



PHILIPPINE
NORMAL
UNIVERSITY



Graduate Theses

CGSTER

September 2022

Teachers' Perceptions, Attitudes, And Experiences Toward the Integration of Environmental Education in the Science Curriculum: Context of Pandemic

Christopher Habunatalia Punzalan

Philippine Normal University

Follow this and additional works at
pnu-onlinecommons.org/omp/index.php



Online Commons Citation

Punzalan, C. H., & Delos Santos, V. J. (2022)

Teachers' Perceptions, Attitudes, And Experiences Toward the Integration of
Environmental Education in the Science Curriculum: Context of Pandemic
(Master's Thesis, Philippine Normal University)

Retrieved from pnu-onlinecommons.org/omp/index.php/pnu-oc/catalog/book/1494

**TEACHERS' PERCEPTIONS, ATTITUDES, AND EXPERIENCES TOWARD
THE INTEGRATION OF ENVIRONMENTAL EDUCATION IN THE SCIENCE
CURRICULUM: CONTEXT OF PANDEMIC**

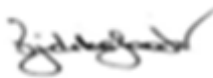
A Thesis Paper Presented to the
Faculty of College of Graduate Studies and Teacher Education Research
Philippine Normal University

In Partial Fulfillment of the Requirements for the Degree
Master of Arts in Science Education
with Specialization in Integrated Science

CHRISTOPHER HABUNATALIA PUNZALAN
September 2022

APPROVAL SHEET

This thesis entitled “**TEACHERS' PERCEPTIONS, ATTITUDES, AND EXPERIENCES TOWARD THE INTEGRATION OF ENVIRONMENTAL EDUCATION IN THE SCIENCE CURRICULUM: CONTEXT OF PANDEMIC**” prepared and submitted by **CHRISTOPHER HABUNATALIA PUNZALAN** in partial fulfillment of the requirements for the degree of Master of Arts in Science Education with specialization in Integrated Science, is hereby recommended for approval and acceptance.



VICTORIA J. DELOS SANTOS, Ph.D.

Adviser

Approved in partial fulfillment of the requirements for the degree Master of Arts in Science Education with specialization in Integrated Science **by the Oral Examination Committee.**



ARLYNE C. MARASIGAN, Ph.D.

Chairperson



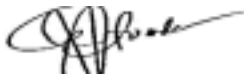
LEAH AMOR S. CORTEZ, Ph.D.

Member



MEAH L. GONZAGA, Ph.D.

Member



JOSEPHINE E. TONDO, Ph.D.

Member

Accepted in partial fulfillment of the requirements for the degree Master of Arts in Science Education with specialization in Integrated Science.



MARILYN U. BALAGTAS, Ph.D.

Dean

College of Graduate Studies and
Teacher Education Research

September 29, 2022

Date

ACKNOWLEDGMENT

I would want to express my gratitude to Dr. Victoria J. Delos Santos, my thesis adviser, for making this work possible. Her support and advice guide me through every step of the thesis writing process. I would also like to thank my committee members, Dr. Arlyne C. Marasigan (Chair and Director of the Graduate Research Office), Dr. Leah Amor S. Cortez, Dr. Josephine E. Tondo, and Dr. Meah L. Gonzaga for their expertise, insightful comments, and suggestions on how to improve my research paper.

This study was also made feasible through the academic community's cooperation in the preparation of needed requirements for conducting several research procedures. I would like to thank the Dasmarias City Schools Division for endorsing my thesis during the data collection phase, as well as the principals and school authorities for allowing me to conduct my research at their respective schools. I deliver my special thanks to the science teachers from several junior high schools who volunteered to be my respondents for their time and expertise. Finally, I would want to express my gratitude to the specialists and academic professionals from various universities who worked as language editors and instrument validators.

Finally, I would like to express my gratitude to my family for their unwavering support and understanding during my research and writing process. Your prayers for me have kept me.

I am eternally grateful to our Almighty God for allowing me to overcome all obstacles. Day by day, I have felt your guidance and given me strength and inspiration.

You made me realize that I can finish this research undertaking despite the challenges and difficulties. I will continue to put my faith in you for my future.

Table of Contents

	Page
Title	i
Approval Sheet	ii
Acknowledgment	iii
Table of Contents	v
List of Tables	vii
List of Figures	viii
List of Appendices	ix
Abstract	X
 CHAPTER 1: THE PROBLEM AND LITERATURE REVIEW	 1
1.1 Background of the Study	1
1.2 Literature Review	6
1.2.1 Essential Underpinnings of Environmental Education	6
1.2.2 Goals of Environmental Education	8
1.2.3 Teachers as Environmental Educators	10
1.2.4 Integration of Environmental Education in the Curriculum	12
1.2.5 Environmental Education amidst the COVID-19 Pandemic	15
1.3 Conceptual Framework	17
1.4 Statement of the Problem	21
1.5 Scope and Limitations	21
1.6 Definition of Terms	22
 CHAPTER 2: METHODOLOGY	 24
2.1 Research Design and Method	24
2.2 Research Site	26
2.3 Selection Criteria and Participants	27
2.4 Instruments and Data Collection	30

2.5 Data Analysis	32
2.6 Role of Researcher	33
2.7 Methods of Validation	34
2.8 Ethical Considerations	35
 CHAPTER 3: RESULTS AND DISCUSSION	 37
3.1 Science teachers' integration of environmental education into the curriculum amidst the COVID-19 pandemic	37
3.2 Perceptions of science teachers in integrating environmental education into the curriculum amidst the COVID-19 pandemic	48
3.3 Attitudes and experiences of science teachers in integrating environmental education into the curriculum amidst the COVID-19 pandemic	73
 CHAPTER 4 SUMMARY, CONCLUSION, AND RECOMMENDATIONS	 90
4.1 Summary of the Study	90
4.2 Summary of Results	91
4.3 Limitations	92
4.4 Conclusion	92
4.5 Recommendations	95
 REFERENCES	 98
APPENDICES	112

List of Tables

1	Demographic Profile of Science Teachers	29
2	Science Teachers' Integration of Environmental Education in Online Distance Learning Modality	42
3	Experiences of Science Teachers on EE Integration	46
4	Science topics that teachers integrated the environmental education	47

List of Figures

1	Relationships between and within social, environmental, and economic sustainability by Wanamaker (2018)	5
2	Interrelated elements of environmental education by Palmer and Neal (1994)	8
3	The Conceptual Framework of Science Education (Department of Education, 2016)	13
4	Conceptual framework of the study	19

List of Appendices

A	Letter of Request for Data Gathering	118
B	Letter of Request for Instrument Validation	119
C	Research Endorsement for Data Gathering	122
D	Informed Consent Form	123
E	Interview Questionnaire	125
F	Survey Questionnaire	126

ABSTRACT

Name: Christopher Habunatalia Punzalan

Title: TEACHERS' PERCEPTIONS, ATTITUDES, AND EXPERIENCES TOWARD THE INTEGRATION OF ENVIRONMENTAL EDUCATION IN THE SCIENCE CURRICULUM: CONTEXT OF PANDEMIC

Key Concepts: Environmental Education, Science Curriculum, Pandemic

Degree: Master of Arts in Science Education with specialization in Integrated Science

Adviser: Victoria J. Delos Santos, Ph.D.

In the context of the education paradigm, it is crucial to consider how education can be used to manage the enormous changes in the environment and biodiversity that cause exponential degradation, particularly in the wake of the pandemic. In this regard, the main objective of this study was to analyze the selected science teachers' perceptions, attitudes, and experiences toward the integration of environmental education in the curriculum through online distance learning modality amidst the COVID-19 pandemic.

This study utilized both survey and case study designs to understand the process of environmental education integration into the science curriculum by 32 science teachers from 8 junior high schools in Dasmarinas City, Cavite which were selected through purposive sampling. Quantitative results revealed that science teacher respondents

integrated environmental education during the pandemic. From the data gathered from participants on how to integrate environmental education, the majority (53%) of respondents agreed that they introduce environmental themes or topics which are most of the time encountered in real-life scenarios. While 66% also mentioned that they prepare appropriate teaching materials about the environment. Further, 63% said they integrate EE in the learning process using a variety of learning methods.

From the qualitative data analysis, themes drawn related to the science teachers' perceptions include 1) impressions and understanding of EE, 2) benefiting from EE integration in science amidst the pandemic, and 3) balancing the values and drawbacks of EE integration amidst the pandemic. Additional themes that emerged based on the attitudes and experiences of science teachers include 1) pedagogical strategies, methods, and resources to integrate EE in science teaching; 2) confronting the issues on EE integration amidst the pandemic; 3) initiating best practices for EE integration in the science curriculum, and 4) advocating for an intensified EE integration in science amidst the pandemic. Finally, the researcher suggests viable ways to promote the integration of environmental education into the science curriculum using the online distance learning modality.

Chapter 1

THE PROBLEM AND LITERATURE REVIEW

1.1 Background of the Study

Sustainable living has been an issue for the people to achieve given that the world has a finite carrying capacity and resources that cannot support an exponentially rising population. It is very difficult to maintain global ecological sustainability without caring for every portion of the world, given the diversity and complexity of the systems. To achieve ecological sustainability, everything on earth, no matter how large or small, alive, or nonliving, is fundamentally necessary. The sustainability of life on earth depends on ecological diversity. In relation to this, environmental education draws attention to a variety of environmental topics that encourage youth knowledge and compel public concern over the most urgent environmental issues. It is reasonable to assume that when the public has been informed, this will increase responsible decision-making in taking action to improve our environment by addressing environmental challenges. Through public awareness, critical thinking, and problem-solving abilities, this sector of education seeks to engage the public and foster a profound understanding of the pressing environmental concerns at hand.

In today's era of globalization, we are faced with many social disturbances, including environmental dilemmas. Rogayan and Nebrida (2019) reiterated that the Earth is now suffering from a myriad of sufferings caused by terrible human activity that is

constantly damaging the environment. The challenge for all is to take the circle of action and move towards a common goal of sustaining life on Earth.

Currently, COVID-19 is a global catastrophe with multiple environmental and climate impacts. Rume and Islam (2020) pointed out that movement restrictions and significant slowdowns in social and economic activity have improved air quality in many cities and reduced water pollution. In addition, the increase in the use of personal protective equipment (masks, gloves, etc.), indiscriminate disposal, and the generation of enormous hospital waste are negatively affecting the environment.

Coronaviruses belong to a large family of enveloped RNA viruses that have a crown-like surface overhang of glycoproteins (hence the name coronavirus). There are four main subgroups of coronaviruses: alpha, beta, gamma, and delta. Genomic studies have shown that animals including humans, bats, camels, and rodents are sources of alpha and beta coronavirus genes, whereas birds are sources of gamma and delta coronaviruses. Though, the recently identified beta-coronaviruses such as SARSCoV2, MERS-CoV, and now SARSCoV2 have led to large-scale outbreaks with clinical severities ranging from mild self-limiting to life-threatening diseases (Chan et al., 2013; Hasöksüz et al., 2020; Singhal, 2020).

On the positive side, anecdotal evidence shows that closures have increased animal pregnancies in zoos, expanded programs to reintroduce vulnerable species, and increased wildlife sightings near human habitats around the world (Moulds, 2020; Bang & Khadakkar, 2020).

In contrast, negative perceptions of wildlife as disease transmitters can lead to retaliatory killings of vector species such as bats and pangolins, with serious consequences for these endangered species (Kissui, 2008). Additionally, unemployment and mass migration caused by the pandemic can place additional strains on wildlife and habitats in search of food and livelihoods due to increased poaching, hunting, and logging. These could also lead to close contact between humans and wildlife, increasing the risk of zoonotic diseases in the future and might cause outbreaks (Bloomfield et al., 2020; Johnson et al., 2020).

Education is considered as one of the most powerful driving forces to promote peace and environmental sustainability (UNESCO, 2013a; McKeown & Hopkins, 2007). One of the main reasons why the effective implementation and realization of ESD remained a challenge in the Philippine system of education was the teacher (pre-service and in-service) education, training, and preparation program (UNESCO, 2011b). On a positive note, UNESCO has called for Education for Sustainable Development to be a core component of all education systems at all levels by 2025 (UNESCO, 2021).

As stated in Goals 4 and 7 of the SDGs, achieving inclusive and excellent education for all is one of the most powerful and proven strategies of education for sustainable development (United Nations Development Programme, 2015). Education for Sustainable Development by UNESCO (2017a) includes teaching biodiversity, climate change, disaster risk mitigation, ecosystem consumption, and poverty reduction. When these three pillars are considered in educating the people, it is likely to be sustainable. As a result, three interconnected sustainability domains emerge, clarifying the relationships between

and within the environmental, economic, and social components of sustainable development. In the early 1950s, the Philippine government and non-government organizations started to formally advocate and promote environmentalism directly linked to sustainable development through education (UNESCO, 2011b). Developing countries still need to continue and improve on key areas such as climate action, biodiversity, disaster risk reduction, and responsible consumption and production as listed in the Global Action Programme on ESD (UNESCO, 2014a).

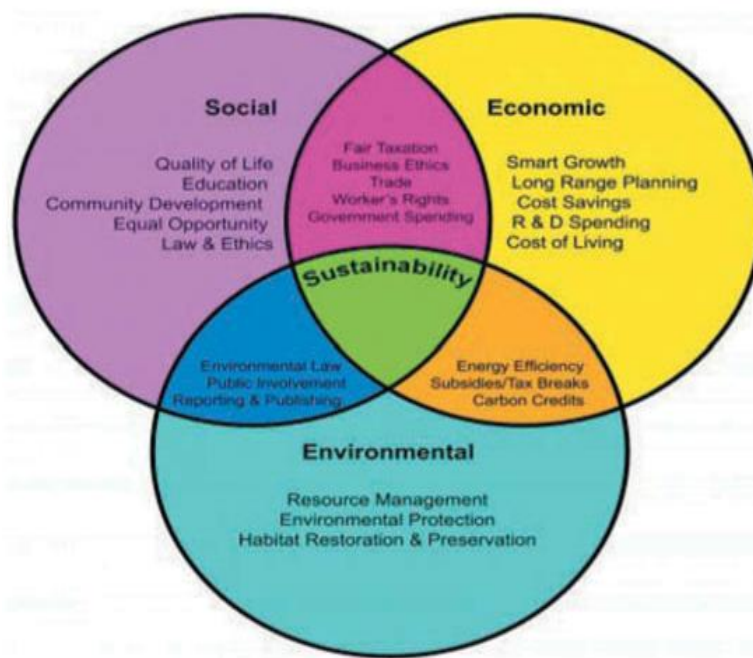
Basically, from Figure 1 it can be concluded that almost everything that humans do or plan to do on Earth affects the environment, economy, or society, and thus the survival and well-being of people improve. Therefore, as Wanamaker (2018) claims, the sphere represents a collection of interconnected notions that must underpin human decision-making and behavior in the pursuit of long-term growth (SD). The argument is that when the concepts in the three areas of sustainability are successfully applied to real-world situations, natural resources are preserved, the environment is protected, the economy is booming, and resilient, and social life is peaceful, all of which benefit everyone because human rights are respected (Desa, 2018; Kaivo-oja et al., 2013).

Brodhag and Taliere (2006) stated that environmental sustainability refers to the natural environment and how it maintains productivity and resilience to support human life. Environmental sustainability is linked to the ecosystem's integrity and the natural environment's carrying capacity. Natural capital must be utilized as a source of economic input and a waste sink in a sustainable manner (Goodland & Daly, 1996). This means that natural resources should not be depleted faster than they can be replenished, and trash

should not be disposed of faster than it can be absorbed by the ecosystem (Diesendorf, 2000; Evers, 2018).

Figure 1

Relationships between and within social, environmental, and economic sustainability by Wanamaker (2018)



However, as demand for the Earth's system grows, and technical improvements may not be able to support exponential expansion, the search for unrestrained growth places an increasing burden on these boundaries. Concerns about environmental sustainability are becoming more prevalent (ICSU, 2017). Climate change, for example, has sparked a heated debate over the need for environmental sustainability. Climate change is a significant long-term change in the climate system induced by natural or human-made factors (Coomer, 1979). Furthermore, Du and Kang (2016) indicated that warming of the

atmosphere and oceans, ice loss, rising sea levels, increasing ocean acidity, and rising greenhouse gas concentrations are all examples of these changes.

Besides, biodiversity is already being harmed because of climate change. Higher temperatures are thought to have an impact on the time of reproductive flora and fauna species, animal migration patterns, species distribution, and population growth (Kumar et al., 2014). Despite numerous disastrous forecasts, the full impact of global warming has yet to be determined (Ukaga et al., 2011). It is suggested by Campagnolo et al. (2018) that all societies must adapt to new realities in terms of ecosystem management and acknowledge the limits of natural growth to be sustainable.

1.2 Literature Review

Essential Underpinnings of Environmental Education

International proposals tend to focus on education as a tool to achieve pre-defined goals, but they need to think about the environment and developmental reality that is considered problematic remains in the shadows. An even bigger exclusion is an educational idea that reflects the concept of the environment itself and the concept of development. Reflexive ideas are ignored by the constant claim that there is an urgent need to learn how to deal with critical problems like the word "reflexivity" and the phrase "critical thinking" which are not included in Agenda 21 at all (United Nations Conference on Environment and Development, 1993).

Koszo and Szabo (2013) provided a focus on the hallmarks of environmental education: a) a lifelong process as an approach to education in general and not as a specific

subject, b) positive responsibility, c) learner aspects through hands-on experience emphasizing psychomotor, d) support from the organizations of the entire educational institution, e) improving attitudes towards environmental issues, and f) awareness, knowledge and problem solving to strengthen learner's critical thinking skills.

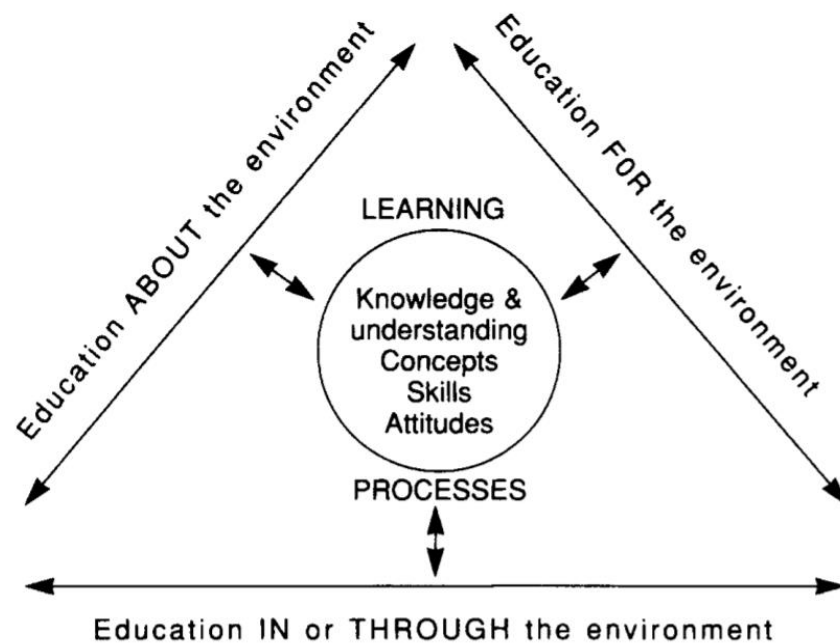
In the Philippines, Ramos (2016) emphasized that education is essential for awareness and action to protect the dying earth in an article on environmental awareness and action. Also highlighted was Republic Act No. 9512, known as the National Environmental Awareness and Education Act of 2008. This law requires all courses and academic institutions, both formal and informal, to integrate environmental education into the teaching-learning process. Section 3 of the law (RA 9512, 2008, p.2) stipulates that “The Department of Education (DepEd), the Commission on Higher Education (CHED), the Technical Education and Skills Development Authority (TESDA), the Department of Social Welfare and Development (DSWD), in coordination with the Department of Environment and Natural Resources (DENR), the Department of Science and Technology (DOST) and other relevant agencies, shall integrate environmental education in its school curricula at all levels, whether public or private, including in barangay daycare, preschool, nonformal, technical vocational, professional level, indigenous learning, and out-of-school youth courses or programs.”

Furthermore, when planning to include environmental education in the curriculum, people need to consider the three interrelated elements that make up the theme: education about the environment, education for the environment, and education within or through the environment. These elements as shown in Figure 2 are interrelated from school-wide and

grade-wide curriculum planning to more specific planning of subjects, learning programs, and assignments designed for classes, learner groups, or individuals. It should be an important part of the plan at all educational levels to become valid (Palmer & Neal, 1994).

Figure 2

Interrelated elements of environmental education by Palmer and Neal (1994)



Goals of Environmental Education

Environmental education is the process of developing a world population that is aware of the environment as a whole and the problems it possesses and is concerned to solve emerging problems. The population commits to working together with knowledge, skills, attitudes, motivations, and existing solutions to suppress problems and new ones (UNESCO-UNEP, 1976 in Athman & Monroe, 2000, p. 38).

The Belgrade Charter has set goals for environmental education in which the world's population should be developed based on appropriate awareness and interest in environmental and related issues in terms of people's knowledge, skills, attitudes, commitments, and motivations (United Nations Educational, Scientific and Cultural Organization, 1975). Similarly, UNESCO for the Decade of Education for Sustainable Development (UNDP, 2005) suggested the promotion of environmental education and sustainability in diverse schools around the world for the future leaders of this planet to build recognizable solidarity to become responsible citizens.

Dennis and Knapp (1997) classified the goals of environmental education as moral or ethical, pursuing respect for nature and people, and the ethics of solidarity, human equality, and cooperation for problem-solving in addition, environmental education should be affective or emotional to foster love and respect for nature and humanity. It also aims to develop students' understanding of the complex interactions between cognitive, resource, economics, political and social systems; and behavior-oriented which seeks to help students develop problem-solving skills. Environmental education encourages involvement in improving the sustainability of human-nature interactions over time through the development of attitudes, values, knowledge, aptitudes, and skills for conducting environmental protection activities (Mastrángelo et al., 2019; Monroe, 2003; UNESCO, 1978).

Moreover, environmental education includes the practice of location-based and behavior-based stewardship, including local vegetable fields (Delia & Krasny, 2018). Kopar (2013) explained that an effective environmental education program is characterized

by repetitive, unstructured activities in the environment that allow young people to focus their energy and time on having an environmentally friendly attitude as a characteristic of their community's goals. It states that it needs a clear and accessible area that can be exposed.

Meanwhile, Szczytko et al. (2019) mentioned that environmental education (EE) practitioners find it difficult to evaluate programs consistently and rigorously, especially when evaluation time is limited. Since environmental literacy (EL) is a goal of environmental education, a very short EL instrument (suitable for use when longer tests are not practical for practitioners) addresses critical environmental education needs.

Teachers as Environmental Educators

Teachers have a great influence and play many roles in the growth of young people. As facilitators, they provide support and advice as needed, and the necessary scaffolding and skill training. Teachers need to continue to teach and train their students on all the specific skills required for each task. Teachers create a culture of lifelong learning that combines teachers' work instructions to improve each student's outcomes (Wei et al., 2009). In contrast, Ashmann (2010) believed that the degree of integration of environmental education depends on who teaches each course. Teachers and educators who are interested in or familiar with environmental education are more likely to include it in their courses (Ashmann, 2010; Mastrilli, 2005; Mckeown-Ice, 2000).

According to Marpa (2020), environmental education integration is usually done by teachers, but they believe that integration can happen in all subjects. On the other hand,

the implementation of R.A. 9512, teaching materials, and teacher training are considered obstacles to environmental education integration. Similarly, if environmental education is integrated into classroom activities, students are not encouraged to form their own opinions. Therefore, environmental education integration should be included in the learning competencies which should be reflected in various materials such as books and other supplements.

