teachers embraces to learn advanced levels of biological sciences such as human and animal physiology and implement what they have learned into practicum as student teachers at high schools and middle schools.

Research Questions

Based on the background mentioned above, the following research questions guided the current study:

1. Does fieldwork improve the Indonesian pre-service biology teachers be more environmentally friendly attitude?
2. To what extent educational years impact pre-service biology teachers' environmental attitudes and behaviors?

METHODS

Population and Sample

Within survey research design, the current study gathered the data. A total of 285 pre-service biology teachers that enrolled to an Indonesian public university focusing on education majors were surveyed. All participants were affiliated with the department of biology education. Those pre-service biology teachers were in the first (22%), second (25%), third (29%) and fourth (24%) year of the study. The sample of the current study comprised of 16% male students and 84% female students, and most of them were Muslim (98%) and approximately 2% of participants were Christian and Catholic. We did not collect age data because the Indonesian students enrolling undergraduate programs (from the first to the fourth year of the study) have consistently ranged from age 19-23. Besides gender and religion, the current study also collected whether they came from small (village and coastal area are included) or large cities. Over half of them (57%) originally came from small cities and the rest of them (41%) came from large cities. Moreover, 2% of participants' origins were unknown, because they did not fill in origin home in the questionnaire form.

Instruments

Two different instruments namely Environmental Attitude Inventory (EAI) by Milfont and Duckitt (2010) and Environmental Attitudes of the University Scale (EAU) by Fernandez-Manzanal, Rodríguez-Barreiro and Carrasquer (2007) were used to collect data. However, since these instruments have several constructs, the current study only used related constructs that were in line with its research questions. Three out of eleven constructs in the EAI, namely Personal Conservation Behavior, Human Utilization and Ecocentric Concern, and only one construct out of five constructs in the EAU instrument were employed in the current study. All instruments were bipolar Likert-type with 1-6 scale (1 = Strongly Disagree, 6 = Strongly Agree). The negative statement responses were reversed when coding data. Before conducting statistical analyses, reliability and validity of the instruments were tested. The reliability issue (Cronbach's alpha) was tested through SPSS version 23 software and item fit indices with Rasch analyses were examined through WINSTEP software. Moreover, for the reliability issue the current study also reported the reliability computed from Rasch analysis, person and item reliability. Person reliability refers to what traditional internal consistency is, however item reliability refers to how effectively the items diversely measure participants' abilities (Linacre, 2012). The interpretation of those three reliabilities is same, and current study follows DeVellis (2002) interpretation of the reliabilities. For interpretation of item fit, we used the benchmark of reliable instruments more than 0.6 and item fit indices 0.5-1.5 for outfit and infit MNSQ assumed as productive measurement (Wright and Linacre, 1994). Based on our benchmark, our instrument is appropriate for further statistical analyses. Reliability and validity of each variable are provided in the following section and a brief-short description of each variable is elucidated as well.

a) Personal Conservation Behavior

Personal conservation behavior variable is a kind of self-reported behavior. This variable measures how one perceives conserving resources in daily behavior (Milfont and Duckitt, 2010). Pre-service biology teachers achieving high scores in this variable indicated that they conserved resources to protect the environment in daily behavior, whereas low scores indicated a lack of interest in conserving resources in daily behavior (Milfont and Duckitt, 2010). The original instrument of Personal Conservation Behavior consisted of 10 items (five negative, and five positive items). Because of an internal consistency issue, we deleted one item, thus we used nine items in this study from the original instrument. Our nine-item instrument had internal consistency (Cronbach's alpha) at the value of 0.696 and person and item reliability were found to be 0.65 and 0.98 respectively. The fit of each item ranged from 0.67 to 1.25 for infit MNSQ and 0.64 to 1.26 for outfit MNSQ (see Appendix 1).

