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Effectiveness of "Greening" the Professional Education Courses in Teacher Education Program in the National Network of Normal Schools

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ABSTRACT

This study determined the effectiveness of the Professional Education lessons embedded with environmental concepts and principles using the materials from the Department of Environment and Natural Resources (DENR). It involved the 399 third Teacher Education students from the eight member institutions of the National Network of Normal Schools (3NS) during the first term of the academic year 2016-2017. Data gathering strategies were parallel pretest and posttest, focus group discussion, document analysis, and process documentation of the class project implementation. Data sources were the results of validated researcher-made Test on Environmental Concepts and Principles, focus group discussion, analysis of the curriculum guide, and the documentation of the students' environmental project implementation. The t-test (4.443) between the pre-test mean of 14.50 and the post-test mean of 18.83 showed a significant increase in the test at 0.05 level of significance. The results show that the EE-enriched lessons in Professional Education courses were found effective in enhancing the level of environmental competence of the students based on the test results and supported by the students' narratives and project implementation. The institutionalization of the integration of environmental education in the Professional Education courses in the Teacher Education curriculum is strongly recommended.

KEYWORDS

Eco-mentors; environmental principles; EE integration; professional education courses; teacher education curriculum

INTRODUCTION

Environmental problems persist and even continue to worsen, affecting people, properties, and processes worldwide. Lives are threatened, properties are destroyed, and human activities are challenged. In these situations, it is more exigent than ever that environmental education (EE) is given the utmost attention and serious consideration. EE is education *in*, *about*, and *for* the environment (Lucas, 1972, as cited by Monroe et al., 2007). It is evident, therefore, that EE is learning for the environment and simply learning about or in the environment (Glackin & King, 2020). It aims to create an environmentally literate citizenry vital to resolving environmental issues (North American Association for Environmental Education, 2004).

EE has evolved through the years from the Belgrade Charter in 1976 and the Tbilisi Declaration (NAAEE, 2004). In more than four decades, EE has been reconceptualized, studied, and implemented worldwide to what it is now. Recognizing the significance of viewing the environment within the context of human influences, EE integrates an

investigation of economics, political structure, culture, and social equity along with natural processes and systems (NAAEE, 2004).

To cultivate skills and habits that people can use to understand and act on environmental issues (NAAEE, 2004), EE may be done formally or informally. With an integrative approach, EE can be integrated in the curriculum as a "greening of the curriculum" (Ajiboye & Ajitoni, 2008; Artun & Ozsevgec, 2016; Chimbodza & Ongevelle, 2004; Cutter-Mackenie & Edwards, 2010; Emmanue & Ambe, 2014; Ormond et al., 2014). In informal education, EE can be implemented outside a mandated or prescribed curriculum and even outside the classroom or school, such as in school gardens (Bowker & Tearle, 2007), botanical gardens (Drissner et al., 2013), eco-attractions (Dunkley, 2016), forest conservation (Dickinson, 2011), and using place-based education (Dale et al., 2020).

In the Philippines, EE is mandated by the Philippines' National Awareness and Education Act of 2008. The national agency in the country called the Department of Environment and Natural Resources (DENR) leads its implementation in partnership with government and non-government agencies, including the education sector. This law mandates these agencies to promote environmental awareness and education and support all public education and awareness programs dealing with environmental protection and conservation, including developing and producing EE materials (Section 7, RA 9512, 2008).

Higher education has a crucial role in promoting EE nationally in support of the EE as a relevant and essential human endeavor and of this law. Recognized as the key players in reorienting education to address sustainability (Hopkins & McKeown, 2005), the higher education institutions offering Teacher Education programs need to prioritize EE in partnership with DENR. The different specializations in the Teacher Education curriculum can appropriately serve as a meaningful context for EE. In this way, EE becomes a transversal theme (Conde & Sanchez, 2010), so EE is not delivered using a biological perspective (Pasin & Bozelli, 2019). Among the options for EE mainstreaming in the TEIs is the National Network of Normal Schools (3NS) involvement. It is a national organization composed of normal schools which have become highly reputable universities offering the Teacher Education program. A collaborative EE on a national scale can serve as a compelling undertaking to support EE in higher education. Thus, this study on EE integration in the Professional Education courses of the Teacher Education program is deemed important and beneficial.

This paper deals with the following research objectives: (1) Develop an EE curriculum guide in the Professional Education courses using an integrative approach; (2) Assess students' level of environmental competence; and (3) Determine the effectiveness of the EE-enhanced lessons in Professional Education courses in the 3NS institutions.