Buza (2010) examined environmental education not as a scientific subject matter but as a teaching process that includes social and cultural elements. The study investigated the ways how to improve the issues encountered in integrating environmental education which is focused on its importance, curriculum, and methods of teaching to help achieve the quality of knowledge and ways of teachers preparing students to live in this new century. Apart from this, the levels of environmental literacy and integration of environmental issues of teachers can be employed to construct training on the integration of environmental education in the curriculum (Garcesa & Limjuco, 2014).

The results of a survey conducted by Sukma et al. (2020) revealed that most teachers agreed that it was valuable to integrate environmental education into the learning process of students. Still, this integration has a limitation including inadequate time. Based on the investigation, at the primary school level, environmental education can be best integrated into science learning.

Additionally, a review of teachers' views on the definition, meaning, and approach of environmental education in Aboriginal schools was led by Rahman et al. (2018). As a result, teachers conducted environmental education by promoting the environmental value

of the subjects taught, creating a clean environment in the classroom, writing essays on environmental issues, and stimulating students' thinking through observation.

Integration of Environmental Education in the Curriculum

Mwendwa (2017) found that most environmental education competencies are delivered mainly through the geography subject, and some in biology using an integrated teaching approach. Students and teachers were knowledgeable and understood basic environmental issues. The main challenges facing the implementation of environmental education included an integrated learning approach, inadequate knowledge of environmental education, lack of support from each other and school administration, and cultural myths and beliefs.

Several studies have found that the integration of environmental education through various sources from schools to other venues using television and the internet, and environmental awareness campaigns can highly develop the students' knowledge by establishing links with other environmental institutions. This strategy can also strengthen education for sustainable development. Likewise, the relationship between students' awareness and practice toward environmental issues can be improved through greater integration of issues in the curriculum (Medallon & Gallardo, 2014; Labog, 2017; Lopez & Malay, 2019; Rogayan & Nebrida, 2019; Punzalan et al., 2019).

The Philippine Department of Education (2016) gives importance to environmental education in teaching science topics as it asserts that the curriculum is constructed around the development of students who are scientifically, technologically, and environmentally

literate Filipinos. They are expected to be critical problem solvers, responsible stewards of nature, innovative and creative citizens, informed decision-makers, and effective communicators as shown in Figure 3.

Figure 3

The Conceptual Framework of Science Education (Department of Education, 2016)



Some studies determined various factors that affect how students learn environmental education as integrated into the curricula. Specifically, the aim to enhance the environmental awareness of students as a basis to evaluate the effectiveness of the integration of environmental education in the curriculum was affected by the family, media, religion, gender, socio-economic status, and distribution of topics in the curriculum. It is evident that when the students receive a proper academic education, the effects of these factors can ease and they can be involved in environmental protection activities (Altin et al., 2014; Rahman et al., 2014; Chikati & Okendo, 2018; Boca & Saraçlı, 2019).

Even so, integrating environmental education into different subjects possess some limitations and challenges to the educational system (Stevenson, 1993). When environmental education is integrated into the content of other subjects, it is claimed that learners do not clearly understand the goals of different disciplines and forms of knowledge to support their understanding of environmental issues (Kadji, 2002). In addition, teachers find it difficult to relate environmental education topics to the subject matter because there is no clear way to do it. As a result, many teachers are not satisfied with the education provided by integration. It should also be recognized that the integration of environmental education into existing subjects may not be adequately addressed in all subjects.

From the qualitative study conducted by Marasigan (2017), the pre-service teachers' perceptions toward environmental pedagogies were clearly identified as they explored pre-service teachers' perceptions of environmental pedagogies (i.e., Environmental Education and Education for Sustainable Development). Similarly, Kelani (2015) interviewed teachers and they acknowledged that EE should be regarded as

important for secondary school students. In contrast, it cannot be denied that there are always problems in the implementation of any programs in the school. The integration of EE posed problems for our teachers, school administrators, and other stakeholders. Challenges or obstacles experienced were the implementation of R.A. 9512, quality of materials in the curriculum, and training for teachers which emerged from the qualitative study (Marpa, 2020).

Environmental Education amidst the COVID-19 Pandemic

In the education paradigm, it is important to consider the role of education in managing the tremendous changes in the environment and biodiversity that lead to exponential degradation, especially amidst the pandemic. Aside from a significant threat to education, the COVID-19 pandemic poses specific, potentially irreparable, and long-term risks to environmental education. This is an important area that provides many cognitive, emotional, and health-related benefits (Ardoin & Bowers, 2020).

Environmental education organizations encounter challenges when delivering programs during the COVID-19 pandemic. Despite these challenges, environmental educators' adaptation was still evident via the organizations as they continue to offer instructional programming live and asynchronously online and in person. These programs provided activities for individuals of all ages to perform securely at home or outside, as well as a reason to leave the house safely and take in the outdoors for instructors and parents who struggle to keep their students and children engaged (Janz, 2021). At some point, an environmental education and engagement program developed by Iyengar and Shin (2020)

fostered a sense of community among participants as well as a connection between them and the surrounding environment.

An article about the impact of the pandemic on environmental education by Collins et al. (2020) described COVID-19 as "catastrophic" to school activities. Millions of learners will miss the opportunity to participate in environmental education programs. These students will also miss the opportunity to learn about environmental and outdoor science learning. On a positive note, the growing increase in environmental awareness and sustainable consumption can be partly explained by the pandemic situation and by studies by Cohen (2020) and Sarkis et al. (2020), as the pandemic marks the beginning of a sustainable consumption transition, as well as a reduction in air pollution.

The old and problematic way of thinking is still inherited by environmental education today. Environmental education shows that the external environment is plagued by problems that need to be mitigated and corrected. Certainly, there are environmental problems and concerns which are getting worse. Therefore, people must work on them, find solutions, and take action (Bai, 2020). Quay et al. (2020), in a frequently recognized study, gathered testimonies from teachers all over the world about how the pandemic affected EE and environmental educators. The article's perspectives are all very different from one another. An advantage the epidemic has had on EE, according to several authors, is a rise in awareness of the region's natural resources and locations. Others remark on this and voice their worries about environmental justice and unequal access to the outdoors. A few talks about the chance given to EE by developing the field's expertise in online pedagogy. These viewpoints are informative and offer suggestions for how to proceed.

They do not say anything about the kind of programming that is being provided considering the social distance rules or the growing interest in social justice.

As a community, it is a must to continue to advance the research on geographical and environmental education on policy, curriculum, instruction, and assessment of environmental issues even during these times so that it can inform better teaching and learning well into a future when the pandemic is over (Chang & Kidman, 2020). In this scenario of the pandemic, Sarkis et al. (2020) and Cohen (2020) present a new existing link, in which a window of opportunity opens to accelerate environmental awareness, after the COVID-19 pandemic, towards broader sustainability transitions. Meaningfully, environmental education may help students develop crucial abilities for coping with challenging situations on both an individual and group level, as well as, more crucially, the desire to change (Fazey et al., 2007).

1.3 Conceptual Framework

Constructivist Approach and Critical Thinking for Environmental Education

Teachers, as constructivists, are knowledge facilitators of learning in the 21st century. As facilitators, they create ways to provide rich learning environments, interactions, and activities by integrating collaborative opportunities, problem-solving, and meaningful challenges for the students to experience and learn environmental education (Alzahrani & Woolard, 2013). Through constructivism, teachers deepen the student's awareness of reflection and behavior and translate it into real-life situations and scenarios. Teachers integrate students with contextualized concepts so that they can easily identify

and solve specific environmental problems through experimentation, problem-solving, and collaborative learning with the help of supporting communities. This idea gives rise to improving students' knowledge, understanding, and awareness of the environment, both in the community and their natural environment (Umholtz, 2013). Finally, environmental education attitudes are mainly learned through direct and indirect experiences of things around them, including various situational considerations (De Houwer et al., 2001).

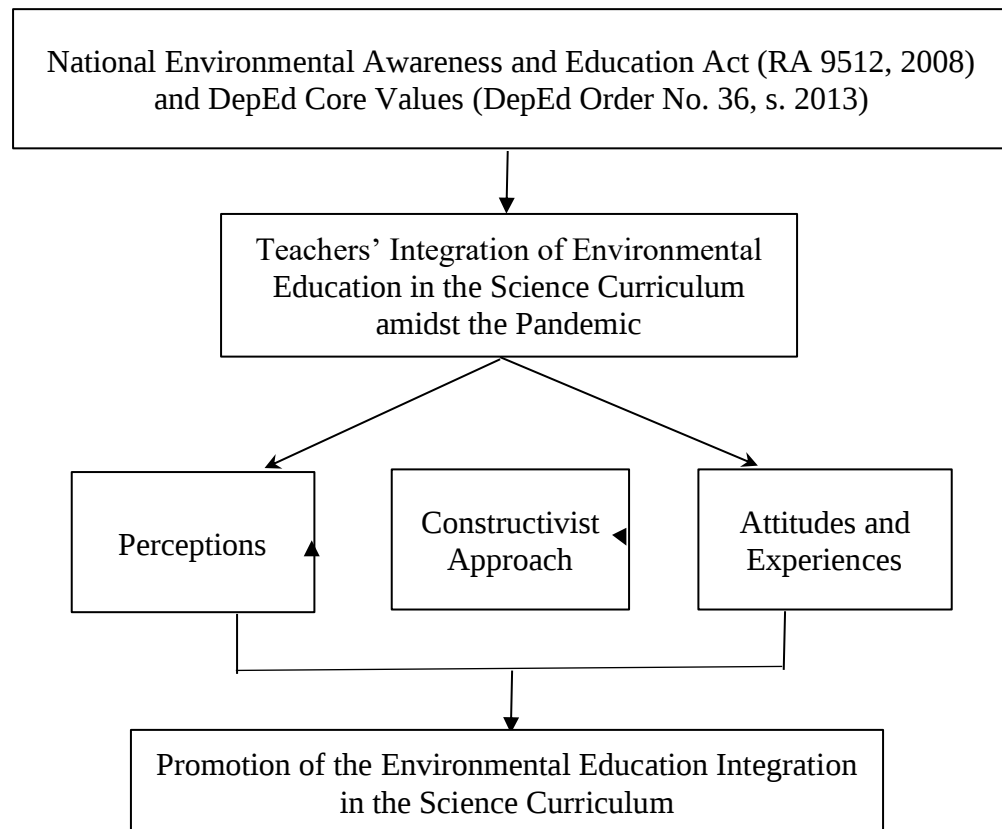
In the general educational context, true dialogue needs to be born to encourage students' critical thinking. This process of acquiring and developing critical thinking releases individuals from oppression as it helps awaken their consciousness, which leads to transformative behavior. Without dialogue, critical thinking is impossible, and without critical thinking, transformative action is impossible. When it comes to environmental education, learners are not the only ones who are oppressed. Gadotti (2009) states: "in the present time, we consider Earth as an oppressed, being as well, the most oppressed of all. Therefore, we also need a pedagogy of that oppressed, which is the Earth. We need a Pedagogy of the Earth (i.e., to acknowledge that the Earth is also suffering from oppression, teachers, and students must realize this condition) as a great chapter of the Pedagogy of the Oppressed, so we need an ecopedagogy" (p. 15).

Given the legal foundations to realize environmentally literate students, it is expected that the science teachers serve the primary role to integrate environmental education into the science curriculum and other subject areas as mandated by law through various activities to discuss the emerging issues in the ecosystem most especially during the time of the pandemic. As shown in Figure 4, science teachers' integration of

environmental education in the curriculum through the online distance learning modality amidst the pandemic served as the core target of this study. Meaningfully, their perceptions, attitudes, and experiences were uniquely analyzed by utilizing various approaches to data gathering.

Figure 4

Conceptual framework of the study



Through the constructivist approach, teachers help students develop a deeper understanding of reflection and conduct and how to apply it to circumstances and scenarios

from the real world. For students to discover and resolve specific environmental problems through experimentation, problem-solving, and collaborative learning with the aid of supporting communities, teachers integrate students with contextualized concepts in relation to the issues and concerns in the environment. As the main goal of this study, the promotion of the integration of environmental education in the science curriculum based on the significant findings from the analyses of the science teachers' concepts and ideas shall be achieved.

Limited studies were found that tackled the practice of environmental education integration in the science curriculum in the Philippines. Meanwhile, there is no published study that tackles the environmental education integration in the Philippines during the pandemic which may transpire with the science teachers' perceptions, attitudes, and experiences. In this regard, the objective of this study was to analyze the selected teachers' perceptions, attitudes, and experiences toward the integration of environmental education in the science curriculum through a constructivist approach in Dasmarinas City, Cavite. The adaptation of the Most Essential Learning Competencies (MELCs) as stated in DepEd Order No. 12 (2020) has allowed environment-related topics to be emphasized in the online distance learning modality, as one of the distance education modes employed during the pandemic. Examples of these competencies from grades seven to ten where science teachers can integrate environmental education include: citing and explaining ways of using Earth's resources sustainably, explaining the advantage of high biodiversity in maintaining the stability of an ecosystem and suggesting ways to minimize human impact on the environment.

1.4 Statement of the Problem

The general objective of this study was to analyze the selected teachers' perceptions, attitudes, and experiences toward the integration of environmental education in the science curriculum through a constructivist approach in Dasmarinas City, Cavite. The following statements are the specific questions of this study:

1. How do science teachers integrate environmental education into the curriculum amidst the pandemic?
2. What are the perceptions of science teachers in integrating environmental education into the curriculum amidst the pandemic?
3. What are the attitudes and experiences of science teachers in integrating environmental education into the curriculum amidst the pandemic?

1.5 Scope and Limitations

This study focused on the perceptions, attitudes, and experiences of selected science teachers toward the integration of environmental education in the curriculum through online distance learning modality amidst the pandemic. During the pandemic, the Philippine Department of Education through the educational institutions in the Philippines adapted the Most Essential Learning Competencies (MELCs) to be delivered in multiple learning modalities and platforms like Online Distance Learning (ODL) by the classroom teachers as part of the curriculum.

Additionally, this study discussed the science teachers' strategies to integrate environmental education into their subject, their views on the significance of

environmental education, and their experiences in integrating environmental education into science amidst the pandemic. Hence, this study was conducted with the selected junior high school science teachers who are handling classes through an online distance learning modality during the School Year 2021-2022. Lastly, this study was limited to the study site, selected participants, and time of data gathering.

1.6 Definition of Terms

The terms listed are defined operationally as used in the study.

Attitude. It is a consistent manner of thinking or feeling about someone or something, usually mirrored in one's actions.

Education for Sustainable Development (ESD). This aims to enable a more sustainable and just society for all, education that supports changes in knowledge, skills, values, and attitudes is necessary.

Environmental Degradation. It is the degradation of the environment caused by the depletion of resources such as air, water, and soil; ecosystem destruction; habitat loss; wildlife extinction; and pollution.

Environmental Education. It is a method that helps people to learn about environmental issues, solve problems, and take steps to improve the environment.

Environmental Issues. These are the difficulties with the planet's systems (air, water, soil, and so on) that have arisen because of human meddling or mistreatment.

Environmental Sustainability. This is involved with the protection and maintenance of environmental resources for future generations.

Experience. This is people's knowledge and expertise obtained through doing something for a long period.

Most Essential Learning Competencies (MELCs). This is a last-ditch effort to allow teachers to focus on the most important learning in the face of adversity, as well as to simplify the criteria for adapting classroom-based learning resources for distance learning.

Pandemic. It is due to a susceptible population, an epidemic (a rapid outbreak) that becomes exceedingly widespread and affects a whole region, a continent, or the entire world.

Perception. It is the world's sensory experience. It entails both sensing environmental cues and acting in response to them.

Chapter 2

METHODOLOGY

This chapter presents a description of the research design, research site, sampling and target participants, proposed instruments, procedures for data gathering and analysis, and potential ethical issues.

2.1 Research Design and Method

The study investigated how the selected science teachers integrated environmental education into the curriculum based on their perceptions, attitudes, and experiences amidst the pandemic. This focused on gathering quantitative and qualitative data from the surveys, interviews, and focus group discussions. Background of the participants like teaching experiences, teachers' perceptions of environmental education, the importance of environmental education integration in the curriculum, and the process of integrating environmental education in teaching and learning were some concepts involved in the study. This study utilized both survey quantitative and case study qualitative designs to better understand the process of environmental education integration in the science curriculum by selected teachers.

The survey approach was used in the quantitative portion of this study, with a questionnaire form containing questions relating to the research subjects. Researchers can use surveys to gather information on a variety of topics by asking questions and, in some situations, to collect data that cannot be obtained through systematic observation. To distinguish quantitative from qualitative, according to Bryman (2008), quantitative should

not be perceived or misconstrued as quantifying social components of existence. Quantitative has its own epistemological and ontological viewpoints, which are separate from the sheer presence of numbers.

Alternatively, the qualitative part of this study used the case study as an approach. According to Stake (1994) “the purpose of the case study is not to represent the world, but to represent the case. The utility of case research to practitioners and policymakers is in its extension of experience” (p. 245). Creswell (2013) introduced various viewpoints of qualitative researchers by emphasizing their ideas about case studies as follows: Yin (2009) highlighted case study research as a “case within real-life, contemporary context or setting” (p. 97). In contrast, Stake (1994, p.97) underscored that the case study research was “not a methodology but a choice of what is to be studied.” Regardless of how the case study was interpreted, it all came down to the present, or how it reflected one aspect of global reality that occurred in a specific context and time.

The target participants' data were collected using both quantitative (survey) and qualitative (semi-structured interview and focus group discussion) methods. The quantitative data came from a series of survey questions, while the qualitative data were derived from interviews and focus groups captured during data collection. Furthermore, using mixed methods to conduct a survey and a case study was the best methodology for this research to provide a thorough grasp of the "how's and why's" in the environmental education integration of science teachers in the curriculum amidst the pandemic.

2.2 Research Site

This study focused on junior high schools in Dasmarinas City, Cavite Province, Philippines. The junior high schools under this division cater to academic programs composed of a general high school curriculum and a special science curriculum. During the pandemic, the Department of Education mandated the basic education institutions in the country including the junior high schools under this division to shift to multiple learning delivery modalities including modular (printed or digitized) and online distance learning. In this regard, the data gathering among the participants was conducted using online platforms to follow the safety protocols during the pandemic.

Moreover, Dasmarinas City, among other cities and municipalities in Cavite province, is a first-class component city that experienced rapid development because of the growing congestion and outward urban expansion of the Metro Manila area. The development in the city was manifested by the influx of shopping malls, schools and universities, hospitals, industrial parks, and residential subdivisions to accommodate its growing population. The city is also coined the University City of Cavite due to several schools and universities that provide educational programs to its community members and students from other places. Given these conditions, the integration of environmental education in the teaching of science in junior high schools in Dasmarinas City is influenced by the environmental conditions and makes the study site to be suitable for the study.

The division office is the government agency that oversees the functions of both public and private basic education institutions in the city. Aside from the handful of private basic education schools in Dasmarinas, its public-school districts are divided into five from

Dasmarinas I to V which are only applied in elementary schools. There are thirteen junior high schools in the city that prepare the students for senior high school tracks and strands. There were eight participating junior high schools in this study to meet the suitable number of participants and able to collect the similarities of the evolving data.

2.3 Selection Criteria and Participants

The objectives and questions of the study were used as a basis for the process of determination and selection of teachers as participants. Purposive sampling was used in this research as it guarantees that participants will be able to deliver substantial information to answer the research questions (Patton, 2001). The participants were selected junior high school science teachers from grades 7 to 10 who were teaching in government schools under the division office. There were eight science teachers from each grade level of selected junior high schools who were involved in the study to meet the total of thirty-two participants. A purposive sampling technique was employed to acquire data from the selected participants based on the criteria for selection. The selection of the participants was based on their willingness to be actively involved in survey, semi-structured interview, and focus group discussion (FGD), their science teaching experience through online distance learning modality, and their involvement with the environmental education activities or programs conducted in or out of their schools, and their experiences on integrating the environmental education in the science curriculum.

Science teachers handling various levels from eight junior high schools served as the participants of this study. Their practice of integrating environmental education into

the science curriculum was at the core of this study. Based on the demographic profile of the science teachers as shown in Table 1, the participants fall into various age groups with half of them being 30 to 40 years old (50%). The majority of them are female (72%) and are in teaching service for less than 10 years (44%). The researcher made sure that there are science teachers representing all grade levels from each junior high school which made the summary of the participants equally distributed with 25% participation per grade level. When it comes to educational attainment, even though the participants are basic education teachers, some of them finished their master's degrees in the fields of pure science and science education (16%). This idea supports that there is an application of advanced knowledge in the teaching practice of science through collaboration among science teachers within their school community and school division. These science teachers who obtained graduate degrees helped in addressing the problems encountered by other teachers, especially in the execution of the online distance learning modality.

Since the K-12 curriculum implementation in 2016, science teachers were tasked to follow a new science curriculum through spiral progression by which all the science areas (biology, chemistry, earth and space, physics) are part of general science subjects from grade 7 to 10. On this note, regardless of science specialization, these junior high school science teachers had to handle all science areas.

The majority of the participants are Biology majors (56%) which is a good thing to note in this study since that environmental education is one of the core areas of biology. Though, it is also noted that some teachers have their specialization in general science (22%) which made it easier for them to handle their subject. Aside from the specializations

in pure sciences including chemistry (3%), physics (6%), and physical science (9%), there is another participant whose background is in applied science or engineering (3%). In terms of the environmental education course in college and their knowledge about it, the majority of the science teachers (78%) stated that they took a course related to environmental education while they equally believed that they have knowledge of environmental education which helped them to integrate it in science topics.

Table 1

Demographic Profile of Science Teachers

Variable	n = 32	f	%
Age	below 30 years old	11	34%
	30 to 40 years old	16	50%
	above 40 years old	5	16%
Gender	Female	23	72%
	Male	9	28%
No. of years in the teaching profession	below 10	14	44%
	10 to 15	12	38%
	above 15	6	19%
Current grade level assignment	Grade 7	8	25%
	Grade 8	8	25%
	Grade 9	8	25%
	Grade 10	8	25%
Educational Attainment	Bachelor's degree	27	84%
	Master's degree	5	16%
Specialization	General Science	7	22%
	Biology	18	56%
	Chemistry	1	3%
	Physics	2	6%
	Physical Science	3	9%
	Engineering	1	3%
Environmental Education (EE) Course in College	Yes	25	78%
	No	7	22%
Knowledge related to EE	Yes	16	50%
	No	16	50%

This research study generally aimed to identify and analyze the practices of science teachers on the integration of environmental education through online distance learning modality during the pandemic. To achieve this aim, the researcher formulated three research questions founded on both quantitative and qualitative designs to complement the various research data and better understand the solution to the research problem.