b) Human Utilization of Nature

Human use of the nature variable measures one's attitude in perceiving nature as a priority, especially regarding economic development. Pre-service biology teachers achieving high scores in this variable indicated strong beliefs in assuming economic development with a higher priority than protecting the environment, while achieving low scores in this variable indicated protecting environment with a higher priority than using nature for economic development (Milfont and Duckitt, 2010). Similarly, with the previous variable, this variable originally consisted of 10 items, but because of an internal consistency issue, we deleted one item, thus we used nine items in this study. Our nine-item Human Utilization of Nature instrument had internal consistency (Cronbach's alpha) at the value of 0.714 and person and item reliability were found to be 0.70 and 0.97 respectively. The fit of each item ranged from 0.74 to 1.17 for infit MNSQ and 0.75 to 1.15 for outfit MNSQ (see Appendix 1).

c) Ecocentric Concern

Ecocentric concern is a variable that related to nostalgic concern and sense on losing environmental properties from damaging the environment. Achieving high scores in this variable indicated a concern about environmental loss, while low scores indicated absence of concern about the environment (Milfont and Duckitt, 2010). Like two previously mentioned variables, this variable originally consisted of 10 items, and because of an internal consistency issue, we deleted one item, thus we used nine items in this study as well. The ecocentric concern instrument had internal consistency at the value of 0.714 and person and item reliability were counted to be 0.70 and 0.97 respectively. The fit of each item ranged from 0.79 to 1.52 for infit MNSQ and 0.83 to 1.27 for outfit MNSQ (see Appendix 1).

d) Perceptions of Fieldwork as Environmental Education

This variable was adapted from a twenty-item EAU instrument measuring university students' attitude towards the environment. There were five scales or dimension in EAU and one of them was fieldwork or field trips perception. We selected seven items related to fieldwork perception from EAU. This fieldtrip perception measured pre-service biology students' perceptions towards fieldwork activities (Fernandez-Manzanal, Rodríguez-Barreiro and Carrasquer, 2007) and perceptions of the significance of improving one's environmental attitudes and behaviors. Fernandez-Manzanal, Rodríguez-Barreiro and Carrasquer (2007) developed this instrument with reasoning that direct experience (fieldwork) on the environment or nature engaging in people emotionally and increasing their awareness of the environment. Achieving high scores in this variable indicated fieldwork was assumed to be a form of environmental education and vice versa. The fieldwork perception instrument had internal consistency at the value of 0.832 and person and item reliability were 0.80 and 0.99

respectively. The fit of each item ranged from 0.70 to 1.28 for infit MNSQ and 0.66 to 1.33 for outfit MNSQ (see Appendix 1).

Data Analyses

We conducted Rasch analysis to explore item fit of each item for all four instruments. When Rasch analysis was completed, we obtained a set of composite scores of participants termed as person ability in each variable. This set score was no longer in the form of ordinal scale, but in the form of interval scale, thus we used it for further statistical analyses. We conducted Rasch analysis through WINSTEP software version 3.92.1.

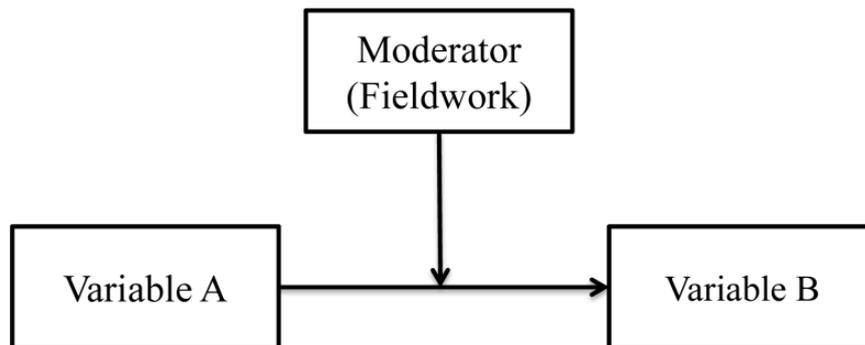


Figure 1. Conceptual Diagram for Moderating Variables (Hayes, 2013)