RESEARCH METHODS

Research Design. This research used descriptive research design and pre-experimental research design. The descriptive research was used to describe the EE materials for the Professional Education courses and to describe the environmental awareness and environmental competencies of the Teacher Education students in the 3NS institutions. This research design is deemed appropriate since descriptive research aims to describe a phenomenon and its characteristics rather than how or why something has happened (Nassaji, 2015). Documentary analysis was used to describe the EE materials and the EE-enriched lessons in the different Professional Education Courses. A survey using a validated researcher-made test was used to determine the environmental competence of the Teacher Education students before and after EE intervention.

The pre-experimental design was used to test whether the EE-enriched lessons in the different Teacher Education courses could enhance the environmental awareness and competencies of the preservice teachers in the eight universities. Pre-experimental designs are research schemes in which a subject or a group is observed after a treatment has been applied to test whether the treatment has the potential to cause change (Frey, 2018). As elaborated further by Frey (2018), pre-experiments are often preparative forms of exploration before engaging in experimental endeavors, providing cues or indications that an experiment is worth pursuing. Pilot testing was used to determine whether the EE-enriched lessons in Professional Education courses have the potential to enhance environmental competence as a means of further validating the juror-validated session plans that integrate environmental concepts and principles using the DENR EE materials.

The setting of the study. The pilot testing was conducted during the first term of the academic year 2016-2017, in eight 3NS institutions, with Bicol University as the lead institution, and it is essential to mention that parallel studies in different disciplines are conducted both in Bicol University and other institutions. It involved a total of 399 third year Teacher Education students. Since the lessons are from various Professional courses spread throughout the second to fourth year level, the research intervention was done through a lecture series. Shown in Table 1 is the number of student participants from each of the eight 3NS institutions.

Table 1. Students from 3NS Institutions who participated in the Pilot-testing of Mainstreaming of EE in the Professional Education Courses

3NS Institutions	*f*	%
Bicol University	63	15.79
Bukidnon State University	26	6.52
Cebu Normal University	40	10.03
Palawan State University	19	4.76
Pangasinan State University	24	6.02
Philippine Normal University Cadiz	47	11.78
Western Mindanao State University	90	22.56
Western Visayas State University	90	22.56
Total	399	100.00

Sources of Data. The primary sources of the data were the pretest and posttest results. The pretest and the Posttest were administered to the students during the first term of the academic year 2016-2017. Other sources of data were the results of the analysis of the Curriculum Guide together with the session plans done after the jurors' critiquing, focus group discussion, documentation of the students' environmental project implementation.

Data Gathering Tools. The data gathering tools were the validated researcher-made objective-type test on different environmental principles and concepts and the FGD guide questions.

The Pretest on Environmental Concepts and Principles covers 15 items on self-assessment on environmental principles and 15 multiple choice types of test items with four options dealing with varied environmental concepts and principles based on the validated Table of Specifications. The Table of Specifications was prepared based on the developed Session Plans in different Professional Education lessons considering the available DENR-produced materials. It also includes an essay type of question asking the students to present and discuss the responsible environment-related actions and behaviors that they practice consciously, which influence their future role as a teacher.

The Posttest consists of 15 items using modified identification of environmental principles and 15 multiple choice type of test items on different environmental concepts and principles similar to the pretest but with a different sequence of test items. It also includes an essay type of test where the students are to reflect by describing their experiences gained in the lecture series on environmental education and how their day-to-day decisions and behaviors were influenced by the environmental concepts and principles discussed.

Statistical Tools. Data were interpreted using frequency count, percentage, weighted mean, mean, and t-test. The performance level was described using the following ranges of ratings: 0-20-Poor/Needs Improvement; 21-40-Fair; 41-60-Satisfactory; 61-80-VerySatisfactory; and 81-100-Excellent. The interpretation of the level of competence of the environmental education concepts and principles is shown in Table 2.

Table 2. Range of Ratings for Level of Competence in Environment Concepts and Principles

Range of Score (15)	Range of Score (30)	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

RESULTS AND DISCUSSION

EE Curriculum Guide in the Professional Education Courses using Integrative Approach

The curriculum guide for integrating EE in the lessons in Professional Education courses includes the topic for the lesson, the EE integration, the DENR EE materials to be used, and the part of the lesson/assessment techniques where there is EE integration. The validated Curriculum Guide includes eight session plans but covers the ten original topics based on the original ten session plans and requires a 9-10 week engagement, including the proposal making, revision and implementation if delivered in a lecture-series or training format. Two lessons are scheduled to be delivered per week.

