

Level of Competence of Environmental Education Concepts and Principles of Students from the National Network of Normal Schools (3NS)

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Abstract

One of the goals of environmental education is to develop environmentally literate citizens who are equipped with awareness, knowledge, attitudes and skills to make informed and responsible decisions and participate in resolving environmental challenges. Pre-service teacher education is one avenue to promote environmental literacy, hence, there is a need to adequately train pre-service teachers so they can achieve the professional competencies of an environmentally educated person and educator. This study aimed to assess the pre-service students' level of awareness and understanding and their level of competence on environmental education concepts and principles after mainstreaming environmental education in the teacher education curriculum of the 3NS institutions in the Philippines. A developed curriculum guide for Physical Science and lesson plans were implemented over a 9-week period and an assessment tool was used to determine the students' level of understanding and competence on environmental education concepts and principles. Results of the study showed that the 3NS pre-service students' know and understand very well the environmental education concepts and principles and obtained a satisfactory level of competence of environmental education concepts and principles. Students also gained positive attitudes towards the environment and developed better awareness and understanding of the environment. However, due to the satisfactory level of competence obtained by the students, there is still a need to further enhance the mainstreaming of environmental education in the teacher education curriculum in order to get more positive results.

Keywords: *environmental education, EE integration, environmental concepts and principles*

Introduction

Environmental education is crucial amidst the increasing devastations and threats to the environment. The Stockholm conference on Human Environment in 1972 declared that education in environmental matters is essential for younger generations as well as adults (Biedenwig *et al.*, 2013). The Belgrade Charter of 1975 (UNESCO-UNEP, 1976) provides a widely accepted goal statement for environmental education which is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones. At the world's first intergovernmental conference on environmental education in Tbilisi in 1977, the Tbilisi Declaration, which was built on the Belgrade Charter, established three broad goals for environmental

education. These are (1) to foster clear awareness of and concern about economic, social, political, and ecological inter-dependence in urban and rural areas; (2) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment; and (3) to create new patterns of behaviour of individuals, groups, and society as a whole towards the environment. The Tbilisi Declaration further defines environmental education as a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action" (UNESCO, Tbilisi Declaration, 1978). Simply put, individuals are expected to develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions.

In the Philippines, science education aims to develop students who are environmentally conscious and ecologically friendly. The laws related to environment and natural resources as well as knowledge about the environment from science and social science perspectives provide the foundation for environmental education. Of the numerous laws on environment and natural resources, Republic Act 9512, An Act to Promote Environmental Awareness through Environmental Education and for Other Purposes, specifically spells out the involvement of the education sector in climate change adaptation and disaster risk management. This involvement includes raising public awareness and improving education on disaster management. Other laws that serve as basis for environmental education are RA 10121, Creation of policy framework on environmental education and disaster risk reduction, RA 8749 or the Philippine Clean Air Act of 1999, and RA 9003 or An act providing for an ecological solid waste management.

The Department of Education (DepEd), the Commission on Higher Education (CHED) and the Technical Education and Skills Development Authority (TESDA), in coordination with the Department of Environment and Natural Resources (DENR), the Department of Science and Technology (DOST) and other relevant agencies has taken steps to strengthen environmental education in public and private schools to boost the government's efforts in dealing with climate change. This is in compliance with Republic Act 9512 or the National Environmental Awareness and Education Act of 2008. This Act provides for the promotion of environmental awareness through environmental education which encompass environmental concepts and principles, environmental laws, the state of international and local environment, local environmental best practices, the threats of environmental degradation and its impact on human well-being, the responsibility of the citizenry to the environment and the value of conservation, protection and rehabilitation of natural resources and the environment.