For the statistical analysis, we firstly conducted Pearson's correlation test to assess the relationship of variables. We used results from Pearson's correlation test as the basis for multiple regression tests. To assess the moderator effect, we conducted the moderator test developed by Andrew F. Hayes (2013, www.afhayes.com) through SPSS extended package called "PROCESS" on multiple regression test. We hypothesized that field trip was the moderating effect in the relationship between two attitude variables (Human Utilization of Nature and Ecocentric Concern) and self-reported conservation behavior (Personal Conservation Behavior). We used the model proposed by Hayes (2013) represented in Figure 1. Once we conducted the PROCESS we obtained the effect of each level of moderating factor on the targeted relationship. Following analysis, we did analyses of variance (ANOVA) test to explore differences between all educational years for each variable. For further interpretation of the existing mean differences of all educational years we conducted Tukey post hoc test with Bonferroni methods as adjustment for multiple comparisons. All statistical tests were conducted using SPSS 22.

Limitations

Although this study was refined with Indonesian pre-service biology teachers' curriculum, it had several limitations that may be considered for further studies. First, our limitation was related to the fieldwork variable, as we mentioned before that our fieldwork variable was not the real fieldwork activities, nevertheless pre-service biology teachers' perceptions had experienced and already obtained fieldworks activities in their courses. Secondly, even though we found the relationship between all four variables; we could not directly explain their relationship in the form of a model supported with statistical analysis. Understanding one's attitude and behavior towards environment is very complex in generating a psychological model supported with statistical analysis (Barr, 2007). Therefore, we encourage other researchers on environmental education and science education to add relevant variables that may be significant to generate a psychological

model that can present the connection(s) between pre-service biology teachers' attitudes and behavior towards the environment.

FINDINGS

Relationships among Attitude, Behavior towards Environment and Fieldwork Perception

As seen in Table 1, the results of Pearson's correlations showed that all variables were correlated. Personal Conservation Behavior was negatively correlated with Human Utilization of Nature in the medium level ($r(285) = -0.379$), while it was positively correlated in the medium-high level and in the medium level with Ecocentric Concern ($r(285) = 0.453$) and Fieldwork perception ($r(285) = 0.391$) respectively. Human Utilization of Nature was negatively correlated with Ecocentric concern ($r(285) = -0.588$) and Fieldwork perception ($r(285) = -0.431$) in the high and medium-high level respectively. Last, Ecocentric concern was positively correlated in the medium-high level with Fieldwork perception ($r(285) = 0.485$).

Table 1. Pearson's Correlation Test Results among Four Variables

Variables	(1)	(2)	(3)	(4)
Personal Conservation Behavior (1)	1			
Human Utilization of Nature (2)	-0.379**	1		
Ecocentric Concern (3)	0.453**	-0.588**	1	
Fieldwork Perception (4)	0.391**	-0.431**	0.485**	1

** $p < 0.01$, * $p < 0.05$, 'no mark' refers to 'non-significant'

Testing Fieldwork as Moderating Effects

Based on previous correlation results, all variables were significantly correlated in middle until high level correlation. The multiple regression results were especially on identifying moderating effects. We conducted multiple regression tests twice. In the first test, we examined the effect of fieldwork on the relationship between Human Utilization of Nature and Personal Conservation Behavior, and in the second test on Ecocentric Concern and Personal Conservation Behavior.

Table 2. Multiple Regression Human Utilization as Independent Variables

Model	Unstandardized Coefficients		T	p-value	R ²	F	p-value
	B	Std. Error					
Constant	1.051	0.054	19.617	0.000	0.246	25.718	0.000
Fieldwork (2)	0.160	0.033	4.825	0.000			
Human Utilization (1)	-0.274	0.089	-3.067	0.002			
Interaction (1 and 2)	0.085	0.035	2.456	0.015			

Table 3. The Effect of Moderator on the Relationship between Human Utilization and Personal Conservation Behavior