2.4 Instruments and Data Collection

The researcher submitted a request to conduct the study to the school division and selected junior high schools to inform them about the objectives of the study and the process of data gathering (see Appendix A). After receiving the research endorsement for data gathering, the research data was collected using two instruments a quantitative survey and semi-structured and focus group discussion interview questionnaires to answer the research questions (see Appendix C). These three data collection tools did not limit to the characteristics of the prospective participants and are free from biases in terms of their gender, class, ethnicity, and culture. A survey questionnaire (see Appendix F) was adapted from the study of Sukma et al. (2020) which includes twelve questions on how the teachers integrate environmental education into the science curriculum amidst the pandemic. This instrument was administered among elementary school teachers in Indonesia to assess their opinions and knowledge regarding the integration of environmental education in the learning process at the elementary school level. The researcher has modified the questionnaire based on its relevance in the Philippine setting and the current pandemic before it underwent content validation by three experts in the fields of environmental and

science education. Meanwhile, the purpose of the semi-detailed interview was to gain a deeper understanding of teachers' perceptions, attitudes, and experiences toward environmental education integration into the science curriculum using the instrument. This was conducted individually among teachers to elicit detailed information about their perceptions and experiences. Lastly, focus group discussion (FGD) is frequently used as a qualitative approach to gain an in-depth understanding of social issues. The method aims to obtain data from a purposely selected group of individuals rather than from a statistically representative sample of a broader population (Nyumba et al., 2018). Through this method, a wide range of opinions and perspectives from the group's participants will be captured. This was conducted on a basis per school with the science teachers from grades seven to ten as the discussants.

Moreover, the data collection was conducted provided with the consent from the participants to undergo the survey, semi-detailed interview, and focus group discussion together with the orientation on the study's objectives and ethical considerations. The privacy and confidentiality of participants' information were protected by which their real names were disclosed in the paper, instead, the suitable coding of participants based on their schools and grade levels was employed. A short briefing and orientation were made to make the participants feel comfortable before the actual interview and focus group discussion. This was directed and recorded using a video teleconferencing computer application due to the limitation on physical interaction as a quarantine restriction during the pandemic. The researcher prepared a series of questions for the interview and FGD with some items coming from pertinent literature and validated by experts in the field of

environmental education and research (see Appendix E). Additionally, the participants were allowed to freely express their responses in English and Filipino language for them to provide extensive data for the research. Some additional or follow-up questions were asked to clarify some ideas.

All science teachers who participated in the FGD must be willing to be interviewed. Examples of the questions used for the semi-structured interview and FGD include: “Do you think that you have knowledge related to EE to be able to integrate it into your subject? Why or why not?”, “Do you think that your teaching of EE integrated into your teaching help your student learn about EE? Why or why not?”, “What is your understanding about integrating environmental education in the science curriculum?”, “What do you think of the significance of integrating EE in science amidst the pandemic?”, “What do you consider environmental education (EE) to be? What would you not consider to be EE?”, “What are the lessons/topics in science that you have integrated environmental education like issues, problems, and projects?”, “How often do you integrate EE in your lessons?”, and “What are your common resources used in integrating EE in science?”

2.5 Data Analysis

The data analysis was separately done using quantitative and qualitative responses of the participants from three data gathering techniques. Using the quantitative data from the survey, descriptive statistics were involved to obtain the mean and standard deviation. This group of data was analyzed and the results for each question were summarized in tables. On the other hand, qualitative data gathered were transcribed and themes were

generated based on the participants' responses from the conducted semi-structured interviews and focus group discussions. Merriam (1998) emphasized that evidence should be systematically managed and recorded. They also recommended the use of three levels of analysis such as 1) construction of categories or themes; 2) naming the categories and sub-categories, and 3) developing systems for placing the data into the categories. Likewise, Yin (2009) suggested that the coding by theme technique was helpful to find orientations among the data and provide apparent explanations.

Saldaña (2009) recommended that coding using hard-copy printouts gave more focus on the data that were analyzed instead of spending mental resources on the software on how to analyze the data. With this, the research data from a semi-structured interview with each participant and focus group discussion were analyzed separately to see the participants' perspectives on the research topic. Research data from the interviews and focus group discussions were evaluated for thematic commonalities. The text transcriptions were analyzed by the researcher to identify commonalities and differences among the participants' perceptions and experiences. Lastly, the qualitative data were utilized to support the participants' responses to the quantitative survey regarding their integration practices.

2.6 Role of Researcher

The researcher conducted the study to the utmost of its capacity to perform the required tasks and attain the research objectives. Following the guidelines set by the University to legally gather the research data, the researcher asked for permission from the

Division Office together with the participating junior high schools under their supervision and the schools' principals and administrators through a formal request. Afterward, the researcher sought approval from the selected teachers who are qualified to serve as participants in the study. The researcher oriented them about the purpose and significance of the study as written in the consent form to participate in the research study (see Appendix D). Once the data gathering was done, the researcher analyzed the participants' responses to derive the themes that emerged from the data. The researcher supported the results with the existing findings and theories from the body of knowledge. Moreover, the researcher formulated attainable recommendations that will help the schools and teachers who participated in the study as well as other stakeholders and researchers to better improve the process of integrating environmental education during the pandemic.

2.7 Methods of Validation

The research instrument is primarily a set of research questions utilized for conducting the survey, semi-structured interview, and focus group discussion. The survey questionnaire was adapted from the pertinent literature while the open-ended questions were developed from the related literature and will undergo a validation process. The researcher requested at least three experts in the fields of environmental education and research to validate the research instruments based on the purpose and research questions of the study (see Appendix B). The three expert validators were environmental science and environmental education professors and have research designations in different universities. Additionally, the researcher allowed the participants to check the series of

questions that were asked to them before the conduct of interviews and FGD to know if they can be able to answer those questions. Lastly, the researcher revised the final instrument according to the suggestions of the experts and participants to arrive at acceptable results. When it comes to the answers of the participants, the researcher grouped the responses based on their relevance and quality to exclude inappropriate answers.

2.8 Ethical Considerations

The ethical issues that were considered by the researcher throughout the conduct of this study included confidentiality, respect for intellectual property, social responsibility, legality, non-discrimination, and honesty. In terms of confidentiality, this study protected the participants' privacy by creating trust and connection with study participants throughout the research. They have informed the records from this study will be kept as confidential as possible. No individual identities will be used in any reports or publications resulting from the study. All transcripts, questionnaires, video recordings, and summaries will be coded and stored separately from any participant names or other direct identification. Before using any intellectual property, the researcher obtained the necessary authorization and licensing agreements, and rigorously adhere to the terms of usage with the involved schools and offices to respect the intellectual property. The researcher also paid attention to the probable societal consequences of the study like its impacts on society's safety, health, or welfare as part of social responsibility. In terms of legality, the participants volunteered and were not forced to engage in the study or submit any information. The researcher also made sure that discrimination against participants based

on their sex, color, ethnicity, or other criteria unrelated to their scientific competence and integrity was avoided. Lastly, the researcher made sure that the study lacks data tampering and that the manuscript's originality based on the information gathered is maintained.

Chapter 3

RESULTS AND DISCUSSION

This chapter presents the results and discussion of science teachers' perceptions, attitudes, and experiences toward the integration of environmental education into the curriculum amidst the pandemic. The data were primarily based on science teachers' perspectives that were collected through questionnaires, interviews, and focus group discussions. The study involved thirty-two science teachers from eight junior high schools.

3.1 Science teachers' integration of environmental education into the curriculum amidst the COVID-19 pandemic

Using an adapted structured questionnaire, the science teachers were asked to rate their agreement on the following statements involving their practice of integrating environmental education in online distance learning modality during the pandemic as shown in Table 2. According to the survey, 17 (53%) of the science teachers strongly agreed that it is important to educate their students about the environment but there was 1 (3%) who strongly disagreed with this statement. On average, science teachers' answers to this statement reported a mean of 3.47 or agree. It is a good thing to know that they value the importance of the environment and consider the teaching profession to promote the awareness of the students. Combining environmental education and science is an effective way to enhance and foster student awareness (Abdullah et al., 2011; Bonnett, 2011; Hadzigeorgiou & Skoumios, 2013). Aside from this, the majority of the science teachers

also agreed (17 or 53%) that they utilized environmental themes in the learning process as it is important for students. These themes are incorporated into selected topics in science, and some depend on the context of the community where the students reside.

It is important to take note that for the teachers to deliver the lessons effectively in their classes most especially in online distance modality, the preparation of teaching materials should also be prioritized. In this study, the majority (66%) of the science teachers strongly agreed that they prepare appropriate teaching materials about the environment for the students which makes their online classes more engaging and interactive. These teaching materials vary based on science topics, possible integration of environmental education, and the availability of digital and online setups. From the data gathered from participants on how to integrate environmental education, the majority (53%) of respondents agreed that they introduce environmental themes or topics which are most of the time encountered in real-life scenarios. While 66% also mentioned that they prepare appropriate teaching materials about the environment. Further, 63% said they integrate EE in the learning process using a variety of learning methods. 59% of science teachers agreed that they make an important contribution to introducing environmental knowledge through classroom teaching. Students can develop their competencies and teachers can reinvent their practice by posing relevant challenges and articulating multiple dimensions of knowledge through interdisciplinary courses (Illich, 1970; Benavot, 2002; Tovar-Gálvez, 2021). This means that science teachers activate the interest of students in environmental issues by introducing phenomena or events related to the topic.

Due to the pandemic, the educational system shifted from traditional to distance learning modality and one of these is the online option. Aside from this, curriculum modification resulted in the delivery of the most essential learning competencies (MELCs). This made the number of hours for teaching become compressed as there were selected lessons that were removed from the curriculum. Among the participants, 13 (41%) strongly agreed and 15 (47%) agreed that there is enough time in the curriculum to integrate environmental education into the learning process while others disagreed. It highlights that it is still a challenge for other science teachers to integrate environmental education into science teaching due to the available time allotted for online classes. From a different perspective, the majority (63%) of science teachers agreed that they integrate environmental education into the learning process using a variety of learning methods. This supports their agreement to prepare appropriate teaching materials to deliver their lessons. Their various teaching materials coincide with the learning methods they employ based on the learners' capacities.

As mentioned in the demographic profile of the participants the majority of them took a course related to environmental education, and the majority (75%) of science teachers agreed that they have enough ability to integrate environmental education into learning activities. This is also supported by their knowledge of environmental education which they self-reported in their profile. These capacities of the science teachers are based not only on the course taken in college but also on the various professional development programs they received on the number of years they were in the teaching profession. Even though they have enough capacity to integrate environmental education into science

teaching, the majority (53%) of them take part in activities related to the environment in their respective schools. The available opportunities in the school setting for the teachers to promote their understanding and skills in environmental education led to a ripple effect on their students. Since that science is the most related and relevant subject to environmental education, science teachers are usually assigned to develop and implement environment-related programs in their respective schools. In contrast, there is a limited opportunity to conduct these activities through online distance learning modality during the pandemic.

About science teachers' reports on their preparation of appropriate teaching materials related to the environment, the majority (69%) of them agreed that they have teaching materials about environmental education that can be found in various media. This means that they can cater to the specific interests of the students in several ways even though it is in an online modality. What has been prepared and utilized by science teachers during traditional classes were still useful during online modality as they have just transformed them into digital versions. These various media where their teaching materials can be found include videos, pictures, slide presentations, and articles. From a personal perspective, the majority of science teachers (63%) agreed that they integrate environmental education into the learning process to provide solutions to solve environmental problems. This supports and expands their response to the previous statement about the importance of educating the students about the environment. This means that science teachers do not only understand the role of education to promote the significance of the environment for people's lives, but they also help to determine the

solutions to address the current environmental concerns that will affect the students as they are the future generation who will much more experience the impacts of the problems in nature. Indeed, environmental education develops a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments, and skills to work individually and collectively toward solutions to current problems and the prevention of new ones (UNESCO, 2015a).

When science teachers were asked about the time allotted in the curriculum for environmental education to be integrated, they stated a positive response. Although, the majority (66%) of the science teachers agreed that they review the curriculum, and they believe that it must be reorganized to include more about environmental education for various levels of education. Aside from the compressed time to teach the science topics and integrate environmental education into online classes, they also noticed that there is a limited number of topics about the environment. Most of these are incorporated in biology which is just a quarter of the school year. This idea of reorganizing the curriculum is a big concern especially since the adaptation of the most essential learning competencies was done due to the limited number of teaching hours. Lastly, the majority of the science teachers (56%) agreed that they undergo special training to be able to integrate environmental education into the learning process. This is supported by their response to the statement about their participation in school activities related to environmental education.

Table 2*Science Teachers' Integration of Environmental Education in Online Distance Learning**Modality*

Statement	SA (4)		A (3)		D (2)		SD (1)		M	DI	SD
	N	%	n	%	n	%	n	%			
1. I educate the students about the environment because I believe that it is important.	17	53%	14	44%	0	0%	1	3%	3.47	A	0.67
2. I use environmental themes in the learning process as it is important for students.	12	38%	17	53%	3	9%	0	0%	3.28	A	0.63
3. I prepare appropriate teaching materials about the environment for the students I will teach.	8	25%	21	66%	3	9%	0	0%	3.16	A	0.57
4. I make an important contribution in introducing environmental knowledge through classroom teaching.	10	31%	19	59%	3	9%	0	0%	3.22	A	0.61
5. I agree that there is enough time in the curriculum to integrate environmental education (EE) into the learning process.	13	41%	15	47%	3	9%	1	3%	3.25	A	0.76
6. I integrate EE into the learning process using a variety of learning methods.	7	22%	20	63%	5	16%	0	0%	3.06	A	0.62
7. I have enough ability to integrate EE into learning activities.	5	16%	23	72%	4	13%	0	0%	3.03	A	0.54
8. I take part in activities related to the environment in my school.	11	34%	17	53%	4	13%	0	0%	3.22	A	0.66
9. I use teaching materials about EE that can be found in various media.	5	16%	22	69%	4	13%	1	3%	2.97	A	0.65
10. I integrate EE into the learning process to provide solutions to some environmental problems.	9	28%	20	63%	2	6%	1	3%	3.16	A	0.68
11. I review the curriculum and I believe that it must be reorganized to include more about environmental education for various levels of education.	6	19%	21	66%	4	13%	1	3%	3.00	A	0.67
12. I undergo special training to be able to integrate environmental education into the learning process.	3	9%	18	56%	9	28%	2	6%	2.69	A	0.74

Note: Descriptive Interpretation (DI) of Means (M): 1.00-1.49 - Strongly Disagree (SD), 1.50-2.49 – Disagree (D), 2.50-3.49 – Agree (A), 3.50-4.00 - Strongly Agree (SA)

On a positive note, they are highly willing and interested to undergo professional development programs to enhance their capacity to integrate environmental education into teaching science. Braus (1993) as cited in Lane (2006) directly states that “it is difficult to infuse EE and requires extensive teacher training and effort [and that it] often relies on motivated teachers for efforts to succeed.” Several experts in the field of education and environmental pedagogies recommended and suggested a change or a reorientation of teacher training and education (Hopkins, 2012; McKeown, 2015; Goldman et al., 2014) of environmental pedagogies teaching (Gadotti, 2009, 2010; Misiaszek, 2012, 2015; Paden, 2007). It is understood that special training should be provided for science teachers for them to effectively enhance their practice of environmental education integration in the science curriculum, especially in online distance learning modality during a pandemic.

Generally, science teachers agreed that they integrate environmental education into the curriculum via online distance learning modality based on the various statements. In terms of the highest reported mean (3.47), science teachers educate their students about the environment because they believe that it is important. On the other hand, science teachers reported the lowest average (2.69) on the statement about their involvement in special training to be able to integrate environmental education into the learning process as almost half of the sample disagree with it. Regardless of the mean scores, science teachers agreed that they integrate environmental education in an online distance learning modality during the pandemic according to the employed descriptive interpretation of means. This is a positive result to take note especially since the communities worldwide are still executing quarantine protocols due to pandemics and the pandemic has originated from the existing

problems in the environment. The two-year implementation of distance education so far serves as a good experience for the school members including the teachers and students to find better ways to address the current and future environmental issues.

In support of the level of agreement of science teachers toward their integration of environmental education in teaching science, their experiences were gathered and analyzed to supplement their self-report responses on the questionnaire. When science teachers incorporate EE in their instruction of science topics, they make use of a variety of techniques to encourage student participation, particularly in online classes and when they carry out their asynchronous activities. This includes creating posters or engaging in practical tasks, reflecting on how they apply EE through real-life settings, and participating in forums where other students can benefit from their expertise. Another teacher mentioned that the ozone layer is a topic covered in Earth Science; teachers incorporate EE by having students learn about the causes and effects of the depletion of the ozone layer. The students will then be able to consider strategies to protect the environment as a result. Additionally, they suggested that teachers not only correctly focus on a conversation but also, whenever possible, integrate EE from the engagement to the assessment part of the session. If there is a way to include EE in the various themes, especially when there is an environmental topic. Finally, EE is incorporated into the motivation or reflection phase.

Environmental education was being incorporated into science lectures, but the pandemic altered the outlook. The teachers' main topics of discussion centered on the pandemic itself and its causes like one's own and family member's health. When science teachers asked students online about environmental problems and ways to safeguard the

environment, it was clear that environmental education was being integrated. The participants incorporated environmental education into the teaching of science topics by offering examples that are simpler for the students to follow if they are related to the environment. The participants also noted that while it is simpler to incorporate environmental education into science during face-to-face classes, teachers are now challenged to accomplish the objectives of environmental education integration using only the most fundamental learning competencies due to the pandemic (MELCs).

Since they cannot assess how their students have used what they have learned, teachers find it challenging to convey the fundamentals of environmental education to their charges. Given that many science topics are closely tied to environmental issues and are encountered in real-life situations, the majority of science teachers said that they unconsciously practice the integration of environmental education into their courses. Science teachers frequently used open forums and critical questioning to integrate their lessons into the subject matter. The science teachers proposed incorporating environmental education into science through a case study, exercises like composing poems and making flyers, lecture discussions, inspirational activities, open forums, and the use of pictures and films. Teachers thought that by doing this, kids would learn in the long run how to care for the environment. Erdogan et al. (2009) believed that the subjects of the science curriculum give much more scientific bases on environmental literacy than the other curriculum.

Understanding the level of integration and perceptions of science teachers in integrating environmental education in the science curriculum does not recount for in-depth analysis of their involvement in this practice, especially amidst the pandemic. This

reason allowed this study to examine their experiences as presented in Table 3. When asked about how often they integrate environmental education in their lessons, 15 (46.9%) of them stated that it depends on the topics in science which is supported by their background in environmental education as stated in the demographic profile of the participants. On a positive note, other science teachers reported that they integrate environmental education in their lessons sometimes (25%) and every time (28.1%) which means that it is not required for them to practice it.

Table 3

Experiences of Science Teachers on EE Integration

How often do you integrate EE into your lessons?	Frequency	Percentage
Sometimes	8	25%
Every time	9	28.1%
Depends on the topics	15	46.9%

This study also collected the topics and lessons in science from each grade level where teachers integrated environmental education to better understand their reason, especially about the relation of the topic to environmental themes as shown in Table 4. It also highlighted that majority of the reported topics or lessons are related to biology and earth and space sciences which are taught for two quarters in each grade level since the science curriculum follows a spiral progression approach. Aside from these relevant science areas, the participants still considered integrating the teaching of environmental education in chemistry and physics topics.

Table 4*Science topics that teachers integrated the environmental education*

What are the lessons/topics in science that you have integrated environmental education like issues, problems, and projects?	Participant	Topics
Grade 7	S2-G7	effects of changes on abiotic factors and harmful/toxic chemicals on the environment
	S5-G7	biodiversity particularly the abiotic and biotic factors and the pollution itself
	S6-G7	scientific investigation and climate change
	S8-G7	pollution (air, water, and land) and ecosystems
Grade 8	S3-G8	ways to minimize human impact on the environment.
	S4-G8	formation of stronger storms due to the changes in the temperature brought about by global warming
	S5-G8	biodiversity, food chain and food web, physical and chemical changes, and genetics
	S6-G8	biodiversity, ecosystem, and biogeochemical cycle
	S7-G8	atomic structure of atoms, chemical bonding, periodic table of elements, respiratory, genetic disorders, biodiversity, water cycle, food chain, and earthquake. respiratory system
Grade 9	S1-G9	volcanoes and climate change
	S3-G9	factors that cause extinction and climate change
	S4-G9	species extinction and climate change
	S7-G9	volcanoes and earthquakes
	S8-G9	factors affecting climate, volcanoes, climate change, biodiversity and evolution, ecosystem, and life energy
Grade 10	S1-G10	pollution, anthropogenic activities, and deforestation
	S2-G10	DNA/RNA, mutation, biodiversity, and evolution
	S3-G10	volcanic eruption, typhoon, earthquake, global warming, greenhouse effects, pollution and its effects on the environment, preventive measures we can do as human beings
	S4-G10	chemical reaction, electromagnetic waves, and plate tectonics

Although there are similar topics mentioned by the participants from different grade levels, they clarified that some topics from the previous grade levels were still reviewed and encountered in the delivery of the new lessons. It is a good thing to appreciate that some of these topics are related to the current pandemic that is globally experienced and has highly affected even the education sector. These topics include biodiversity, food chain and food web, genetics, ecosystem, respiratory system, extinction, evolution, mutation, and anthropogenic activities. This could be a reason why science teachers believed that they effectively practiced the integration of environmental education in teaching science according to the learning acquired by their students. In connection, promoting environmental consciousness can be achieved through better curriculum and pedagogy and formal teacher education on environmentally related topics that relate to their experiences and are linked to real-life situations (Littledyke, 2008; Gray & Gray, 2018).

3.2 Perceptions of science teachers in integrating environmental education into the curriculum amidst the COVID-19 pandemic

This study aimed to understand the background and perceptions of science teachers on environmental education integration aside from how they integrate environmental education into the curriculum based on their level of agreement and experiences. As much as teachers must be passionate about educating others, it is even more crucial that they develop an interest in environmental issues in order to impart the solutions to resolving these numerous issues. In relation to this, the majority of science teachers (59%) did not view teaching as their top-choice job. One of the claimed explanations is a lack of funding

for what they planned to complete. Even the minority (41%) of them totally resolved to continue the teaching profession because they wanted to pass on their expertise to pupils and because of the influence of others, such as their relatives and former teachers. The majority of science teachers (84%) agreed that they promoted their students' environmental awareness and practices because of the knowledge gained from current news and participation in community works when it came to their assessment of the efficacy of their environmental education teaching as integrated into the curriculum. Other scientific teachers, however, believed that there were some limitations that prevented pupils from learning about environmental education in terms of tactics and methodologies, appropriate training, assessment of learning, and subject matter understanding.

From the results of individual interviews and focus group discussions, in-depth ideas were generated and thematically analyzed based on their relevance to the research objectives. From the analysis of qualitative data, several themes emerged and were narrowed down according to the commonalities of shared knowledge by the participants. Themes drawn related to the science teachers' perceptions in integrating environmental education in the curriculum include the 1) impressions and understanding of EE, 2) benefiting from EE integration in science amidst the pandemic, and 3) balancing the values and drawbacks of EE integration amidst the pandemic.

1. Impressions and understanding of environmental education

Environmental education is broad, but it is important and needed in teaching science. Everybody is part of the environment so environmental education must be

integrated. Science teachers' impressions of science and environmental education are interesting and essential since these two are connected. As science teachers, for them, science helps people understand the world and the things around them. By understanding this world, people will realize that it is essential to recognize the need to take care of our environment and lessen the activities that may harm the environment. Their understanding of environmental education is that it refers to organized efforts to teach how the natural environment function and how human beings can manage it. Also, they understand that the integration of environmental education into the science curriculum awakens the students' minds to identify what human activities can significantly impact the earth's system. Environmental awareness necessitates environmental knowledge and understanding of the natural environment (DiEnno & Hilton, 2005; Kousar et al., 2022). Encouraging them to live sustainably can help in protecting and conserving the environment. Helping the students become aware of how they utilize the environment's resources and buying things and using them, like gadgets, etc. to their full potential can help save the earth. Science teachers always ensure that they discuss some issues in the news related to the environment, like the issue of mining in the country, which will help students to recognize in buying and consuming products. Selected responses of science teachers' impressions and understanding of the integration of environmental education in science are shown below.

