

Mainstreaming of Environmental Education in the Physical Science Courses of Bicol University College of Education

Maria Eden A. Ante

Bicol University College of Education, Legazpi City
Correspondence: meaante@bicol-u.edu.ph

Abstract

The main objective of the study is mainstreaming an environmental education (EE) program in the Bachelor in Secondary Education (BSED) curriculum of Bicol University College of Education and determining its effectiveness in developing awareness and understanding of environmental concepts and principles. The study utilized mixed methods of research, specifically the developmental-descriptive-evaluative method in the development of the curriculum guide for physical science courses. The curriculum guide showing the integration of environmental education concepts and principles consisted of ten lessons distributed across the different subjects. This was successfully implemented over a nine-week period. The EE-enhanced physical science lessons were effective in developing awareness and understanding of the environmental concepts and principles. Students further gained positive attitudes and behaviors, which prepared them for their job as future eco-mentors. It is recommended that the curriculum guide and the EE-enhanced physical science lessons be implemented in other teacher education institutions and in other institutions of higher learning offering a variety of undergraduate courses other than teacher education.

Keywords: *curriculum guide, EE integration, Physical Science lessons, environmental concepts and principles*

Introduction

The need to implement an effective environmental education program in schools is of great importance. The ultimate goal of environmental education is the development of an environmentally literate citizenry. Environmental education is rooted in the belief that humans can live compatibly with nature and act equitably toward each other and that people can make informed decisions that consider future generations. Environmental education aims for a democratic society in which effective, environmentally literate citizens participate with creativity and responsibility (NAAEE, 2010).

The Tbilisi Declaration (UNESCO, 1978) defines environmental education (EE) 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.” According to the Declaration, environmental education is seen as a life-long process that is interdisciplinary and holistic in nature and application. Similarly, according

to the US Environmental Protection Agency (EPA), as cited by Dienno and Hilton (2005), environmental education allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. EPA outlines the following components of environmental education: (1) awareness and sensitivity to the environment and environmental challenges, (2) knowledge and understanding of the environment and environmental challenges, (3) attitudes of concern for the environment and motivation to improve or maintain environmental quality, (4) skills to identify and help resolve environmental challenges, and (5) participation in activities that lead to the resolution of environmental challenges. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions.

The Association of Southeast Asian Nations (ASEAN) (2014) is on its way to fulfilling a clean and green environment for regions while promoting sustainable development through public participation and environmental education. In its Environmental

Education Action Plan for 2014–2018, it hopes to realize a clean and green ASEAN with citizens who are environmentally literate, imbued with environmental ethics, and willing and capable to ensure the sustainable development of the region through environmental education and public participation efforts.

In response to the initiatives of various international agencies for a clean and green and sustainable environment, the Philippines through the Department of Education (DepEd) has taken steps to strengthen environmental education in public and private schools to boost government 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. Other related Philippine laws are RA 10121–Creation of Policy Framework on Environmental Education and Disaster Risk Reduction, RA 8749–Philippine Clean Air Act of 1999, and RA 9003–An Act Providing for an Ecological Solid Waste Management. These laws embody the voices of the clean and green planet partners and members to call the attention of the education sectors to partake in capacity-building of various sectors on environmental education and the production and development of environmental education materials. Moreover, they reiterated on the special ability of the youth to build the nation and the significance of education to foster nationalism and patriotism to provide human development, liberation, and social progress.

Advocates for environmental education have consistently targeted pre-service teacher education as an avenue to promote environmental literacy (Franzen, 2017; Plevyak *et al.*, 2001; Ballantyne, 1995; UNESCO, 1978). In a systematic review of the existing evidence from studies, which evaluated and analyzed the relationship between EE, environmental competencies, and pre-service primary school teacher training, Alvarez-Garcia and colleagues (2015) pointed to the undeniable role of teachers in the infusion of EE into schools as a tool to environmentally educate future citizens. However, according to Alvarez and Vega (2004), in order for this education to be effective in schools, adequate training of pre-service teachers is needed so they can achieve the competencies of an environmentally educated person and the professional competencies of an environmental educator. In addition, teachers have continued to enter the workforce ill-equipped for the important task of preparing citizens to make educated and informed decisions about the

environment (Liu *et al.*, 2015). Numerous barriers have been identified that make it difficult to include environmental education (EE) in pre-service teacher education programs, among which is the absence of a resource—material or human or both (Ashmann & Franzen, 2015).

