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Environmentally responsible behaviors of pre-service science educators in a State University in Central Visayas, Philippines

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Abstract

Behavior towards the environment greatly contributes to things that matter in time when preservation and conservation movements are addressed. This research study sought to determine the environmentally responsible behaviors of pre-service Science educators. This research utilized a non-experimental quantitative design through survey of a 32-item questionnaire. Data were gathered and results were accumulated. Pre-service Science educators showed Very High Awareness on most of the Philippine laws and university regulations prioritizing the welfare of the environment. When it comes to implementation, respondents had Very Highly Implemented action, enforcement and support. The levels of implementation between these environmentally responsible behaviors did not possess significant difference. Awareness to laws and regulations did not exhibit relationship with environmentally responsible behaviors. Overall, Pre-service Science educators possess environmental behaviors, which make them environmentally literate. With this, they shall serve as role models to enhance conservation and preservation of the environment as recommended.

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Introduction

The environment is a complex of physical, chemical and biotic factors acting upon the organisms for survival (Britannica, 2020). It provides air, food, shelter and other necessities that support the entire life system, as well as the wellbeing of all life on Earth. In particular, it plays an important role in the healthy living of human beings, as it is the only home that humans have. However, there have been observed and experienced drastic changes in the environment, which are consequences of human actions. In fact, 118 (39%) out of 301 of the disaster events worldwide in 2017 were man-made, ranging from small-scale fire, water and air pollution to global warming (Swiss Re Institute, 2018). If disciplinary steps are not taken, environmental issues will continue to grow and burden the lives of the people. There may be no viable world for the descendants to inhabit. With this, people should exhibit environmentally responsible behaviors.

Environmentally responsible behaviors constitute one of the components of environmental literacy. Environmentally literate people do not only possess knowledge and understanding of as well as atittudes towards the environment, but also exhibit appropriate behaviors to apply the former components to make sound, effective decisions in situations involving environmental issues (Hollweg *et al.*, 2011; Spinola, 2020).

These behaviors include active and considered participation to solve problems and resolve issues such as consumer action and ecological management (Simmons, 1995; Erdogan *et al.*, 2009). Increased environmental knowledge leads to more responsible behavior and attitudes influence such behavior (Goldman *et al.*, 2006; Goulgouti *et al.*, 2019). Due to the importance of such responsible behaviors, studies were also focused on evaluating environmental education programs and ecoclubs (Spinola, 2015; Puri and Joshi, 2017) and science textbooks (Erdogan *et al.*, 2009) and correlating the behaviors to student profiles and other literacy components (Spinola, 2020). Human beings as curators responsible in administering and ensuring prosperity of the environment should behave more consciously in order to survive (Howe, 2009). Attitudes and behavior towards the environment are two important things that matter to act responsibly in a time when preservation and conservation advocacies are formulated (Goldman *et al.*, 2006). Environment advocates highlighted that education is the key for people to do desirable behaviors that will shape them optimally to form a society of responsible citizens (Hollweg *et al.*, 2011). In the pursuit of achieving this educational objective of molding individuals to become environmentally-responsible, teachers are considered the most important parties involved in the process of delivering knowledge. Specifically, pre-service teachers are the ones who will ensure the effective implementation of the responsible environmental citizenship.

They must be imbued with environmentally responsible behaviors and attitudes. Therefore, this research study seeks to determine the environmentally responsible behaviors of pre-service science educators. The findings of the study are important as pre-service teachers play a vital role in the development of environmental literacy to their students in the future; hence, the conduct of the study.

Materials and methods

Research Environment

The study was conducted in a state university located at the heart of Cebu City in Central Visayas, Philippines. The said environment has three colleges, namely Teacher Education, Arts and Sciences, and Nursing. Several government and non-governmental agencies have accredited the institution's programs as high as level IV.

Research Respondents

The target population of the study was the students pursuing Bachelor of Secondary Education with specialization in Science (N=80). Using Slovin's formula, the sample of the study was 66 students. These 66 students were selected randomly using the lottery method. The demographic profiles of these students are shown in Table 1 below.

Table 1. Demographic profile of pre-service science educator participants.