Science teachers from School 1 perceived a good impression and understanding of environmental education. They consider this practice as an approach to transformative education which is one of the aims of education for sustainable development (ESD).

Students being engaged with environmental issues allow them to think critically and prepare themselves for their future environment as the future generation. S1-G9 mentioned that their impressions and thoughts about science subjects and environmental education are it can transform lives and the lessons are based on reality. For them, environmental education is a process that allows individuals to explore environmental issues, engage in problem-solving and take action to improve the environment. Integration of environmental education in the science curriculum helps to solve environmental problems. Meanwhile, S1-G10 stated that environmental education enlightens them on how to conserve the environment in the face of increasing human population growth and anthropogenic activities that degrade natural resources and ecosystems. She added that EE helps students understand why the environment is important and provides them with the building blocks they need to live eco-friendly and sustainable lives.

In the case of School 2, science teachers assumed that it is easy to integrate environmental education into science topics. As they noticed that it is about real-life scenarios which require them to be interested in the current events as well, they realized that it is challenging work to influence the students to become responsible individuals in the biosphere. According to Ergin (2019), science is one technique to tackle human problems with nature, and education may provide information and raise awareness, therefore learning natural science and environmental education can easily be combined. They also considered the current condition of the earth as the reason why it is necessary to educate the students about the environment through integration. Also, environmental education can result in direct benefits to the environment and address conservation issues

concretely (Ardoin et al., 2020). S2-G8 thought that teaching science and environmental education is easy but as they go along with it, it is challenging especially on how they are going to teach their students the importance of it. For this teacher, environmental education is all about teaching people how to be responsible citizens as they identify issues about the environment. It also includes how to manage these issues and be able to benefit from them. S2-G8 shared: “Integrating environmental education into the science curriculum for me means helping students to promote creative and critical thinking skills especially in engaging with their community.” Similarly, S2-G9 pointed out that environmental education is about how the environment functions and how humans will be able to manage the diversity of the environment. S2-G9 shared: “It is necessary to integrate EE into the science curriculum because of the present condition of our Earth. We need to impart this in a mainstream classroom.” Moreover, S2-G10 stated that EE is very broad and very engaging because EE increases people’s knowledge and awareness about the environment like environmental issues and problems, and how to critically think to solve these issues and problems. She added: “Integrating environmental education into the science curriculum is necessary because as a human we are the guardians of the environment so we all should be knowledgeable about the environment as a teacher to educate our students about EE.”

The technical aspect of the problems in the environment can be deeply understood in natural science while the participation of the people including the education sector is catered by environmental education. They also added the inclusion of the student organization in schools, Youth for Environment in School Organization (YES-O), as a

helpful program initiator to bridge the integration of environmental education in science topics and within the entire school community. S3-G8 expressed that environmental education is where someone can learn different aspects of the environment and promote proper management and interaction in the ecosystem to have a sustainable community. Integrating environmental education into the science curriculum entails incorporating the concept of EE into the topics. Additionally, S3-G9 thought that they coincide or correspond with each other. Science is more on the integration of information and knowledge on a scientific basis of everything around us while environmental education helps in applying the knowledge to real-life situations that can better our environmental situation and need to create sustainable development goals for the future. The focus of environmental education is sustainable development and acting on environmental issues that can be addressed with the help of technology and science. S3-G9 added: “My understanding is that there is a relevance in integrating EE in science because it serves as their application for real-life situations and environmental concerns that occur in the present time.” Likewise, S3-G10 believed that science and environmental education can be linked together to analyze underlying environmental issues and the process that can be done to lessen or resolve these underlying issues. He added: “Yes, it is not environmental education, but the content was about the underlying environmental issues. Environmental education, for me, taught us the ways and processes we can do to lessen or resolve environmental issues.” They also emphasized during the discussion that integrating environmental education into the science curriculum is not a new thing for them since that secondary schools have this organization named Youth for Environment in School

Organization (YES-O). They shared that YES-O as an organization was conducting programs and activities every year to raise the awareness of high school students about environmental issues. Webinars and clean-up drives were some of the programs and activities conducted by YES-O.

Moreover, one of the core values maintained by the Department of Education is to build the students to become 'Makakalikasan'. This core value was emphasized by one of the science teachers from School 4 who believed that the integration of environmental education in the curriculum is one way how to make this aim of the Department to become possible. Also, since that science is a broad subject, science teachers were able to understand one of its areas which promotes the awareness of the people about the calamities. S4-G9 mentioned: "Environmental education is part of teaching science subjects. Environmental education allows us to explore environmental issues to create an action on how to improve their impact on the environment." Meanwhile, S4-G10 stated: "Science is such a broad topic; however, integration of environmental education is quite hard to include in all MELCs. EE helped me understand many concepts about the environment and why natural disasters happen." S4-G7 believed that science subject not only ends in the four corners of the classroom and should be applied in real-life situations. He also emphasized that as one of the core values of the Department of Education is 'Makakalikasan', environment education must be integrated into science.

The integration of environmental education for science teachers from School 5 is one way how the concepts of science can be understood in real-life scenarios whereas everyone can be interested to study. Aside from the benefits which people obtain from the

environment, environmental education assures the chance for people to think of solutions to solve the enormous impacts of anthropogenic activities. S5-G10 shared: “Today for what is happening, or during a pandemic, I think it is better to integrate environmental education into science. Before I just only discuss the lesson and there was no integration of the environment.” Likewise, S5-G7 shared that EE is about the study of the environment, how the abiotic and biotic factors interact, and the importance of conservation. S5-G7 added: “As a science teacher, integrating environmental education into the science curriculum helps the students to be aware of our environment and to be more engaged with our environment and the community.” S5-G8 believed that they are interrelated in all aspects. Teaching science would integrate environmental education for future use. Environmental education not just refer to the environment itself but also deals with the issues that may affect human. S5-G8 shared: “We need to touch on EE in our lessons preparation for them to understand the world around us.” Lastly, S5-G9 mentioned that environmental education enables people to understand the problems that the environment is facing and take part in finding a way to help solve them. He also shared: “It is a must to enlighten our students that we should take good care of the environment because it is for our own benefit.”

Science teachers from School 6 do not only consider the integration of environmental education to be focused on environment-related disciplines like biology and earth science. They suppose that it is important to incorporate examples related to the environment across all science disciplines so that the learners would understand the holistic connection of the environment in various scientific concepts. S6-G7 mentioned: “I love science as an engineer, and I love teaching it to my student. Make use of the environmental

resources as a platform for topic discussion and learning during the teaching of science.” Still, S6-G8 thought that they are connected since in science, biology is part of the subject, and it is important also to teach or be part of the said discussion. It is necessary to integrate it so that the students will learn how to protect and know more about the environment. S6-G9 thought that science is very interesting and embedded in it is environmental education which is essential now that people are experiencing the effect of global warming. Integrating environmental education into the science curriculum is not just putting it in a related branch of science like biology or ecology but more importantly, is how teachers integrate those topics into physics, chemistry, and all the branches of science so that it will be seen across the science curriculum.

At the same time, science teachers from School 7 considered environmental education as a process that allows individuals to explore environmental issues, engage in problem-solving, and take action to improve the environment. This integration into the science curriculum is a big part of achieving it. They recognize that science comprises its nature and aims to develop scientific knowledge and better the process skills to help us evaluate the impacts of scientific and technological developments on the environment. S7-G7 thought: “EE must be part of the science curriculum. It must be involved in the learning competencies.” Also, S7-G8 discussed: “Environmental education and science subjects go hand in hand. Integrating environmental education into the science curriculum is a must although EE is already affiliated with a science subject. EE must be integrated across the curriculum in learning exemplars.” Furthermore, S7-G9 shared that during their high school level, science and environmental education was hard. They taught that it is a

complicated subject to understand. But when they reached college, they slowly understand its concept. She added: “It is not a subject that we need to comprehend but somehow it is part of our daily applications. Being a science major, I had a lot of environmental education.” Looking back, she thought it is just a boring one or a commonsense subject because they were just going to talk about the environment, but as they go deeper it is not just a subject, but the concept itself gave them content and knowledge they should apply in the day-to-day life.

Lastly, science teachers from School 8 noticed the need to incorporate environmental education in teaching science topics because of the ongoing environmental crisis. Even before the pandemic, climate change and global warming affect the lives of the people which would increase in the future years. For this reason, they know that it is important to build both the critical and creative thinking skills of the students for them to address these concerns. S8-G8 pointed out: “Integration of EE in the science curriculum will require training and seminars for the science teacher to be able to equip them with the exact knowledge.” while S8-G10 stated: “Environmental education promotes creativity and critical thinking for the students to be engaged with their environment.” S8-G7 mentioned that she was very curious and eager to learn about it. Also, as of today, she believed that it is very timely to integrate it into the lessons in science as climate change progresses. She added: “EE is about the understanding of nature and how to nurture and protect it. Integration of lessons in EE is mostly done in the application and reflection parts of the lesson.”

2. Benefiting from EE integration in science amidst the pandemic

It is highly noted from the answers of the science teachers that the integration of environmental education in science topics increased the awareness of students about environmental preservation and helped students to give solutions to these problems. Teachers must understand the environment to effectively integrate it into science topics and impart it to the learner. It is also significant for teachers to know how to take good care of the environment to minimize the negative effects that humans are creating and for people to be aware of the consequences that they will be experiencing if people will not take care of our environment. The participants also believed that as environmental integration is part of the core values of the Department of Education and in all subject areas especially in science, integration of environmental education in science is possible because there are specific topics that are related to the environment. The world is still facing a lot of problems in terms of climate change and everything that happens in the environment so there is still a need to strengthen environmental education not only in science but also in all subject areas. Environmental literacy and knowledge were found to be useful to some level but not adequate in changing overall ecological behavior toward environmental sustainability, according to several studies (Roczen et al., 2014; Amirshokoohi, 2010; Ahi & Alisinanoglu, 2015). Despite the problems brought by the pandemic for the integration of environmental education in science, it is still important for the learners to be aware of the importance of the environment even though it is mostly taught in theoretical ways especially now that they cannot apply what they have learned.

When science teachers were asked about what environmental education is to be integrated with the science curriculum, they mentioned that it is needed to consider the environment of their learners so that they can learn freely around their surroundings and be able to appreciate nature and its various aspects. Even though some of them do not have subjects like environmental education during their college years, other science teachers value the aims of learning environmental science instead. Other teachers also stated that it is unspoken that they always integrate it into science teaching like giving solutions, identifying problems in the environment and which is essential not just in integrating it to the environmental subject but also in other branches of science like physics, chemistry, and the others. This means that the interdisciplinary approach is the way how science teachers integrate environmental education into the science curriculum. Also, teachers do not give much focus to integrating environmental education. On a positive note, environmental education is commonly integrated into the science curriculum, but they mentioned that it can be integrated into other subjects. Some researchers claimed that incorporating environmental education into many subjects imposes a variety of constraints and obstacles on the educational system (Johnson-Pynn & Johnson, 2005; Palmer, 1998).

For science teachers in School 1, environmental education integration in science is important because it helps the students to learn sustainable practices that they can maintain in the future years. This form of education does not only help the students in the current time but also prepares them for the future by becoming responsible decision-makers. Teaching the skill associated with environmentally supportive behavior was just as important as teaching environmental knowledge (Charron, 2013). S1-G7 shared: “Students

became more aware of the degrading environment and happenings around us. EE is about problems concerning our environment and issues on health as well as drastic changes in climate that lead to a more destructive place to live.” Also, S1-G10 stated: “EE helps students understand how students’ decisions and actions affect the environment and build the knowledge and skills necessary to address complex environmental issues, as well as ways to take action to keep the environment healthy and sustainable.” S1-G9 mentioned that the significance of environmental education in science amidst the pandemic includes the student’s awareness, knowledge, and understanding of EE. She added: “I considered the EE when students develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions.”

In the context of School 2, science teachers considered the protection and conservation of the environment as a continuous approach and should not only be practiced when there are only issues faced by society. The existing media in the present time also helps to promote the significance of environmental education among a wider audience aside from the students. It is also the role of the people to take care of the environment and look for ways how to conserve it as they are the ones who also benefit from it. S2-G8 said: “We will be able to impart to students how their actions and decisions could change the environment and its effect. I consider EE to be a responsible citizen when it comes to the environment.” Further, S2-G7 mentioned that the significance of integrating EE in science amidst the pandemic is that people can continue protecting and conserving the environment and its resources. Integrating it into science will help the learners become aware and act at home to live sustainably without harming the environment. She added: “Even though we

are in the pandemic, we can still be Earth warriors. I consider EE to be when the teacher allows the students to be aware of the current news about environmental problems and act in solving them.” S2-G9 said that to give awareness and to realize that despite the pandemic, people need to face and find a solution to this critical situation in the environment. EE is one way for the students to take part in the solutions to the existing problems in the environment. Lastly, S2-G10 thought that it is a must to integrate EE amidst a pandemic because, people know that this pandemic is caused by the virus from the bat, and this is an effect of overpopulation. Environmental factors include the increase of being exposed to infectious diseases just as this COVID-19. Environmental education should be integrated into the science curriculum to spread or disseminate and share knowledge about the environment and to develop responsible environmental behavior and skills so that people can improve the quality of the environment.

Science teachers from School 3 mentioned that the pandemic promoted the value of environmental education for more people. In addition, the mutation of the virus and the concept of vaccines has great significance in the study of EE. The perspectives of sanitation and disinfection are greatly taught by teachers to students. EE should highly be considered and should be further explored. The issue of climate change and how each student and their small actions may contribute to climate change. S3-G8 believed that environmental education gives students important opportunities to become involved in real-life issues as well as the complex environmental issues that our planet is facing. Meanwhile, S3-G9 observed that people learning about EE during this pandemic have made their concept broader. For example, medical wastes such as facemasks, syringes, etc. have risen in

number during a pandemic and the difference in air and land pollution in public places during the pandemic has changed. For S3-G10, EE became more important during this time of the pandemic. She added: “Integrating EE in science can make us understand and explain to the students the origin, nature, and preventive measures we can do to lessen and/or slow down the spread of COVID-19.” She considers EE as a process of exploring environmental issues, as well as exploring the ways to prevent or lessen the serious effect of environmental issues people are facing worldwide. She does not consider EE as teaching only the definition and concepts of these environmental issues. For her, teaching only the definition does not make it understandable for the students about the real issue or the effect of these environmental problems, thus, teaching about the preventive measures and ways to resolve them makes it more likely as environmental education.

In School 4, science teachers appreciate the importance of environmental education as an approach to allow the students to explore the problems in nature and how scientific investigation can help to solve them. They also educate their learners to realize the various impacts of human actions like negligence on the bad effects contributed by anthropogenic activities. The right values on how to maintain pro-environmental behavior are also a positive benefit of the incorporation of environmental education in the curriculum. S4-G7 shared: “Integrating EE in science is significant because the students should realize that whatever actions people made to the environment have consequences.” Also, S4-G8 mentioned: “EE integration is important since most diseases are caused by changes in the environment and human activities. Environmental education is when you study the environment, its status, issues, concerns, management, and sustainability practices.”

During the discussion, S4-G9 said that environmental education allows people to explore environmental issues to create action on how to improve its impact on the environment while S4-G10 mentioned that integration of EE in science is very much important. She added: “We all know that pandemic is mostly caused by our negligence and lack of concern for our environment.”

Among the respondents of this study, science teachers from School 5 emphasized the importance of environmental education integration in science as a way for how students realized the value of both biotic and abiotic factors on earth. During the pandemic, it is also a good way for how the students to learn the connection between health and the environment. They also thought of the relevance of environmental education for the promotion of sustainable lives. S5-G8 shared: “It is important nowadays to integrate EE amidst pandemics because this situation is considered an environmental issue. It means that with the EE integration, we can expand or give information about what is happening around us.” Meanwhile, S5-G10 said: “It is very important to understand environmental education as we need clean air, water, and food to have better health.” As shared by S5-G7, EE integration will help the students to reflect and be aware of the importance of the environment as well as the conservation of the abiotic and biotic factors during the pandemic. Environmental education helps the students to understand why the environment is important and provides them with the building blocks they need to live eco-friendly and sustainable lives.

Going back to the definition of science, science teachers from School 6 connect it with environmental conditions. For them, since that science is about understanding real-

world scenarios, it is the role of everyone including the students to understand the consequences of their actions. They emphasized that environmental education is informing and educating students about the current situation of our environment and what solutions can be done to be able to stop further damage to the environment and to actively participate in different programs, activities, and training that will not just inform them but also empower them to become warriors for the environment. S6-G7 mentioned: “Students were able to understand and comprehend what is happening in our environment that greatly affects the entire world.” Likewise, S6-G9 said: “Now more than ever, we really must integrate environmental education into all aspects of the science curriculum because we heard and have known that the source of this pandemic is the transmission of viruses from animals to humans.” He added that all the use of single-use items like face masks, face shields, and a lot of disposables really must make students understand that this pandemic has caused a lot of damage to the environment because of all the things that people throw away.

Through simple actions for the benefit of the environment and the people, science teachers at School 7 believed that environmental education supplies the information needed by the students for them to understand the chaos that happens in their surroundings. They stated that environmental education is a learning process that increases students' knowledge and awareness about environmental concerns, and they develop decisions to address the issues. If a person is not aware of the uses and importance of the environment, he/she is not undertaking EE. S7-G7 mentioned: “Students became more aware of what is happening to the environment.” Also, S7-G8 shared: “The importance of integrating EE in science in

this situation is that students learned to plant trees and vegetables or practiced urban gardening which helped them to save some money and have an extra food supply." As for S7-G9, since it is timely, integration of EE in science would be a great idea because people will be more aware of what is happening around them. On the other hand, it will also have a good effect so that people can better take care of their surroundings. She added: "The most I consider when it comes to EE is the process that allows individuals to explore environmental issues, engage in problem-solving, and take action to improve the environment." With this, every individual develops a deeper understanding of environmental issues and has the skills to make informed and responsible decisions.

Lastly, from the perspectives of the science teachers from School 8, they think that environmental education is about the exploration of environmental issues, and how people act or deal with those issues. They also think that everything must be considered when people deal with environmental education which the education sector has a big role to commit. The translation of words to actions is also a great benefit that students can gain from understanding the true meaning of environmental education. S8-G7 shared: "The significance of integrating environmental education in science is for the learners to be aware of what is happening right now, and the possible causes it may bring, and for students to be able to translate their learnings into actions." Further, S8-G8 thought that integration of EE in science allows learners to become more aware of the environment. She considers environmental education to be the key to solving the problem of climate change and the pandemic that people are currently experiencing. Also, S8-G9 said: "Environmental education is about the issues, concerns, and problems in the environment to promote

possible solutions to the different issues.” Lastly, as for S8-G10, environmental education can help the students understand how their decisions affect the environment.

3. Balancing the values and drawbacks of EE integration amidst the pandemic

Through the possible integration of environmental education into science even during the pandemic through online distance learning modality, science teachers observed various advantages of this practice to impart to students the significance of the environment. Teachers were able to encourage students to find ways how to preserve the environment. It also strengthens the specific communities where students as members of it can partake in the solution-making for existing concerns in their setting. Education about the environment shows the reality of certain issues that are happening worldwide just like the pandemic. The online distance learning modality also allowed the students to learn on their own and they can focus without hassle from their other classmates. There are independent learners, and some can learn in a group. During the online class, it gives the students more engagement to learn. Students must be aware of what is happening in our environment. As young as they are, science teachers need to introduce it to them. Because one of them may be the source of a solution to the problem we are encountering. Another participant mentioned that there are no cons because it is not hard to integrate environmental education into the science curriculum.

As there is a limited application of the lesson learned, teachers were not sure if the students were the ones who accomplished the given activities. Internet connectivity and the availability of gadgets are problems that students faced, even those enrolled in the

online modality. The permitted 30-minute online class is also not enough to integrate environmental education into science topics as the emphasis is much more given to the learning competencies. Same idea with science teachers that since some students are environmentalists or highly interested in environmental issues, it is easier for teachers to integrate environmental education into the discussions. There are activities that both teachers and students cannot do during an online class. Some learners do not have good internet connections, and they are not able to attend the synchronous class. It is hard to integrate EE into some branches of Science like Physics and Chemistry. Previous studies indicated that teachers do not include environmental education aspects in their lessons because they believe the concept of environmental education has no relevance to the subject being taught (Samuel, 1993; Lane et al., 1994).

Students are motivated in learning EE because they are surrounded by their friends and classmates face to face. But in distance learning, students are unmotivated to study. They are unmotivated to apply the learning that their teachers taught them. There are struggles, especially during the pandemic, students cannot go outside and apply their learnings. Meanwhile, outdoor education allows students to learn outside of the classroom while also enhancing their social development and leisure skills (Knapp, 2000; Emmons, 2016; Larsen et al., 2017). Students are distracted because they are not focused. It is easily relatable to students. It is easier to grasp the lesson because they are living in the environment.

One of the science teachers from School 1 believed that the current learning modality brought both positive and negative factors in incorporating environmental concepts in

science. As science is related both to the environment and health, the experiences during the pandemic increased the awareness of the students on hygienic practices which made it easier for teachers to make sure that their students value the lesson. Despite the linkages between the environment and health, environmental campaigns are rarely framed in terms of human health, and health-related behavior-change tactics are rarely applied to environmental behavior (Nisbet & Glick, 2008). Meanwhile, the integration of environmental concepts in teaching science also consumes the allocated time for specific lessons to deliver. S1-G9 mentioned: “The possible advantages include the encouragement of a healthy lifestyle improving academic achievement and strengthening communities. The disadvantages include time constraints and being overloaded with schoolwork.”

It is a good thing that despite the distance learning setup, science teachers from School 2 still value the positive impacts of incorporating environmental education in science teaching. They understood that science topics are more appreciated by the students as these relate to environmental issues which helps the students to take part in various actions to help conserve the environment. Although, they also claimed that there are some lessons that environmental education can be easily incorporated due to the limited time for an online class, and if possible, they cannot assure the credibility of the outputs submitted by the students. S2-G7 stated: “The possible advantage of integrating EE in Science is that it will allow the learners to protect and conserve the environment. The disadvantage is that some topics are not easy to integrate.” Meanwhile, S2-G8 said: “Because of the situation, through ODL it is hard to assess based on their submitted outputs because you do not know if they did the activity.” Additionally, S2-G9 shared: “The available assessment in the

module is limited and you cannot measure the learnings of the students. Lastly, S2-G10 mentioned: “Students gain knowledge about the environment and how they can contribute to solving problems in our environment.”

Science teachers from School 3 noticed that environmental education concepts are a good addition to science topics for the students to appreciate the value of everything in the surroundings. Though, due to distance modality, this integration is quite ineffective because of the limitations on the hands-on activities that students can be engaged in when they are in school settings. At the same time, they also believed that other science topics cannot be easily integrated into environmental education due to different concepts. S3-G7 stated: “Students are excited when we integrate EE but there was no hands-on experimentation. Students cannot appreciate the learnings because there is no application.” Also, S3-G8 mentioned: “It promotes critical thinking and encourages a healthy way of life.” As shared by S3-G9, he believed that it helps students to integrate the lesson into real-life situations in EE and they may assist in dealing with and solving environmental issues. The disadvantage is that it cannot be integrated into all topics and may deviate from the competencies in the provided matrix. Further, S3-G10 claimed that the advantage of integrating EE into Science was raising the awareness of the students about the environmental issues people are facing worldwide. They can gain knowledge on how to prevent these environmental issues. As for the disadvantage, he thought: “EE has a wide or broad range of topics and that we cannot integrate it all into science at the secondary level because science subject has their topic limitations.”