The curriculum for BSED major in Physical Science of Bicol University College of Education includes two major subjects on environmental science; however, environmental education is not mainstreamed in all their major science subjects as well as in their general and professional education subjects. Yavetz and colleagues (2014), in their study comparing differences in environmental literacy between students with environmental and non-environmental areas of specialization, found that there were significant differences in students' basic environmental knowledge and in some characteristics of their environmental behavior. They recommended including at least one specific EE course in the degree program for non-environmental specialists or including it as a component of a subject. Consequently, the authors stated that all student teachers should receive appropriate preparation in EE and that it should not be limited to science disciplines; rather, it should be included in all teacher education programs.

By mainstreaming environmental education in all subjects in the teacher education curriculum (Figure 1), it is hoped that future teachers who are the frontline service providers in schools, will be adequately trained to become eco-mentors who can be described as dedicated, empowered, engaged, nurturing, responsible, and resilient teachers in the future. The eco-mentors are great stewards in conducting and integrating environmental education to the students and communities in the future. They bequeath a strong impact in influencing the young generation on how to give proper care to the environment.

The objectives of the study are the following: (1) to prepare a curriculum guide showing the integration of environmental education concepts and principles in the physical science courses of BSED Physical Science majors and (2) to evaluate the effectiveness of implementation of the EE-enhanced lessons in the physical science courses.

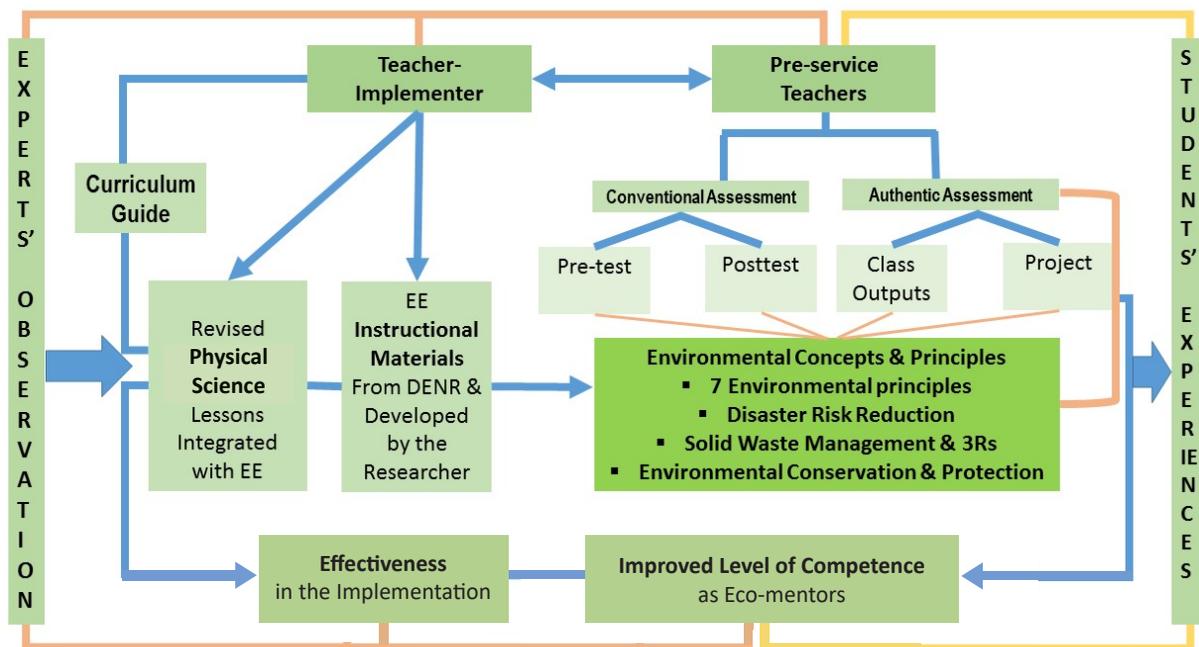


Figure 1. Mainstreaming of environmental education in the Physical Science Curriculum