Profile Variable	f (n=66)	%
Age		
18 years old	12	18.20
19 years old	47	71.20
20 years old	7	10.60
Sex		
Male	13	19.70
Female	53	80.30
Present Address		
Inside Cebu City	32	48.50
Outside Cebu City	34	51.50
Last School Attended		
Private School	36	54.50
Public School	30	45.50
Senior High School Strand		
STEM	25	37.90
Non-STEM	41	62.10

The table above shows the demographic profile of the respondents with regards to their age, sex, present address, last school attended and SHS strand. In terms of their age, forty- seven (47) of the respondents or 71.20% are nineteen (19) years of age. With regards to sex, majority of them are female and live outside Cebu City. Thirty-six (36) or 54.50% of them attended private schools which mostly offer a Non-STEM strand.

Research Instruments

Three instruments were used by the study. The first instrument is composed of 12 items, which gathered the extent of pre-service teachers' awareness on the Philippine laws and the university's regulations. The second and third instruments have 10 items each, which included items on action and enforcement/support that the respondents do, respectively. These instruments underwent validation and pilot testing. Three experts and teachers on Environmental education validated the instruments. Results of the pilot testing showed that the first instrument had Cronbach's alpha values of 0.885 (for *Philippine laws*) and 0.790 (for *university's regulations*) while the second and third instruments had values of 0.798 and 0.853, respectively. Hence, the tools were valid and reliable.

Conduct of the Survey

Before conducting the survey, the researchers took a formal permission through a consent letter to the university specifically to the dean of College of Teacher Education regarding data collection to adhere the ethical form provided by the university. After the permission was granted, researchers identified the respondents and gave a written consent for their approval. With their approval, the researchers conducted the survey for data collection.

Data Analysis

After gathering the data, the results were tabulated and analyzed. Frequency and mean were utilized to determine the level of awareness and extent of actions, and enforcements and supports. In order to determine whether there is a significant difference between awareness on Philippine laws and University policies, and between the extent between actions, and enforcements and supports, t-test for two independent samples was used. To determine the relationship between level of awareness, and extent of environmentally responsible behaviors, Pearson *r* correlation was utilized. All data were tested at $\alpha=0.05$.

Ethical Considerations

Ethical considerations guarantee reliability and validity of the research findings. Researchers took a formal permission through a consent letter to the university specifically to the research advisers as well as the college dean regarding data collection to adhere the ethical practice provided by the university. With regards to the privacy and the rights of the respondents, researchers took formal permission and approval of respondents for taking part in this data collection activity and no force or compulsion were on any respondents for responding to the survey questionnaire. Researchers had treated the data gathered unbiased and have ensured the confidentiality of the data obtained to maintain the privacy of the respondents.

Results and discussions

Level of Awareness on Laws and Policies

Philippine Laws

Table 2 below shows the level of awareness of pre-service science educators on the six Philippine laws concerning the environment. With the means of 4.26 and 4.21, pre-service science educators show very

high level of awareness on RA 9003 (Ecological Solid Waste Management Act of 2000) and RA 9147 (Wildlife Resources Conservation and Protection Act), respectively. Both laws were legalized under the same year and majority of the respondents came into existence within the same time frame which means that these laws were not that old and unknown. When it comes to RA 9003, the common wastes generated are from households such as glass bottles, cans, boxes, and plastic bags and as part of different households, waste management is common and necessary for any individual (Briguglio, 2016). With regards to RA 9147, more than half of the respondents live outside the metropolitan area which means that they are accustomed to experiencing and seeing nature around. On the other hand, respondents show poor level of awareness on PD 1568 (Environmental Impact Statement).

Among all the laws above, this PD 1568 was legalized many years before any of the respondents live making it unfamiliar and old. Aside from being unfamiliar, this law contains the predicted impacts that mainly affect the environment which can only be evident once it happens. The results also showed that respondents are Highly Aware on RA 9275 (Philippine Clean Water Act of 2004), RA 8749 (Philippine Clean Air Act of 1999) and RA 9072 (National Caves and Cave Resources Management Act).

These laws primarily protect resources that are essential to living. Clean air, clean water, and cave resources which include animal life, plant life, paleontological, archaeological deposits and cultural artifacts supplement areas in living that no one should and can neglect. Knowing and applying these laws help humanity survive.

University Regulations

Table 3 below shows the level of awareness of pre-service science educators on the six University regulations prioritizing environmental concerns. The table above shows that the six policies have an overall mean of 3.62 which corresponds to very high awareness. CLAYGO Policy, "flushing the toilet" Policy, "conserve water" Policy, waste segregation Policy, and "no littering" Policy are five of the six policies with very high awareness.