For some reason, science teachers from School 4 recognized more on the advantages of the integration of environmental education in the science curriculum. They noticed that due to the high demand for environmental connection among humans, it is highly significant to raise the awareness of the students also because of the pandemic setting. It would also benefit not only the environment but also humans as they depend on their ways of living from it. S4-G8 mentioned: “It makes students aware of the status of the environment and think of ways to help improve it.” Likewise, S4-G9 said: “It increases students' awareness of different environmental issues.” Lastly, S4-G10 shared: “Teaching EE will benefit not just the environment but us, humans, as well.”

The positive and negative impacts of integrating environmental education were the thoughts of science teachers from School 5 regarding the advantages and disadvantages it brought during the pandemic. As the learners are exposed in their communities or learning settings, they can either be encouraged or discouraged by the different environmental problems they face. Due to a lack of training for teachers, the integration of environmental education in science topics is questionable especially when it is delivered in a distance modality. S5-G8 said: “The advantage is they will be aware of the real situation of our world. The disadvantage nowadays is how are we going to teach them despite the limited access for the students.” Also, S5-G9 stated: “It is an advantage that the learners will be aware of the problems of the environment. The disadvantage is that the learners are also exposed to the reality of what is the situation in the environment.” For S5-G7, the advantages of integrating EE in science make the students understand the importance of the science and environment, promote a sustainable lifestyle, explore environmental issues,

engage in problem-solving, and take action to improve the environment. The disadvantages are lack of proper training for the teachers, lack of resources, students not engaged in the community, lack of engaging activities in the environment and community, and lack of exposure to the environment and community.

When science teachers at School 6 integrate environmental education into science topics, they cannot assure if the learners acquired the real meaning of the concept or idea explained by the teachers based on their outputs. At the same time, they also considered the integration to consume the time for discussion allotted for specific topics. As there is already limited time for the lessons to be delivered, the integration still consumes the allocated time even though it is minimal. S6-G7 mentioned: “Possible advantage is for students to be able to relate, apply and integrate science topics to EE. The disadvantage would be the funding to properly introduce this to the learners.” While, S6-G8 said: “We cannot easily gauge if they understand the lesson that is integrated into EE.” S6-G9 said that there are a lot of advantages of environmental education and that is focusing more on real-life situations and real-life problems and solutions, but its disadvantage would be if it needs to consume a lot of time to be able to absorb its essence. Finally, S6-G10 believed that the students will be able to understand the lesson well. During a pandemic, it is very difficult to measure how the students learn about the integration of EE in their lesson and that is because of the limited time so it is hard to gauge how well they understand the lesson about EE.

Science teachers from School 7 stated that aside from the advantages that the integration of environmental education brings to online science teaching, the interests of

some students on environmental issues are still limited because they consider it to be boring. Additionally, there is a difficulty in applying this integrated environmental education in the form of activities due to distance modality. S7-G7 stated: “Students will be more aware of environmental issues. At the same time, they will be able to think of ways how they can help in solving those problems.” Further, S7-G8 shared: “The students become aware of the environment and environmental issues. But it just stops the awareness and no actual practice and that is the disadvantage of integrating EE in science.” As for S7-G9, when it comes to advantages, many people can be aware of the state of the environment, but for disadvantages, the first problem will be people’s interest in learning using it. She also shared: “It is the stigma because when it comes to the environment, it is always boring or nerdy to look at. So, I think that is the one that will be a disadvantage.”

Even though there is still an integration of environmental education in teaching science topics, science teachers from School 8 considered the allotted time for online classes to view the integration practice as a disadvantage because it uses the time for the students to focus on the specific lesson. Despite this reason, they entirely value the essence of empowering the environmental awareness of the students during this time of pandemic as it is highly needed to be tackled these days. S8-G7 mentioned: “Advantages are for the students to be aware of the issues of what is happening right now in our environment, and to be able to think of ways or means how to solve those issues.” On the other hand, S8-G8 stated: “The time allotment for integrating environmental education into the teaching of science is a disadvantage because of its limitation.” S8-G9 responded during the discussion that the application process is a problem because teachers cannot measure or gauge the

learnings of the students. As for S8-G10, its advantage is critical and creative learning is enhanced; however, its disadvantage is it is a limited topic to be integrated.

3.3 Attitudes and experiences of science teachers in integrating environmental education into the curriculum amidst the COVID-19 pandemic

The attitudes and experiences of science teachers in integrating environmental education into the curriculum are emphasized more on the themes generated from the conducted data analysis of their responses from the individual interviews and focus group discussions. Themes related to this third question are comprised of 1) pedagogical strategies, methods, and resources to integrate EE in science teaching; 2) confronting the issues on EE integration amidst the pandemic; 3) initiating best practices for EE integration in the science curriculum, and 4) advocating for an intensified EE integration in science amidst the pandemic.

1. Pedagogical strategies, methods, and resources to integrate EE in science teaching

When science teachers integrate EE in teaching science topics, they utilize various methods to allow the participation of their students, especially during online classes and when they accomplish their asynchronous activities. This includes poster making or hands-on activity, lectures, and related activities, reflection on how they apply EE through real-life scenarios, and forums, students can share their knowledge.

Another teacher shared that in Earth Science there is a topic about the ozone layer, teachers integrate EE by teaching students the cause and effect of the depletion of the ozone

layer. This will lead to allowing the students to think of ways how to help the environment. Also, they mentioned that, if possible, teachers should integrate EE from the engagement to the assessment phase of the lesson and should not only focus on discussion properly. If there is a possibility to integrate EE into the different topics specifically when there is a topic related to the environment. Lastly, EE is integrated into the reflection or motivation part.

Science teachers were integrating environmental education in their lessons, but the perspective changed because of the pandemic. The teachers focused more on the reasons behind the pandemic and the pandemic itself such as the health of oneself and their family members. The integration of environmental education was observed during the online classes where science teachers asked the students about environmental issues and how to protect the environment. As science teachers, the participants integrated environmental education in teaching science topics by giving scenarios that are easier for the students to adopt if the given examples are related to the environment. Teachers with a positive attitude toward the environment are more likely to incorporate environmental education into their classrooms (Chung Ko & Kin Lee, 2003; Kim & Fortner, 2006). In the learning management system (LMS), there is a discussion forum where students can share their opinions about environmental issues and problems.

The participants also mentioned that it is easier to integrate environmental education in science during face-to-face classes but now because of the pandemic, teachers were challenged to deliver the goals of environmental education integration using only the most essential learning competencies (MELCs). It is hard for teachers to impart to students

the essence of environmental education as they cannot evaluate how the students applied what they have learned. Most of the science teachers claimed that they were unaware of their integration practice of environmental education in their lessons as specific science topics are highly related to environmental issues and experienced in real-life scenarios. The integration practice of science teachers was usually done through asking critical questions and conducting open forums related to the specific event. Teachers also believed that through the online distance learning modality, it was easy to integrate environmental education because they can let the students watch videos related to problems in nature.

Science teachers from School 1 shared their teaching strategies using different resources in integrating environmental education in teaching science topics. These are common teaching styles that other teachers also use in distance modalities. Some of these methods are lecture-discussion, think-pair-share, and collaborative learning. S1-G9 shared: “The common resources I used in integrating EE in science include internet access, modules, and books. The pedagogical strategies in teaching science to integrate EE are project-based learning, cooperative learning, and experiential learning.” Also, S1-G10 disclosed: “I use the approach of Constructivist, Collaborative, Integrative, Reflective, and Inquiry-Based Learning depending on a specific lesson and how it must be delivered to my students based on their learning styles.”

Similarly, science teachers from School 2 believed that it is more effective to integrate environmental education in teaching science topics when the examples are connected to real-life scenarios. Online and book resources are both useful in the distance learning modality as they also consider the credibility of information about environmental

topics brought by various websites. Aside from the relationship between science topics and environmental education, they believed that it is much better to assign the students to do research works like case studies about environmental issues. S2-G8 mentioned: “I just relate the science topics to real-life issues for students to appreciate them.” Meanwhile, S2-G9 said: “Giving the students some situational problems help them realize the importance of the environment.” As for S2-G7, she claimed that she always used EPA.gov and Conservatree.org as her resources in integrating environmental education. She shared: “My pedagogical strategies and methods in teaching science to integrate EE are inquiry-based and case studies that allow the learners to be aware of current trends related to what is happening in the environment.”

For science teachers at School 3, environmental education is also integrated through assimilation during the reflection stage. Environmental education is integrated by giving situational examples wherein students can relate. They integrate environmental education when they discuss calamities while allowing the students to recite and share their experiences. S3-G7 stated: “EE is being integrated through lectures.” Meanwhile, S3-G8 mentioned: “I looked for some articles on the internet that are related to environmental education.” Likewise, S3-G10 shared that their common resources are books, articles, news, and other published studies about environmental issues, species extinction, and environmental calamities. As for the strategies and methods, she sometimes presents documentaries, videos, and other visual presentations to her students about the topics that she discusses. Making these may trigger the thinking skills of her students because not every day they saw or experience, say, for example, volcanic eruption or earthquake. But

watching documentaries and videos of survivors make them realize or understand what should be done before, during, and after these calamities. Finally, S3-G9 said “Modules, books, and reliable online resources are the common resources I used in integrating EE into science. Strategies include integration and conceptualizing, like lectures, and videos as collaborative work. Most of the strategies are more on the learner-centered side.”

As per School 4 science teachers, environmental education integration is not part of the lesson plan which challenges them to think of pedagogical strategies on how to incorporate it during the discussion. For them, it is a better way to include it in the lesson plan so that they can integrate it into the lesson properly. They also stated that while teachers serve as the main source of information during online discussions, internet resources are useful to make the class more interactive. S4-G7 shared: “We always integrate in one way or another it is not that in-depth because we have different topics.” Also, S4-G8 stated: “During this time, it is more teacher-led discussion, so we do not integrate EE into doing activities.” As for S4-G9, it is important to remind the students of their role as stewards of God’s creation. Lastly, S4-G10 said: “The internet for current events and latest data is the common resource I used in integrating EE into science.”

If the lessons are about natural calamities, it is easier to integrate environmental education as per science teachers from School 5. Environmental education is integrated during the engagement party of their S5-G8 mentioned: “Documentary videos, newspapers, articles, and some books are the common resources I used in integrating EE into science. Usually, in a collaborative and reflective approach.” Meanwhile, S5-G9 stated: “The modules, internet like Google and YouTube, and other apps helped improve

the visual representation of environment-related topics. Group discussions or assigning groups in making campaigns for the environment are also helpful.” She also emphasized that it is also integrated during the reflection part of the lessons. Further, S5-G7 shared that she used YouTube for video clips and music playing. She also used Facebook to share information like trivia, facts, and educational programs online provided by different organizations for learning about science and the environment. Lastly, she shared: “I do discussion methods and use social media platforms to share content about the environment. I also include film viewing in my lesson exemplar.”

Science teachers from School 6 usually get their resources from the internet apart from the provided books. They also use previous lessons and adapt good lesson plans in teaching environmental education. They integrate environmental education into science teaching by placing it in the motivation such as puzzle pictures. Lastly, they also integrated it during the lesson proper and in the reflection part.

A science teacher from School 7 mentioned that they used instructional materials like PowerPoint presentations and videos, sometimes pictures, to show the students that environmental topic is part of the lesson. For example, science projects related to environmental education that includes reading build science knowledge while strengthening literacy skills about the environment. S7-G7 stated: “Brainstorming, use of audio-visual teaching tools, and storyboarding are my pedagogical strategies and methods in teaching science to integrate EE.” Besides, S7-G8 said: “I used a real-life situation, picture method, and hands-on activities.”

Whatever component of science, if there is a chance to integrate environmental education, School 8 science teachers integrate it. They also used the reflection part of the discussion to know the reactions of the students about the integrated environmental issues in the topic discussion. Science teachers also integrate environmental education in science using formative and summative assessments. One example that they do is by asking their students about the ways that they can do to help the environment. S8-G7 mentioned: “Books, reliable websites, articles, and journals related to it are the common resources I used in integrating EE in science.” Also, S8-G9 said: “It depends on the lesson. EE is being integrated during the reflection phase of the lesson.” Lastly, S8-G10 believed that if the lesson is about biodiversity or earth science, it is easier to integrate EE.

2. Confronting the issues on EE integration amidst the pandemic

The major problem that science teachers noticed in effectively integrating environmental education into science is time constraints. They mentioned that there is a limited time to do it. As some of them had no environmental education course back in college, they emphasized that the proper integration of environmental education in science should be introduced to teachers through various professional development programs. Teachers have limited knowledge and lack experience in environmental education integration even though it is highly related to natural science. Students only believe their teachers if they see them doing the activity firsthand. The participants also assumed that teachers who are not environmentalists cannot integrate environmental education through their discussion. The preparedness and the capability of the teachers to handle questions

are also a hindrance because when they trigger the curiosity of the students and their willingness to think deeply, there are times that they will ask questions that are not related to the main topic but to the integrated environmental concept. Teachers should broaden their knowledge about environmental education. As stated by Kimaryo (2011), lack of teaching and learning tools, time, and huge courses are all obstacles to EE integration. Teachers' contributions to the application of environmental education in the development of environmentally literate citizens are also critical.

Another problem that they experienced was when students were not willing to listen because they were distracted by different things at home. The interest of the students in environmental topics is also a challenge for science teachers. Just like any other subject in the online distance learning modality, science teachers cannot holistically gauge whether the students learned the lessons or not. The application of what the students learned is limited to what they can perform at home. Internet connectivity is also a problem, especially during the conduct of online discussions. As students' study in their respective learning settings, some places are not conducive to learning.

Due also to the limited physical interaction, it is a struggle to integrate environmental education during online classes unlike before wherein the conduct of ecological activities outside the classroom was still possible. Traditional modality allowed the students to become more engaged with nature, but now during online classes, teachers do not know whether the students are learning or not. Another problem that science teachers encountered is that environmental education is only integrated into science teaching if it is related to the topic. Integrating environmental education in science cannot

be done in all subdisciplines of science like in some chemistry and physics lessons where it is hard for teachers to consider the integration due to limited time.

As science teachers mentioned that it is hard to assess what students learned from the integration of environmental education in teaching science, students are not only limited with environmental awareness but lack practice as well. Students' interest is also noted as a major problem. Some students rely basically on the internet and there is no effort in the submission of outputs. The outputs and outcomes of the students based on what teachers have discussed are great concerns. When it comes to students' interest in environmental issues, it is lacking because they always think that environmental problems are already common. One of the highlights of teachers' responses was about the family orientation of the students as a major factor that affects students' interests in environmental issues since that family value serves as a foundation for curiosity. As there is a limited capacity such as knowledge and training on the teachers' side, there are not aware of the specific lessons in the curriculum guide where they can integrate environmental education. Researchers suggested that curiosity should be piqued by activities and abilities, but the focus should be on the active search for information and comprehension of unexpected things in the environment (Alexandar & Poyyamoli, 2014). Science teachers also assumed that it is not mandatory to integrate environmental education into the science curriculum.

When it comes to the problems encountered by science teachers from School 1, they found it difficult to properly assess the students' learning of environmental education due to the pandemic which shifted the classes to an online modality. The skills related to environmental education that they try to enhance among the students cannot be realized as

well as there is a distance between the teachers and students. S1-G7 expressed: “Students cannot gain enough skills, profound knowledge, and understanding of environmental education when integrated into the lessons.”

The major reason those science teachers considered the reason why there is a problem with the integration of environmental education in science teaching is the interest of the students in environmental concerns. This problem also leads to the low environmental awareness of the students. S2-G7 mentioned: “The challenge or obstacle that I faced in integrating EE into my subject amidst the pandemic is that there is a limit to doing actions that are only doable at home.” Though, S2-G8 stated: “Some topics are hard to understand for me and of course, some students just do not care about them.” S2-G9 mentioned that the level of interest of students in environmental issues is considered as a problem.

For science teachers from School 3, integrating environmental education into science amidst this pandemic is much harder because students cannot conduct on-site activities such as clean-up drives. They only conduct activities virtually such as webinars which they think is not enough because they think that it is more effective if students can apply their learning to the environment by conducting on-site activities such as clean-up drives, tree planting, and the like. S3-G8 shared: “Giving and monitoring hands-on activity in a distance learning environment is a real challenge for me.” Also, S3-G9 stated: “Lack of resources, modular distance learning, and lack of students’ interest in environmental issues.”

As per the experience of science teachers from School 4, the lessons are limited in the curriculum guide and the time is not enough for the integration of environmental education. This problem was also raised by other science teachers since the conduct of synchronous classes was very limited in the online modality. S4-G7 mentioned: “Limited time in teaching and lack of first-hand experience in activities regarding the environment.” Further, S4-G10 said “As for now, the challenge is really on the aspect of time. Time constraint hinders me to discuss or elaborate on the integration of environmental education in science.”

Some teachers from School 6 stated that they cannot see if the students do reflect on what they say during the discussions on environmental education. Even during face-to-face classes, there is still a lack of engagement with the community and environment. There were also limited resources that suit the need of the subject matter. S6-G9 expressed that it is difficult to set an example on how they are going to do the solutions when it comes to environmental education. Even though students are aware of the problems and the solutions, they still find it difficult to act on them, especially during the pandemic.

Lastly, science teachers from School 7 also mentioned that the problems that they considered include the student’s interest in environmental topics and time allotment for the integration of these topics into science topics. They thought that the application of learning is also their first problem. Since that class meeting is delivered in distance learning, no matter how hard they teach the students that they need to apply their learning, the fact that they do not see them if they are doing those things would be hard. S8-G9 mentioned: “There is a limitation on the visiting of desired places to conduct outdoor environmental

education activities like gathering of data.” Additionally, S8-G10 said: “Limited resources and the students cannot go out to explore environmental issues.”

3. Initiating best practices for EE integration in the science curriculum

When looking at the history of the pandemic, those were all related to the changes in the environment from the very first Spanish flu to what people are experiencing now which is Covid-19. Students are also aware that the small actions that they are doing have an impact on our environment which is the reason why teachers really must integrate environmental education into science. Moreover, teachers must know how to contextualize the broad concepts of the environment so that they can effectively deliver them to the students. It will also help the students to grasp their contributions to the changes in the environment.

The science teachers mentioned that they integrated environmental education into science through a case study, activities like poem writing and creating leaflets, lecture discussions, motivational activities, open forums, and the use of images and videos. By doing these, teachers believed that students would have long-term learning on how to take care of the environment. Aside from those strategies, science teachers still look for ways how to integrate environmental education into science teaching. Teachers find it challenging to connect the environmental education curriculum to science classes since there appears to be no clear formula for implementation, making many teachers wary of teaching through integration (Drake, 2004). Unfortunately, environmental education is not

emphasized and is just included in the science curriculum. It is not part of lesson plan making but they can integrate it into the execution of the lesson.

Understanding the connection of environmental education to science gives an in-depth realization for everyone about the origin of the pandemic. The selected science teacher stated that it is more important to integrate environmental education into the science subject so that the teachers clearly explain the reasons why the pandemic started. According to science teachers from School 4, they can integrate that experience during their discussions with the students to show that the teachers from their school have first-hand experience in terms of protecting and conserving the environment. Correspondingly, Uçar and Canpolat (2019) asserted that teachers' environmental behaviors and attitudes will be critical because they will serve as role models for their students in the future, and teacher behavior influences student behavior. S4-G7: shared: “Free time to have community projects like tree planting activities. It is in partnership with the barangays. There is a time to have community linkages.” Additionally, S4-G8 mentioned: “Because of this project we inspired others that this pandemic is not a hindrance to having a concern regarding the environment.” Also, S4-G10 stated that teachers were instructed to look at where they can integrate it into the MELCs.

School 6 science teachers believed that there is a big importance of linking the environment through education because this is a good advantage to those learners who would become inspired in learning, creating, making critical decisions, and creating new ideas. Environment education is a must because learners will be inspired in making critical decisions. They will be able to acquire new ideas based on the lesson that they got from

science and apply them to their environment. S6-G7 shared that, for example, in her grade 7 class, they were studying climate change. If they introduce environmental education to their learners, they learn something from the environment. These are the things that people need to address to be able not to experience climate change, pollution, and all the calamities that people are experiencing. She added: “That is why it is a must to teach EE for us to gain more knowledge, and to inspire students not to be stressed about what is happening around us.”

The integration of environmental education in the science curriculum is timely for science teachers in School 7. They believed that teachers must teach students that people are depending on the environment and not vice versa. Students must know that there is an effect of whatever they are doing on the environment. S7-G7 expressed: “This will help students to preserve and help the environment.” As agreed by S7-G8, students have plenty of time in doing activities on how to take care of the environment like cleaning or planting unlike during face-to-face students used half of their time playing instead of them doing the activity related to EE. Lastly, S7-G9 stated: “Since the environment of the school is a slum area, students must be aware of how to take good care of the environment. Teachers must teach students how to help the environment.”

4. Advocating for an intensified EE integration in science amidst the pandemic

Despite the problems encountered by science teachers in integrating environmental education in the teaching-learning process, they suggest looking for ways to get the interest of students. They also believed that the involvement of the five senses of students will

increase their interest in environmental problems. Even during these times, Chang and Kidman (2020) encouraged that as a community it is needed to continue to develop research on geography and environmental education on policy, curriculum, instruction, and assessment of environmental challenges so that it can inform improved teaching and learning long after the pandemic is over. The online distance learning modality allowed the students to recognize the activities that they can do in their home like conserving electricity and gardening which are some applications of environmental education concepts as part of science topics. Science teachers from School 4 provided some examples that can be continuously done in the online learning modality. S4-G7 stated: “If students are allowed to go outside, they can create videos or vlogs on applying the concept of Environmental Education.” Meanwhile, S4-G8 mentioned: “In our LMS, there is a discussion forum where they can share their opinions about the environment.”

The Department of Education (DepEd) is suggested to come up with a strategy or format on how science and other subject teachers can integrate environmental education in the delivery of lessons so that they will be knowledgeable on how to properly integrate it. Specific topics in the curriculum guide designed to integrate environmental education should be presented to teachers so that there is uniformity in the implementation. It is also advised for the teachers to review the most essential learning competencies (MELCs) and see if environmental education can still be integrated into the lesson even without a deep emphasis. Darner (2014) suggested that more evaluation of scientific information and elements of other educational resources that could contribute to the development of pro-environmental behavior be critically analyzed and evaluated through proper

implementation. These ideas are backed up by the statements of science teachers from School 3. S3-G7 stated: “Look for ways to get the interest of students. Use the 5 senses of students.” Likewise, S3-G8 said: “Let the students watch videos related to EE.” Also, S3-G9 suggested that simulation is also applicable while S3-G10 shared that it is good to make it a habit to integrate EE into the science curriculum.

The practice of allowing the students to watch documentary videos related to environmental education should be promoted as there is a limitation with the conduct of onsite activities. If possible, simulation is also applicable for the students to witness a specific problem or event in the environment. Good practices of science teachers in the integration of environmental education should be maintained. They also propose to make it a habit to integrate environmental education into the science curriculum. Yuan, et al. (2017) underscored that environmental education teachers can learn in their leisure time through online learning or distance teaching for related topics. Supporting these statements, science teachers from School 7 elaborated their responses during the focus group discussion. S7-G7 shared: “Let the students watch videos on how to take care of the environment.” S7-G8 expressed that teacher should encourage students to look for ways to preserve the environment. Moreover, S7-G9 stated: “Before and After Method (Cleaning their environment)” Lastly, S7-G10 suggested: “Environmental education should be highlighted not only in the context of the lesson.”