Materials and Methods

This study was conducted at Bicol University College of Education–Daraga campus. The College offers both BEED and BSED degree programs with several fields of specialization, which include physical science, biological science, mathematics, physics, English, Filipino, social studies, music, arts and PE, and technology and livelihood education. It is recognized by CHED as a Center of Excellence in Teacher Education in the early 2000 and still continues with this status at present. Its students undergo a competitive selection process in order to be admitted to its degree programs.

This study is limited only to BSED major in physical science students. The respondents are third year students consisting of one whole class of 25 students. These students were informed that they will participate in the research study and have given their consent prior to their involvement as respondents.

The research used mixed methods of research. Specifically, the developmental-descriptive-evaluative method was used in the development of the curriculum guide for the mainstreaming of environmental education in the physical science courses through 10 researcher-made lessons. In addition, the effectiveness of the implementation of the EE-enhanced physical science lessons was evaluated using an assessment tool

that served as a pretest and posttest to assess student's level of competence on the environmental concepts and principles covered by the lessons.

The developed lessons for physical science integrating environmental education concepts and principles were validated by content experts and underwent further validation by pilot-testing it to a whole class of physical science majors. 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 were also used in the development of the lessons.

Before the implementation of the developed physical science lessons, the respondents of the study were given a pretest which consisted of 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 competence of environmental concepts and principles, and an essay type of test to determine their environmental behaviors and practices. The same instrument served as posttest after the implementation of the developed lessons.

The implementation of the developed lessons was

conducted during the first semester of the 2016–2017 school year—specifically in August to October 2016—through a lecture-series scheduled every Wednesday for nine weeks. There were two lessons conducted per week, one in the morning and another in the afternoon. Each lesson was taught by one teacher implementer, and three class observers were present during the lesson implementation.

Quantitative data from pretest and posttest results was further augmented with qualitative data coming from the students’ outputs in the various activities required by the developed lessons, the focus group discussions (FGD) of their experiences after the implementation, and the required environmental project that the respondents proposed and implemented as culmination of the environmental education program. It is expected that after the respondents have attended the lecture series on environmental education, they would become future eco-mentors imbued with the knowledge and understanding of environmental concepts and principles, positive values and attitudes towards the environment and a determination to help in solving environmental problems as well as in the conservation and preservation efforts of natural resources for a sustainable future.

The sources of data were the following: (1) pretest results, (2) posttest results, (3) focus group discussion, (4) documentation of the lecture series and project implementation, (5) student outputs, and (6) the curriculum guide and session plans.

Quantitative data were interpreted using descriptive statistical tools. These include frequency count, percentage and weighted mean. The ranges of ratings used for the interpretation of the level of competence of the environmental education concepts

and principles are presented in Table 1.

Results and Discussion

Curriculum guide showing the integration of environmental education concepts and principles in the Physical Science Courses

The curriculum guide for physical science includes an opening program for the lecture series, class orientation, pretest and posttest, a lecture series composed of 10 lessons, a culminating activity, clearinghouse, and a closing program. Each of the ten lessons is integrated with specific environmental concept and principles, which are deemed appropriate for the physical science topic being discussed (Table 2). The teaching strategies, assessment techniques and tools, and instructional resources used per lesson are also included. Each lesson has a time allotment ranging from 60 to 180 minutes depending on the topic. The entire curriculum guide for physical science requires nine weeks for its full implementation.