Bicol University (BU) has initiated a project to establish a functional Environment Education (EE) Learning Resource Center. The center is expected to raise the awareness on environmental issues, climate change adaptation and mitigation among students, teachers and other stakeholders of the member institutions, and of their immediate communities. In addition, it aims to develop and validate environment-related academic programs in order to produce environment professionals and environment entrepreneurs. The EE Learning Resource Center is likewise envisioned to strengthen

environmental education in the ten member institutions of the National Network of Normal Schools (3NS) and in their adopted communities, and enable the University to offer environment-related academic programs. The creation of the Environment Education Learning Resource Center (EELRC) can serve as a model of a disaster resilient institution, and at the same time, can extend assistance to its adopted communities in helping build resilient communities (Llenares and Bercasio, n.d.).

The 3NS is a consortium of formerly normal schools offering teacher education programs such as Bicol University (BU), Philippine Normal University (PNU), West Visayas State University (WVSU), Pangasinan State University (PSU), Western Mindanao State University (WMSU), Bukidnon State University (BSU), and Cebu Normal University (CNU) among others.

Grounding on the framework for environmental education by Monroe and colleagues (2007), the project adopted three categories according to the purposes of the environmental education program which include the following: build understanding, improve skills, and enable sustainable action. An environmental education program or intervention should aim beyond the enhancement of knowledge and building of skills related to the environment. Rather, it should also focus on the clarification and strengthening of values and enabling of sustainable action. Knowledge and skills about the different topics, concepts or principles on the environment do not guarantee appropriate action unless the necessary values such as love and respect for the environment, discipline, compassion for others especially for the marginal sectors of society are imbibed by the people themselves.

The clients of the Environmental Education – Enriched Teacher Education curriculum are expected to adequately gain environmental education competencies making them dedicated, empowered, engaged, nurturing, responsible, and resilient teachers in the future. In brief, the clients of the curriculum are expected to become eco-mentors who will become agents of transformation and sustainable development in their places of work or respective communities. In a cyclical vein, these eco-mentors will conduct environmental education in their own classrooms, schools and communities in the future.

One component of the BU project is to mainstream environmental education in the specialization courses for science and mathematics in the Teacher Education Curriculum, and determine its effectiveness in enhancing

the students' level of awareness and understanding in order to cope with disasters (Ante, 2018). In line with this, a curriculum guide showing the integration of environment education concepts and principles in the Physical Science Education courses for Bachelor in Secondary Education (BSED) and lesson plans were prepared and implemented to students who are majors in Physical Science. The instructional materials produced and provided by DENR and some developed by the researchers were used in the different teaching strategies as deemed appropriate for the lessons.

Specifically, this study aimed to assess the 3NS pre-service students' level of awareness and understanding and their level of competence on environmental education concepts and principles after implementation of the curriculum guide and lesson plans for Physical Science and using the developed assessment tool on environmental education concepts and principles.

Materials and Methods

This research used the descriptive-evaluative method in assessing Physical Science Education students' level of understanding and competence of the environmental concepts and principles using the prepared curriculum guide and lesson plans for Physical Science and the accompanying assessment tool on environmental education for teacher education students in the 3NS institutions.

The developed curriculum guide and lesson plans for Physical Science integrated environmental education concepts and principles and used the DENR EE materials consisting of: (1) DENR-produced Printed EE Materials, (2) DENR-produced Non-Print EE Materials, (3) EE Materials Downloaded from the Official DENR Website, and (4) EE Materials Used by Resource Persons during the Capability-Building Activity of the BU-DENR Research Team.

These were previously validated by content experts and underwent further validation by pilot-testing it to the BUCE BSED Physical Science majors. The pilot-testing was done through a lecture-series scheduled every Wednesday for 9 weeks during the 1st Semester, SY 2016-2017. There were three teacher implementers and observers for Physical Science during the implementation of the lessons plans. Parallel pilot-testing was likewise done by other 3NS institutions.

Before the implementation of the revised Physical

Science lessons, the pre-service teachers who were the respondents of the study, were given a questionnaire on the level of competence on environmental education concepts and principles. This consisted of their personal information, their background experience related to environmental education, a self-assessment checklist on their awareness and understanding of environmental principles, a multiple-choice test to determine their level of content knowledge of environmental concepts and principles, and an essay-type question which seeks information about students' responsible environment-related actions and behaviors and its influence on their future role as a teacher. The same instrument served as posttest after the implementation of the developed lessons.