The school programs and activities related to environmental education should be intensified and become more engaging to the students throughout the school year and not only during the celebration of the specific environment-related event. If students are

allowed to go outside their houses even in their community, they can create videos or vlogs on applying the concept of environmental education and determine a specific problem that their community faces. S2-G10 said: “There should have school programs. We need to intensify the programs and activities to do for the whole school year. It should be more engaging to the students.” Also, S8-G7 stated: “Help the learners to identify the ways how to help conserve the environment.” Lastly, S8-G8 recommended that there must have training for the teachers on how to integrate environmental education in science while S8-G9 suggested that there must be a standardized plan or layout so that it will not be hard for teachers to integrate EE.

Environmentalists believe that for students to learn how to protect and conserve natural resources, they must see them, feel them, and love them. Fieldtrips can help students build social and personal skills, improve observation and perception skills, provide first-hand real-world experiences, and boost intrinsic motivation and interest in the subject (Behrendt & Franklin, 2014; Larsen et al., 2017; Tal & Morag, 2009). Science teachers from Schools 2 and 3 mentioned suggestions about environmental education integration in science teaching.

Chapter 4

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This chapter presents the summary of this research, together with the synopsis of its results. Though the scope of the indicated conclusion is limited within the context of the research site, still the context is relevant to understanding how science teachers integrated environmental education into the curriculum amidst the pandemic. Recommendations for further study conclude this chapter.

4.1 Summary of the Study

Generally, how the science teachers reported their agreement based on their level of practicing the environmental education integration in the science curriculum is complemented by their views and experiences in the conduct of online distance learning. Their understanding of environmental education for the benefit of both the environment and society was enlightened during the pandemic. The challenges that they encountered were transformed into opportunities that strengthened their capacities to better improve the implementation process. These general findings establish the interconnections among the research variables which resulted in the meaningful interpretation of the findings as additional knowledge in the field of environmental education. As this study gathered and analyzed the perceptions, attitudes, and experiences of science teachers' integration of environmental education amidst the pandemic, it supported the significant scenarios that are valuable for the development and implementation of educational policies in relation to

the continual integration of EE in science and other subject areas through different learning modalities.

4.2 Summary of Results

The study's findings implied that, despite the pandemic, science teachers' levels of agreement to participate in the proper integration of environmental concerns in teaching science remained higher. Analyzing this concept shows that science instructors continue to come up with innovative strategies to interest their pupils in the current environmental catastrophe. In light of the pandemic, which was caused by pre-existing environmental issues, civilizations all over the world are currently enacting quarantine protocols, thus it is crucial to draw attention to this fact. Additionally, science teachers' perceptions of the incorporation of environmental education in science were based on their perceptions and understanding of environmental education, which included their impressions and understanding that its lessons are grounded in reality and may change lives. In addition, they held that the inclusion of environmental education in science curricula is advantageous in light of the pandemic because it helps students comprehend how their choices and actions affect the environment and develops the knowledge and abilities needed to deal with challenging environmental problems. The study's findings also highlighted the need to balance the benefits and drawbacks of integrating environmental education in the face of the pandemic. Despite the integration process' time constraints, EE promoted a healthy lifestyle, improved academic achievement, and strengthened communities.

4.3 Limitations

This research study aimed to gather and analyze the level of agreement on environmental education integration based on the given statements of the junior high school science teachers in Dasmarinas City, Cavite under one school division. Together with the quantitative data based on their self-report responses of agreement on the given statements, this study also collected the perceptions, attitudes, and experiences of junior high school science teachers toward the integration of environmental education in the science curriculum amidst the pandemic. This research study is limited to 32 science teachers of 8 junior high schools under the City Schools Division of Dasmarinas in Cavite Province who were handling online distance learning modality. Also, it is limited to the time when the study was conducted which is in the School Year 2021-2022. The involvement of other subject matters and teachers including the students can be considered in future research to deeply understand the phenomena of the implementation of environmental education integration in the curricula. Lastly, the research design was only limited to the purposive sampling technique with a small number of participants and a case study with a preliminary descriptive quantitative design.

4.4 Conclusion

Understanding the science teachers' perceptions, attitudes, and experiences toward the integration of environmental education in the curriculum brings out a significant contribution to enhancing the modern practical ways in which the incorporation of environmental topics will make the science concepts more relevant and applicable. This

study is guided by the formulated research questions based on the literature gap and existing problems observed in the body of knowledge, specific to environmental education integration. Based on the findings of the study from the conducted quantitative and qualitative analyses of participants' responses, the researchers arrived at conclusions in connection to the significant outcomes that would help address the issues encountered in EE integration amidst the pandemic via online distance learning modality.

In dealing with the first research question, more than 50% of science teachers reported in the quantitative survey that they Agree with the list of statements about their EE integration practices in teaching science. From the data gathered from participants on how to integrate environmental education, the majority (53%) of respondents agreed that they introduce environmental themes or topics which are most of the time encountered in real-life scenarios. While 66% also mentioned that they prepare appropriate teaching materials about the environment. Further, 63% said they integrate EE in the learning process using a variety of learning methods. The different perspectives and experiences of science teachers from various schools and grade levels did not contribute a negative impact on the general report as summarized through the mean scores of their responses from each given statement. This connotes that their level of agreement to get involved with the proper incorporation of environmental topics in teaching science despite the pandemic is still possible and at a higher level. Analyzing this idea means that science teachers still find ways how to make their students become engaged with the ongoing environmental crisis. This is an important fact to highlight, especially as societies around the world are currently implementing quarantine protocols because of the pandemic, which stemmed from existing

environmental problems. The school members, including teachers and students, have gained valuable knowledge in finding better ways to solve present and future environmental challenges over the two-year implementation of distance education. Additionally, science teachers expressed their experiences on how they integrated environmental education into teaching science topics aside from their level of agreement with the statements.

The second research question of this study aimed to understand the perceptions of the science teachers on the background, concept, significance, and applications of environmental education in the educational setting in specific to the science curriculum amidst the pandemic. According to the insights shared by the science teachers during the interview and focus group discussion to expound on their responses to the quantitative survey, the researcher was able to generate three themes in connection to the codes and categories drawn from the thematic analysis of data. Themes drawn related to the science teachers' perceptions in integrating environmental education in the curriculum include the 1) impressions and understanding of EE, 2) benefiting from EE integration in science amidst the pandemic, and 3) balancing the values and drawbacks of EE integration amidst the pandemic.

To complement the findings of the previous research questions, the attitudes, and experiences of science teachers on the integration of environmental education in teaching science were raised as the final research question of the study to deeply understand the entirety of the current status of environmental education in the junior high school level in the country. The themes obtained from the performed data analysis of their replies from

individual interviews and focus group discussions stressed more on the attitudes and experiences of science teachers in incorporating environmental education into the curriculum. Themes related to this third research question include 1) pedagogical strategies, methods, and resources to integrate EE in science teaching; 2) confronting the issues on EE integration amidst the pandemic; 3) initiating best practices for EE integration in the science curriculum, and 4) advocating for an intensified EE integration in science amidst the pandemic.

4.5 Recommendations

Not only does the research have to convey its findings, but it also must provide practical solutions for putting the ideas into action. In this regard, the researcher suggests viable ways to promote the integration of environmental education into the science curriculum using the online distance learning modality based on the conclusions offered after the analysis of various data. Because science teachers generally agreed with the various statements on their practice level of integrating environmental concepts in teaching science, it is hoped that this result will reach the level of strongly agreeing with the help of a variety of efforts, including not only the teachers' initiatives but also the efforts of their respective school officials. There should be specific rules for the production and evaluation of environmental education materials for various topic areas, such as science.

It is also necessary to think about ongoing capacity building based on experiences and skills in environmental education integration. A reorientation of teacher training and curricular programs to include ways for integrating environmental education into the

science curriculum is also recommended. Environmental education requires improving science instructors' environmental knowledge and attitudes. Further examination of scientific information and elements of other instructional resources that could contribute to the development of environmental knowledge should be critically analyzed and evaluated through the proper application, it is advised. Collaboration within and between national and local stakeholders is proposed as the most appropriate strategy for understanding environmental education themes since science teachers conducted programs and activities linked to environmental education. To be more specific, this study suggests three critical suggestions for future scholars and stakeholders to examine.

First, the current study only looked at 32 science teachers from eight junior high schools in Dasmarinas, Cavite. Future research should investigate the perspectives, attitudes, and experiences of additional scientific teachers who have incorporated environmental education into their curricula. The findings of this study could be compared to those of future post-pandemic studies.

Second, because this study only covers junior high schools in Dasmarinas City, Cavite which is under one division, a regional or countrywide study on science teachers' preparation and implementation of environmental education integration into science curriculum through various modalities (online, modular, blended) in various educational institutions (basic and tertiary) should be conducted.

Third, it is critical to investigate the perspectives of basic education stakeholders involved in the development of science curricula and capacity building for environmental

education to gain a better understanding of how they can fully engage science teachers in meaningful environmental education integration outside of the classroom.

REFERENCES

- Abdullah, S. I. S. S., Halim, L., & Shahali, E. H. M. (2011). Integration of environmental knowledge across biology, physics and chemistry subject at secondary level in Malaysia. *Procedia- Social and Behavioural Sciences*, 15, 1024-1028. <https://doi.org/10.1016/j.sbspro.2011.03.233>
- Ahi, B., & Alisinanoglu, F. (2015). The evaluation of pre-service preschool teachers' knowledge about the concept of environment. *European Journal of Educational Research*, 4(2), 57-69.
- Alexandar, R., & Poyyamoli, G. (2014). The effectiveness of environmental education for sustainable development based on active teaching and learning at high school level- a case study from Puducherry and Cuddalore regions, India. *Journal of Sustainability Education*, 7.
- Altin, A., Tecer, S., Tecer, L., Altin, S., & Kahraman, B. F. (2014). Environmental awareness level of secondary school students: A case study in Balıkesir (Türkiye). *Procedia - Social and Behavioral Sciences*, 141, 1208-1214. <https://doi.org/10.1016/j.sbspro.2014.05.207>
- Alzahrani, I., & Woolard, J. (2013). *The role of the constructivist learning theory and collaborative learning environment on wiki classroom, and the relationship between them* [Paper presentation]. International Conference for e-Learning & Distance Education, Riyadh, Saudi Arabia. <https://eric.ed.gov/?id=ED539416>
- Amirshokoohi, A. (2010). Elementary pre-service teachers' environmental literacy and views toward science, technology, and society (STS) issues. *Science Education*, 19(1), 56-6.
- Ardoin, N. M., & Bowers, A. W. (2020, December 9). *Environmental education and nature-rich experiences: Essential for youth and community well-being during the COVID-19 pandemic and beyond* [Commentary]. Policy Analysis for California Education. <https://edpolicyinca.org/newsroom/environmental-education-and-nature-rich-experiences>
- Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241, 108224, <https://doi.org/10.1016/j.biocon.2019.108224>

- Ashmann, S. (2010). *In What Ways are Pre-Service Teachers being Prepared to Teach K-12 Students about the Environment?: An Investigation of Wisconsin's Teacher Education Programs*. Wisconsin Environmental Education Board.
- Athman, J. A., & Monroe, M. C. (2000). *Elements of Effective Environmental Education Programs* [Master's thesis]. <https://pdfs.semanticscholar.org/b584/37c13cd70dcdf21fc7dd69a98b9e1e9bccd0.pdf>
- Bai, H. (2020). A critical reflection on environmental education during the COVID-19 pandemic. *Journal of Philosophy of Education*, 54(4), 916-926. <https://doi.org/10.1111/1467-9752.12472>
- Bang, A. & Khadakkar, S. (2020). Biodiversity conservation during a global crisis: Consequences and the way forward. *Proceedings of the National Academy of Sciences, USA*, 117(48), 29995-29999. <https://doi.org/10.1073/pnas.2021460117>
- Behrendt, M., & Franklin, T. (2014). A review of research on school field trips and their value in education. *International Journal of Environmental and Science Education*, 9, 235-245. <http://doi.org/10.12973/ijese.2014.213a>
- Benavot, A. (2002). Education for learning to live together: A critical analysis of comparative research. *Prospects*, 32(1), 51-73.
- Bloomfield, L. S. P., McIntosh, T. L. & Lambin, E. F. (2020). Habitat fragmentation, livelihood behaviors, and contact between people and nonhuman primates in Africa. *Landscape Ecol*, 35, 985–1000. <https://doi.org/10.1007/s10980-020-00995-w>
- Boca, G. D., & Saraçlı, S. (2019). Environmental education and student's perception, for sustainability. *Sustainability*, 11(6), 1553. <https://doi.org/10.3390/su11061553>
- Bonnnett, M. (2011). Environmental education and the concept of Nature. In E. Theodoropoulou (Ed.), *Environmental Ethics* (pp.139-158). Athens, Greece: Atrapos.
- Brodhag, C., & Taliere, S. (2006). Sustainable development strategies: Tools for policy coherence. *Natural Resources Forum*, 30(2), 136–145. <https://doi.org/10.1111/j.1477-8947.2006.00166.x>
- Bryman, A. (2008). *Social research methods* (3rd ed.). Oxford University Press.
- Buza, L. (2010). Environmental education: teaching in the present, preparing students for the 21st century. *Problems of Education in the 21st Century*, 22, 8-15.

- Campagnolo, L., Carraro, C., Eboli, F., Farnia, L., Parrado, R., & Pierfederici, R. (2018). The ex-ante evaluation of achieving sustainable development goals. *Social Indicators Research*, 136, 73–116. <https://doi.org/10.1007/s11205-017-1572-x>
- Chan, J. F., To, K. K., Tse, H., Jin, D., & Yuen, K. (2013). Interspecies transmission and emergence of novel viruses: Lessons from bats and birds. *Trends Microbiol*, 21(10), 544-555. <https://doi.org/10.1016/j.tim.2013.05.005>
- Chang, C., & Kidman, G. (2020). Encouraging preparedness in geographical and environmental education for a post-pandemic future, *International Research in Geographical and Environmental Education*, 29(4), 279-282. <https://doi.org/10.1080/10382046.2020.1831204>
- Charron, R. (2013). *Education for sustainability: A moral framework* (Unpublished doctoral dissertation). University of Alberta.
- Chikati, T. M., & Okendo, E. O. (2018). Teachers' and students' perceptions of integrated environmental education in the secondary school curriculum for managing environmental degradation in Machakos Sub County, Kenya. *International Journal of Social Sciences and Humanities Invention*, 5(7), 4881-4889. <https://doi.org/10.18535/ijsshi/v5i7.08>
- Chung Ko, A. C., & Kin Lee, J. C. (2003). Teachers' perceptions of teaching environmental issues within the science curriculum: A Hong Kong perspective. *Journal of Science Education and Technology*, 12(3), 187-204.
- Cohen, M. J. (2020). Does the COVID-19 outbreak mark the onset of a sustainable consumption transition? *Sustainability: Science, Practice, and Policy* 16(1), 1e3. <https://doi.org/10.1080/15487733.2020.1740472>.
- Collins, M. A., Dorph, R., Foreman, J., Pande, A., Strang, C., & Young, A. (2020). A field at risk: The impact of COVID-19 on environmental and outdoor science education (Policy brief). Retrieved from https://www.lawrencehallofscience.org/wp-content/uploads/2021/10/EE_A_Field_at_Risk_Policy_Brief.pdf
- Coomer, J. (1979). *Quest for a sustainable society*. Oxford: Pergamon.
- Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches* (3rd Ed.). SAGE Publications, Inc.

- Darner, R. (2014). Influences on students' environmental self determination and implications for science curricula. *International Journal of Environmental & Science Education*, 9, 21-39.
- De Houwer, J., Thomas, S., & Baeyens, F. (2001). Association learning of likes and dislikes: A review of 25 years of research on human evaluative conditioning. *Psychological Bulletin*, 127(6), 853-869. <https://doi.org/10.1037/0033-2909.127.6.853>
- Delia, J., & Krasny, M. E. (2018). Cultivating positive youth development, critical consciousness, and authentic care in urban environmental education. *Frontiers in Psychology*, 8. <https://doi.org/10.3389/fpsyg.2017.02340>
- Dennis, L. J., & Knapp, D. (1997). Viewpoint: John Dewey as environmental educator. *The Journal of Environmental Education*, 28(2), 5-9. <https://doi.org/10.1080/00958964.1997.9942817>
- Department of Education. (2016). The Conceptual Framework of Science Education. [Online Document] Available: https://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf
- DepEd Order No. 12. (2020). Adoption of the basic education learning continuity plan for school year 2020-2021 in light of the COVID-19 public health emergency. [Online Document] Available: https://www.deped.gov.ph/wp-content/uploads/2020/06/DO_s2020_012.pdf
- DepEd Order No. 36. (2013). Department of Education Vision, Mission and Core Values. [Online Article] Available: <https://www.deped.gov.ph/about-deped/vision-mission-core-values-and-mandate/>
- Desa, U. N. (2018). The sustainable development goals report 2018. *United Nations*.
- DiEnno, C. M., & Hilton, S. C. (2005). High school students' knowledge, attitudes, and levels of enjoyment of an environmental education unit on nonnative plants. *The Journal of Environmental Education*, 37(1), 13 – 25.
- Diesendorf, M. (2000). Sustainability and sustainable development in Dunphy. *Benveniste D, Griffiths JA, Sutton P, et al. Sustainability: The corporate challenge of the 21st century*.
- Drake, L. (2004). *Mind in Society: The development of higher psychological processes*. Cambridge: Harvard University Press.

- Du, Q., & Kang, J. T. (2016). Tentative ideas on the reform of exercising state ownership of natural resources: Preliminary thoughts on establishing a state-owned natural resources supervision and administration commission. *Jiangxi Social Science*, 6, 160.
- Emmons, N. (2016). Teaching environmental education in the classroom. Retrieved from http://www.huffingtonpost.com/nichlas-emmons/teaching-environmental-ed_b
- Erdogan, M., Kostova, Z., & Marcinkowski, T. (2009). Components of environmental literacy in elementary science education curriculum in Bulgaria and Turkey. *Eurasia Journal of Mathematics, Science and Technology Education*, 5(1), 15-26.
- Ergin, D. Y. (2019). Environmental awareness of teacher candidates. *World J. Educ.*, 9(1), 152-161.
- Evers, B. A. (2018). *Why adopt the Sustainable Development Goals? The case of multinationals in the Colombian coffee and extractive sector* (Doctoral dissertation, Master Thesis, Erasmus University Rotterdam).
- Fazey, I., Fazey, J. A., Fischer, J., Sherren, K., Warren, J., Noss, R. F., & Dovers, S. R. (2007). Adaptive capacity and learning to learn as leverage for social-ecological resilience. *Frontiers in Ecology and the Environment*, 5(7), 375–380. <https://doi.org/10.1890/1540-9295>
- Gadotti, M. (2009). *Education for sustainability: A contribution to the Decade of Education for Sustainable Development*. São Paulo: Editora e Livraria Instituto Paulo Freire.
- Gadotti, M. (2010). Reorienting education practices towards sustainability. *Journal of Education for Sustainable Development*. 4(2), 203-211.
- Garcesa, R. P., & Limjuco, R. P. (2014). Environmental literacy and integration of environment issues among science teachers in Region XI: Basis for training design. *UIC Research Journal*, 20(1), 187-205. <http://dx.doi.org/10.17158/554>
- Goldman, D., Yavetz, B., & Pe'er, S. (2014). Student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies. *International Journal of Environmental & Science Education* 9(4), 369-383.
- Goodland, R., & Daly, H. (1996). Environmental sustainability: Universal and non-negotiable. *Ecological applications*, 6(4), 1002–1017. <https://doi.org/10.2307/2269583>

- Gray, D. S., & Colucci-Gray, L. (2018). Laying down a path in walking: Student teachers' emerging ecological identities. *Environmental Education Research*, 25(3), 341-364. <https://doi.org/10.1080/13504622.2018.1499014>
- Hadzigeorgiou, Y., & Skoumios, M. (2013). The development of environmental awareness through school science: Problems and possibilities. *International Journal of Environmental & Science Education*, 8, 405-426. <https://doi.org/10.12973/ijese.2013.212a>
- Hasöksüz, M., Kiliç, S., & Saraç F. (2020). Coronaviruses and SARS-COV-2. *Turkish Journal of Medical Sciences*, 50, 549-556. <https://doi.org/10.3906/sag-2004-127>
- Hopkins, C. (2012). Reflections on 20+ years of ESD. Opinion Essay. ESD in Higher Education, the Professions and at Home 6(1): 21-35. SAGE Publications. DOI: 10.1177/097340821100600108.
- ICSU. (2017). Guide To SDG Interactions: From Science to implementation, DJ Griggs, M. Nilsson, A. Stevance, D. McCollum. *International Council for Science, Paris*.
- Illich, I. (1970). Deschooling Society. Retrieved October 12, 2015 from <http://philosophy.la.psu.edu/illich/deschool/> and <http://www.arvinguptatoys.com/arvindgupta/DESCHOOLING.pdf>
- Iyengar, R., & Shin, H. (2020). Community-based programs to tackle environmental education and COVID-19: A case study from Millburn, New Jersey. *Prospects*, 1–11. <https://doi.org/10.1007/s11125-020-09467-0>
- Janz, M. (2021). Environmental Education During the COVID-19 Pandemic (Published Thesis). Hamline University.
- Johnson, C. K., Hitchens, P. L., Pandit, P. S., Rushmore, J., Evans, T. S., Young, C., & Doyle, M. M. (2020). Global shifts in mammalian population trends reveal key predictors of virus spillover risk. *Proceedings. Biological sciences*, 287(1924), 20192736. <https://doi.org/10.1098/rspb.2019.2736>
- Johnson-Pynn, J. S., & Johnson, L. R. (2005). Success and challenges in East African Conservation Education. *Journal of Environmental Education*, 36(2), 25 – 39.
- Kadji, C. (2002). *Evaluation of whole school environmental education, Kansas association for conservation and environmental education*, Available at: www.kacee.org (Accessed August 2021).