The validated Curriculum Guide features the following EE concepts and principles: (1) Solid Waste Management; (2) Environmental Awareness, Preparedness, Safety during Disaster; (3) Environmental Conservation; (4) 3R's-Reuse, Reduce, Recycle; and (5) Environmental Principles such as "Everything is connected to everything else," "Ours is a finite earth," and "Nature is beautiful, and we are stewards of God's creation." These EE concepts and principles were covered by the lessons considering both the EE points of integration in the Professional Education courses and the available DENR EE materials in the absence of an official list of minimum EE competencies that a preservice teacher, regardless of specialization, must possess.

The specific DENR EE materials to be used in the lessons include (1) PowerPoint Presentation on Environmental Principles; (2) Pamphlet entitled "The Ecological Solid Waste Management Act of 2000"; (3) Pamphlet entitled "Stop! Think! Act! What You Need to Know About Earthquake Preparedness in the Country"; and (4) Pamphlet entitled "Solid Waste Management Made Easy". Other EE materials are those searched from various internet sources, including videos, PowerPoint presentations, and PowerPoint-based games prepared by the researchers. Overall, the EE materials consisted of printed materials and multimedia materials.

The lessons use the PERC learning model created for this study, which captures the lesson's different phases, such as Presentation, Engagement, Exploration, Recall, Relate, Reflection, and Creation/Collaboration. The strategies used in the lessons are learner-centered and include lecture-discussion using multimedia presentations, collaborative learning, cooperative learning, reflective learning, game-based learning, and project-based learning. The formative assessments include individual, dyadic, and small group activities. These include the question and answer, poster making, reflective writing, video analysis, individual writing task using a worksheet, differentiated group tasks using a worksheet, and a simulated quiz bee.

The time allotment for each lesson was 90 to 120 minutes or approximately a half-day engagement for two lessons. Out of the eight lessons, seven have 90 minutes time allotment, while one has 120 minutes time allotment. The Curriculum Guide is flexible, although the lessons are sequenced based on the relevance of topics to one another such that those closely related topics are scheduled to be delivered in the same week. The number of weeks required may be reduced or increased, whichever is necessary, depending on the availability of the teacher and students. The curriculum guide may serve as a reference for topics of the lesson, EE integration, strategy to be used, assessment tools, and instructional materials if a lecture series or training program format is not desired.

The Curriculum Guide includes the following: orientation, pretest and Posttest administration, and the project proposal preparation, revision, and implementation. The orientation provides the participants clearly with the objectives of the engagement. The pretest and Posttest provide them the opportunity to determine their level of environmental competence. The project proposal making, revision, and implementation provide the students with contextual learning opportunities to transfer learning, thus allowing them to put into action the knowledge, skills, and attitude they gain from the different lessons and EE activities. When the students know the purpose of the activities and understand what they know about EE, they may be expected to participate actively.

The development of the curriculum guide for EE integration in the Professional Education course provides evidence that EE can serve as a transversal theme in the Professional Education courses (Conde & Sanchez, 2010) and, therefore, can be considered a "greening of the curriculum" (Ajiboye & Ajitoni, 2008; Artun & Ozsevgec, 2016; Chimbodza & Ongevelle, 2004; Emmanue & Ambe, 2014; Ormond et al., 2014). This "greening of the curriculum" can help lessen the lack of EE instructional resources (Kimaryo, 2011). With these lessons in Professional Education courses embedded with EE, future teachers are given the opportunity to foster skills and habits to understand and act on environmental issues (NAAEE, 2004), to develop their transdisciplinary and critical thinking about the field of EE (DuBois et al., 2019), and to help nurture future eco-mentors who need pedagogical and content knowledge – what to teach and how to teach (Eames & Birdsall, 2019). Although Kollmuss and Agyeman (2012) found that environmental awareness does not guarantee pro-environmental behavior, studies have shown that EE programs have been found to produce favorable results (Ajiboye & Ajitoni, 2008; Artun & Ozsevgec, 2016; Chimbodza & Ongevelle, 2004; Emmanue & Ambe, 2014; Ormond et al., 2014). Moreover, the development and validation of the EE Curriculum Guide are in response to the mandate of developing EE teaching and learning resources (RA 9512, 2008) and the government's responsibility of developing the capacities in teaching EE (Kimaryo, 2011). Developing relevant EE materials is important since students perform better with pertinent instructional materials than those who do not use such materials (Adalikwu & Iorkpilgh, 2013).