For this study, the sources of data are the pre-test and post-test results from the assessment tool on environmental education for teacher education students in the 3NS institutions. Data were interpreted using descriptive statistical tools. These include frequency count, percentage and weighted mean. Tables 1-3 show the ranges of ratings used for interpretation of the level of understanding and level of competence of the environmental education concepts and principles.

Table 1. Range of Ratings for Level of Awareness and Understanding on Environmental Education Principles

Range	Level of Understanding
1.00 - 1.74	I do not know this yet
1.75-2.49	I know this partly
2.50-3.24	I know this well
3.25-4.00	I know and understand this very well

Table 2. Range of Ratings for Level of Awareness and Understanding on Environmental Education Principles

Range of Scores (15 Items)	Range of Scores (30 Items)	Level of Competence
3 & Below	6 & Below	Poor/Needs Improvement
4 to 6	7 to 12	Fair
7 to 9	13 to 18	Satisfactory
10 to 12	19 to 24	Very Satisfactory
13 & Above	25 & Above	Excellent

In the checklist on students' awareness and understanding of the environmental principles (Part II.A of questionnaire), students were asked to make an honest self-assessment in terms of their level of awareness and understanding of the different environmental principles. From the seven environmental principles, fifteen (15) statements are listed (Table 4). Students were then asked to indicate whether they know and understand the statements very well (4), well (3), partly (2), and does not know yet (1).

Table 3. Range of Ratings for Performance Level of Environmental Education Concepts and Principles

Range	Level of Competence
1.00 – 20.00	Poor/Needs Improvement
21.00 – 40.00	Fair
41.00 – 60.00	Satisfactory
61.00 – 80.00	Very Satisfactory
81.00 – 100.00	Excellent

Results and Discussion

The responses of the Physical Science Education students in the 3NS Institutions are shown in Table 5. It can be seen that 14 out of the 15 statements related to the seven environmental principles were known and well understood by the students (mean = 3.45). Only the 7th statement which is “Chemicals like pesticides induce insect mutations which goes against the natural checks and balances” was described as “I know this well” (w.m. = 3.08). This can mean that students do not have full awareness and understanding of the chemicals found in the environment and they may not be fully aware of the negative effects of using pesticides on the environment, among the effects of which is inducing mutations that could cause changes in the genetic make-up of organisms. Most of the studies conducted to determine the level of awareness on the effects of pesticides were conducted to farmers but not to students. Examples of these studies are that of Hou and Wu (2010), Maitah and colleagues (2015), Jallow and colleagues (2017), Jean and colleagues (2019) and Mubashar and colleagues (2019). The need for comprehensive intervention measures to reduce the health and environmental risks of pesticides and training on pesticide management and pesticide safety were also stressed in these studies.

It is also important to note that the Physical Science

Education students from Bukidnon State University (BSU), Philippine Normal University (PNU), Pangasinan State University (PSU), and West Visayas State University (WVSU) know and understand very well (mean = 3.35 to 3.69) the 15 statements related to the seven environmental principles. Only students from Bicol University (BU) and Western Mindanao State University (WMSU) had overall weighted means of 3.20 and 3.23, respectively, with the description “I know this well.” By examining the weighted means of the fifteen (15) statements related to the seven environmental principles for both BU and WMSU students, it can be noted that the 7th statement which is “Chemicals like pesticides induce insect mutations which goes against the natural checks and balances” has also the lowest weighted mean (2.68). Incidentally, this 7th statement also got the lowest weighted mean for the other 3NS institutions like BSU (3.57), PNU (3.26), and WVSU (2.95). This finding further reinforces the observation that students do not have full awareness and understanding of the chemicals found in the environment and they may not be fully aware of the negative effects of using pesticides on the environment. This finding supports the need to re-examine the content of the syllabus on relevant science and environmental education subjects mainstreamed into the curriculum to make sure that lessons on pesticides, its uses and negative effects to the environment are included. Students' awareness and understanding of this concept could be further enhanced in the lessons and additional information regarding the effects of chemicals, especially pesticides, to the environment and to people's health and well-being could be discussed.