- Kaivo-oja, J., Panula-Ontto, J., Vehmas, J., & Luukkanen, J. (2013). Relationships of the dimensions of sustainability as measured by the sustainable society index framework. *International Journal of Sustainable Development & World Ecology*, 21(1), 39-45. <https://doi.org/10.1080/13504509.2013.860056>
- Kelani, R. R. (2015). Integration of environmental education in science curricula in secondary schools in Benin, West Africa: Teachers' perceptions and challenges. *Electronic Journal of Science Education*, 19(3).
- Kim, C., & Fortner, R.W. (2006). Issue-specific barriers to addressing environmental issues in the classroom: An explanatory study. *The Journal of Environmental Education*, 37(3), 15-22.
- Kimario, L.A. (2011). Integrating environmental education in primary school education in Tanzania: Teachers' perceptions and teaching practices. Published Thesis, Åbo Akademi University Press, 2011. Diss.: Åbo Akademi University.
- Kissui, B. M. (2008). Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. *Anim. Conservation*, 11(5), 422-432. <https://doi.org/10.1111/j.1469-1795.2008.00199.x>
- Knapp, C.E. (2000). Learning from an Out-door Education Hero: Personal Reflections about L. B. Sharp. *Taproot*, 12:7-11
- Kopar, C. (2013). *The characteristics of effective environmental education programs: an exploration of the perceptions of environmental educators in southern Ontario* (Unpublished master's thesis). University of Waterloo, Ontario. <http://hdl.handle.net/10012/7962>
- Koszo, M. F., & Szabo, K. (2013). *Learning it by Doing: Project-based Learning* [PDF]. http://www.jgyph.hu/mentorhalo/tananyag/Tevekenyen_az_iskolaban/
- Kousar, S., Afzal, M., Ahmed, F., & Bojnec, Š. (2022). Environmental awareness and air quality: The mediating role of environmental protective behaviors. *Sustainability*, 14(6):3138. <https://doi.org/10.3390/su14063138>
- Kumar, S., Raizada, A., & Biswas, H. (2014). Prioritising development planning in the Indian semi-arid Deccan using sustainable livelihood security index approach. *International Journal of Sustainable Development & World Ecology*, 21(4), 332-345. <https://doi.org/10.1080/13504509.2014.886309>

- Labog, R. A. (2017). Teachers' integration of environmental awareness and sustainable development practices. *Asia Pacific Journal of Multidisciplinary Research*, 5(3), 102-110.
- Lane, J. F. (2006). Environmental education implementation in Wisconsin: conceptualization and practices (Unpublished doctoral dissertation). University of Wisconsin-Madison
- Lane, J. Wilke, R. Champeau, R., & Sivek, D. (1994). Environmental education in Wisconsin: A teacher survey. *The Journal of Environmental Education*, 25(4), 9-17.
- Larsen, C., Walsh, C., Almond, N., & Myers, C. (2017). The "real value" of field trips in the early weeks of higher education: the student perspective. *Educational Studies*, 43(1), 110-121. <https://doi.org/10.1080/03055698.2016.1245604>
- Littledyke, M. (2008). Science education for environmental awareness: Approaches to integrating cognitive and affective domains. *Environmental Education Research*, 14(1), 1-17. <https://doi.org/10.1080/13504620701843301>
- Lopez, J. J. D., & Malay, C. A. (2019). Awareness and attitude towards climate change of selected senior high students in Cavite, Philippines. *Asia Pacific Journal of Multidisciplinary Research*, 7(2), 56-62.
- Marasigan, A. C. (2017). *A Critical Analysis of Environmental Pedagogies in the Philippine Teacher Education: A Call for a Paradigm Shift Towards Sustainability* (Unpublished doctoral dissertation). Beijing Normal University.
- Marpa, E. P. (2020). Navigating environmental education practices to promote environmental awareness and education. *International Journal on Studies in Education*, 2(1), 45-57. <https://doi.org/10.46328/ijonse.8>
- Mastrángelo, M. E., Pérez-Harguindeguy, N., Enrico, L., Bennett, E., Lavorel, S., Cumming, G. S., Abeygunawardane, D., Amarilla, L. D., Burkhard, B., Egoh, B. N., Frishkoff, L., Galetto, L., Huber, S., Karp, D. S., Ke, A., Kowaljow, E., Kronenburg-García, A., Locatelli, B., Martín-López, B., ... Zoeller, K. (2019). Key knowledge gaps to achieve global sustainability goals. *Nature Sustainability*, 2, 1115–1121, <https://doi.org/10.1038/s41893-019-0412-1>
- Mastrilli, T. (2005). Environmental education in Pennsylvania's elementary teacher education programs: A statewide report. *The Journal of Environmental Education*, 36(3), 22-30. <https://doi.org/10.3200/joe.36.3.22-30>

- McKeown, R. & Hopkins, C. (2007). *Moving beyond the EE and ESD debate in formal education*, 1(1), 17-26. SAGE Publications. 10.1177/097340820700100107
- McKeown, R. (2015). What happened during the UN decade of education for sustainable development? *Applied Environmental Education & Communication* 14, 67-69. Taylor & Francis Group.
- McKeown-Ice, R. (2000). Environmental education in the United States: A survey of preservice teacher education programs. *The Journal of Environmental Education*, 32(1), 4-11. <https://doi.org/10.1080/0095896000959866>
- Medallon, M. C., & Gallardo, M. (2014). Environmental awareness campaign: The change it brings. *Asia Pacific Journal of Multidisciplinary Research*, 2(1), 115-120.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
- Misiaszek, G. W. (2012). Transformative environmental education within social justice models: Lessons from comparing adult ecopedagogy with North and South America. In D. N. Aspin, J. Chapman, K. Evans & R. Bagnall (Eds.). *Second International Handbook of Lifelong Learning*, 26, 423-440. London: Springer.
- Misiaszek, G. W. (2015). Ecopedagogy and citizenship in the age of globalization: Essential connections between environmental and global citizenship education to save the planet. *European Journal of Education*, 50(3). <https://doi.org/10.1111/ejed.12138>
- Monroe, M. C. (2003). Two avenues for encouraging conservation behaviors. *Human Ecology Review*, 10(2), 113-125.
- Moulds, J. (2020, April 7). *5 ways the coronavirus is affecting animals around the world*. World Economic Forum. <https://www.weforum.org/agenda/2020/04/coronavirus-animals-wildlife-biodiversity-tiger-boar-pandas-zoos/>
- Mwendwa, B. (2017). Learning for sustainable development: integrating environmental education in the curriculum of ordinary secondary schools in Tanzania. *Journal of Sustainability Education*, 12.
- Nisbet, E.K.L. & Gick, M.L. (2008). *Can Health Psychology Help the Planet? Applying Theory and Models of Health Behaviour to Environmental Actions*. Ottawa: Carleton University, Canadian Psychological Association.

- Nyumba, T. O., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Special Feature: Qualitative methods for eliciting judgements for decision making*, 9(1), 20-32. <https://doi.org/10.1111/2041-210X.12860>
- Paden, M. (2007). Researcher-practitioner conference in Japan seeks to reorient EE to ESD and set research themes, 1(1), 97-99. SAGE Publications.
- Palmer, J. (1998). *Environmental Education in the 21st Century: Theory, practice, Progress and Promise*. London: Routledge.
- Palmer, J., & Neal, P. (1994). *The handbook of environmental education*. Routledge.
- Partnership for 21st Century Skills. *P21 Common Core Toolkit: A Guide to Aligning the Common Core State Standards with the Framework for 21st Century Skills*; Partnership for 21st Century Skills: Washington, DC, USA, 2011. Available online: <https://files.eric.ed.gov/fulltext/ED543030.pdf> (accessed on 24 September 2020).
- Patton, M. Q. (2001). *Qualitative Research and Evaluation Methods*. 3rd ed. California: Thousand Oak Sage.
- Punzalan, C. H., Signo, C. M. C., Signo, M. T. C., & Marasigan, A. C. (2019). Environmental awareness of selected urban and rural high school students in the Philippines. *i-manager's Journal on School Educational Technology*, 15(2), 15-25. <https://doi.org/10.26634/jsch.15.2.16664>
- Quay, J., Gray, T., Thomas, G., Allen-Craig, S., Asfeldt, M., Andkjaer, S., Beames, S., Cosgriff, M., Dymont, J., Higgins, P., Ho, S., Leather, M., Mitten, D., Morse, M., Neill, J., North, C., Passy, R., Pedersen-Gurholt, K., Polley, S., ... Foley, D. (2020). What future/s for outdoor and environmental education in a world that has contended with COVID-19? *Journal of Outdoor and Environmental Education*, 23(2), 93–117. <https://doi.org/10.1007/s42322-020-00059-2>
- Rahman, N. A., Halim, L., Ahmad, A. R., Hassan, A., & Soh, T. M. T. (2018). Teachers' views on integrating environmental education for Aboriginal students. *International Journal of Academic Research in Progressive Education and Development*, 7(2), 16–29. <http://dx.doi.org/10.6007/IJARPED/v7-i2/4080>
- Rahman, S. M. A., Tasmin, S., Uddin, M. K., Islam, M. T., & Sujauddin, M. (2014). Climate change awareness among the high school students: Case study from a climate vulnerable country. *International Journal of Built Environment and Sustainability*, 1(1), 18-26. <https://doi.org/10.11113/ijbes.v1.n1.4>

- Republic Act No. 8491. (1998). Republic Act No. 8491 on Flag and Heraldic Code of the Philippines, 1998. [Online Document] Available: <https://www.officialgazette.gov.ph/1998/02/12/republic-act-no-8491/#:~:text=REPUBLIC%20ACT%20NO.-,8491,SECTION%201.>
- Republic Act No. 9512. (2008). Republic Act No. 9512 on National Environmental Awareness and Education Act, 2008. [Online Document] Available: <https://www.ecolex.org/details/legislation/republic-act-no-9512-on-national-environmental-awareness-and-education-act-2008-lex-faoc091238/#:~:text=9512%20on%20National%20Environmental%20Awareness%20and%20Education%20Act%2C%202008>
- Roczen, N., Kaiser, F. G., Bogner, F. X., & Wilson, M. (2014). A competence model for environmental education. *Environment and Behavior*, 46(8), 972-992.
- Rogayan, D. V., & Nebrija, E. E. D. (2019). Environmental awareness and practices of science students: Input for ecological management plan. *International Electronic Journal of Environmental Education*, 9(2), 106-119.
- Rume, T., & Islam, S. M. D. (2020). Environmental effects of COVID-19 pandemic and potential strategies of sustainability. *Heliyon*, 6(9). <https://doi.org/10.1016/j.heliyon.2020.e04965>
- Saldaña, J. (2009). *The coding manual for qualitative researchers*. SAGE Publications.
- Samuel, H. R. (1993). Impediments to implementing environmental education. *The Journal of Environmental Education*, 25(1), 26-29.
- Sarkis, J., Cohen, M. J., Dewick, P., & Schroder, P. (2020). A brave new world: Lessons from the COVID-19 Pandemic for transitioning to sustainable supply and production. *Resour. Conserv. Recycl.* 159 (104894). <https://doi.org/10.1016/j.resconrec.2020.104894>.
- Simmons, D. (1998). Using natural settings for environmental education: Perceived benefits and barriers. *The Journal of Environmental Education*, 29, 23-31.
- Singhal, T. (2020). A review of coronavirus disease-2019 (COVID-19). *Indian J Pediatr*, 87(4), 281-286. <https://doi.org/10.1007/s12098-020-03263-6>
- Smith-Sebasto, N. J., & Smith, T. L. (1997). Environmental education in Illinois and Wisconsin: A tale of two states. *The Journal of Environmental Education*, 28, 26-36.

- Stake, R. E. (1994). Case studies. In N.K. Denzin, & Y.S. Lincoln (Eds.), *The Sage handbook of qualitative research*, 443-466. Thousand Oaks, CA: Sage.
- Stevenson, R. B. (1993). Becoming compatible: Curriculum and environmental thought. *The Journal of Environmental Education*, 24(2), 4-9. <https://doi.org/10.1080/00958964.1993.10801968>
- Sukma, E., Ramadhan, S., & Indriyani, V. (2020). Integration of environmental education in elementary schools. *Journal of Physics: Conference Series*, 1481. <https://doi.org/10.1088/1742-6596/1481/1/012136>
- Sward, L. (1999). Significant life experiences affecting the environmental sensitivity of El Salvadoran environmental professionals. *Environmental Education Research*, 5(2), 201-206.
- Szczytko, R., Stevenson, K., Peterson, M. N., Nietfeld, J., & Strnad, R. L. (2019). Development and validation of the environmental literacy instrument for adolescents. *Environmental Education Research*, 25(2), 193-210. <https://doi.org/10.1080/13504622.2018.1487035>
- Tal, T., & Morag, O. (2009). Reflective practice as a means for preparing to teach outdoors in an ecological garden. *Journal of Science Teacher Education*, 20(3), 245-262.
- Tovar-Gálvez, J. C. (2021). Bringing environmental education to the curriculum: Practical elements emergent from teaching experiences and research. *Interdisciplinary Journal of Environmental and Science Education*, 17(3), e2236. <https://doi.org/10.21601/ijese/9606>
- Uçar, M. B., & Canpolat, E. (2019). Modelling preservice science teachers' environment-friendly behaviours. *Aust. J. Teach. Educ.*, 4(2), 1-14.
- Ukaga, U., Maser., C., & Reichenbach, M. (2011). Sustainable development: principles, frameworks, and case studies. *International Journal of Sustainability in Higher Education*, 12(2). <https://doi.org/10.1108/ijshe.2011.24912bae.005>
- Umholtz, J. (2013). Re-engaging youth through environmental-based education for sustainable development. *Journal of Sustainability Education*, 5.
- UNDP. (2005). *Human Development Report 2005: International cooperation at a crossroads - Aid, trade and security in an unequal world*. New York. <http://hdr.undp.org/en/content/human-development-report-2005>

- UNESCO. (1978). *Intergovernmental conference on environmental education: Final report*. Paris, France. <https://unesdoc.unesco.org/ark:/48223/pf0000032763>
- UNESCO. (2005a). *Peace education framework for teacher education*. UNESCO, New Delhi, India.
- UNESCO. (2011b). *Education for sustainable development country guidelines for changing the climate of teacher education to address sustainability: Putting transformative education into practice*, pp. 57-69. UNESCO, Jakarta.
- UNESCO. (2013a). *Global citizenship education: An emerging perspective*. Outcome document of the Technical Consultation on Global Citizenship Education. Retrieved August 20, 2015 from http://www.unesco.org/new/en/education/resources/online-materials/single-view/news/unescos_seoul_consultation_deepens_understanding_of_global_citizenship_education/#.UjxKSX-bFng.
- UNESCO. (2015a). *Education for sustainable development.org*. Retrieved from <http://en.unesco.org/themes/education-sustainable-development>
- UNESCO. (2017a). *Education for Sustainable Development Goals: Learning Objectives*. Paris: UNESCO. <http://unesdoc.unesco.org/images/0024/002474/247444e.pdf>.
- UNESCO. (2021). UNESCO declares environmental education must be a core component of educational system by 2025. <https://en.unesco.org/news/unesco-declares-environmental-education-must-be-core-curriculum-component-2025>.
- United Nations Conference on Environment and Development. (1993). *Agenda 21: Programme of action for sustainable development; Rio Declaration on Environment and Development; Statement of Forest Principles: The final text of agreements negotiated by governments at the United Nations Conference on Environment and Development (UNCED), 3-14 June 1992, Rio de Janeiro, Brazil*. United Nations Dept. of Public Information.
- United Nations Development Programme. (2015). *Human Development Report 2015: Work for Human Development*. Sales No. E.15.III.B.1. Available from http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf.
- United Nations Educational, Scientific and Cultural Organization. (1975). *Belgrade Charter*. Belgrade: UNESCO.
- Wanamaker, C. (2018) *The Environmental, Economic, and Social Components of Sustainability: The Three Spheres of Sustainability*: Adapted from the U.S. Army

Corps of Engineers. <https://soapboxie.com/social-issues/The-Environmental-Economic-and-Social-Components-of-Sustainability>

Wei, R. C., Darling-Hammond, L., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad*. Dallas, TX. National Staff Development Council.

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Los Angeles: Sage.

Yuan, K., Wu, T., Chen, H., & Li, Y. (2017). A study on the teachers' professional knowledge and competence in environmental education. *EURASIA Journal of Mathematics Science and Technology Education*, 13(7), 3163-3175. <https://doi.org/10.12973/eurasia.2017.00710a>

APPENDIX A

Letter of Request for Data Gathering

Letter of Request for Research Endorsement

February 3, 2022

[Redacted]
OIC-Office of the Schools Division Superintendent
City Schools Division of Dasmariñas
Dasmariñas City, Cavite

Dear Mr. Cantonjos,

Greetings of peace and goodwill!

The undersigned is presently working on his graduate thesis titled, "Teachers' Perceptions, Attitudes, and Experiences Toward the Integration of Environmental Education in the Science Curriculum: Context of Pandemic", under the program Master of Arts in Science Education with specialization in Integrated Science at Philippine Normal University, Manila. This case study will explore the teaching approaches including the opportunities and challenges currently faced by the science teachers in integrating environmental education in their subject through the online distance learning modality.

In this regard, I would like to request your endorsement to gather the substantial data through a survey, semi-structured interview, and focus group discussion from selected junior high school science teachers who are handling online distance learning modality classes from grades 7-10 under the City Schools Division of Dasmariñas this School Year 2021-2022. There will be a total of 32 participants from 8 junior high schools (4 science teachers per school) that are the research subjects in the study. I will personally facilitate the interview and discussion via an accessible teleconferencing application due to the quarantine restrictions between February and March this school year. Below is the list of schools where the study is to be conducted upon approval. In case there are no science teachers that handle the online distance learning (ODL) modality classes in a specific school, I will be asking for your recommendation of another school to meet the expected number of participants.

1. Congressional National High School
2. Dasmariñas Integrated High School
3. Dasmariñas North National High School
4. Dasmariñas West National High School
5. Dasmariñas East Integrated High School
6. Francisco E. Barzaga National High School
7. Pag-Asa National High School
8. Paliparan National High School

Rest assured that the teacher-participants will receive an orientation regarding their participation in the study before the data gathering. Attached are copies of the instruments and consent forms. Also, the data that will be gathered will be treated with the utmost confidentiality. A copy of the findings and results of this study can be provided to implement the recommendations in their respective institutions. I am looking forward to your positive response to this request. Thank you very much.

Respectfully yours,

[Redacted]
Christopher H. Punzalan
Graduate Student

Noted:

[Redacted]
Victoria J. Delos Santos, PhD
Adviser

APPENDIX B

Letter of Request for Instrument Validation

Letter of Request for Instrument Validation

February 3, 2022

[Redacted Address Block]

Dear I [Redacted Name]

Greetings of peace and goodwill!

The undersigned is presently working on his graduate thesis titled, “Teachers’ Perceptions, Attitudes, and Experiences Toward the Integration of Environmental Education in the Science Curriculum: Context of Pandemic”, under the program Master of Arts in Science Education with specialization in Integrated Science at Philippine Normal University, Manila. This study will explore the teaching approaches including the opportunities and challenges currently faced by the science teachers in integrating environmental education in their subject through the online distance learning modality.

In this regard, I would like to request your expertise to validate the attached questionnaires that will be used for data gathering procedures (survey, interview, and FGD). The series of questions were adapted from pertinent literature in the Philippines and abroad. Though, it must be validated to evaluate if it is suitable for Filipino participants and in the current educational situation. I believe that your wisdom and background in science education, environmental education, and research will help improve the research instruments.

I am looking forward to your positive response on this request. Thank you very much.

Respectfully yours,

[Redacted Signature]

Christopher H. Punzalan
Graduate Student

Noted:

[Redacted Signature]

Victoria J. Delos Santos, PhD
Adviser

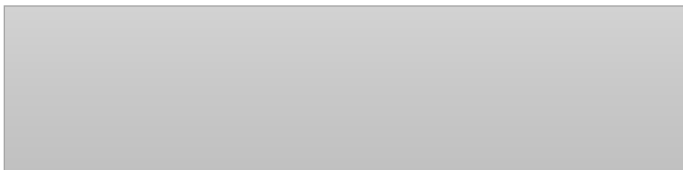
9. I have teaching materials about EE that can be found in various media.				
10. I integrate EE in the learning process to provide solutions to solve environmental problems.				
11. I review the curriculum and I believe that it must be reorganized to include more about environmental education for various levels of education.				
12. I undergo special training to be able to integrate environmental education in the learning process.				

Comments and Suggestions:

Validated by:



Validator



Comments and Suggestions: 1. Instead of gender, use "Sex" if you would want to know if the respondent is a male or female. Gender is very broad.
 2. There must be an option if the respondent do not want a recorded interview.
 3. main question No. 6, the question is too broad. An example statement could help the respondent.
 4. main question No. 11, for consistency you can re-phrase the question and use personal pronoun.

Validator (Signature Over Printed Name): _____
 Date: FEB. 14, 2022
 Position: _____
 Institution: _____
 Email address: _____

Comments and Suggestions on Interview Questionnaire and Consent Form

1. Separate pages of Interview Questionnaire and Consent Form/letter.
2. Re-arrange the body of the letter (using usual form of a letter)
3. After the body of the consent letter, write researcher's name and signature.
4. Conformer: Name, age etc. written on top of the letter be placed at the bottom part e.g I understand... (re-arrange)
5. Note part be included also in the letter and also reminding the respondents before the interview and FGD.
6. Preliminary Questions: Delete the *and environmental education* since it is mentioned in Number 1 of your Main Questions
7. Q 1: How about if the teacher was not able to take EE during his time in college? Wouldn't he felt excluded in the sharing?
3. Q 2: How about if their knowledge is not enough say if EE is not present in their curriculum? Re-state the question in a more encouraging manner.
9. Q3: Do you think integrating EE in your subject _____ (can attain _____ e.g. what is your objective in the integration?)
10. The questions are too many for interviewing and FGD for 30 minutes.
11. Questions must be interconnected/ interlink.
12. Survey Questionnaire (perception? Attitude?): have you asked permission of the author to use his instrument?

APPENDIX C

Research Endorsement for Data Gathering


Republic of the Philippines
Department of Education
REGION IV-A CALABARZON
CITY SCHOOLS DIVISION OF DASMARIÑAS

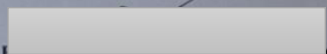
City Schools of Division of Dasmariñas
RECORDS UNIT
RELEASED
DATE: **FEB 15 2022**
BY: **7**
DOC NO: **020422-DB**

1st INDORSEMENT
February 14, 2022

RESEARCH

Respectfully referred to the School Heads of Congressional Integrated High School, Dasmariñas Integrated High School, Dasmariñas North National High School, Dasmariñas West National High School, Dasmariñas East Integrated High School, Francisco E. Barzaga Integrated High School, Pag-Asa National High School, and Paliparan National High School in the City Schools Division of Dasmariñas, Dasmariñas City, Cavite with the information that the undersigned interposes no objection to the attached request of **Christopher H. Punzalan**, student of Master of Arts in Science Education at Philippine Normal University to conduct his research titled **"Teachers' Perceptions, Attitudes, and Experiences Toward the Integration of Environmental Education in the Science Curriculum"** provided that the activity will give utmost consideration to the safety of the research participants during a pandemic, DepEd Order No. 9, s. 2005 and that **NO CLASSES WILL BE DISRUPTED**.

Hoping for your most favorable response.


Assistant Schools Division Superintendent
Officer-In-Charge
Office of the Schools Division Superintendent

Attached: as stated
(046) 432 9355



Address: CSDO Bldg., DasCA Compound, Burol-II, City of Dasmariñas, 4115
Telephone No: (046) 432 9355
Email Address: dasmariñas.city@deped.gov.ph
Website: <https://depeddasma.edu.ph>

APPENDIX D

Informed Consent Form

Informed Consent Form

Philippine Normal University
104 Taft Ave, Ermita, Manila,
1000 Metro Manila

Title of the Thesis: Teachers' Perceptions, Attitudes and Experiences Toward the Integration of Environmental Education in the Science Curriculum: Context of Pandemic

Name of the Researcher: Christopher H. Punzalan

Contact number: 0907-139-6599

A. PURPOSE AND BACKGROUND

Mr. Christopher H. Punzalan, a graduate student at Philippine Normal University, is conducting research on the perceptions, attitudes, and experiences of science teachers in integrating the environmental education in the curriculum during the pandemic. The purpose of your participation in this research is to help the researcher by sharing your experiences to help better understand the challenges and opportunities of environmental education integration in junior high schools during the pandemic. You were selected as a possible participant in this study because you are a junior high school science teacher handling online classes in Dasmariñas City, Cavite, Philippines, as the study site. This study will involve 32 junior high school science teachers from 8 schools handling online distance learning modality classes.

B. PROCEDURES

If you agree to participate in this research study, the following will be carried out:

- The researcher will contact you through Messenger (an instant messaging app and platform developed by Meta Platforms) to explain and discuss the research study.

- Informed consent form will be provided first for you to review the important details about the study and to provide your consent to participate in the study by uploading your scanned signature in the Google Forms.