Students' Level of Environmental Competence

The student's level of competence in terms of the environmental concepts and principles covered by the lessons was gauged by considering both self-assessment rating and test consisting of modified identifying error, multiple-choice, and essay type. Results are presented per item, per student, and per level of competence to have a comprehensive perspective on the student's performance.

Of the 399 students, 178, or 44.61%, had a satisfactory level of environmental competence, while 111, or 27.82 %, had a very satisfactory level of environmental; competence (see table 3). A minimal number of students had either excellent or poor levels of competence. Although generally, the students had a satisfactory or very satisfactory level of competence in EE, the results imply the need for further EE lessons or activities to increase the number of students with excellent or very satisfactory levels of competence in EE. This finding suggests that universities do not generally have institutionalized EE programs for students enrolled in the Teacher Education program or other academic programs. Currently, there has been no wide-ranging initiative in "greening the curriculum" for the Teacher Education curriculum or other curricula either as integration in the courses where appropriate or as a comprehensive after-class program or academic support/enrichment EE program. Though the universities, through different organizations or clubs, currently engage in activities or initiatives related to environmental protection and promotion, these do not constitute an institutionalized comprehensive EE program for the students in general.

Table 3. Students' level of environmental competence

University	Level of Environmental Competence										Total	
	Excellent		*Very Satisfactory*		*Satisfactory*		*Fair*		*Poor*			
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
1	1	1.59	26	41.27	27	42.86	9	14.29	0	0.00	63	15.79
2	0	0	5	19.23	17	65.38	4	15.38	0	0.00	26	6.52
3	0	0	0	0	3	7.5	37	92.5	0	0.00	40	10.03
4	0	0	4	21.05	12	63.16	3	15.79	0	0.00	19	4.76
5	0	0	0	0	1	4.17	19	79.17	4	16.67	24	6.02
6	2	4.26	25	53.19	17	36.17	3	6.38	0	0.00	47	11.78
7	0	0	20	22.22	50	55.56	19	21.11	1	1.11	90	22.56
8	0	0	31	34.44	51	56.67	8	8.89	0	0.00	90	22.56
Over-all	3	0.75	111	27.82	178	44.61	102	25.56	5	1.25	399	100

Likewise, the students whose performance falls below a satisfactory level may have misconceptions about different EE concepts and principles, and therefore they may need some review or refresher. While these results may be normal since the students had exposure to EE in the previous years, this finding suggests that they may not have fully understood the different EE concepts and principles; over time, they gained some misconceptions or failed to retain basic information. This finding could also indicate that there may be no regular transfer of learning of EE concepts and principles to everyday life through pro-environmental behaviors, although environmental knowledge or awareness is not directly related to pro-environmental behavior (Kollmuss & Agyeman, 2002).

In summary, results show that the mean scores of the eight groups of students from the 3NS institutions range from 8.63 as the lowest (University 5) and 18.55 as the highest (University 6), with 28.75 % and 61.84% levels of performance, respectively. Out of these

eight groups of students, five groups of students from 1, 2, 4, 7, and 8 had a satisfactory level of performance, two groups of students from University 3 and 5 had fair performance and students from University 6 had a very satisfactory performance. Overall, the mean score is 15.33, with 51.12% level of performance or satisfactory (see table 4). While the assessment results are generally favorable, it is to be noted that the performance of students from Universities 3 and 5 was below the satisfactory level.

These results imply that the students may not yet be fully qualified enough to become eco-mentors since they would need some more EE. In turn, these suggest that EE is still in the marginal area at the tertiary level, specifically in the teacher education program, in particular, contrary to the call of UNESCO that the teacher education program has a crucial role in reorienting education for sustainability (Hopkins & McKeown, 2005). Contrary to EE discussed from a biological perspective (Pasin & Bozelli, 2016), EE integration in Professional Education courses presents EE from another perspective other than the biological perspective. Before the current study, the EE integration in the current Teacher Education curriculum may only be limited and covered primarily as part of technical or major courses. There has been no institutional initiative for greening the Teacher Education Program in the universities.