Included in the curriculum guide is a culminating activity (week 7) after the lessons were discussed. In this activity, students prepared a research or activity proposal regarding environment conservation and preservation incorporating the concepts learned from the ten lessons. There was also a discussion of the proposal in class together with the teacher. Comments and suggestions gathered during the discussion were incorporated in the revised proposal. The revised project proposals were implemented by the whole class on week 8 of the implementation of the curriculum guide. The posttest, FGD, and sharing of impressions was done on the last week (week 9) of the implementation of the curriculum guide.

The methods and content that were integrated into the lessons for physical science courses may lead to enhanced environmental literacy. Through EE, students develop questioning, analysis and interpretation skills, knowledge of environmental processes and system, skills for understanding and addressing environmental issues, and personal and civic responsibility (NAAEE, 2010). According to Libermann and Hoody (1998), using the environment as the integrating context for learning has been linked to improved test scores, engagement, and teacher satisfaction.

Table 1. Ratings used for Interpretation of the Level of Competence of the Environmental Education Concepts and Principles

Range of Scores (15 Items)	Range of Scores (30 Items)	Level of Competence
3 & Below	6 & Below	Poor
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

Table 2. Lessons in the curriculum guide of BSED major in Physical Science

No.	Lesson	Time Allotment	Subject	EE concept integrated	Activity	Assessment
1	The Scientific Method	60 min	Phy Sci Ed 9 – General and Inorganic Chemistry	Awareness on environmental problems	Presentation/ discussion of the scientific method. Think-pair-share activity: “Be an Environmental Detective” to find out whether detergents can fertilize plants and cause eutrophication. They are asked to design a house experiment to answer the problem	The students identify an environmental problem that affects their community and address such problem by applying the scientific method
2	Physical and Chemical Change	120 min	Phy Sci Ed 5 – Inorganic Chemistry	Saving water and preventing water pollution	Video presentation about physical and chemical changes Teacher demo of a chemical change	Students share ideas on how they can help save water and prevent water pollution
3	Balancing Chemical Equations	120 min	Phy Sci Ed 5 – Inorganic Chemistry	Proper waste disposal	Presentation/ discussion of chemical reactions and how to balance chemical equations Problem solving on balancing chemical equations	Students cite examples of some chemical reactions that are beneficial and harmful to the environment
4	Introduction to Organic Reactions (Halogenation of alkanes: chlorination and bromination)	120 min	Phy Sci Ed 11 – Organic Chemistry	Protection of the ozone layer	Presentation/ discussion of the concept of halogenation;	Students are asked to compose and present a jingle on how ordinary citizens can help in saving the ozone layer.

No.	Lesson	Time Allotment	Subject	EE concept integrated	Activity	Assessment
5	Education for Sustainable Development	60 min	Phy Sci Ed 17 – Biochemistry	Management, protection and conservation of available resources	<p>Thinking/ writing activity: Students answer questions on how they can maintain a progressive community without sacrificing the resources and the environment.</p> <p>Students react on a given environmental passage: “Nations shall cooperate to conserve, protect and restore the health and integrity of the Earth’s ecosystem”</p> <p>Video presentation about the bombing of Hiroshima and Nagasaki by American forces during WWII.</p>	<p>Students will evaluate their community, whether it is developed or not; discuss the manifestations of development; and how development could be achieved.</p> <p>Internet search for articles that discuss the benefits and risks of using nuclear power.</p>
6	Applications of Nuclear Chemistry	120 min	Phy Sci Ed 18 – Physical Chemistry	Awareness on environmental issues	<p>Students identify the impacts of nuclear chemistry to the fields of medicine, industries, food and agriculture, human, animal and plant genetics, war and peace, and electric power generation.</p>	<p>Fishbowl discussion to present arguments for and against the reopening of the Bataan nuclear power plant as a solution to energy shortages.</p>
7	Work, Power and Machines	180 min	Phy Sci Ed 4 - Mechanics	Influence of human activities and technologies on the natural environment; Energy conservation	<p>Role playing on the efficiency of simple machines and the benefits to both humans and the environment derived from its use.</p>	<p>The students work in groups to create an efficient simple machine that could lessen energy requirements</p>