- The data gathering will be divided into three parts and will be conducted between March and April 2022: 1) Survey using structured questionnaire (Environmental Education Integration in the Learning Process Questionnaire), 2) Written interview using open-ended questionnaire, and 3) Focus Group Discussion (FGD) per school with 4 participants each which will be scheduled based on the availability of all teachers per school.

1. Survey questionnaire will be provided using the Google Forms (a survey administration software included as part of the free, web-based Google Docs Editors suite offered by Google) link. This adapted instrument will measure the level of environmental education integration in the learning process. The Google Forms link will be provided in the group chat and answering the survey will take about 10 minutes. The researcher will do the follow-up in the group chat to ensure that all the participants are done with the survey. Proposed date to accomplish: March 19, 2022 (Saturday)

2. Written interview will be conducted using the Google Forms link with open-ended questions about the teachers' perceptions, attitudes, and experiences toward the integration of environmental education in science curriculum during pandemic. The Google Forms link will be provided in the group chat and answering the survey will take about 30 minutes. The researcher will do the follow-up in the group chat to ensure that all the participants are done with the survey. Proposed date to accomplish: March 19, 2022 (Saturday)

3. Focus Group Discussion will be conducted per school with 4 science teachers as the participants and the researcher as the moderator based on a schedule which will take about 1 to 2 hours using Google Meet (a video-communication service developed by Google). The meeting link will be provided in the group chat prior to the FGD schedule. The Google Meeting will be recorded to ensure the accuracy of data collection. The researcher will conduct an orientation and ensure that no third party or outsider can join or listen during the online interview by secure invitation link that is only accessible to you as the participant. Afterwards, the researcher will email you the verbatim files so that you can cross-check your responses with the written analysis. Proposed date for the conduct of the FGD per school will be posted in the group chat.

C. RISKS

It is possible that the time commitment involved in this study will cause you inconvenience, but you will realize that time spent in study will allow you to explore and gain a better understanding of your perceptions, attitudes, and experiences toward the integration of environmental education in science curriculum.

D. CONFIDENTIALITY

The records from this study will be kept as confidential as possible. No individual identities will be used in any reports or publications resulting from the study. All transcripts, questionnaires, video recordings, and summaries will be coded and stored separately from any participant names or other direct identification. At all times, research data will be encrypted. Only the researcher will have access to the transcripts, questionnaires, video recordings and summaries and only those with an essential need to see names or other identifying information will have access to a particular file. After the study is completed, any information that identifies you as a participant will be kept for three years and will be destroyed.

E. BENEFITS OF PARTICIPATION

You will receive a token of appreciation for your time and effort in answering the questions of the researcher. It will serve as a non-monetary compensation in your active participation in the data gathering process. The anticipated benefit of your participation in this study is to unravel the various issues that junior high school science teachers are facing during the pandemic. This study can also be used as a reflection tool for teachers who have similar experiences and discover the best practices and good contributions in science teaching. Moreover, the findings of the study will serve as a guide or input for administrators to develop various intervention programs to assist the science teachers in integrating the environmental education in the curriculum. Lastly, this can also help improve policy and guidelines for teachers' assignment in teaching science in junior high schools.

F. VOLUNTARY PARTICIPATION

Your decision whether to participate in this study is voluntary. This will not affect your relationship with the Philippine Normal University if you choose to participate in this study. You can withdraw your consent and discontinue participation at any time without prejudice.

G. QUESTIONS

If you have any questions about the study, please contact Christopher H. Punzalan through 09071396599 or punzalan.ch@pnu.edu.ph.

CONSENT

You are deciding whether to participate in a research study. your signature below indicates that you have decided to participate in the study after reading all the information above and you understand the information in this form, have had any questions answered and have received a copy of this form for you to keep.

Signature over printed name
Research Participant

Date

Thank you very much in advance.

Sincerely,



Christopher H. Punzalan
Researcher

March 9, 2022
Date

APPENDIX E

Interview Questionnaire

Interview Questionnaire

Name: _____ Age: _____ Gender: _____
No. of years in service as science teacher: _____ Grade Level: _____
Highest educational attainment/degree: _____

Note:

- This interview will consist of two parts (individual and focus group) and will take around 20 to 30 minutes per part via teleconferencing.
- I will be recording this interview with your consent and all your responses will be kept confidential.

Preliminary questions:

Is teaching your first and personal professional career choice? Why or why not?

What are your impressions and thoughts about science subject and environmental education?

Main questions:

1. Did you have an Environmental Education (EE) course/subject back when you were in college? What is your understanding of EE?
2. Do you think that you have enough knowledge related to EE to be able to integrate it in your subject? Why or why not?
3. Do you think that your teaching of EE integrated in your teaching help your student learn about EE? Why or why not?
4. What is your understanding of integrating environmental education in the science curriculum?
5. What do you think of the significance of integrating EE in science amidst the pandemic?
6. What do you consider environmental education (EE) to be? What would you not consider to be EE?
7. What are the lessons/topics in science that you have integrated environmental education like issues, problems, and projects?
8. How often do you integrate EE in your lessons?
9. What are your common resources used in integrating EE in science?
10. What are your pedagogical strategies and methods in teaching science to integrate EE?
11. What do you think are the possible advantages and disadvantages of integrating EE in science?
12. What are some of the challenges or obstacles that you faced in integrating EE in your subject amidst the pandemic?

APPENDIX F

Survey Questionnaire

Survey Questionnaire

Name: _____ Age: _____ Gender: _____
 No. of years in service as science teacher: _____ Grade Level: _____
 Highest educational attainment/degree: _____

Environmental Education Integration in the Learning Process Questionnaire

Source: Sukma, E., Ramadhan, S., & Indriyani, V. (2020). Integration of environmental education in elementary schools. J. Phys.: Conf. Ser. 1481 012136. doi:10.1088/1742-6596/1481/1/012136

Instructions: Using the scale, rate the following items according on how you integrate environmental education in the science curriculum amidst the pandemic.

- 4 – Strongly agree
 3 – Agree
 2 – Disagree
 1 – Strongly Disagree

Item	4 – Strongly agree	3 – Agree	2 – Disagree	1 – Strongly Disagree
1. I educate students about the environment because I believe that it is important.				
2. I use environmental themes in the learning process as it is important for students.				
3. I prepare accurate teaching materials about the environment for the students I will teach.				
4. I make an important contribution in introducing environmental knowledge through classroom teaching.				
5. I agree that there is enough time in the curriculum to integrate environmental education (EE) in the learning process.				
6. I integrate EE in the learning process using variety of learning methods.				
7. I have enough ability to integrate EE in learning activities.				
8. I take part in activities related to the environment in my school.				
9. I have teaching materials about EE that can be found in various media.				
10. I integrate EE in the learning process to provide solutions to solve environmental problems.				
11. I review the curriculum and I believe that it must be reorganized to include more about environmental education for various levels of education.				
12. I undergo special training to be able to integrate environmental education in the learning process.				

CURRICULUM VITAE

CHRISTOPHER HABUNATALIA PUNZALAN, LPT

Address: B 45 L 16, San Miguel II, Dasmariñas City, Cavite, 4115 Philippines

Contact number: +63 907 139 6599

Email address: topherhpunzalan@gmail.com

Google Scholar:

<https://scholar.google.com/citations?user=34zYzCkAAAAAJ&hl=en>



ACADEMIC BACKGROUND

Master of Arts in Science Education – Integrated Science (MASE IS)	Candidate
Completed Academic Requirements and Passed the Comprehensive Examination Philippine Normal University, Manila	
Bachelor of Technical Teacher Education (BTTE)	October 2016
Academic Scholar, 1st Semester, S.Y. 2016-2017	
Diploma in Power Plant Engineering Technology (DPPET)	March 2013
Technological University of the Philippines at Cavite	

PROFESSIONAL CERTIFICATIONS

Licensed Professional Teacher (LPT) Secondary Level	License Number: 1543703
Professional Regulation Commission (PRC)	
Career Service Sub Professional Eligibility	Effectivity: June 11, 2015
Civil Service Commission (CSC)	

PROFESSIONAL EXPERIENCES

Professional Lecturer	National University, Mall of Asia, Pasay City, Philippines August 2021 – Present <i>Courses taught:</i> Biochemistry (Lab/Lec); Science, Technology, and Society; Math in the Modern World
Instructor	PTS College and Advanced Studies, Cavite, Philippines September 2019 – June 2021 <i>Courses taught:</i> Ecology, Teaching Science in Elementary Grades, STS, Inorganic Chemistry, Earth Science, Philippine Geography
Teacher	Jesus Christ King of kings and Lord of lords Academy, Inc. SHS Department, Dasmariñas City, Cavite, Philippines November 2016 – June 2021

CURRICULUM VITAE

Positions handled: Senior High School Coordinator, STEM strand adviser, STEM Club adviser/founder, Science area coordinator, SDRRM committee coordinator-alternate

Courses taught: Research, Earth Science, DRRR, Physics, Science

Student Asst. to the Head Technological University of the Philippines at Cavite, Philippines
July 2016 – October 2016

University Lab Technician Technological University of the Philippines at Cavite, Philippines
December 2014 – June 2016

RESEARCH AND SCHOLARLY WORKS

Published Papers

Punzalan, C. H. (2022). STEM interests and future career perspectives of junior high school students: A gender study. *International Journal of Research in Education and Science (IJRES)*, 8(1), 93-102. <https://doi.org/10.46328/ijres.2537>

Laudato, E. E., and **Punzalan, C. H.** (2021). Digital Literacy of Selected Senior High School Students: An Analysis for Online Education Readiness. *i-manager's Journal of Educational Technology*, 18(2), 53-62. <https://doi.org/10.26634/jet.18.2.17817>

Punzalan, C., & Escalante, L. (2021). Museum Trip to Enrich Environmental Awareness and Education. *International Electronic Journal of Environmental Education*, 11(1), 13-23. <https://doi.org/10.18497/iejeeegreen.759224>

Punzalan, C. H., & Balanac, M. L. M. (2020). Students' Participation in Tree Planting Activity: Promoting the 21st Century Environmental Education. *Journal of Sustainability Education*, 24. <http://dx.doi.org/10.13140/RG.2.2.29445.47849>

Punzalan, C. H. (2020). Evaluating the Environmental Awareness and Practices of Senior High School Students: Basis for Environmental Education Program. *Aquademia*, 4(1), ep20012. <https://doi.org/10.29333/aquademia/8219>

Punzalan, C. H., Signo, C. M. C., Signo, M. T. C., & Marasigan, A. C. (2019). Environmental Awareness of Selected Urban and Rural High School Students in the Philippines. *i-manager's Journal on School Educational Technology*, 15(2), 15-25. <https://doi.org/10.26634/jsch.15.2.16664>

Heat-Loss-Remunerated Calorimeter: An Innovation, RED Journal Book of Abstracts (2016), REDTI Publications, Quezon City, Philippines, ISSN No. 1656-166, 2016

International Graduate Teacher Education Summit. (2021). Book of Abstracts. Philippine Normal University, Manila, Philippines.

CURRICULUM VITAE

1st IPOPHL-DLSU IP and Innovation Research Conference. (2020). Book of Abstracts.
Intellectual Property Office of the Philippines and De La Salle University, Manila, Philippines

International Conference on Green and Renewable Energy (GREEN2020). (2020). Book of Abstracts. Universiti Putra Malaysia Bintulu Sarawak Campus, Malaysia

Paper Presentations

National Graduate Teacher Education Seminar Workshop
Philippine Normal University, Philippines, February 25-27, 2022

2021 Regional Research Conference on Educational Policy and Practice (RCEPP)
Philippine Normal University, Manila, December 10-12, 2021

3rd National Conference on Science, Technology, and Mathematics Education
Philippine Normal University, Manila, December 1-3, 2021

29th Philippine Biodiversity Symposium
Biodiversity Conservation Society of the Philippines, December 1-3, 2021

2nd International Conference on Multi-perspectives in Education
Far Eastern University, Manila, Philippines, November 25-27, 2021

2nd DLSU-IPOPHL Research Conference
Intellectual Property Office of the Philippines and De La Salle University, November 26, 2021

13th PNEE International Conference and Scientific Meeting
Philippine Network of Educators on Environment, November 11-12, 2021

Annual Conference on Transformative Education International 2021
Philippine Normal University, Manila, October 20-22, 2021

International Graduate Teacher Education Summit 2021 (Best Abstract Awardee)
Philippine Normal University, Manila and International Organization of Educators and Researchers, Inc., March 13-14, 2021

4th International STEAM Research Congress
Eastern Visayas State University, Tacloban City, Philippines, February 3-5, 2021

17th International Postgraduate Research Colloquium (IPRC)
International Islamic University Malaysia, February 3, 2021

International Conference on Recent Advances in Management and Technology
Invertis University, Bareilly, UP, India, January 8-9, 2021

1st IPOPHL-DLSU Intellectual Property and Innovation Research Conference
Intellectual Property Office of the Philippines and De La Salle University, December 4, 2020

CURRICULUM VITAE

1st International Research Webcon and 6th Guro Research Awards

Polytechnic University of the Philippines, Manila, November 25, 2020

International Joint Conference on STEM Education 2020

SEAMEO Regional Center for QITEP in Mathematics and Science, Indonesia and The Institute for the Promotion of Teaching Science and Technology, Thailand, November 18-19, 2020

Lukad Virtual Conference 2020

Philippine Normal University South Luzon, Philippines, September 24-26, 2020

International e-Conference on Green and Renewable Energy (GREEN 2020)

Universiti Putra Malaysia Bintulu Sarawak Campus, Malaysia, August 18-19, 2020

National Graduate Teacher Education Seminar-Workshop and Networking

Philippine Normal University, Philippines, February 14-16, 2020

2nd National Conference on Science, Technology and Mathematics Education

Philippine Normal University, Philippines, November 30 – December 1, 2019

International Postgraduate Roundtable and Research Forum cum Summer School 2019

The Education University of Hong Kong, Tai Po, New Territories, Hong Kong, July 3-5, 2019

DLSU-D Research Week 2018: Envisioning a Sustainable Cavite

De La Salle University – Dasmariñas, Philippines, April 18, 2018

2nd Education Research Congress

National Research Council of the Philippines, De La Salle Araneta University, Nov. 25, 2017

2016 National Research Conference of Faculty Members and Undergraduate Students

Research and Educational Development Training Institute, Baguio City, Sept. 28-30, 2016

Research Participations

2nd DOST-SEI Project STAR International Conference

Department of Science and Technology (DOST), November 16-18, 2021

3rd DLSU Senior High School Research Congress

De La Salle University, Manila, April 30, 2021

2nd National Graduate Teacher Education Seminar-Workshop

Philippine Association of Graduate Students in Teacher Education, April 30 - May 2, 2021

Research Integrity and Plagiarism Webinar

University of the Philippines Manila, April 12, 2021

SEAMEO Centres Policy Research Network (CPRN) Virtual Summit 2021

CURRICULUM VITAE

SEAMEO Secretariat, Bangkok, Thailand, March 10, 2021

Asian Multidisciplinary Research Conference 2020

Pangasinan State University Lingayen Campus, December 18-20, 2020

2nd National Conference on STEM Education

University of the Philippines, Diliman, Quezon City, December 12, 2020

The Education Research Forum

Far Eastern University, Manila, December 2, 2020

National Conference on Higher Education 2020

Enderun Colleges, Philippines, September 17-18, 2020

Making Research Accessible and Meaningful to Practitioners – Online Panel Talk

National Institute of Education, Nanyang Technological University, Singapore, August 29, 2020

Research Article Writing and Publishing in Good Impact Journal

Institute for Engineering Research and Publication, India, June 13, 2020

Navigating the Philippine Resource Landscape – Asian Studies Research Forum

Asian Center, University of the Philippines, Philippines, December 12, 2019

University Research Forum

Philippine Normal University, Philippines, September 28, 2019

International Seminar-Workshop on Wow Bali's Sustainable Dynamics Framework for Action Research in Community Collaborations

Wow Bali Indonesia and University of Perpetual Help, Cavite, Philippines, Aug. 30, 2019

Panel Member (Oral Presentation Committee)

SHS Department, Jesus Christ King of kings and Lord of lords Academy, 2018-2021

Water Research Forum

University Research Office, De La Salle University – Dasmariñas, Philippines, April 20, 2018

2nd Dissemination and Appreciation of Research Exhibit (DARE)

Technological University of the Philippines, Cavite, Philippines, March 26, 2018

Student-Faculty Research Collaborations

- **Potential of Bay Laurel as Natural Larvicide against the Philippines' Common Mosquito Species**
- **Potential of Greywater Reuse for Irrigation based on the Growth of *Ipomoea aquatica* (Kangkong)**
- **Effects and Influences of Lemon Water-Detox to the Urine pH level of Early Adults**

CURRICULUM VITAE

PROFESSIONAL DEVELOPMENT

1st JCKL Academy Senior High School Research Forum Jesus Christ King of kings and Lord of lords Academy, Inc., May 14, 2021	Forum Chair
Disaster Readiness and Risk Reduction Seminar Jesus Christ King of kings and Lord of lords Academy, Inc., May 7, 2021	Organizer
Annual Educators' Congress (AECON) 2021 Rex Education and Ateneo Salt Institute, January 22-23, 2021	Participant
2nd Integrated STEM Leadership Summit in Asia CISTEM, Inc., Unilab Foundation, STEM Ed Centre, January 21-22, 2021	Participant
International Conference on Equitable Education: All for Education UNESCO Asia and Pacific Regional Bureau for Education, Bangkok, Thailand, July 10-11, 2020	Participant
YANGG SDG Virtual Training on Sustainable Environment Young Africans Network for Global Goals, Nigeria, May 6, 2020	Facilitator
Youth in Climate Action Webinar Greenducation Ph, Department of Environment and Natural Resources, April 28-29, 2020	Trainee
Urban Gardening Webinar IAMHampasLupa Ecological Agriculture Movement, Inc., April 22, 2020	Participant
Orienting Oneself to Environmentally Sustainable Workplace Course Poken Youth Alliance, Inc., Tigbauan, Iloilo, Philippines, April 22, 2020	Participant
Let's Break the Chain of COVID-19 Infection Online Course University of Medical & Health Sciences, United Arab Emirates, April 22, 2020	Participant
Whole Child Education Roadshow REX Bookstore, Inc., Rogationist College, Silang, Cavite, Philippines, March 7, 2020	Participant
Library and Information Services Month (Environmental Education Talk) Dr. Jose P. Rizal Elementary School, Dasmariñas City, Philippines, November 28, 2019	Speaker
2019 PNU Regional Inter-School Science and Mathematics Olympiad College of Teacher Development, Philippine Normal University, November 27, 2019	Coach
Teach On: Keeping the Passion Alive (MOOC) Southeast Asian Ministers of Education Organization INNOTECH, Aug 22 – Oct 25, 2019	Trainee
STEM Talks: Stimulating the Interest of Future STEM Leaders Jesus Christ King of kings and Lord of lords Academy, Inc., Dasmariñas, September 19, 2019	Speaker

CURRICULUM VITAE

Youth Empowerment Summit (YES!) 2019	Participant
Rotary International District 3780, Trinity University of Asia, Quezon City, March 17, 2019	
2018 STEM Teach Mapua: Online Teaching Enhancement Training	Participant
Mapua University, Intramuros, Manila, December 15, 2018	
2018 School Press Conference (Science Writing)	Lecturer
Jesus Christ King of kings and Lord of lords Academy, Inc., September 3 and 5, 2018	
PNU Environmental Science Tree Planting & Watershed Activities	Participant
Department of Environment and Natural Resources, Quezon City, Philippines, August 26, 2018	
Basic Leadership Training, Formation & Youth Volunteer Course	Trainee
Red Cross Youth Department, Philippine Red Cross Manila Chapter, April 29, 2018	
Disaster Preparedness and Response Training	Trainee
Fort San Felipe Lions Club, Sangley Point, Cavite City, October 7 – November 5, 2017	
2017 DepEd-PEAC Summer In-Service Training (InSeT) for SHS Teachers	Trainee
Private Education Assistance Committee (PEAC), Laguna, Philippines, May 5-7, 2017	
2017 DepEd-PEAC Summer In-Service Training (InSeT) for JHS Teachers	Trainee
Private Education Assistance Committee (PEAC), Laguna, Philippines, May 1-3, 2017	
Teacher Enrichment Program: 21st Century Learning for the Whole Child	Participant
Rex Book Store, Inc., Rogationist College, Silang, Cavite, November 19, 2016	
National Environmental Awareness Month's Seminar on Envi. Education	Facilitator
JCKL Academy, Inc., November 11 and 14, 2016	
Green that Works: A Seminar-Workshop on Practical Green Living	Participant
The Climate Reality Project Philippines, DENR, Quezon City, Philippines, October 15, 2016	
Field Studies and Teacher Development Training	Practice Teacher
Department of Industrial Technology, TUP at Cavite, June 2016 – October 2016	
CSCS Graduate Studies Seminar: Discovery to Product	Participant
College of Science and Computer Studies Graduate Studies, DLSU – Dasmariñas, April 2, 2016	
Google Apps for Education Basic Course (Drive, Sheet, Docs, Slide, Forms)	Trainee
GEG Dasmariñas, University Information Technology Center, TUP at Cavite, Nov. 28, 2015	
K-12 Program Curriculum Seminar-Workshop	Project Leader
Department of Industrial Education, TUP at Cavite, October 23, 2015	
Accreditation Survey Visit	Technical Assistant
TUP at Cavite, August 3-7, 2015	

CURRICULUM VITAE

Public Speaking Seminar: Communicating with Confidence	Participant
Toastmasters Club of Dasmariñas, Church of God World Missions, July 18 and 25, 2015	
Google for Education Innovation Tour (Cavite)	Attendee
Google Philippines, Inc., Orchard Golf and Country Club – Dasmariñas, May 9, 2015	
Supervised Industrial Training (SIT)	Trainee
Central Azucarera Don Pedro, Inc., Nasugbu, Batangas, Philippines, Dec. 2012 – Mar. 2013	
Training Seminar in Heavy Equipment Maintenance (Hydraulic System)	Trainee
Construction Manpower Development Foundation, CMDC, Dasmariñas City, February 29, 2012	

AWARDS RECEIVED

International Graduate Teacher Education Summit, Best Abstract	March 13-14, 2021
Filipino Science Hub Essay Writing Competition, 3rd Prize	June 15, 2020
Gawad Karangalan ng Lungsod ng Dasmariñas	May 3, 2018

AFFILIATION AND VOLUNTEER ACTIVITY

National Research Council of the Philippines <i>Associate Member</i>	January 2022 – Present
Ronin Institute for Independent Scholarship, United States <i>Research Scholar</i>	June 2020 – Present
Philippine Network of Educators on Environment <i>Individual Member</i>	November 4, 2021 – Present
Electronic Journal for Research in Science and Mathematics Education, Texas, United States <i>Manuscript Reviewer</i>	August 2020
International Journal on Research in STEM Education, Indonesia <i>Manuscript Reviewer</i>	September 2020
Institute for Engineering Research and Publication, India <i>Professional Member</i>	June 29, 2020
Disaster Response Team: Fort San Felipe Lions Club <i>Volunteer</i>	October 2017

CURRICULUM VITAE

Greenpeace Southeast Asia – Philippines (GPSEA Ph)

Volunteer

October 2016

Department of Education Brigada Eskwela 2016

Volunteer

May 30 – June 4, 2016

Parish Pastoral Council for Responsible Voting (PPCRV)

Volunteer Poll Watcher

May 9, 2016

Rotaract Club – TUP Cavite Chapter

P.I.O., RY 2011 – 2012

Member, RY 2010 – 2011