It has been studied that pre-service science educators are mostly aware of the environmental behaviors which requires increasing their role in influencing the society (Koc and Kuvac, 2016). Also, pre-service science educators were found to be favorable of any environmental activities in universities and regulations which are mostly found in cafeterias, comfort rooms, and more around the vicinity of the universities and are more visible to other students as well.

Table 2. Philippine Laws Awareness Levels.

Phil. Laws	VHA	HA	PA	VPA	NA	Mean	Description
1. PD 1568- Environmental Impact Statement of 1978	11%	36%	39%	3%	11%	3.33	PA
2. RA 8749- Philippine Clean Air Act of 1999	30%	44%	24%	0%	2%	4.02	HA
3. RA 9003- Ecological Solid Waste Management Act of 2000	39%	50%	9%	0%	2%	4.26	VHA
4. RA 9147- Wildlife Resources Conservation and Protection Act	36%	50%	12%	2%	0%	4.21	VHA
5. RA 9072- National Caves and Cave Resources Management Act	12%	38%	38%	6%	6%	3.44	HA
6. RA 9275- Philippine Clean Water Act of 2004	36%	47%	15%	2%	0%	4.18	HA
OVERALL						3.91 (Highly aware)	
VHA	VA		PA	VPA		NA	
28%	44%		23%	2%		3%	

Legend: 1.00-1.80–NA (Not aware) 1.81-2.60 –VPA (Very poorly aware)
2.61-3.40 –PA (Poorly aware) 3.41-4.20- HA(Highly aware)
4.21-5.00 – VHA (Very highly aware)

Table 3. University Regulations Awareness Level.

Statements	VHA	HA	PA	VPA	NA	Mean	Description
1. CLAYGO Policy	85%	12%	3%	0%	0%	4.82	VHA
2. Waste Segregation Policy	77%	14%	9%	0%	0%	4.68	VHA
3. "Last to go has to do" Policy	47%	24%	23%	2%	5%	4.02	HA
4. Flushing the Toilet Policy	80%	17%	3%	0%	0%	4.77	VHA
5. Conserve Water Policy	79%	45%	3%	3%	0%	4.70	VHA
6. No Littering Policy	74%	18%	5%	2%	2%	4.62	VHA
OVERALL		4.61			Very Highly Aware		
VHA	HA		PA		VPA		NA
73%	17%		8%		1%		1%

Legend: 1.00-1.80–NA (Not aware) 1.81-2.60 –VPA (Very poorly aware)
2.61-3.40 –PA (Poorly aware) 3.41-4.20- HA(Highly aware)
4.21-5.00 – VHA (Very highly aware)

The table above also shows that "Last to go has to do" Policy ranked with high awareness with the mean 4.02. Koc and Havuc (2016) revealed that pre-service science educators are aware of environmental behaviors, proper way of developing nature, and factors possible of destroying it.

However, pre-service science educators are also doubtful on where to take a stand. Better regulations are necessary for economic recovery, to manage risks, and to cut unnecessary red tape and regulation or policy is an effective contribution to prescribe and control behavior (Organisation for Economic Co-operation and Development, 2009), which means a guided action is desirable than a forcing command.

This reason made the six university policies noticeable, effective and favorable to the pre-service teachers, because these policies help them to be aware of the responsible behaviors as stewards of nature and to maintain cleanliness in and out of the university (Punzalan, 2020).

Extent of Implementation of Environmentally Responsible Behaviors

Actions

Table 4 below shows the ten environmentally responsible behaviors and its level of implementation classified into very high, high, poor, and not implemented. Planting trees, recycling used materials, conserving water, segregating garbage, not burning garbage, proper throwing of garbage, using eco-friendly bags, collecting recyclable materials, and turning off the appliances are the environmentally responsible behaviors showing very high implementation.

From planting of trees, the Department of Education (DEPEd) being true to Makakalikasan core value requires elementary and high school students to plant trees before graduating as stipulated in D.O. 57, s. 1996 ("The Revitalized Tree Planting and Greening Program Implementing Guidelines"). The behaviors that follow are commonly practiced in households. Anyone can apply these in daily living which in turn results to very high implementation.

Table 4. Environmentally Responsible Behaviors Level of Implementation.

