

Experiences, Approaches, and Factors Influencing Teachers' Ability in Promoting Environmental Awareness in Select Junior and Senior High School Students in the Division of Laguna

Tessaflor A. Suerte*

^a *tessaflor.suerte@deped.gov.ph*

^b *suertetessaflor@gmail.com*

^a *Laguna Senior High School, Santa Cruz, Laguna, 4009*

^b *University of Perpetual Help System DALTA, Graduate School of Education, Las Piñas City, 1740, Philippines*

Abstract

This study examined the integration of environmental awareness into science education among junior and senior high school teachers in the Division of Laguna. It explored the key factors influencing environmental education, including institutional support, teacher development, teaching strategies, and student engagement. A quantitative research design was employed, utilizing survey questionnaires to gather data from science teachers. Findings revealed that while teachers demonstrated a strong commitment to environmental education, they faced several challenges, including insufficient administrative support, lack of assessment tools, and limited student engagement. Professional development significantly influenced teachers' ability to integrate environmental topics, with those who pursued higher education levels being more proactive in seeking training opportunities and employing engaging instructional strategies. Additionally, teachers' behavior had the strongest correlation with effective environmental integration, followed by knowledge, while attitude alone was not a significant determinant. The study also found that experiential learning methods, such as project-based and inquiry-based approaches, enhanced student engagement but were less frequently implemented due to resource and logistical constraints. Based on these findings, a conceptual framework was proposed, emphasizing the role of institutional support, continuous teacher development, interactive teaching strategies, and student engagement in fostering environmental awareness and action. The study recommends strengthening administrative backing, expanding professional development programs, promoting experiential learning, developing standardized assessment tools, and fostering collaborations with external organizations. By addressing these areas, schools can enhance the effectiveness of environmental education and encourage students to become proactive advocates for sustainability.

Keywords: Environmental education; science teaching; professional development; student engagement; sustainability

1. Introduction

The importance of environmental awareness and education has gained significant recognition globally, particularly in the context of sustainable development. In the Philippines, this recognition is reflected in Republic Act No. 9512, also known as the National Environmental Awareness and Education Act of 2008. This law mandates the promotion of national awareness regarding the critical role of natural resources in economic growth and emphasizes environmental conservation and ecological balance as fundamental components of sustained national development (Official Gazette, 2008). The Department of Education (DepEd) has acknowledged the role of teachers in fostering environmental consciousness among students, emphasizing that educators serve as key drivers in promoting sustainable practices through their teaching approaches (DepEd, 2020). This aligns with global initiatives such as the United Nations' Sustainable Development Goals (SDGs), particularly Goal 4 (Quality Education) and Goal 13 (Climate Action) (UN, 2015).

The Philippines continues to face significant environmental challenges, including deforestation, pollution, climate change, and biodiversity loss. The Philippine Statistics Authority (PSA) reported that between 2000 and 2020, the country lost over 2.1 million hectares of forest cover, significantly affecting biodiversity and ecological balance (PSA, 2021). Additionally, urban pollution has been linked to increasing health risks and environmental degradation (DENR, 2021). Addressing these challenges requires an informed and proactive population, and science teachers play a crucial role in shaping students' environmental attitudes and behaviors. Through their teaching practices, science educators can help students develop a deeper understanding of environmental issues and empower them to engage in sustainable actions.

This study focuses on the Division of Laguna, a region known for its rich biodiversity but also experiencing environmental pressures due to urbanization and industrialization (Laguna Provincial Environment Office, 2023). It seeks to identify and evaluate the best teaching practices that Senior High School (SHS) science teachers utilize to promote environmental awareness among students. Teachers, as key facilitators of environmental education, significantly influence students' understanding and engagement with environmental issues. Their experiences, strategies, and the challenges they encounter in incorporating environmental topics into science lessons are critical in determining the effectiveness of environmental education.

By examining teachers' professional backgrounds, their approaches to integrating environmental awareness, and the factors that influence their ability to teach environmental concepts effectively, this research aims to provide valuable insights into science education. Additionally, it will assess the impact of these teaching practices on students' environmental knowledge and engagement. The findings will inform

recommendations for strengthening environmental education in science classrooms, particularly within the Division of Laguna.

In summary, promoting environmental awareness through science teaching is not merely an academic pursuit but a crucial strategy for developing responsible and environmentally conscious individuals. By focusing on the role of SHS science teachers in the Division of Laguna, this study underscores the importance of effective teaching practices in fostering environmental stewardship, ultimately contributing to national and global sustainability goals (UNESCO, 2021).

1.1. Statement of the Problem

The purpose of this study was to identify and evaluate the best practices in promoting environmental awareness among junior and senior high school students in the Division of Laguna. It aimed to assess the effectiveness of these practices in enhancing students' environmental knowledge and engagement.

Specifically, it sought answers to the following questions:

1. What is the demographic profile of the respondents in terms of;
 - 1.1. Number of Years of Teaching Science;
 - 1.2. Educational Attainment; and
 - 1.3. Sex?
2. What is the level of integration of environmental awareness in teaching science in terms of;
 - 2.1. Perceived Challenges;
 - 2.2. Professional Development; and
 - 2.3. Student Engagement?
3. What is the extent of teachers' approaches in integrating environmental awareness in teaching Science?
4. What are the factors influencing teachers' ability to effectively integrate environmental awareness into their teaching in terms of;
 - 4.1. Attitude;
 - 4.2. Behavior; and
 - 4.3. Knowledge?
5. Is there a significant difference in the level of integration of environmental awareness in teaching science based on their demographic profiles?
6. Is there a significant relationship between the approaches do teachers use to integrate environmental awareness in teaching Science and factors influencing teachers' ability to effectively integrate environmental awareness into their teaching?
7. Do the factors influencing teachers' ability to effectively integrate environmental awareness into their teaching significantly affect their level of integration of environmental awareness in teaching science?
8. Based on the findings, what model or framework is most applicable for integrating environmental awareness into teaching Science subjects in Junior and Senior High School students?

1.2. Hypothesis

This study tested the following hypotheses.

1. There is no significant difference in teachers' experiences integrating environmental issues into their regular teaching practices based on their demographic profiles.
2. There is no significant relationship between the approaches teachers use to integrate environmental awareness and the factors influencing their ability to effectively incorporate environmental issues into their teaching.
3. The factors influencing teachers' ability to effectively integrate environmental issues not significantly affect their experiences with integrating these issues into their regular teaching practices.

2. Methodology

2.1 Research Design

This study adopted a descriptive correlational research design, which was appropriate for examining the relationships between variables and identifying the factors that influenced the promotion of environmental awareness among junior and senior high school students. Descriptive correlational research allowed for a systematic exploration of the extent to which different variables were related without manipulating the study environment. By using structured surveys or questionnaires administered to JHS and SHS teachers, this design enabled the study to gather numerical data on factors such as teaching strategies, institutional support, and teachers' attitudes and behaviors. Statistical tools were employed to analyze patterns, identify correlations, and determine the strength and direction of relationships between these variables.

The use of a descriptive correlational design was particularly suited to this study because it facilitated the comparison of various educational practices and their influence on students' environmental awareness. This method enabled the objective assessment of how specific teaching approaches, demographic profiles (e.g., age, years of teaching experience, and subject specialization), and institutional factors related to the successful integration of environmental education. Additionally, the correlational aspect allowed the study to identify predictive relationships that informed actionable recommendations for enhancing environmental education. This approach ensured that the research provided evidence-based insights into best practices that could be implemented within the Division of Laguna to foster environmental awareness effectively.