Table 4. Summary of Students' Level of Environmental Competence

University	Students' Level of EE Competence		
	Mean score (30)	Performance level	Interpretation
1	17.21	57.35	Satisfactory
2	18.26	60.88	Satisfactory
3	10.75	35.83	Fair
4	16.16	53.86	Satisfactory
5	8.63	28.75	Fair
6	18.55	61.84	Very Satisfactory
7	15.38	51.26	Satisfactory
8	17.74	59.15	Satisfactory
Overall	15.33	51.12	Satisfactory

Effectiveness of the EE-enhanced lessons in Professional Education Courses

The t-test of the pretest and posttest results for EE Test of Professional Education students in eight 3NS institutions reveals that, generally, the posttest results are significantly higher than the pretest results. Results in six institutions such as Universities 1,3,4,5,6, and 8 show a significant increase in the posttest results compared to the pretest results. Meanwhile, results in two institutions indicate that the increase in the posttest results is not statistically significant at 0.05% level of significance compared to the pretest results. Overall, the t-test results (0.00107825) reveal a significant increase in the posttest results compared to the pretest results (see table 5).

The effectiveness of the intervention may be explained by a number of factors such as content and purposes, which were covered by the lessons and the learning activities, the use of the different learner-center strategies, appropriate EE materials, and delivery of the lessons. The use of appropriate materials, which include the curriculum guide, the lessons embedded with EE, the DENR EE materials, and the materials searched or developed by the researcher, is considered a factor that significantly helped increase the EE competence level of the Teacher Education students. The EE integration blended well with the Professional Education lessons with clear and explicit EE purposes. The DENR materials were noted as comprehensive and accurate though generally less appealing or attractive, less stimulating, and less interactive. Most of the contents of these materials were encoded

or scanned and included as part of the PowerPoint presentations, so they become more appropriate for classroom use among learners who are digitally inclined. The researcher searched and developed EE materials consisting of print (worksheets), and non-print (PowerPoint presentations, games, and videos) were noted by the teacher-observers and students as attractive or appealing, and interactive.

Table 5. Test of significance of the pretest and posttest results on EE test of professional education students in 3NS institutions

University	Pretest		Post-test		t-test	p-value	Interpretation
	mean	I	mean	I			
1	17.21	S	20.95	VS	8.393932963	0.0411111E-10	Significant
2	15.62	S	16.69	S	3.191493184	0.09615346	Not Significant
3	10.75	F	17.30	S	15.86516	0.006.62E-16	Significant
4	16.16	S	25.58	E	12.48837	0.00132E-7	Significant
5	8.63	F	14.29	S	6.33744	0.009.09E-04	Significant
6	17.38	S	19.21	VS	3.228896	0.001582	Significant
7	15.38	S	21.97	VS	17.3455943	0.01.35458E-28	Significant
8	17.74	S	18.50	VS	1.473993558	0.072005866	Not Significant
Over-All	14.50	S	18.83	VS	4.4439783	0.00107825	Significant

Legend: I- Interpretation: F- Fair; S-Satisfactory; VS-Very Satisfactory; E-Excellent
$p<.05$ – significant

Similarly, the effectiveness of the EE mainstreaming in Professional Education courses supports that this alternative to the traditional science-oriented approach to EE works. Specifically, the current study provides evidence that EE can be substantially covered in lessons in Professional Education courses and embedded throughout the lesson, such as in the motivation part, lesson proper, values integration, generalization, assessment, and homework. Moreover, the current study specifically addressed the gap in the strategies used in EE, such as the use 4As (Activity, Analysis, Abstraction, and Application) and the PERC learning model (Presentation, Engagement, Exploration, Recall, Relate, Reflection, and Creation/Collaboration), an innovative learning model designed for this specific study. Briefly, the different EE learning tasks have helped in addressing the gaps in the environmental competencies of the students, and therefore it can be argued that the EE strategies can be considered effective environmental and sustainability education (ESE) pedagogical strategies (Sims, Asselin & Falkenberg, 2020). In particular, the strategies used in the Professional Education lessons validated previous studies' claims on effective EE strategies (Stern et al., 2013; Dunkley, 2016; Ormond et al., 2014). Using effective strategies will then help ensure that EE integration in the Professional Education courses will support learning *for* the environment (Glackin & King, 2020) and not only about the environment.