Statements	VHI	HI	PI	NI	Mean	Description
I plant trees to save mother earth	74%	24%	2%	0%	3.73	VHI
I recycle used water to save water.	76%	24%	0%	0%	3.76	VHI
I turn off the faucet to conserve water.	89%	11%	0%	0%	3.89	VHI
I segregate my garbage to reduce pollution.	68%	30%	2%	0%	3.67	VHI
I produce compost to reduce waste disposal.	33%	61%	6%	0%	3.27	HI
I avoid burning plastics to prevent air pollution.	68%	29%	3%	0%	3.65	VHI
I throw my garbage properly to reduce pollution.	74%	24%	2%	0%	3.73	VHI
I use eco-friendly bags to lessen usage of plastics.	39%	56%	5%	0%	3.35	VHI
I collect recyclable materials to reduce waste disposal.	44%	52%	5%	0%	3.39	VHI
I turn off appliances to minimize the usage of electricity.	79%	21%	0%	0%	3.79	VHI
OVERALL		3.62		Very Highly Implemented		
VHI	HI		PI		NI	
65%	33%		2%		0%	

Legend: 1.00-1.75—NA (Not Implemented) 1.76-2.50—PI (Poorly Implemented)
2.51-3.25—HI (Highly Implemented) 3.26-4.00—VHI (Very Highly Implemented)

On producing compost, respondents show high implementation. This is because producing compost requires a lot of work and time to prepare. There is also a need of space for compost and there are health risks from compost exposure like how decaying materials get microorganisms that can cause allergies (Ayilara *et al.*, 2020). Another factor that also contributes to the extent of implementation is the place where the respondents reside and the responsibilities they carry as students such as prioritizing the academic aspect. Actions toward supporting the environment are implemented by the respondents. One of them may slightly differ in the extent of implanting, but the results clearly show that respondents are making actions for a better environment or a place to live in (Puri and Joshi, 2017; Rogayan and Nebrida, 2019).

Enforcements and Supports

Table 5 below shows the ten environmentally responsible behaviors and its level of implementation classified into very high, high, poor, and not implemented. The table above shows that most of the enforcements and support system to the community are very highly implemented by the pre-service teachers. With the same weighted highest means 3.74, some of the pre-service teachers follow the CLAYGO Policy, observe proper usage of electricity, and throw garbage at the correct trash bin. Followed by helping in maintaining proper waste management with the weighted mean 3.70, participating clean up drives and following the "no burning" policy with the same means 3.58, participating in tree activities with the weighted mean 3.55, applying the principle of 3 r's with the weighted mean 3.50, and lastly joining environmental protection awareness program with the weighted mean 3.42. Referring to the results above, it shows that the pre-service teachers are very exposed to activities that will culture their environmental behaviors and reinforce them to pursue the action made for nature. It simply means that all of these became possible even without exerting money or too many efforts but by just being responsible and aware in every action made.

Table 5. Enforcements and Supports Level of Implementation.

Statements	VHI	HI	PI	NI	Mean	Description
I follow the CLAYGO policy.	77%	20%	3%	0%	3.74	VHI
I participate in clean up drives.	59%	39%	2%	0%	3.58	VHI
I apply the principle of the 3r's.	55%	39%	6%	0%	3.50	VHI
I follow the "no burning" policy.	62%	33%	5%	0%	3.58	VHI
I observe the proper usage of electricity.	76%	21%	3%	0%	3.74	VHI
I participate in tree planting activities.	59%	36%	5%	0%	3.55	VHI
I throw my garbage to correct trash bins.	74%	26%	0%	0%	3.74	VHI
I help in maintaining proper waste management.	70%	30%	0%	0%	3.70	VHI
I organize environmental activities for the youth.	41%	42%	17%	0%	3.24	VHI
I join environmental protection awareness program.	43%	45%	6%	0%	3.42	VHI
OVERALL			3.59		Very Highly Implemented	
VHI	HI		PI		NI	
65%	33%		5%		0%	

Legend: 1.00-1.75—NA (Not Implemented) 1.76-2.50—PI (Poorly Implemented)
2.51-3.25—HI (Highly Implemented) 3.26-4.00—VHI (Very Highly Implemented)

The table also shows the bottom ranked but still highly implemented action with the weighted mean of 3.24, which is organizing environmental activities for the youth. This kind of event needs financial support and requires more effort in earning the presence and the attention of the youth. And its result shows a noticeable gap compared to others because this is the only reinforcement that ranked as highly implemented. By the required action needed to be done for the activity to become possible, only some of the pre-service teachers favored this idea. The youth are to continue and enhance their knowledge and understanding in protecting and preserving the nature, and basing on the results shown above, most of the pre-service teachers are into practicing nature-friendly behaviors. The ten enforcements and support are evidently existing and being justified by the willingness of pre-service teachers to participate and the cooperation of community leaders to anticipate. With this, it is evident that the pre-service teachers

are not just aware of what to do but also takes an action of what they knew. This finding provides a positive note that future science teachers are highly implementing responsible behaviors, coherent with the studies of Puri and Joshi (2017) and Rogayan and Nebrida (2019) but in contrast with the read literature stating that teachers have limited participation in such behaviors (Goldman *et al.*, 2006; Liu *et al.*, 2015; Goulgouti *et al.*, 2019).