2.2 Respondents and Participants of the Study

The respondents of this study consisted of 178 junior and senior high school public science teachers from the Division of Laguna. These teachers were directly involved in subjects that naturally integrated environmental education, making them key contributors to promoting environmental awareness among students. Their specialized knowledge, practical experience, and responsibility in implementing strategies that addressed environmental issues were vital for understanding effective teaching practices. This study explored their approaches, attitudes, and challenges in integrating environmental topics into their teaching practices, providing a focused analysis of their role in fostering sustainability.

The respondents represented teachers from public schools to capture a wide-ranging perspective on how institutional contexts influenced teaching strategies. Focusing on science teachers specifically ensured that the study targeted those most aligned with environmental topics, as these subjects provided a natural framework for environmental awareness. This comprehensive selection approach enabled the study to gather valuable insights into how teachers effectively integrated environmental education into their classrooms, enhancing both student engagement and environmental literacy in the Division of Laguna.

2.3. Research Instrument

Data for this study were collected using a researcher-developed questionnaire, which served as the primary instrument. This thoughtfully designed survey aimed to identify and evaluate the best practices for promoting environmental awareness among senior high school (SHS) students in the Division of Laguna. The questionnaire assessed the effectiveness of these practices in enhancing students' environmental knowledge and fostering their active engagement in sustainability initiatives.

Construction. Before formulating the questionnaire, an extensive review of various sources was conducted to ensure the content's validity and relevance. Collaboration with respected educators in the field was sought to validate the questionnaire items, ensuring the development of a reliable and robust instrument. Insights from the literature review and consultations with educators enriched the questionnaire's construction, enhancing its depth and comprehensiveness. To maximize its effectiveness, the questionnaire was divided into four distinct sections. The first section gathered demographic information from participants, providing essential context for the study. The second section explored teachers' experiences in integrating environmental issues into their regular teaching practices. The third section examined the approaches teachers used to integrate environmental awareness into senior high school subjects. Lastly, the fourth section identified the factors that influenced teachers' ability to effectively incorporate environmental issues into their teaching.

Administration. Following the validation process, the questionnaire was prepared for distribution. To comply with health protocols and safety measures, it was offered in both electronic and hard-copy formats, utilizing platforms such as Google Forms. This dual approach allowed participants to choose their preferred response method, enhancing accessibility and convenience. The administration of the online questionnaire was rigorously monitored to ensure the accuracy and authenticity of the collected data, which was vital for maintaining the study's credibility and integrity. By providing both electronic and physical options, the researcher aimed to boost participant engagement, ensure high-quality data collection, and adhere to safety guidelines. This flexible approach was especially fitting, reflecting the adaptability necessary in studying environmental design education and constructivist teaching methods.

Scoring of the Responses. The second, third, and fourth sections of the questionnaire were scored on a 4-point scale, where 1 represented the lowest score and 4 indicated the highest. The scale is as follows:

Options	Scale Ranges	Verbal Interpretation
4	3.50-4.00	Strongly Agree
3	2.50-3.49	Agree
2	1.50-2.49	Disagree
1	1.00-1.49	Strongly Disagree

2.4. Data Gathering Procedure

The data-gathering procedure for this study began with securing the necessary permissions from relevant authorities, including the Division of Laguna and the respective schools where the study took place. Once approval was obtained, the researcher proceeded by distributing the questionnaire to the selected respondents, ensuring that all ethical guidelines and confidentiality agreements were strictly followed. The questionnaire was distributed in both electronic (via Google Forms) and hard-copy formats, allowing teachers to choose the format that was most convenient for them. This approach increased accessibility and encouraged higher participation rates.

Once the questionnaires were distributed, the researcher allowed an appropriate amount of time for the respondents to complete them. Regular follow-ups were conducted to ensure timely responses. The data collected was then systematically organized, coded, and entered into statistical software for analysis. This

analysis focused on identifying best practices in promoting environmental awareness among Junior and Senior High School students, particularly the methods and strategies used by teachers to integrate environmental issues into their lessons. Throughout this process, the researcher maintained rigorous monitoring and documentation to ensure data integrity and accuracy.

2.5. Statistical Treatment of Data

In order to analyze and interpret the data, the following statistical treatments will be used: statistical analysis of quantitative data through the use of percentages and frequency distributions. Professional statistical software, such as SPSS, will also be employed for data processing and analysis to ensure precision and reliability. These tools will facilitate the comprehensive examination of trends and patterns in the data, enabling a thorough evaluation of the effectiveness of the identified best practices in promoting environmental awareness among Junior and Senior High School students.

Frequency and Percentage. This was used to determine the demographic profile of the respondents in terms of age, years of teaching experience, educational background, and subject area.

Mean Score. This was used to identify teachers' experiences in integrating environmental issues into their regular teaching practices, teachers' approaches used to integrate environmental awareness into Junior and Senior High School subjects, and factors that influence teachers' ability to effectively integrate environmental issues.

Composite Mean. This was used to summarize the responses from the perspective of the respondents.

Two Independent Samples t-test and Analysis of Variance (ANOVA). This was used to show significant differences in teachers' experiences integrating environmental issues into their regular teaching practices based on their demographic profiles.

Pearson's r Correlation Coefficient. This was used to identify a significant relationship between the approaches teachers use to integrate environmental awareness and the factors influencing their ability to effectively incorporate environmental issues into their teaching.

Regression Analysis. This was used to determine the significant effect of factors influencing teachers' ability to effectively integrate environmental issues into their experiences with integrating these issues into their regular teaching practices.

3. Results and Discussion

This chapter presents the results, analysis, and interpretation of data based on the responses gathered from the respondents.

1. What is the demographic profile of the respondents in terms of number of years of teaching science, educational attainment, and sex?

This part presents the distribution of the demographic profile of the respondents in terms of number of years of teaching science, educational attainment, and sex.

1.1. Number of Years of Teaching Science. Table 1 presents the distribution of respondents based on their years of experience in teaching science.

The majority of the respondents (33%) had between 0 to 5 years of teaching experience, indicating a significant proportion of relatively new science teachers in the Division of Laguna. This suggests that many educators responsible for promoting environmental awareness were still in the early stages of their careers, which may impact their familiarity with and confidence in integrating environmental topics into their teaching practices.

Table 1
 Profile of the Respondents in terms of Number of Years of Teaching Science

Number of Years in Teaching Science	Frequency	Percent (%)
0-5 years	58	33
6-10 years	40	23
11-15 years	30	17
16-20 years	22	12
21 years and above	28	16
Total	178	100

Teachers with 6 to 10 years of experience comprised 23% of the respondents, while those with 11 to 15 years made up 17%. This distribution highlights that nearly half (40%) of the participants had moderate teaching experience, likely possessing a balance between theoretical knowledge and practical classroom implementation of environmental education. The presence of experienced teachers, those with 16 to 20 years (12%) and 21 years or more (16%), suggests that a considerable number of respondents had extensive backgrounds in science education. These experienced educators may have well-established teaching strategies and a deeper understanding of environmental issues, which could contribute significantly to best practices in promoting environmental awareness.