Level of Moderator	Effect (β)	Std. Error	t	p-value
Low (1SD below Mean)	-0.430	0.133	-3.233	0.001
Medium (Mean)	-0.274	0.089	-3.067	0.002
High (1SD above Mean)	-0.119	0.080	-1.491	0.137

As observed in Table 2, significant value appeared in the Interaction model ($t(285) = 2.456$, $p < 0.05$) indicating that Fieldwork was the moderating factor of the relationship between Human Utilization of Nature and Personal Conservation Behavior. Human Utilization of Nature, Fieldwork and interaction between both variables significantly predicted Personal Conservation Behavior ($\beta = 1.051$, $t(285) = 19.617$, $p < 0.01$). Predicted variables also explained a significant proportion of variance in Personal Conservation Behavior ($R^2 = 0.246$, $F(3,281) = 25.718$, $p < 0.01$). As can be seen in Table 3, the effect (β) moderator was an increase from low level to high level of Fieldwork. Results are displayed in Figure 2.

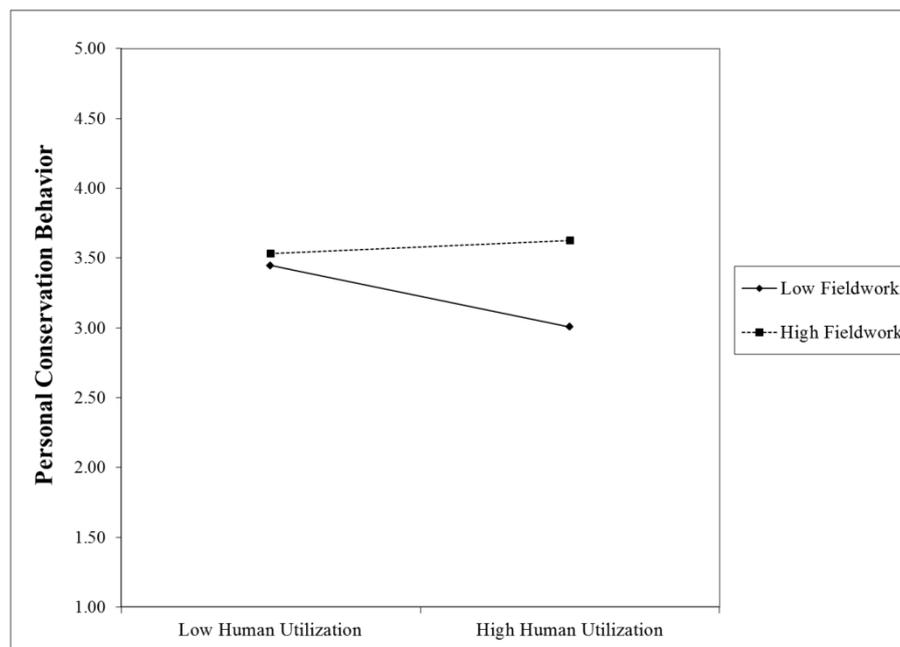


Figure 2. Regression Plot for Personal Conservation Behavior and Human Utilization Moderated by Fieldwork Perception

Table 4. Multiple Regressions for Ecocentric Concern as Independent Variables

Model	Unstandardized Coefficients		t	p-value	R ²	F	P-value
	B	Std. Error					
Constant	1.049	0.051	20.723	0.000	0.272	31.526	0.000
Fieldwork (2)	0.123	0.033	3.734	0.000			
Ecocentric Concern (1)	0.292	0.064	4.587	0.000			
Interaction (1 and 2)	-0.056	0.024	-2.345	0.020			

Table 5. The Effect of Moderator on the Relationship between Ecocentric Concern and Personal Conservation Behavior

Level of Moderator	Effect (β)	Std. Error	t	p-value
Low (1SD below Mean)	0.394	0.087	4.500	0.000
Medium (Mean)	0.292	0.064	4.587	0.000
High (1SD above Mean)	0.190	0.065	2.919	0.004