No.	Lesson	Time Allotment	Subject	EE concept integrated	Activity	Assessment
8	Electrical Power and Electrical Energy	60 min	Phy Sci Ed 9 – Electricity and Magnetism	Wise consumption of electrical energy	Powerpoint presentation to discuss how electrical consumption could be minimized or used wisely	Problem-solving activity: students are given problems on electric power and energy to be solved and computed.
9	Direct current, Motor and Electric Generators	180 min	Phy Sci Ed 9 – Electricity and Magnetism	Designing technology to address energy problems; Environmental awareness	<p>Video presentation that discusses the historical events of electric motors and generators</p> <p>Teacher demonstration of Faraday’s experiment</p> <p>Analogy organizer to discuss the similarities and differences between motors and generators</p>	Students work in groups to design a simple motor and generator that could help address energy consumption problems
10	Introductory DC Circuits	120 min	Phy Sci Ed 15 – Basic Electronics	Resourcefulness: identifying environment-friendly materials in making simple circuits	Class discussion of concepts about electric circuits by means of a power-point presentation	Students work in groups to make simple electric circuits using environment-friendly and highly efficient materials.

Effectiveness of Implementation of the EE-enhanced Lessons in Physical Science Courses

Table 3 presents a comparison of the pretest and posttest results in the modified identification and multiple choice tests to determine the level of competence on environmental education concepts and principles of physical science students.

Majority (18 out of 25) of the students showed a positive increase in their pretest and posttest results; although, the increase in the scores in the posttest is not substantial, ranging from 1 to 6 points only. Looking at the description of the level of competence between the pretest and posttest, however, only nine students had an increase in their level of competence, i.e., from Poor to Fair (1), Fair to Satisfactory (6), and Satisfactory to Very Satisfactory (2); while 13 students have no increase, i.e., Satisfactory to Satisfactory (12) and Very Satisfactory to Very Satisfactory (1).

However, the result of the t-test on Table 4 would show that the difference in the mean scores between the pretest (13.92) and posttest (15.84) is significant, which means that the students gained a significant level of competence in understanding environmental principles after the implementation of the lessons.

These results would suggest that the students developed an awareness and understanding of the different environmental principles after the lessons had been conducted where the environmental concepts and principles were integrated. This finding is similar to the findings of Schmitz and Da Rocha (2018) and Erhabor and Don (2016), which showed that participation in an environmental education program improved students' environmental knowledge and attitudes towards the environment. Likewise, the study of Tal (2010) on pre-service teachers' reflection on an environmental knowledge questionnaire administered in an introductory environmental education course showed that students' initial environment knowledge was poor, but increased substantially after the course, especially when exposed to a variety of teaching methods such as debate forum and field trips which contributed a great deal to their learning.

The physical science students do have a general idea of what they need to do to have a clean and safe environment. When they were asked through an essay type test after the implementation of the lessons what responsible environment-related actions and behaviors they consciously practice every day, the following

common themes in Table 5 emerged.

It is evident that the students exhibited basic to more complex pro-environmental behaviors during exposure to environmental education lessons. Basic pro-environmental behaviors exhibited include among others walking rather than taking a ride in jeepneys, planting more trees, using a glass of water when brushing teeth, disposing of garbage properly and using eco-bags instead of plastic bags. More complex behaviors include maintaining a compost pit at home for organic farming, using recycled paper in doing class projects, involvement in environmental trainings and education that promote conservation of the environment, and supporting programs related to environmental awareness. In a study by Cheeseman and Wright (2019) exploring how environmental knowledge, attitudes, and behavior changed as a result of participation in an outdoor summer camp and which experiences in camp led the campers to change perspective, participants expressed deeper care for the environment, a more complex understanding of nature, and a deeper desire to protect the natural world. The authors suggest that camp participation may have helped participants feel more positively about tackling environmental issues.