It was also observed that BU, PNU, and WMSU had the highest weighted mean (3.7, 3.9, and 3.68, respectively) for the 15th statement which says “Humans cannot live without nature so they should not destroy or ravage it, but rather take care of it”. For BSU, the statement with the highest weighted mean (3.86 for both statements) were statements 1 and 9. For PSU, the statement with the highest weighted mean (3.89) is Statement 5 while for WVSU it is Statement 12 (3.74). All these statements deal with the nature of the environment as well as living organisms including humans and its relationship with one another. Students have enough knowledge and awareness of the nature of the environment and its importance to humans as well as to other organisms and they know that it is important to take care of the environment in order to maintain life.

The findings in Table 5 are further elaborated in Table 6 which shows the 3NS Physical Science Education students' level of understanding of the environmental principles. PNU has the highest percentage of students

Table 4. The fifteen statements related to the seven environmental principles.

Number	Statement
1	Living organisms and the environment change with the seasons.
2	Although renewable resources can be replenished, the rate of consumption or exploitation should be balanced to the rate of replenishment.
3	Human as beings gifted with reason and free will have dominion over all creatures and are capable of using these creations responsibly to their advantage.
4	Organisms are linked to another through a feeding series, to the environment and the environment is also affected by the organisms living in it including the humans through their actions and practices.
5	Population growth, polluting technologies and consumerist's lifestyle contribute to the depletion of the earth's limited resources.
6	Wastes which are thrown away and disappear from sight does not cease to exist, they dispersed in the atmosphere or remain in the ecosystem in another form whether in useful or hazardous form.
7	Chemicals like pesticides induce insect mutations which goes against the natural checks and balances.
8	Practices such as the use of chemical pesticides, use of crude oil and burning of wastes go against the natural processes and lead to ecological backlash.
9	Nature has its own mechanism to maintain balance such as in the conduciveness of environment for growth and reproduction and feeding relationship between and among organisms.
10	Both big and small creatures have invaluable roles in the ecosystem, and therefore to human life.
11	Unlovely, wriggly and troublesome creatures such as earthworms, snakes, spiders and others are necessary part of nature.
12	All faiths, whether religious or tribal beliefs, teach that everyone should respect all life and the order of nature and reject those that degrade the environment and human condition.
13	Deforestation in the mountains may adversely affect the lowlands through erosions, floods and drought because all components of the ecosystem are linked to each other.
14	Classification of wastes facilitates their proper disposal and minimizes the entry of toxic substances in the ecosystem, but does not eliminate wastes from the ecosystem.
15	Humans cannot live without nature so they should not destroy or ravage it, but rather take care of it.

(87.10%) who know and understand very well the 15 statements related to the seven environmental principles, whereas BU has the lowest percentage of students (40%) who said that they know and understand very well the statements related to the seven environmental principles. BU and WMSU has the most number of students who said that they only know and understand well the 15 statements related to the seven environmental principles (52% and 46.43%, respectively).

However, by looking at the total percentage of 3NS Physical Science Education students' level of understanding of the statements related to the seven environmental principles, 67.68% of the students are aware and understand very well the seven environmental principles. The rest of the students know well (28.66%) or partly know (3.66%) the statements related to the

seven environmental principles. These results imply that although majority of students are aware and understand very well the 15 statements related to the seven environmental principles, there is a good number of students who lack an awareness and understanding of environmental concepts and principles.

Table 7 shows the level of competence of Physical Science Education students of the 3NS institutions on the environmental concepts and principles. Only 22.44% of the students has a Very Satisfactory level of competence and almost half (42.93%) showed only a Satisfactory level of competence while the rest of the students had Fair and Poor level of competence totalling 34.64%. PNU had the highest percentage of students (54.84%) with a very satisfactory level of competence, while the rest of the 3NS institutions had less than half of the students with

a very satisfactory level of competence. More than half of the 3NS Physical Science education students had only a satisfactory level of competence, specifically WVSU (69.57%), BU (60%), WMSU (53.57%) and CNU (51.22%). Students from PSU had only a fair level of competence (94.44%).