The variation in teaching experience among respondents indicates a diverse mix of perspectives and methodologies in environmental education. Less experienced teachers might bring innovative and technology-driven approaches, while veteran educators could offer time-tested strategies. Understanding how teaching experience influences the effectiveness of environmental awareness programs is crucial for designing professional development initiatives tailored to educators at different career stages. This diversity underscores the need for ongoing training and collaboration among science teachers in the Division of Laguna to ensure the consistent and effective integration of environmental education across all experience levels.

1.2. Educational Attainment. Table 2 illustrates the educational attainment of the junior and senior high school science teachers in the Division of Laguna.

A majority of the respondents (55%) held a bachelor's degree, indicating that more than half of the teachers had the minimum required qualifications to teach at their respective levels. This suggests that while these educators possessed the necessary academic background in science education, they may have had limited formal exposure to advanced pedagogical strategies or specialized training in environmental education.

Table 2
 Profile of the Respondents in terms of Educational Attainment

Educational Attainment	Frequency	Percent (%)
Bachelor's Degree	97	55
Master's Degree	70	39
Doctorate Degree	11	6
Total	178	100

Meanwhile, 39% of the respondents had obtained a master's degree, signifying that a substantial portion of the teaching workforce pursued higher education to enhance their professional competencies. These teachers were likely to have a deeper understanding of scientific concepts, teaching methodologies, and curriculum development, which could contribute to more effective integration of environmental awareness into their lessons. The presence of teachers with postgraduate education indicates their willingness to engage in continuous professional development, which is essential for adopting innovative teaching practices in environmental education.

A smaller percentage (6%) of the respondents had attained a doctorate, representing a highly specialized group with extensive knowledge and research experience. Although relatively few, these educators could serve as valuable resources in developing and promoting best practices for environmental education, mentoring less-experienced teachers, and contributing to policy recommendations within the division.

The distribution of educational attainment among respondents suggests a diverse teaching force with varying levels of expertise and pedagogical training. While having a strong foundation in science education, the predominance of bachelor's degree holders highlights the need for further professional development opportunities, such as training workshops, seminars, or graduate studies focused on environmental education. Strengthening the academic qualifications and research engagement of science teachers could enhance their ability to implement more effective strategies in promoting environmental awareness among junior and senior high school students in the Division of Laguna.

1.3. Sex. Table 3 presents the sex distribution of the junior and senior high school science teachers in the Division of Laguna.

The majority of the respondents were female, accounting for 67% of the total sample, while male teachers comprised only 33%. This finding aligns with the broader trend in the Philippine education sector, where female educators often outnumber their male counterparts, particularly in basic education.

Table 3
Profile of the Respondents in terms of Sex

Sex	Frequency	Percent (%)
Male	58	33
Female	120	67
Total	178	100

The predominance of female teachers in science education may have implications for environmental awareness initiatives. Studies suggest that female educators often exhibit strong nurturing qualities, which can

positively influence students' attitudes toward environmental responsibility. Their approach to teaching may emphasize care for nature, sustainability, and social responsibility, which are essential in fostering pro-environmental behaviors among students. Additionally, the higher percentage of female teachers suggests that they play a significant role in shaping the environmental consciousness of junior and senior high school learners.

On the other hand, while male teachers were fewer in number, they also played an essential role in environmental education. Research has indicated that male educators tend to incorporate analytical and problem-solving approaches, which can be beneficial in discussing environmental issues from a scientific and technical perspective. Their contributions to environmental education include lessons on climate change, pollution, and ecological conservation framed through investigative and research-based methodologies.

The results highlight a gender imbalance in the teaching workforce, which could influence how environmental awareness is integrated into science education. While female teachers may emphasize the affective and ethical dimensions of environmental education, male teachers may contribute a more technical and scientific perspective. Ensuring that both perspectives are incorporated into environmental education strategies may enhance the effectiveness of teaching practices and provide a well-rounded approach to promoting environmental awareness among students in the Division of Laguna.

2. What is the level of integration of environmental awareness in teaching science in terms of perceived challenges, professional development, and student engagement?

This study shows the level of integration of environmental awareness in teaching science in terms of perceived challenges, professional development, and student engagement.

2.1. Perceived Challenges. Table 4 illustrates the perceived challenges faced by junior and senior high school science teachers in integrating environmental awareness into their teaching.

The analysis revealed that the most pressing challenge faced by teachers in integrating environmental awareness into science education was insufficient administrative support, with the highest mean score of 3.40. This underscores a critical institutional gap, indicating that without strong leadership, supportive policies, and adequate resource allocation from school administrators, teachers feel constrained in implementing environmental initiatives. The high mean score of 3.35 for the lack of appropriate assessment tools further highlights a systemic deficiency in evaluating students' environmental learning outcomes. This suggests that teachers are not only unsupported but also under-equipped to measure the effectiveness of their instruction, which can hinder efforts to refine and sustain environmental education programs.

Table 4

Level of Integration of Environmental Awareness in Teaching Science in terms of Perceived Challenges

Statements	Mean	Interpretation
1. I find it challenging to integrate environmental awareness topics into the existing science curriculum due to time constraints.	2.69	Agree
2. Limited access to up-to-date teaching resources and materials hinders my ability to incorporate environmental topics effectively.	2.71	Agree
3. I encounter difficulties in aligning environmental education with the required learning competencies in science subjects.	2.53	Agree
4. A lack of professional development opportunities specific to environmental education poses a challenge in enhancing my teaching strategies.	2.70	Agree
5. Insufficient administrative support limits my ability to implement environmental awareness activities in science lessons.	3.40	Agree
6. I find it difficult to engage students in discussions about environmental issues due to their limited interest or awareness.	3.11	Agree
7. The absence of appropriate assessment tools for evaluating environmental awareness makes it hard to measure students' learning outcomes effectively.	3.35	Agree
8. Large class sizes make it challenging to conduct hands-on or experiential learning activities focused on environmental awareness.	3.02	Agree
9. Limited collaboration opportunities with external organizations or environmental experts restrict my ability to bring real-world context into lessons.	3.16	Agree
10. I experience challenges in addressing the diverse environmental knowledge and understanding levels of my students in science classes.	3.17	Agree
Composite Mean	2.98	Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

Teachers also expressed difficulty in engaging students (mean = 3.11) and collaborating with external organizations (mean = 3.16), suggesting that both internal student motivation and external partnerships are critical but underutilized components in delivering meaningful environmental content. The challenge of

addressing varied levels of student environmental knowledge (mean = 3.17) indicates the struggle to differentiate instruction effectively, which becomes even more complex in contexts of large class sizes (mean = 3.02)—a logistical barrier to hands-on and experiential learning, which are vital for deepening environmental understanding.

Moreover, the relatively lower mean scores for limited access to up-to-date teaching resources (2.71), lack of professional development (2.70), time constraints (2.69), and difficulties aligning with learning competencies (2.53) still reflect notable concerns. Although these scored lower, they collectively point to structural and curricular inflexibility that prevents the seamless integration of environmental topics. These findings mirror those of Nguyen et al. (2023) and Mashaba et al. (2022), who reported similar challenges, including limited institutional guidance, insufficient teacher training, and lack of time for integration.