As seen in Table 4, significant value appeared in the Interaction model ($t(285) = -2.345$, $p < 0.05$), indicating Fieldwork was the moderating factor of the relationship between Ecocentric Concern and Personal Conservation Behavior. Ecocentric Concern, Fieldwork and interaction between both variables significantly predicted Personal Conservation Behavior ($\beta = 1.049$, $t(285) = 20.723$, $p < 0.01$). Predicted variables also explained a significant proportion of variance in Personal Conservation Behavior ($R^2 = 0.272$, $F(3, 281) = 31.526$, $p < 0.01$). As observed in Table 3, the effect (β) moderator was a decrease from low level to high level of Fieldwork. Results are shown in Figure 3.

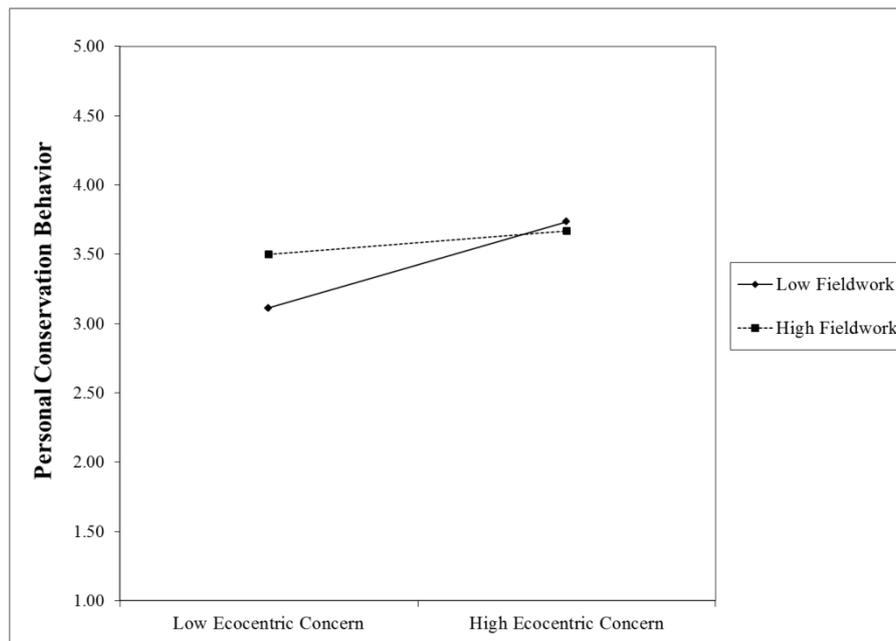


Figure 3. Regression Plot for Personal Conservation Behavior and Ecocentric Concern Moderated by Fieldwork Perception

DISCUSSION and CONCLUSION

The findings indicate that all involved variables were significantly correlated in medium level to medium-high level. Positive correlations were found between three variables: Ecocentric Concern, Fieldwork Perception and Personal Conservation Behavior, while these variables were negatively correlated with Human Utilization of Nature. Regarding the Planned Behavior theory proposed by Ajzen (1991), we assumed that self-reported conservation behavior was the outcome from attitude and perception towards the environment that are Ecocentric Concern and Human Utilization of Nature. So, we inferred that higher scores of the Indonesian pre-service biology teachers' attitudes, concerns and senses towards environmental loss would increase frequencies of their daily conservation

behaviors. This inference was aligned with the Human Utilization Variable, correlated negatively with Personal Conservation Behavior, indicating that lesser scores on Human Utilization, attitude towards economic development, and not considering preserving balance of the environment, would increase daily behavior on conserving resources used in daily activities. These polarity differences indicated that the four variables were in accordance with the theory.