A summary of these results is shown in the Table 8 on the level of understanding and competence of 3NS Physical Science Education students on environmental concepts and principles. In general, it can be said that the 3NS students' level of awareness and understanding is 3.45 (I know and understand this very well) and their level of competence is satisfactory (48.81).

Students do have a general idea of what they need to do to have a clean and safe environment, as seen from the responses that emerged in the essay type test about students' responsible environment-related actions and behaviors and its influence on their future role as a teacher (Table 9).

Although it can be seen from the table that students have developed positive attitudes towards the environment, still the findings in this study indicate the need to increase the level of awareness and understanding of the environmental concepts and principles of Physical Science Education students of the 3NS institutions by institutionalizing the mainstreaming of environmental education in the teacher education curriculum. According to Alvarez and Vega (2004), pre-service teacher education is one avenue to promote environmental literacy, hence, there is a need to adequately train pre-service teachers so they can achieve the professional competencies of an environmentally educated person and educator.

The findings in this study have also some similarities with the findings and recommendations of other studies. For example, the study of Rogayan and Nebrida (2019) which aimed to measure the level of awareness and practices of 100 Science students in a public secondary school in Zambales, Philippines revealed that science students are very aware of environmental concepts, state of the environment and environmental issues and problems. Students often practice taking actions to solve environmental problems and to possess a high degree of commitment towards the environment. This study also recommended that information dissemination programs regarding environmental concepts, state of environment, ecological issues and problems could be sustained by the school to keep the ecological awareness of the students high and that environmental advocacies and eco-movement projects may be institutionalized in the school

through student organizations like YES-O and Science clubs.

Similarly, Punzalan (2020) determined the relationship between environmental awareness and practices of Filipino senior high school students and found that the students have good level of environmental awareness but poor extent of environmental practice and that the level of awareness of the students is significantly related to the extent of their environmental practice. He further recommended the development of environmental education programs that will both aim to maintain and increase the understanding and capacities of the students in terms of environmental problems and environmental sustainability principles.

Marpa and Juele (2016) likewise studied the environmental awareness and practices among high school students. Their findings revealed that high school students' extent of awareness and practices was great while moderate in the greening of the environment. Significant differences among high school students' environmental awareness and practices were observed on the greening of the environment, elimination of pollutants, and maintaining ecological balance.

According to Erhabor and Don (2016), environmentally aware and empowered youth are potentially the greatest agents of change for the long term protection and stewardship of the environment, and that environmental education which promotes such change will enable these youth to have a greater voice on environmental issues.

Sharma (2014) also concluded from the results of his study that college students have fairly good environmental awareness level and that students play a big role in protecting the environment. The study recommended that integration of environmental education into the curriculum, teachers' training, development and distribution of resource material, conduct of extracurricular activities on environmental protection and conservation, and campaign through mass media, are some of the ways to increase environmental awareness among students.

The environment is not only an ecological entity distinct from people but a cultural, social, and political construct, thus understanding how learners conceptualize 'environment' may contribute to more effective environmental education (EE) (Yavetz, *et al.*, (2014). While student teachers, regardless of their major, acknowledged the importance of EE to their future function as teachers, they do not demonstrate an

Table 5. Awareness and Understanding of the Environmental Principles of Physical Science Education Students in the 3NS Institutions

Statements Related to the 7 Environmental Principles	3NS Institutions												Overall	
	BU		BSU		PNU		PSU		WMSU		WVSU		wm	D
	wm	D	wm	D	wm	D	wm	D	wm	D	wm	D		
Living organisms and the environment change with the seasons.	3.08	3	3.86	4	3.61	4	3.71	4	3.04	3	3.43	4	3.46	I know and understand this very well
Although renewable resources can be replenished, the rate of consumption or exploitation should be balanced to the rate of replenishment	2.88	3	3.62	4	3.58	4	3.61	4	3.11	3	3.09	3	3.32	I know and understand this very well
Human as beings gifted with reason and free will have dominion over all creatures and are capable of using these creations responsibly to their advantage.	3.52	4	3.71	4	3.71	4	3.86	4	3.43	4	3.52	4	3.63	I know and understand this very well
Organisms are linked to another through a feeding series, to the environment and the environment is also affected by the organisms living in it including the humans through their actions and practices.	3.29	4	3.81	4	3.65	4	3.56	4	3.39	4	3.61	4	3.55	I know and understand this very well