In an FGD organized by the researcher to gain insights about students' experiences after the implementation of the 10 lessons, the following sample extracted statements showed some of the students' responses to the questions posed by the researcher.

The first question, "What environmental concepts and principles do you recall most easily?" generated the following answers from the students:

- Nature knows best. In nature, nutrients pass from the environment to the organisms and back to the environment. Any disruption in the cycle can bring about an imbalance.
- Everything is connected with each other. Every species are interconnected with each other, humans eat other plants and animals and we also feed them. Our actions affect many others, whether positive or negative.
- Everything that happens in our environment is like a chain reaction; everything has a cause and effect.
- Everything changes. Due to the fast-paced living we are into nowadays, humans and other living things have to cope, adjust or

Table 3. Physical Science Students' Level of Competence in the Pretest and Posttest on Environmental Concepts and Principles using modified identification (15 items) and multiple choice (15 items) tests.

Student	Pretest			Description*	Posttest			Difference	
	Modified Identification Test	Multiple Choice Test	Total (30)		Modified Identification Test	Multiple Choice Test	Total (30)		
1	10	8	18	S	12	6	18	S	0
2	10	1	11	F	10	4	14	S	3
3	10	1	11	F	11	5	16	S	5
4	6	7	13	S	11	4	15	S	2
5	9	5	14	S	10	4	14	S	0
6	7	4	11	F	8	5	13	S	2
7	12	7	19	VS	10	6	16	S	-3
8	8	5	13	S	12	7	19	VS	6
9	6	3	9	F	9	4	13	S	4
10	5	1	6	P	6	5	11	F	5
11	9	4	13	S	9	6	15	S	2
12	11	8	19	VS	10	8	18	S	-1
13	7	8	15	S	9	9	18	S	3
14	12	7	19	VS	12	8	20	VS	1
15	11	5	16	S	12	6	18	S	2
16	10	4	14	S	12	6	18	S	4
17	9	5	14	S	12	4	16	S	2
18	6	3	9	F	11	4	15	S	6
19	10	5	15	S	11	6	17	S	2
20	11	6	17	S	13	8	21	VS	4
21	11	3	14	S	9	4	13	S	-1
22	9	3	12	F	10	5	15	S	3
23	10	6	16	S	9	8	17	S	1
24	9	7	16	S	8	4	12	F	-4
25	9	5	14	S	10	4	14	S	0

*E- Excellent (25 & above); VS - Very Satisfactory (24 to 19); S - Satisfactory (18 to 13); F - Fair (12 to 7); P - Poor (6 & below).

change their way of living.

- Sustainable development. The improvement of industrialization has damaged our natural resources.
- Sustainable development is important to the improvement not just of our economy but also our society and most importantly our environment.

Environmental principles (EP) 1, 3, 4, and 7 are the ones most easily recalled by the students. These are: EP 1, living organisms and the environment change with the seasons; EP 3, humans as being are gifted with reason and free will and have dominion over all creatures and are capable of using these creations responsibly to their advantage; EP 4, organisms are linked to one another through a feeding series, and the environment is also affected by the organisms living in it including humans through their actions and practices; and EP 7, chemicals like pesticides induce insect mutations which go against the natural checks and balances. The statements written by the students about these environmental principles may be attributed to the fact that they are able to relate their own experiences and observations to the everyday occurrences on earth such as energy cycling, food chains and food webs, disasters and calamities, and industrialization and technology. In a similar study where students were asked about “what changes have they observed in the environment?” students considered global warming, deforestation, extinction of species, natural disasters, water scarcity, flooding, erosion, garbage and ice melt as the major changes in the environment. When asked “how these changes in the environment affected their lives?” students complained about emotional and physical negative impacts of environmental changes on their lives in the first place and the lack of fresh air, environmental degradation, soil erosion, and desertification as other important negative changes in their environment (Eylem Kaya *et al.*, 2012).