The composite mean of 2.98 indicates general agreement among teachers that these challenges significantly affect their instructional efforts. Taken together, the results emphasize the need for holistic reforms: strengthening administrative support, providing regular and targeted professional development, improving access to current instructional materials, and creating systemic opportunities for collaboration and innovation. Addressing these issues is vital for enabling science teachers in the Division of Laguna to effectively cultivate environmental awareness and responsibility among students.

2.2. Professional Development. Table 5 highlights the level of professional development support that junior and senior high school science teachers in the Division of Laguna received for integrating environmental awareness into their teaching.

The analysis revealed that peer collaboration during professional development had the highest mean score (3.32), emphasizing its pivotal role in enhancing teachers' capacity to integrate environmental awareness into science education. This finding highlights the value of collaborative learning environments where teachers can exchange strategies, share best practices, and collectively develop innovative approaches. Peer interactions likely fostered practical, classroom-ready solutions that teachers found applicable and effective. Closely following this, teachers reported increased confidence in integrating environmental topics due to knowledge gained from professional development activities (mean = 3.22), suggesting that these sessions effectively built teachers' self-efficacy and preparedness.

Table 5

Level of Integration of Environmental Awareness in Teaching Science in terms of Professional Development

Statements	Mean	Interpretation
1. I have participated in professional development programs or training sessions focused on integrating environmental awareness into science teaching.	3.04	Agree
2. The professional development opportunities provided to me are sufficient to enhance my skills in teaching environmental topics effectively.	3.12	Agree
3. I feel confident in integrating environmental issues into my science lessons due to the knowledge gained from professional development activities.	3.22	Agree
4. I receive ongoing support and guidance from educational leaders to apply environmental education strategies in my teaching practices.	2.99	Agree
5. Collaboration with peers during professional development sessions has improved my ability to incorporate environmental awareness into science subjects.	3.32	Agree
6. I am regularly updated with innovative teaching approaches and best practices related to environmental education.	3.11	Agree
7. Professional development activities have equipped me with effective tools and resources for promoting environmental awareness in science lessons.	3.19	Agree
8. Opportunities for attending workshops, seminars, or conferences on environmental education are readily available to me.	3.02	Agree
9. The professional development programs I have attended emphasize real-world applications of environmental awareness in science teaching.	3.16	Agree
10. My school actively supports my participation in professional development programs related to environmental education.	3.18	Agree
Composite Mean	3.14	Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

The availability of tools and resources provided through professional development (mean = 3.19) and active school support for participation in these programs (3.18) further underscore the significance of institutional encouragement. These findings suggest that when schools prioritize and facilitate professional development, teachers are more likely to implement environmentally focused instructional strategies. Similarly, programs that emphasize real-world applications of environmental issues (mean = 3.16) proved effective, reinforcing the notion that contextually relevant and experiential content enhances environmental education's impact.

Despite the positive outlook, some areas revealed opportunities for improvement. Ratings for the sufficiency of professional development opportunities (3.12) and access to innovative teaching approaches (3.11) suggest that while opportunities exist, they may lack frequency, depth, or diversity. More notably,

participation in environment-specific seminars or workshops (3.04) and the availability of such events (3.02) received slightly lower scores, pointing to a scarcity of focused, specialized training. The lowest-rated item (2.99) referred to ongoing support and guidance from educational leaders, indicating a critical gap in sustained mentorship and follow-through after initial training sessions.

The composite mean of 3.14 affirms that teachers generally recognized the importance of professional development in improving their environmental education practices. This supports the findings of Tran et al. (2020), who asserted that the absence of structured training left educators feeling unprepared to integrate sustainability topics, and Gheith (2019), who found that participation in targeted workshops boosted teacher confidence and instructional quality in environmental education.

In summary, while professional development efforts have positively influenced teachers' integration of environmental awareness, the findings point to a need for more comprehensive, sustained, and leadership-supported training programs. Institutionalizing regular, context-specific professional development—with strong administrative follow-through—will not only deepen teachers' environmental competencies but also ensure that science classrooms in the Division of Laguna foster long-term environmental consciousness among students.

2.3. Student Engagement. Table 6 illustrates the extent to which integrating environmental awareness into science teaching has influenced student engagement.

The highest mean score (3.47) was observed in the statement regarding group activities and collaborative projects on environmental topics, encouraging active student participation. This suggests that interactive and cooperative learning approaches played a crucial role in increasing students' involvement. Group-based activities likely provided students with opportunities to share ideas, work collaboratively, and engage more deeply with environmental issues.

Table 6**Level of Integration of Environmental Awareness in Teaching Science in terms of Student Engagement**

Statements	Mean	Interpretation
1. My students actively participate in discussions related to environmental issues during science lessons.	3.42	Agree
2. I observe an increased interest among students when science topics are connected to real-world environmental problems.	3.46	Agree
3. Students are enthusiastic about completing projects or activities that involve environmental themes.	3.40	Agree
4. My students regularly ask questions and seek further information about environmental issues discussed in class.	3.29	Agree
5. Students demonstrate critical thinking when analyzing the causes and effects of environmental challenges in science lessons.	3.38	Agree
6. Group activities and collaborative projects on environmental topics encourage active student participation.	3.47	Agree
7. Students show initiative in applying environmental concepts learned in science class to real-life situations.	3.37	Agree
8. Environmental awareness activities integrated into science lessons enhance students' engagement and attentiveness.	3.46	Agree
9. My students actively contribute ideas and solutions during classroom discussions about environmental conservation.	3.37	Agree
10. Students exhibit a strong sense of responsibility toward environmental stewardship as a result of our science lessons.	3.33	Agree
Composite Mean	3.39	Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

Following closely, two statements received a mean score of 3.46: the observation that students' interest increased when science topics were connected to real-world environmental problems and that environmental awareness activities enhanced engagement and attentiveness. These findings indicate that contextualizing environmental education within real-life situations helped capture students' interest and sustained their engagement. When students see the relevance of environmental topics in their daily lives, they are more likely to participate actively in discussions and activities.

Additionally, students were found to actively participate in discussions about environmental issues during science lessons (3.42), demonstrating that integrating environmental topics into the curriculum sparked curiosity and encouraged dialogue. Similarly, students showed enthusiasm for completing environmental-themed projects or activities (3.40), reinforcing the idea that hands-on learning fosters deeper engagement. The study also found that students exhibited critical thinking when analyzing environmental challenges (3.38) and demonstrated initiative in applying environmental concepts to real-life situations (3.37). These findings suggest that students not only engaged with environmental topics during class discussions but also applied their learning beyond the classroom.

Furthermore, students actively contributed ideas and solutions in discussions about environmental conservation (3.37), reflecting their growing awareness and willingness to participate in sustainability efforts. The observation that students exhibited a strong sense of responsibility toward environmental stewardship (3.33) indicates that exposure to environmental topics in science lessons positively influenced their attitudes and behaviors. Lastly, the lowest mean score (3.29) was recorded in the statement about students regularly asking questions and seeking further information on environmental issues. While this score still falls within the "Agree" range, it suggests that more strategies could be employed to encourage students to take greater initiative in exploring environmental topics independently.