The literature review has reported that there are several factors and environmental education efforts or programs that could increase one's attitude and behavior towards the environment (Boeve-de Pauw and Van Petegem, 2013; Todd, 2016). In this study we used one of the significant factors associated with pre-service biology teachers, fieldwork activities assumed by most environmental experts as a key factor in improving one's attitude and behavior towards the environment (e.g. Fernandez-Manzanal, Rodríguez-Barreiro and Carrasquer, 2007; Tal and Morag, 2013). This study used fieldwork as a moderating factor in correlation between attitude (Human Utilization of Nature and Ecocentric Concern) and self-reported behavior towards the environment. We scrutinized the impact of fieldwork on the correlation between attitude (Human Utilization of Nature and Ecocentric Concern) and self-reported behavior towards the environment. It should be reiterated that the fieldwork variable we used in this study is the perception of pre-service biology teachers towards fieldwork as a form of environmental education. Fieldwork is significantly accepted as a moderating factor in the relationship between Human Utilization of Nature and Personal Conservation Behavior, as well as correlation between Ecocentric Concern and Personal Conservation Behavior. However, the effects of fieldwork on those two relationships were not as positive as expected (see Figures 2-3). As seen in Figure 2 and Table 3, the low level of fieldwork appeared a negative strong correlation between Human Utilization of Nature and Personal Conservation Behavior than the effect of fieldwork in the higher level. Figure 3 also showed that a lower level of fieldwork resulted in a stronger effect on the relationship between Ecocentric Concern and Personal Conservation Behavior, while a higher level of fieldwork negatively impacted the relationship between those variables. This indicates that fieldwork activities, conducted by the Indonesian pre-service biology teachers, decreased their attitudes and conservation behaviors. Findings are not aligned with Fernandez-Manzanal, Rodríguez-Barreiro and Carrasquer's (2007) and Tal and Morag's (2013) statements. That is, fieldwork or other outdoor activities that directly contact nature increase one's attitude and behavior towards the environment.

Regarding the current study's results, there was a problem with the Indonesian pre-service biology teachers' curriculum, especially in implementation of fieldwork. As aforementioned, fieldwork activities conducted by the Indonesian pre-service biology teachers are concentrated in the second year and third year, and fieldwork mechanism in most of the courses, for example botany, is conducted before students attend class or a laboratory because they have to conduct fieldwork to identify species of plants that relate to the topic they will learn in class. When they collect samples of plants, they often collect it excessive amounts of samples, and thus pre-service biology teachers with experienced fieldwork will have the perception that fieldwork is not a kind of environmental education than pre-service biology teachers that haven't acquired that kind of experience. As seen in Figure 4, the second year, third year, and fourth year students had lower perceptions of fieldwork as a form of environmental education as compared with the first year students that have not experienced the fieldwork. In addition, the inappropriate sampling mechanism on fieldwork activities may have affected pre-service biology teachers' attitudes on using natural resources and their Ecocentric Concern as well. On the Human Utilization variable, the second and third year students had higher scores than the first year

students assuming that using more natural resources would not affect the environment. Based on post-hoc ANOVA tests, as compared to pre-service biology teachers, that have not engaged in the fieldwork activities (the first year), the second and third year students were significantly different.

A similar pattern was exhibited on the Ecocentric Concern variable, whereby the mechanism of fieldwork conducted by the Indonesian preservice biology teachers decreased their nostalgic sense and concern towards environmental damage. This result indicated those that had experienced fieldwork would lose their feeling and sense when environmental and natural properties were damaged. It is also supported by ANOVA post-hoc results indicating that there was a statistical difference between the first-year and third-year students experiencing and engaging in fieldwork in terms of Ecocentric Concern. Similarly, the same pattern was found in the Personal Conservation Behavior. Based on ANOVA post-hoc testing the first year students, who had significantly higher conservation behavior than the second and third year students, and the fourth year students, who had already passed and did not have any fieldworks again, showed significantly higher Personal Conservation Behavior than the third year students.