Some of the students’ answers to the second question: “What activities related to the environment do you like best? Why?” are the following:

- Tree planting, because it helps in providing fresh and clean air, also prevents soil erosion, deforestation and depletion of ozone layer.
- Clean-up drive, because it helps in saving aquatic and marine life.

- Going to coastal areas or even urban areas in which people of the community are getting informed and eventually involved.
- Making flyers campaigning for proper waste disposal. We are able to show our concern for the conservation of the environment.
- Conducting science camps where the activities focus on environmental concerns like planting trees, waste management and seminar about environmental concepts. It helps in deepening my understanding to handle environmental problems that we encounter every day.

From these responses, it can be seen that students enjoy being provided with stimulating and outdoor activities related to the environment. These activities enable students to get close to Nature and observe how nature works. It is evident that students value their surroundings, they enjoy being close to nature and they value these God-given resources both for their use as well as for aesthetic purposes and they are very willing to participate in conservation and preservation efforts. These are reflected in their answers to the third question stated below.

“In what way do you consider your participation in this activity fruitful and relevant?” Students’ answers included the following:

- I think that my participation in this activity was fruitful and relevant in a way that I effectively learned what was taught and I came up with various ideas which I can apply in my own community.
- I consider my participation in this activity as fruitful and relevant to my field of specialization because as a future teacher, we will have a great influence to our students.
- It is relevant to me because as a future teacher we are able to acquire knowledge and skills needed for the preservation and conservation of the environment.
- I will be able to appreciate and promote awareness to the members of my community, and as a future educator, I will influence my students to conduct the same activities as we had.
- I can apply the things that I have learned to our daily living; I can apply them to my teaching

Table 4. Comparison of Competence on Environmental Education as Revealed by the Pretest and Posttest of the Physical Science Students

Competence on Environmental Education	Pretest		Posttest		t-test	t Critical	p value	Interpretation
	Mean	SD	Mean	SD				
Physical Science Education (N=25)								
Test on Environmental Principles	9.08	1.96	10.24	1.64	3.0754	1.7108	0.0025	Significant
Test on Environmental Concepts and Principles	4.84	2.15	5.60	1.61	2.0244	1.7108	0.0270	Significant
Overall Mean Scores	13.92	3.30	15.84	2.54	3.7434	1.7108	0.0005	Significant

Table 5. Common Themes in Physical Science Education Students' Responses to the Essay Type Test on Environmental Education

Discipline and Cleanliness	<ul style="list-style-type: none"> • Walking rather than taking a jeepney ride in going to not-so-far-away places. • Proper waste disposal for a clean environment. • Avoiding the use of materials that can produce CO₂ that will contribute to global warming. • Wearing light-colored clothes. • Minimizing the use of gadgets that make use of electricity. • Being a nature lover.
Conservation and Preservation	<ul style="list-style-type: none"> • Minimizing 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. • Avoiding burning of material waste which produce carbon dioxide.
Proper Segregation and Disposal	<ul style="list-style-type: none"> • Maintaining a compost pit at home for organic farming. • Disposing of garbage properly like having separate containers for biodegradable and non-biodegradable waste.
3Rs – Reduce, Reuse, Recycle	<ul style="list-style-type: none"> • Using recycled paper in doing class projects and visual aids. • Using Eco bags instead of plastic bags when going to the market or grocery. • Reducing the use of plastics.
Conduct Environmental Education and Activity	<ul style="list-style-type: none"> • Involvement in environmental trainings and education that promote conservation of the environment. • Raising awareness of the bad effects of human actions to the environment. • Planting more trees to have clean and green community. • Support programs related to environmental awareness. • Inform citizens to join clean and green programs in the community. • Participating in the Earth hour.

someday.