The composite mean of 3.39 indicates that teachers generally agreed that integrating environmental awareness into science lessons enhanced student engagement. This finding aligns with Yeşilyurt et al. (2020), who emphasized that hands-on activities, such as community clean-ups and recycling projects, significantly increased student interest in environmental topics. Additionally, Husin et al. (2020) found that student engagement improved when discussions about climate change and pollution were linked to local environmental issues and when interactive teaching methods, such as debates and project-based learning, were utilized.

Overall, the findings suggest that active learning approaches, real-world connections, and collaborative activities were effective strategies for engaging students in environmental education. However, while students showed high levels of engagement, efforts could be strengthened to encourage deeper inquiry and independent exploration of environmental issues. Enhancing professional development for teachers on interactive teaching strategies and providing more opportunities for students to engage in real-world environmental projects could further sustain and deepen student engagement in environmental education.

3. What is the extent of teachers approaches in integrating environmental awareness in teaching Science?

This study also presents approaches do teachers use to integrate environmental awareness in teaching Science.

Table 7
Teachers' Approaches to Integrate Environmental Awareness in Teaching Science

Statements	Mean	Interpretation
1. I incorporate real-life environmental issues, such as climate change or pollution, into my science lessons to enhance students' understanding of these topics.	3.55	Strongly Agree
2. I use hands-on activities, such as experiments or fieldwork, to help students explore environmental concepts and issues.	3.37	Agree
3. I integrate environmental themes into project-based learning activities to encourage student engagement and critical thinking.	3.36	Agree
4. I utilize multimedia resources, such as videos, presentations, or online simulations, to teach environmental topics in science classes.	3.55	Strongly Agree
5. I encourage students to participate in environmental campaigns or initiatives as part of my teaching strategy.	3.50	Strongly Agree
6. I design assessments, such as quizzes or assignments, that evaluate students' understanding of environmental issues in the context of science.	3.47	Agree
7. I collaborate with other teachers to develop interdisciplinary lessons that connect science with environmental education.	3.38	Agree
8. I organize class discussions or debates about current environmental challenges to promote critical thinking and awareness.	3.37	Agree
9. I provide opportunities for students to engage in environmental problem-solving activities, such as designing solutions for local ecological issues.	3.40	Agree
10. I regularly update my teaching materials to include recent scientific findings and advancements related to environmental topics.	3.41	Agree
Composite Mean	3.44	Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

The results in Table 7 reveal various approaches that junior and senior high school science teachers in the Division of Laguna use to integrate environmental awareness into their lessons. The highest mean scores (3.55) were observed in two statements: incorporating real-life environmental issues, such as climate change or pollution, into science lessons and utilizing multimedia resources, such as videos, presentations, or online simulations, to teach environmental topics. These findings suggest that teachers recognize the importance of contextualizing environmental education through real-world applications and digital tools to enhance students' understanding. By integrating current environmental challenges into their lessons, teachers make the subject matter more relevant and engaging, allowing students to connect theoretical knowledge with practical implications. Similarly, the use of multimedia resources likely aids comprehension by providing dynamic and visually stimulating content that captures students' interest.

Closely following these statements, encouraging students to participate in environmental campaigns or initiatives as part of teaching strategies received a high mean score of 3.50. This indicates that teachers actively promote real-world engagement by involving students in environmental advocacy efforts, reinforcing the idea that learning should extend beyond the classroom. Furthermore, designing assessments that evaluate students' understanding of environmental issues in the context of science (3.47) reflects an effort to systematically measure students' grasp of environmental concepts, ensuring that these topics are meaningfully integrated into the curriculum.

Teachers also reported collaborating with colleagues to develop interdisciplinary lessons that connect science with environmental education (3.38), emphasizing the value of cross-subject integration. Organizing class discussions or debates about current environmental challenges (3.37) was also a common approach, highlighting the role of dialogue in fostering critical thinking and awareness. Additionally, providing students with opportunities to engage in problem-solving activities related to local environmental issues (3.40) suggests that teachers encourage students to apply their knowledge to practical situations. Regularly updating teaching materials to include recent scientific findings (3.41) further underscores the commitment to keeping environmental education relevant and evidence-based.

The lowest reported strategies, though still within the "Agree" range, were using hands-on activities like experiments or fieldwork (3.37) and integrating environmental themes into project-based learning (3.36). While these approaches are effective, their relatively lower scores may suggest that logistical challenges, such as lack of resources or time constraints, limit their full implementation.

The composite mean of 3.44 suggests that teachers generally agree on the importance of integrating environmental awareness into their science instruction and employ a variety of strategies to do so. These findings align with the study of Tal et al. (2019), which emphasized the effectiveness of inquiry-based learning through research projects, experiments, and fieldwork in fostering environmental literacy and engagement. Likewise, the study by Mongar (2022) highlighted the role of interdisciplinary teaching in making environmental education more meaningful, as teachers connected ecological concepts to subjects such as biology, chemistry, and geography.

Overall, the results indicate that science teachers in the Division of Laguna effectively incorporate environmental awareness into their teaching through real-world connections, multimedia tools, and interactive strategies. However, there is room for improvement in implementing more hands-on and project-based learning activities, which could be addressed through additional training, resource allocation, and institutional support.

4. What are the factors influencing teachers' ability to effectively integrate environmental awareness into their teaching in terms of attitude, behavior, and knowledge?

This study presents the factors influencing teachers' ability to effectively integrate environmental awareness into their teaching in terms of attitude, behavior, and knowledge.

4.1. **Attitude.** Table 8 highlights the strong commitment and positive attitudes of junior and senior high school science teachers in the Division of Laguna toward integrating environmental awareness into their teaching.

Table 8

Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness in terms of Attitude

Statements	Mean	Interpretation
1. I believe integrating environmental awareness into science teaching is essential for students' holistic development.	3.69	Strongly Agree
2. I am confident that teaching environmental concepts contributes to creating environmentally responsible citizens.	3.63	Strongly Agree
3. I feel motivated to incorporate environmental topics into my science lessons despite the additional planning required.	3.59	Strongly Agree
4. I consider promoting environmental awareness a core responsibility as a science teacher.	3.59	Strongly Agree
5. I believe that integrating environmental issues into my teaching enhances students' understanding of science concepts.	3.65	Strongly Agree
6. I am open to modifying my teaching strategies to better include environmental awareness activities.	3.63	Strongly Agree
7. I value professional growth opportunities that enhance my ability to teach environmental topics effectively.	3.65	Strongly Agree
8. I feel enthusiastic about engaging students in discussions and activities related to environmental conservation.	3.64	Strongly Agree
9. I believe that incorporating environmental awareness into science lessons positively impacts students' attitudes toward the environment.	3.66	Strongly Agree
10. I feel a sense of accomplishment when students demonstrate increased awareness and interest in environmental issues as a result of my teaching.	3.65	Strongly Agree
Composite Mean	3.64	Strongly Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

The highest-rated statement, with a mean of 3.69, reflects the teachers' strong belief that incorporating environmental education is essential for students' holistic development. This underscores the idea that environmental awareness goes beyond scientific knowledge, fostering responsible citizenship and sustainability values among students. Closely following this, teachers strongly agreed (3.66) that

incorporating environmental topics positively impacts students' attitudes toward the environment, reinforcing the role of educators in shaping students' environmental consciousness.