Table 5 (continuation). Awareness and Understanding of the Environmental Principles of Physical Science Education Students in the 3NS Institutions

Statements Related to the 7 Environmental Principles	3NS Institutions												Overall	
	BU		BSU		PNU		PSU		WMSU		WVSU		wm	D
	wm	D	wm	D	wm	D	wm	D	wm	D	wm	D		
Population growth, polluting technologies and consumerist's lifestyle contribute to the depletion of the earth's limited resources.	3.29	4	3.67	4	3.35	4	3.89	4	3.21	3	3.55	4	3.49	I know and understand this very well
Wastes which are thrown away and disappear from sight does not cease to exist, they dispersed in the atmosphere or remain in the ecosystem in another form whether in useful or hazardous form.	3.20	3	3.71	4	3.48	4	3.78	4	2.89	3	3.04	3	3.35	I know and understand this very well
Chemicals like pesticides induce insect mutations which goes against the natural checks and balances.	2.68	3	3.57	4	3.26	4	3.33	4	2.68	3	2.95	3	3.08	I know this well
Practices such as the use of chemical pesticides, use of crude oil and burning of wastes go against the natural processes and lead to ecological backlash.	2.8	3	3.71	4	3.29	4	3.11	3	3.25	4	3.43	4	3.27	I know and understand this very well

Table 5. Awareness and Understanding of the Environmental Principles of Physical Science Education Students in the 3NS Institutions

Statements Related to the 7 Environmental Principles	3NS Institutions												Overall	
	BU		BSU		PNU		PSU		WMSU		WVSU		wm	D
	wm	D	wm	D	wm	D	wm	D	wm	D	wm	D		
Nature has its own mechanism to maintain balance such as in the conduciveness of environment for growth and reproduction and feeding relationship between and among organisms.		3	3.86	4	3.68	4	3.50	4	3.29	4	3.30	4	3.45	I know and understand this very well
Both big and small creatures have invaluable roles in the ecosystem, and therefore to human life.		4	3.67	4	3.84	4	3.39	4	3.36	4	3.22	3	3.51	I know and understand this very well
Unlovely, wriggly and troublesome creatures such as earthworms, snakes, spiders and others are necessary part of nature.		4	3.62	4	3.77	4	3.72	4	3.25	4	3.35	4	3.55	I know and understand this very well
All faiths, whether religious or tribal beliefs, teach that everyone should respect all life and the order of nature and reject those that degrade the environment and human condition.		3	3.57	4	3.61	4	3.61	4	3.32	4	3.74	4	3.51	I know and understand this very well

Table 5. Awareness and Understanding of the Environmental Principles of Physical Science Education Students in the 3NS Institutions

Statements Related to the 7 Environmental Principles	3NS Institutions												Overall	
	BU		BSU		PNU		PSU		WMSU		WVSU		wm	D
	wm	D	wm	D	wm	D	wm	D	wm	D	wm	D		
Deforestation in the mountains may adversely affect the lowlands through erosions, floods and drought because all components of the ecosystem are linked to each other.		4	3.67	4	3.68	4	3.83	4	3.54	4	3.70	4	3.65	I know and understand this very well
Classification of wastes facilitates their proper disposal and minimizes the entry of toxic substances in the ecosystem, but does not eliminate wastes from the ecosystem.		3	3.57	4	3.55	4	3.47	4	2.96	3	3.17	3	3.25	I know and understand this very well
Humans cannot live without nature so they should not destroy or ravage it, but rather take care of it.		4	3.76	4	3.90	4	3.67	4	3.68	4	3.17	3	3.65	I know and understand this very well
Overall	3.20	3.69	I know and understand this very well	3.60	I know and understand this very well	3.60	I know and understand this very well	3.23	I know this well	3.35	I know and understand this very well	3.45	I know and understand this very well	

Legend: D - Description. 4 (4.00-3.25) – I know and understand this very well; 3 (3.24-2.50) – I know this well; 2 (2.49-1.75) – I know this partly; 1 (1.74-1.00) – I do not know this yet. No data for CNU, LNU, MMSU and PalSU.