- By gaining information from the lessons, the awareness that I can share will be more meaningful because the scope of my understanding became wider. It molded me to be more responsible of my place in the environment.
- I consider my participation in this activity as fruitful and relevant to my field of specialization because it is important to also focus on environmental concerns because this really need attention especially that industrialization has deteriorated our natural resources. So as stewards of the earth we should gain awareness on what are the things that we should do and avoid to preserve and restore the richness and beauty of the environment.
- My participation in this activity became fruitful because it enlightened my mind on the importance of nature and to us to attain sustainable development. Nature is our home which gives all our needs, so we should protect it, not destroy it.

Most of the students said that their participation to the lecture series was fruitful and relevant to their lives. They were able to learn new ideas and gain an appreciation of the importance of environmental education to themselves as well as to their future as science educators. They said that they can apply what they have learned to their daily lives and impart the knowledge and skills that they have learned to their future students as well as to the members of the communities in which they live. They would be able to participate in conservation efforts by the government taking into account the different environmental concepts and principles in any decision-making processes that they will encounter.

It can be gleaned from these responses that students are receptive to any environmental education program that may be imposed on them by the curriculum and that they take this endeavor as a positive measure in order to foster awareness and understanding of the many environmental issues and problems that might be encountered as a result of increasing population, weather disturbances and climate change. Students view themselves as future eco-mentors which are very important in order to attain sustainable development. The implementation of the lecture series

on environmental education opened their minds and hearts. They became more sensitive to the issues about the environment and they are very willing to help in any undertaking related to conservation and preservation efforts of the environment.

Grounding on the legal bases of environmental education (EE) and on the new framework for environmental education of Monroe and colleagues (2007), this study purports the significance of mainstreaming of EE in the Teacher Education Program. Republic Act No. 9512–National Environmental Awareness and Education Act of 2008 mandates the involvement of various sectors in environmental education in order to ensure that the environmental laws are upheld and that practices and behaviors are environmentally responsible. Part of the mandate of this law is the development and production of environmental education materials, and teacher education courses, and related livelihood programs (Sections 6 and 7, RA 9512).

The mainstreaming of environmental education in the physical science courses can be seen in the developed curriculum guide as well as the developed lessons in physical science. The instructional materials from DENR and those developed by the researchers were used in the different teaching strategies as deemed appropriate for the lesson. Conventional and authentic assessments are incorporated in the EE-enhanced lessons in order to determine whether environmental concepts and principles can improve students' level of competence as eco-mentors as well as determine the effectiveness of its implementation.

In addition to the content or scope, the purposes of the environmental education program or intervention need to be clarified at the outset. Grounding on the new framework for environmental education by Monroe and colleagues (2007), this framework adopts three categories according to the purposes of our 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 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, and compassion for others

especially for the marginal sectors of society are imbibed by the people themselves. There is then the strong need to include clarifying and strengthening values in order to ensure a holistic and genuine environmental education program.

With content or scope and purposes in place, there is a need to specify strategies for implementation or delivery. Among the strategies suggested by Monroe and co-workers (2007) and generally recognized as learner-centered strategies are active learning, collaborative learning, inquiry-based learning, problem-based learning, contextual learning, project-based learning, and service learning. These strategies are premised on the principle of “learning by doing” and, therefore, are deemed to stimulate active participation of the learners.

The content or scope, purposes, and strategies for delivery or implementation are considered in making innovation in the teacher education curriculum through the integration of environmental education. The effective and efficient delivery of these lessons would require support from stakeholders, such as school officials and teachers and relevant school policies to permit an innovation in the curriculum. Additionally, appropriate materials and competent and committed teachers are necessary in the actual delivery of the lessons. The materials refer to the environmental education materials produced and provided by DENR.

Conclusion

The following conclusions may be drawn from the results of the study:

1. A curriculum guide showing the integration of environmental education concepts and principles in the Physical Science courses for BSED Physical Science majors was prepared consisting of ten lessons distributed across the different subjects. This was successfully implemented over a nine-week period.
2. The EE-enhanced physical science lessons were effective in developing awareness and understanding of the environmental concepts and principles. Students further gained positive attitudes and behaviors, which prepared them for their job as future eco-mentors.

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