Several other statements received similarly high ratings, including the belief that teaching environmental issues enhances students' understanding of science concepts (3.65) and valuing professional development opportunities that improve their ability to teach environmental topics effectively (3.65). This suggests that teachers recognize the interconnectedness of environmental education with broader scientific learning and are willing to continuously develop their expertise in this area. Additionally, the statement, "I feel a sense of accomplishment when students demonstrate increased awareness and interest in environmental issues as a result of my teaching," also received a mean of 3.65, indicating that teachers find fulfillment in seeing tangible improvements in students' environmental engagement.

Teachers also strongly agreed (3.64) that they feel enthusiastic about engaging students in discussions and activities related to environmental conservation. This enthusiasm is crucial in motivating students to participate actively in environmental initiatives. Furthermore, confidence in the impact of environmental education on shaping responsible citizens (3.63) and openness to modifying teaching strategies to include environmental awareness (3.63) highlight the adaptability and dedication of educators in ensuring that environmental education remains relevant and impactful.

The lowest-rated statements, although still within the "Strongly Agree" range, were related to motivation despite additional planning (3.59) and considering environmental awareness a core responsibility as a science teacher (3.59). These results suggest that while teachers are committed to integrating environmental topics, additional effort and time required for planning may present challenges. However, their overall positive attitude remains evident.

The composite mean of 3.64 indicates a unanimous agreement among teachers regarding the importance of environmental education and their strong willingness to incorporate it into their teaching. These findings align with McKenna's (2020) study, which found that teachers with a strong commitment to environmental sustainability were more likely to integrate environmental topics into their lessons despite challenges such as limited resources. Similarly, the study by Alabdallat et al. (2021) emphasized that teachers with pro-environmental attitudes were more likely to advocate for sustainability initiatives within their schools, further reinforcing the connection between teachers' attitudes and their effectiveness in promoting environmental awareness.

Overall, the results suggest that teachers in the Division of Laguna demonstrate a strong personal commitment to environmental education. Their positive attitudes serve as a driving force in integrating environmental awareness into their science teaching, fostering both knowledge and responsible behavior

among students. However, to sustain this enthusiasm, it is essential to provide continued professional development and institutional support, ensuring that teachers have the necessary resources to effectively translate their commitment into impactful teaching practices.

4.2. **Behavior. illustrates the behavioral factors influencing teachers' ability to integrate environmental awareness into their science lessons.**

Among the listed behaviors, the highest-rated statement, with a mean of 3.57, reflects the strong agreement among teachers regarding the use of technology, such as videos and interactive simulations, to enhance students' understanding of environmental issues. This suggests that educators recognize the effectiveness of digital tools in making environmental concepts more engaging and accessible. Closely following this, teachers also strongly agreed (3.53) that they use real-life examples of environmental problems to connect with students' everyday experiences and that they encourage student participation in community-based environmental initiatives. These results highlight teachers' emphasis on making environmental education relevant and action-oriented, ensuring that students develop both knowledge and a sense of responsibility toward environmental conservation.

Table 9

Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness in terms of Behavior

Statements	Mean	Interpretation
1. I regularly include discussions on environmental issues in my science lessons.	3.31	Agree
2. I use real-life examples of environmental problems to connect with students' everyday experiences.	3.53	Strongly Agree
3. I incorporate hands-on activities, such as experiments or fieldwork, to teach environmental concepts.	3.44	Agree
4. I actively seek and use updated materials or resources to improve the teaching of environmental topics.	3.47	Agree
5. I adapt my lesson plans to include current environmental challenges, such as climate change or pollution.	3.43	Agree
6. I collaborate with colleagues to develop interdisciplinary approaches for teaching environmental awareness.	3.39	Agree
7. I encourage students to participate in community projects or initiatives related to environmental conservation.	3.53	Strongly Agree
8. I integrate technology, such as videos or interactive simulations, to enhance students' understanding of environmental issues.	3.57	Strongly Agree
9. I design assessments that measure students' knowledge and attitudes toward environmental issues.	3.45	Agree
10. I consistently model environmentally responsible behavior, such as recycling or energy conservation, to inspire students.	3.47	Agree
Composite Mean	3.46	Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

Several other behavioral aspects received positive ratings, albeit slightly lower. Teachers agreed (3.47) that they actively seek and use updated materials or resources and that they model environmentally responsible behaviors such as recycling and energy conservation. This indicates that while teachers strive to stay informed and set an example for their students, there may still be challenges in consistently acquiring new resources or institutional support for sustainability practices. Additionally, teachers agreed (3.45) that they design assessments to measure students' knowledge and attitudes toward environmental issues, underscoring their effort to evaluate students' learning beyond traditional content knowledge.

Moreover, teachers acknowledged incorporating hands-on activities such as experiments or fieldwork (3.44) and adapting lesson plans to include current environmental challenges like climate change and pollution (3.43). These findings indicate that experiential learning methods are valued, though there may be barriers, such as limited resources or time constraints, that prevent their full implementation. Collaboration among colleagues to develop interdisciplinary approaches (3.39) and the regular inclusion of environmental discussions in science lessons (3.31) were among the lowest-rated behaviors, suggesting that while teachers recognize the importance of integrating environmental topics, structured collaboration and consistent lesson integration might require further institutional encouragement and support.

The composite mean of 3.46, interpreted as "Agree," indicates that teachers generally engage in environmentally conscious teaching practices, though to varying extents. These results align with the findings of Olawumi and Mavuso (2023), who emphasized that teachers who actively seek out professional development opportunities and new teaching resources are more successful in integrating environmental topics into their lessons. The results also support O'Hare et al. (2020), who found that teachers who model pro-environmental behaviors in their personal lives tend to translate these values into their classroom practices, reinforcing environmental consciousness among students.

Overall, the findings suggest that while teachers exhibit environmentally supportive behaviors, strengthening collaboration, increasing access to resources, and promoting interdisciplinary teaching approaches could further enhance the integration of environmental education. Providing ongoing professional development and institutional support will be crucial in ensuring that teachers can sustain and expand their efforts in promoting environmental awareness among students.

4.3. Knowledge. Table 10 reveals the role of teachers' knowledge in effectively integrating environmental awareness into their science teaching.

The highest-rated statement, with a mean of 3.60, indicates that teachers strongly agreed that they understand how human activities impact ecosystems and biodiversity and can confidently teach these

concepts. This suggests that educators recognize the importance of explaining ecological relationships and environmental consequences to their students, reinforcing the idea that human actions play a crucial role in environmental sustainability.

Table 10
 Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness in terms of Knowledge

Statements	Mean	Interpretation
1. I am knowledgeable about current environmental issues, such as climate change, deforestation, and pollution.	3.45	Agree
2. I understand the connection between environmental science concepts and the Senior High School science curriculum.	3.53	Strongly Agree
3. I am familiar with the principles of sustainable development and their application in teaching.	3.49	Agree
4. I am aware of teaching strategies that effectively convey environmental concepts to students.	3.43	Agree
5. I understand how human activities impact ecosystems and biodiversity and can teach these concepts confidently.	3.60	Strongly Agree
6. I have sufficient knowledge of environmental laws and policies in the Philippines, such as Republic Act No. 9512.	3.33	Agree
7. I can explain the scientific principles underlying renewable energy and its importance in environmental conservation.	3.53	Strongly Agree
8. I am well-informed about global environmental movements and their relevance to local contexts.	3.44	Agree
9. I understand the role of environmental education in fostering critical thinking and problem-solving skills among students.	3.57	Strongly Agree
10. I am knowledgeable about integrating environmental topics into science lessons using interdisciplinary approaches.	3.44	Agree
Composite Mean	3.48	Agree

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

Following this, teachers also strongly agreed (3.57) that they understand the role of environmental education in fostering critical thinking and problem-solving skills among students. This highlights their awareness of the broader educational benefits of environmental education, which extend beyond knowledge acquisition to developing students' analytical and decision-making abilities.