Comparison of the Extent between Actions, and Enforcements & Supports

Environmentally responsible behaviors are divided in terms of actions and enforcements and supports. Table 6 below shows the significant difference among them. With a p-value of 0.450, there is no significant difference between pre-service teachers' pro-environmental action to their level of support towards Philippine laws and University regulations. This simply implies that the two factors are comparable but not to the extent that the two are dependent with each other that when action increases/decreases, enforcements and supports also increases/decreases.

Table 6. Environmentally Responsible Behaviors Significant Difference.

Aspect	Mean Extent	Difference	SD	*t*-value	p-value
Actions	3.62				
Enforcements and Supports	3.58	0.04	0.14	0.760 ^{ns}	0.450

Legend: ^{ns} Not significant at α =0.05.

According to the study conducted by Eom *et al.* (2016), data collected from individuals in 48 countries for the world values survey showed that the expressing concern about environmental issues was not necessarily linked with support for environmental action: "We found that nations dramatically differed in how much personal concerns about the environment were associated with intentions to perform environmentally friendly behavior." In line with this, since pre-service science teachers have high awareness in terms of Philippine laws and University regulations, result simply implies that they are not just only taking effective actions but are also showing high enforcement and support towards pros environmental behaviors.

Relationship between Awareness and Environmentally Responsible Behaviors

Table 7 shows the r-value and p-value results of the data gathered to identify the relationship of awareness of Philippine laws and university regulations to environmentally responsible behaviors in terms of action, enforcement and support. Based on the results shown, in terms of the relationship of pre-service educators' awareness to Philippine laws with action and enforcement/support ERBs, there is no significant relationship between them. This implies that even though pre service teachers are aware of the laws and policies, it does not mean that they are acting in accordance with that certain law or policy to the corresponding action, or if they were doing the corresponding action, they do not necessarily know that it is under that particular law or policy. This non-significant relationship may be due to the fact that even though pre service teachers are aware of the laws and policies that are being implemented, they still do not know that their actions are under that law or policy, or they may have somewhat forgotten about it.

Table 7. Awareness and Environmentally Responsible Behaviors Relationship.

Variables	r-value	p-value
Phil. Laws Awareness vs. Action ERB	0.118^{ns}	0.345
Phil. Laws Awareness vs. Enforcements/Supports ERB	0.211^{ns}	0.089
Univ. Policies Awareness vs. Action ERB	0.474**	0.000
Univ. Policies Awareness vs. Enforcements/Supports ERB	0.988**	0.000

Legend: ** Significant at alpha=0.05, ^{ns} Not significant at α =0.05.

In the study of McMillan (2003), behaviors and attitude are influenced by values, and education can possibly change one's values, therefore education can influence that behavior and attitude in that manner. The study says that in addressing environmental problems, one must first make a high-quality environment education as an important component in the curriculum or educational system (Hollweg *et al.*, 2011; Sanchez and Alejandro, 2020). From these mentioned reasons, must be value-based in terms of its syllabus so that significant changes can occur in the students' values and can drive positive changes.

Also, for these reasons, Tuncer *et al.* (2010) stated that improvising the interdisciplinary course could be a great solution so that students can realize the important relationship between education, development and environment, and can also drive them to promote environmental care in any aspects of their lives. In terms of the relationship of university policy awareness to action and enforcement/support ERB, there is a moderate and very high significant relationships, respectively. This implies that the pre service teachers are really aware of what they are doing and what they are supporting. They are aware enough to the extent that they know what actions that would correspond and supports a particular University policy. This significant relationship were may be due to the fact the some University Policies are in posters and is being used in a certain university which serves as a reminder for pre service teachers. Environmental awareness inside school premises can promote good environmental practice and stewardship (Punzalan, 2020).

Conclusion and future directions

In general, pre-service science educators show high level of awareness in terms of Philippine laws and University regulations leading to high level of action and enforcement/support. This means that pre-service science educators possess environmentally responsible behaviors. By being able to possess the environmentally responsible behaviors with desirable outcomes, the pre-service science educators are proven ecologically literate.

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