Additionally, the effective and efficient delivery of these lessons, as noted by the teacher-observers, is considered instrumental in the effectiveness of the EE. The teacher's competence or adequate background on the environmental concepts or principles and how these were spontaneously blended with the lesson may have motivated the students to participate better; thus, their significant learning as teacher engagement and style of instruction are among the elements which may positively influence the outcomes of EE program (Stern et al., 2013). During the focus group discussion, the students reported that they felt the teacher's sincerity in helping the student participants motivated them to participate and implement the project despite their hectic schedules. Likewise, they mentioned that the teacher's love and genuine concern for the environment kept them

engaged in the EE lessons and learning tasks. According to Smith (2020), for teachers to emerge as sustainability exemplars, affective qualities such as love for the environment are essential.

All students claimed that they realized the significance of the lecture series on EE, which they have applied to their daily lives already, as shown by responsible use of electricity and water (such as turning off electrical appliances and devices when not used, exercising practicality when washing clothes, using used water for watering plants), the practice of reduce, reuse and recycle (3Rs) (such as carrying of eco bags, reusing back part of the paper, using boxes or empty containers of food and groceries for some practical purposes such as organizing and making a clean and green environment (such as segregating waste, minimizing waste, proper waste disposal and planting trees). Although these may seem small positive changes in the students' behaviors, it is clear that the environmental knowledge of the students helped in their pro-environmental behaviors, contrary to the findings of Kollmuss and Agyeman (2002).

The class project consisted of two major activities: (1) Clean and Green, which covered cleaning the campus, segregation of wastes, and tree planting, and (2) Making Bags and Wallets using plastic straws gathered from stores, canteens, and fast-food restaurants in the locality and selling the products. The students were observed to have cooperated in all the Clean and Green activities in the campus. For bag and wallet making, the class divided the class into groups, and each group was tasked with collecting plastic straws, weaving bags and wallets, and then selling the finished products. After the project implementation, the students reported their appreciation for the environmental project and their intention to apply to their personal lives what they learned about waste segregation, tree planting, minimizing wastes, recycling, and even upcycling. Essentially, students' involvement in the environmental project which they themselves planned and implemented may be considered as one way to address the lack of environmental competence among preservice teachers and the gaps in the teacher training curriculum regarding EE (Garcia, Negre & Forgas, 2015).

In brief, the EE integration in the Professional Education courses is effective in preparing the students to become eco-mentors. Through their performance in the test and, more specifically, in the project proposal making and implementation, these eco-mentors can be expected to become competent and committed EE teachers. The results indicate the high potential for the transversal integration of EE in the Teacher Education curriculum, which means that the greening of the Professional Education courses can be institutionalized without incurring additional units and costs. Consequently, the TEIs in the country can be more active in assisting the DENR in implementing the National Awareness and Education Act of 2008 and fulfill its key role in reorienting education for sustainability which integrally includes EE (Hopkins & McKeown, 2005). Nevertheless, there remains a need to validate further the mainstreaming of EE in Professional Education courses, perhaps considering other theories aside from Monroe, Andrews, and Biedenweg's (2007) theory, such as the five core outcomes for EE (Clark et al., 2020) and the transformative climate change education curriculum (TrEC) (Wi & Chang, 2019).

CONCLUSION

EE is crucial for society to address the persisting and worsening environmental problems. The sustained efforts to mainstream EE in the Teacher Education curriculum will help ensure that EE in basic education will be strengthened since future teachers are trained to become environmental educators regardless of their fields of specialization. In this study, the EE Curriculum Guide, which includes the EE-enriched lessons in the different

Professional Education courses, DENR EE materials, and other EE materials, shows the transversality of EE in the Professional Education courses. Most of the students in eight 3NS institutions had a satisfactory level of environmental competence based on the EE test. The EE-enriched lessons in Professional Education courses were effective in enhancing the students' level of competence in terms of environmental concepts and principles, as confirmed by the significant increase in test results for the students. The student' narratives and experiences during the class environmental project implementation support the effectiveness of EE in Professional Education courses.

The EE integration in the Professional Education courses of the Teacher Education curriculum should be continued and institutionalized. These exemplar EE-enriched Professional Education lessons are also recommended to be disseminated and further validated. Future research recommendations include gender responsiveness of EE integration in the Professional Education courses, students' attitude towards EE, authentic assessment tools in EE, strategies in EE, and evidence-based application of EE. Other research recommendations may address EE-related areas, such as contextualization of EE, environmental philosophies of teachers and learners, collective responsibility in EE, and EE practice group innovations.

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