Another highly rated statement (3.53) shows that teachers strongly agreed they understand the connection between environmental science concepts and the Senior High School science curriculum. This suggests that educators see environmental education as an integral part of their existing teaching framework rather than as an isolated subject. Similarly, teachers strongly agreed that they could explain the scientific principles underlying renewable energy and its importance in conservation (3.53). This finding underscores

their confidence in teaching renewable energy topics, which are essential for addressing climate change and promoting sustainable solutions.

Other aspects of environmental knowledge received slightly lower but still positive ratings. Teachers agreed (3.49) that they are familiar with the principles of sustainable development and their application in teaching, indicating a good grasp of long-term environmental solutions. Likewise, they agreed (3.45) that they are knowledgeable about current environmental issues, such as climate change, deforestation, and pollution, reflecting a general awareness of pressing environmental concerns. However, slightly lower ratings were observed in statements related to teaching strategies (3.43) and interdisciplinary approaches (3.44), suggesting that while teachers are aware of environmental issues, some may need further support in translating this knowledge into effective teaching methods.

Notably, the lowest-rated statement (3.33) indicates that teachers agreed they have sufficient knowledge of environmental laws and policies in the Philippines, such as Republic Act No. 9512. This suggests that while they have a basic understanding of environmental policies, there may be gaps in their familiarity with specific legal frameworks and their application in classroom instruction. Strengthening teachers' knowledge in this area could enhance their ability to educate students about environmental rights, responsibilities, and national conservation efforts.

The composite mean of 3.48, interpreted as "Agree," signifies that teachers generally possess a strong foundation in environmental knowledge but may benefit from additional training in specific areas such as environmental policies, interdisciplinary teaching, and instructional strategies. These results align with the study by García-González et al. (2021), which found that teachers with a strong background in environmental science were more confident in integrating sustainability topics into their lessons. Furthermore, the findings support the study by Zwolińska et al. (2022), which highlighted the importance of teachers' knowledge of global environmental policies in engaging students in discussions about real-world environmental challenges.

Overall, the results indicate that while teachers have a solid understanding of environmental concepts, continued professional development, particularly in environmental laws, interdisciplinary teaching strategies, and global sustainability frameworks, could further enhance their ability to integrate environmental education effectively. Strengthening teachers' knowledge in these areas will not only improve lesson delivery but also ensure that students receive a well-rounded education on environmental issues, fostering greater awareness and engagement.

5. Is there a significant difference in the level of integration of environmental awareness in teaching science based on their demographic profiles?

This part presents the summary of statistical analysis performed to determine the difference in the level of integration of environmental awareness in teaching science based on their demographic profiles. To explain the difference in the level of integration of environmental awareness in teaching science, the hypothesis was tested through Two-Independent Samples t-test and Analysis of Variance (ANOVA). The null hypothesis stated that there is no significant difference in the level of integration of environmental awareness in teaching science based on their demographic profiles (H_0).

Table 11

Significant Difference in the Level of Integration of Environmental Awareness in Teaching Science based on their Years of Teaching Science

Environmental Awareness	F-value	p-value	Decision on H_0	Interpretation
Perceived Challenges	1.364	0.249	Failed to Reject	Not Significant
Professional Development	2.275	0.063	Failed to Reject	Not Significant
Student Engagement	0.370	0.830	Failed to Reject	Not Significant

The findings in Table 11 indicate that there is no significant difference in the level of integration of environmental awareness in teaching science based on teachers' years of experience. This is reflected in the p-values for perceived challenges (0.249), professional development (0.063), and student engagement (0.830), all of which exceed the 0.05 significance level, leading to a failure to reject the null hypothesis. These results suggest that regardless of how long teachers have been teaching science, their ability to integrate environmental awareness remains similar.

Among the three factors examined, professional development had the lowest p-value (0.063), indicating a slightly stronger but still statistically insignificant variation among teachers with different years of experience. This implies that while more experienced teachers may have had more exposure to professional training opportunities, the difference in how they apply environmental education in their classrooms is not significant. Meanwhile, the results for perceived challenges and student engagement confirm that teachers, regardless of tenure, face similar obstacles in incorporating environmental issues into their lessons and in engaging students in environmental discussions.

These findings align with Corpuz et al. (2022), who emphasized that teachers, regardless of experience, face common barriers such as limited resources, inadequate training, and a lack of institutional support, highlighting the systemic nature of these challenges. Similarly, Marques and Xavier (2020) noted the difficulty of integrating environmental education into an already packed curriculum, affecting teachers across

all experience levels. Moreover, Karim et al. (2022) found that professional development plays a crucial role in teachers' confidence and ability to integrate environmental topics, suggesting that access to training and support mechanisms is more influential than teaching tenure alone. Santos et al. (2020) further emphasized the importance of administrative and institutional support, indicating that when present, these structures benefit all teachers equally, while their absence hinders integration regardless of experience.

Overall, these findings underscore the need for continuous and structured professional development, as experience alone does not necessarily equate to a higher level of environmental awareness integration. Schools and education policymakers should focus on strengthening institutional support, improving teacher training programs, and providing adequate resources to ensure that all teachers, regardless of their tenure, can effectively integrate environmental education into their science curriculum.

Table 12

Significant Difference in the Level of Integration of Environmental Awareness in Teaching Science based on their Years of Educational Attainment

Environmental Awareness	F-value	p-value	Decision on Ho	Interpretation
Perceived Challenges	0.472	0.624	Failed to Reject	Not Significant
Professional Development	4.033	0.019	Reject	Significant
Student Engagement	3.932	0.021	Reject	Significant

The results indicated that educational attainment played a significant role in teachers' ability to integrate environmental awareness into their science instruction, particularly in terms of professional development and student engagement. The significant difference in professional development ($F = 4.033$, $p = 0.019$) suggests that teachers with higher educational attainment had greater access to training opportunities or were more proactive in seeking professional growth related to environmental education. This finding aligns with the study by Karim et al. (2022), which emphasized that teachers who actively participated in professional development programs demonstrated greater confidence and effectiveness in integrating environmental topics into their lessons. Higher education may have provided these teachers with advanced knowledge of environmental issues and contemporary teaching strategies, enabling them to maximize professional development opportunities and translate them into classroom practice.

Similarly, the significant difference in student engagement ($F = 3.932$, $p = 0.021$) suggests that teachers with higher education levels were more adept at fostering meaningful discussions and interactive learning experiences related to environmental awareness. This may be attributed to their deeper understanding of environmental concepts, which allowed them to design more engaging and comprehensive lessons. The study by Santos et al. (2020) supports this finding, highlighting that teachers with greater institutional support

and advanced knowledge levels were more successful in integrating environmental topics in ways that captured students' interest and encouraged active participation. Teachers with higher educational attainment may also have been more familiar with student-centered approaches, such as project-based learning, experiential activities, and technology-enhanced instruction, which have been shown to improve student engagement in environmental education.