Table 6. 3NS Physical Science Education Students Level of Understanding of the Environmental Principles

3NS Institutions	Level of Understanding								Total	
	4		3		2		1			
	f	%	f	%	f	%	f	%	f	%
BU	10	40.00	13	52.00	2	8.00	0	0.00	25	15.24
BSU	17	80.95	4	19.05	0	0.00	0	0.00	21	12.80
PNU	27	87.10	4	12.90	0	0.00	0	0.00	31	18.90
PSU	29	80.56	6	16.67	1	2.78	0	0.00	36	21.95
WMSU	14	50.00	13	46.43	1	3.57	0	0.00	28	17.07
WVSU	14	60.87	7	30.43	2	8.70	0	0.00	23	14.02
Total	111	67.68	47	28.66	6	3.66	0	0.00	164	100.00

Legend: 4 – I know and understand this very well; 3 – I know this well; 2 – I know this partly; 1 – I do not know this yet.

Table 7. Level of Competence as shown by the Test Results on Environmental Concepts and Principles in Physical Science Education in the 3NS Institutions

3NS Institutions	Level of Competence										Total	
	Excellent		Very Satisfactory		Satisfactory		Fair		Poor			
	f	%	f	%	f	%	f	%	f	%	f	%
BU	0	0.00	3	12.00	15	60.00	6	24.00	1	4.00	25	12.20
BSU	0	0.00	9	42.86	9	42.86	3	14.29	0	0.00	21	10.24
CNU	0	0.00	15	36.59	21	51.22	5	12.20	0	0.00	41	20.00
PNU	0	0.00	17	54.84	11	35.48	3	9.68	0	0.00	31	15.12
PSU	0	0.00	0	0.00	1	2.78	34	94.44	1	2.78	36	17.56
WMSU	0	0.00	2	7.14	15	53.57	11	39.29	0	0.00	28	13.66
WVSU	0	0.00	0	0.00	16	69.57	7	30.43	0	0.00	23	11.22
Total	0	0.00	46	22.44	88	42.93	69	33.66	2	0.98	205	100.00

Legend: Excellent (25 & Above); Very Satisfactory (24 to 19); Satisfactory (18 to 13); Fair (12 to 7); Poor/Needs Improvement (6 & below).
 No data for LNU, MMSU and PalSU.

Table 8. Level of Understanding and Competence of 3NS Physical Science Education Students on Environmental Concepts and Principles

3NS Institutions	Level of Awareness/Understanding		Level of EE Competence		
	wm	*Description	Mean Score (30)	Performance Level	**Interpretation
BU(N=25)	3.20	I know this well	13.92	46.4	Satisfactory
BSU(N=21)	3.69	I know and understand this very well	17.62	58.73	Satisfactory
CNU(N=41)	-	-	16.93	56.42	Satisfactory
PNU(N=31)	3.60	I know and understand this very well	18.13	60.43	Very Satisfactory
PSU(N=36)	3.60	I know and understand this very well	9.14	30.46	Fair
WMSU(N=28)	3.23	I know this well	13.04	43.45	Satisfactory
WVSU(N=23)	3.35	I know and understand this very well	13.89	45.80	Satisfactory
Over-all(N=205)	3.45	I know and understand this very well	14.67	48.81	Satisfactory

**(4.00-3.25) – I know and understand this very well; (3.24-2.50) – I know this well; (2.49-1.75) – I know this partly; (1.74-1.00) – I do not know this yet.*

***Excellent (100.00 & 81.00); Very Satisfactory (80.00 to 61.00); Satisfactory (60.00 to 41.00); Fair (40.00 to 21.00); Poor/Needs Improvement (20.00 & 1.00). No data for LNU, MMSU and PalSU.*

Table 9. Responses of Physical Science Education Students to the Essay Type Test on Environmental Education in the 3NS Institutions.