Based on findings and discussions, the mechanism of fieldwork, which was implemented as a part of Indonesian preservice biology teachers' curriculum, has pitfalls at having maximum effect on their attitudes and behaviors towards the environment. Evaluating and implementing better environmental education, especially fieldwork, calls a need for the Indonesian higher education policymakers to ameliorate pre-service biology teachers' curriculum. Given that pre-service biology teachers maybe environmental educators in Indonesian in the future, equipping them with the best experiences to improve their attitudes and behaviors is imperative and crucial due to their impact would be broad from students to future Indonesian citizens. Other international higher institutions (outside of Indonesia) having pre-service biology teacher program should enable students to experience fieldwork in providing a better understanding and environmental view. However, lecturer or instructor needs to provide some kinds of restrictions and procedures on how large samples can do fieldwork. Giving full authority to pre-service teachers should make them likely take the sample as many as they can, and lead them to hurt their environmental attitudes.

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Appendices

Appendix 1. Reliability and Item Fit Results

Variables	Item Code	Cronbach's Alpha	Item Measure	Infit MNSQ	Outfit MNSQ	Person Reliability	Item Reliability
Personal Conservation Behavior	PCB2	0.696	0.56	1.11	1.25	0.65	0.98
	PCB3		-0.46	1.18	1.05		
	PCB4		0.29	1.15	1.18		
	PCB5		-0.96	1.25	1.16		
	PCB6		0.45	1.05	1.16		
	PCB7		0.03	0.70	0.81		
	PCB8		-0.13	0.81	0.80		
	PCB9		-0.30	0.67	0.64		
	PCB10		0.51	1.25	1.26		
	Human Utilization		HU1	0.714	-0.82		
HU2		0.27	0.95		0.92		
HU3		0.51	1.17		1.13		
HU4		0.13	0.95		0.99		
HU5		0.12	0.87		0.90		
HU7		-0.65	1.04		1.07		
HU9		-0.18	0.74		0.75		
HU10		0.15	0.95		0.98		
Ecocentric Concern	Eco1	0.763	0.74	1.09	1.24	0.72	0.98
	Eco2		-0.62	1.52	1.27		
	Eco4		0.10	0.89	0.93		
	Eco5		0.23	0.88	0.96		
	Eco6		0.35	0.79	0.83		
	Eco7		0.64	1.02	1.09		
	Eco8		-0.78	1.48	1.19		
	Eco9		-0.80	1.32	1.12		
	Eco10		0.13	1.21	1.17		
	Fieldwork Perceptions		FW1	0.832	-0.07		
FW2		0.38	1.05		1.08		
FW3		0.96	1.28		1.33		
FW4		-0.61	0.86		0.80		
FW5		-0.22	0.70		0.66		
FW6		-0.52	1.21		1.12		
FW7		0.07	1.16		1.17		

Appendix 2. Tukey's Pairwise Comparison Post-hoc Results

Dependent Variable	(I) Year	(J) Year	Mean Difference (I-J)	Std. Error	p- value
Personal Conservation Behavior	Year 1	Year 2	0.557	0.143	0.001
		Year 3	0.730	0.137	0.000
		Year 4	0.322	0.143	0.151
	Year 2	Year 3	0.173	0.132	1.000
		Year 4	-0.234	0.138	0.544
	Year 3	Year 4	-0.407	0.133	0.014
Human Utilization of Nature	Year 1	Year 2	-0.023	0.146	1.000
		Year 3	-0.489	0.141	0.004
		Year 4	-0.193	0.147	1.000
	Year 2	Year 3	-0.466	0.135	0.004
		Year 4	-0.169	0.142	1.000
	Year 3	Year 4	0.297	0.136	0.180
Ecocentric Concern	Year 1	Year 2	0.333	0.191	0.498
		Year 3	0.641	0.184	0.004
		Year 4	0.227	0.192	1.000
	Year 2	Year 3	0.308	0.177	0.503
		Year 4	-0.106	0.185	1.000
	Year 3	Year 4	-0.414	0.178	0.125
Fieldwork Perception	Year 1	Year 2	0.158	0.319	1.000
		Year 3	0.649	0.307	0.214
		Year 4	0.546	0.320	0.537
	Year 2	Year 3	0.491	0.296	0.589
		Year 4	0.388	0.309	1.000
	Year 3	Year 4	-0.103	0.297	1.000