Topic	Response
Discipline and Cleanliness	<ul style="list-style-type: none"> • I make sure that my waste are properly thrown in the garbage can. • I will walk rather than take a jeepney ride in going to not-so-far-away places. • We should make it a habit to conserve as much energy and influence our future students. • I will discipline myself and be educated on the preservation and conservation of our environment. • I will not anymore ask for plastic bag when I buy things; I will also not buy things on sachets. • I will avoid the use of materials that can produce CO₂ that will contribute to global warming. • We should wear light-colored clothes. • I will minimize the use of gadgets that make use of electricity.
Conservation and Preservation	<ul style="list-style-type: none"> • I will regularly practice turning off the lights and faucet when not using them; • I will plant vegetable and trees and use only organic fertilizers. • We should avoid illegal activities that could cause erosion or flood. • We should minimize the use of electricity and water by taking shorter showers/baths; turning off electricity when not using them; using a glass of water when brushing teeth. • Using solar panels as a source of electricity. • We should avoid burning of material waste which produce carbon dioxide.
Proper Segregation and Disposal	<ul style="list-style-type: none"> • I consciously practice proper waste disposal and segregation. • I will not burn garbage but do proper waste management and influence my students to do the same; I will maintain a compost pit at home. • I will dispose of garbage properly like having separate containers for biodegradable and non-biodegradable waste.
3Rs – Reduce, Reuse, Recycle	<ul style="list-style-type: none"> • I will use recycled materials and use recycled paper in doing class projects and visual aids. • I will use Eco bags instead of plastic bags when going to the market or grocery.
Conduct Environmental Education and Activity	<ul style="list-style-type: none"> • I will try to promote environmental awareness by attending activities related to it; I join activities with concern to our environment • I will encourage everyone to value our environment, and influence my students by being functional, effective and responsible individuals. • I will provide my students many activities related to our environment that they may know how our environment is important • I will conduct coastal clean-up to reduce and reuse waste found there • I will get involved in environmental trainings and education that promote conservation of the environment. • I will raise awareness of the bad effects of human actions to the environment and support programs related to environmental awareness. • I will plant more trees to have clean and green community. • I will inform citizens to join clean and green programs in the community and participate in the Earth hour.

adequate understanding of the concept environment: humans are not viewed as part of the environment nor is the environment understood as a complex web of interactions among people, man-made systems and natural ecosystems. Toward the end of their study, student teachers' understandings of environment remained essentially basic indicating the necessity to reorient teacher-education programs toward EE.

Esa (2010) stated that educational institutions need to increase their efforts to educate their students for a sustainable future and that teachers are most influential in educating children and teenagers to be leaders of tomorrow in protecting the environment. Thus, aspiring teachers should demonstrate pro-environmental behaviour and attitudes if they are to integrate ESD effectively in their teaching upon graduation. They should also have good knowledge about the environment to ensure effective delivery.

Integrating environmental education across the school curriculum is one strategy to foster environmental awareness (Hollweg, *et al.*, 2011; Burns & Kovacs, 2014; Tomar, 2017). According to Hadzigeorgiou and Skoumios (2013), one possibility of doing this is by way of a pedagogical strategy which will keep the natural environment into focus and in the foreground of the teaching-learning process, thus making the relationship between the self and the natural world explicit. In addition, they said that focusing upon issues/problems of living, school science learning is made more meaningful since the instructional focus is on the interrelationship between the self, science and the natural world.

Learning about the workings of natural and environmental processes feeds into a person's appreciation for nature and ultimately into more environmental protection. With a growing appreciation for nature and an increasing desire to protect the natural environment, people also seem to seek more knowledge about the particular effectiveness of possible behavioural remedies (Roczen, *et al.* 2014)

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