On the other hand, the absence of a significant difference in perceived challenges ($F = 0.472$, $p = 0.624$) suggests that regardless of educational attainment, teachers faced similar obstacles in integrating environmental topics into their teaching. These challenges likely included limited instructional materials, inadequate time allocation in the curriculum, and insufficient institutional support. The findings of Corpuz et al. (2022) reinforce this notion, as their study identified systemic barriers—such as lack of resources and professional training—as common issues faced by teachers across different experience levels. This implies that while higher educational attainment enhances teaching effectiveness and engagement strategies, broader institutional and policy-level changes are still necessary to address the structural difficulties hindering the full integration of environmental education.

Overall, the findings suggest that while educational attainment positively influences professional development and student engagement in environmental education, systemic challenges persist that affect all teachers, regardless of their academic background. Addressing these challenges through curriculum reforms, enhanced resource allocation, and strengthened institutional support can further improve the effectiveness of environmental education in junior and senior high schools.

Table 13

Significant Difference in the Level of Integration of Environmental Awareness in Teaching Science based on their Years of Sex

Environmental Awareness	t-value	p-value	Decision on Ho	Interpretation
Perceived Challenges	0.014	0.989	Failed to Reject	Not Significant
Professional Development	0.125	0.901	Failed to Reject	Not Significant
Student Engagement	0.607	0.545	Failed to Reject	Not Significant

The results indicated that there was no significant difference in the level of integration of environmental awareness in teaching science based on sex across all three dimensions: perceived challenges ($t = 0.014$, $p = 0.989$), professional development ($t = 0.125$, $p = 0.901$), and student engagement ($t = 0.607$, $p = 0.545$). This suggests that both male and female teachers faced similar challenges in incorporating environmental awareness into their teaching, had comparable access to professional development opportunities, and engaged students in environmental discussions at equivalent levels. The lack of significant

differences implies that external factors, such as institutional support, curriculum structure, and resource availability, may have played a more influential role in shaping teachers' experiences than gender-related differences.

These findings align with the study by Corpuz et al. (2022), which emphasized that the challenges teachers encounter in integrating environmental education—such as limited resources, inadequate training, and insufficient institutional support—are systemic rather than gender-specific. Regardless of sex, teachers struggled with similar barriers that hindered their ability to fully engage students in environmental discussions. Likewise, Marques and Xavier (2020) highlighted that science teachers, irrespective of gender, faced difficulties in integrating environmental topics due to a lack of instructional materials and limited time within the curriculum. These studies suggest that addressing these challenges requires structural interventions, such as improved access to professional development and enhanced curricular support, rather than focusing on gender-related disparities.

Overall, the results reinforce the notion that gender does not determine a teacher's capacity to integrate environmental awareness into science education. Instead, the success of environmental education relies on broader institutional efforts, including targeted training programs, sufficient resource allocation, and curriculum adjustments that provide all teachers with equal opportunities to effectively teach environmental topics.

2. Is there a significant relationship between the approaches do teachers use to integrate environmental awareness in teaching Science and factors influencing teachers' ability to effectively integrate environmental awareness into their teaching?

This study provides an overview of the statistical analysis conducted to establish the relationship between the teachers' approaches used to integrate environmental awareness and factors influencing teachers' ability to effectively integrate environmental awareness into their teaching; Pearson's r Correlation Coefficient was employed to test the hypothesis. The null hypothesis stated that there is no significant relationship between the teachers' approaches used to integrate environmental awareness and factors influencing teachers' ability to effectively integrate environmental awareness into their teaching. The study utilized a significance level of 0.05 to make decisions regarding the null hypothesis (H_0).

Table 14

Significant Relationship between the Teachers' Approaches Use to integrate environmental awareness and Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness into their Teaching

Factors	R-value	Degree of Relationship	p-value	Decision on Ho	Interpretation
Attitude	0.669	Strong	0.000	Reject	Significant
Behavior	0.782	Very Strong	0.000	Reject	Significant
Knowledge	0.679	Strong	0.000	Reject	Significant

Legend: Coefficient of correlation (r): +1.0 (Perfect relationship), +.76 to .99 (Very Strong relationship), +.51 to .75 (Strong relationship), +.26-.50 (Moderate Relationship), +.11 to .25 (Weak relationship), +.01 to .10 (Very weak relationship), .00 (No relationship)

The findings of the study revealed a significant relationship between teachers' approaches to integrating environmental awareness in their teaching and the factors influencing their ability to do so. Among the three factors examined, teacher behavior demonstrated the strongest relationship ($r = 0.782$, $p = 0.000$), followed by teacher knowledge ($r = 0.679$, $p = 0.000$) and teacher attitude ($r = 0.669$, $p = 0.000$). These results indicate that while all three factors play a crucial role in shaping how teachers incorporate environmental education into their lessons, teacher behavior has the most substantial impact. This suggests that teachers who actively engage in environmentally conscious practices and integrate sustainability principles into their teaching strategies are more effective in fostering environmental awareness among students.

Furthermore, the strong correlation between teachers' knowledge and their ability to integrate environmental awareness implies that educators with a deeper understanding of environmental issues are better equipped to implement effective teaching approaches. Knowledgeable teachers can provide accurate information, design engaging lesson plans, and respond effectively to students' inquiries regarding environmental topics. Meanwhile, the significant relationship between teacher attitudes and integration strategies highlights that teachers who hold positive attitudes toward environmental education are more likely to promote environmental awareness, although knowledge and behavior are stronger determinants of actual implementation.

These findings align with the study conducted by Tal et al. (2019), which emphasized that inquiry-based learning and interdisciplinary approaches were more effective when teachers possessed the necessary knowledge and displayed environmentally responsible behavior. The study found that teachers who engaged students in hands-on activities such as field research, experiments, and real-world environmental problem-solving experienced higher levels of student engagement and comprehension. Similarly, Mongar (2022) noted that teachers with strong environmental knowledge were more likely to integrate environmental topics across

multiple disciplines, reinforcing the idea that well-informed educators play a critical role in successful environmental education.

Overall, the results highlight the importance of fostering not only environmental knowledge but also behavior and attitudes among teachers. Professional development programs should prioritize enhancing teachers' understanding of environmental issues while encouraging them to model environmentally responsible behaviors in the classroom. By strengthening these factors, educators can adopt more effective approaches to integrating environmental awareness into their teaching, ultimately enriching students' environmental knowledge and engagement.

3. Do the factors influencing teachers' ability to effectively integrate environmental awareness into their teaching significantly affect their level of integration of environmental awareness in teaching science?

This study provides an overview of the statistical analysis conducted to establish the effect of the factors influencing teachers' ability to effectively integrate environmental awareness into their teaching significantly affect their level of integration of environmental awareness in teaching science; Regression Analysis was employed to test the hypothesis. The null hypothesis stated that the factors influencing teachers' ability to effectively integrate environmental awareness not significantly affect their teaching affect their level of integration of environmental awareness in teaching science. The study utilized a significance level of 0.05 to make decisions regarding the null hypothesis (H_0).

Table 15

Significant Effect of the Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness to their Teaching their Level of Integration of Environmental Awareness in Teaching Science in terms of Perceived Challenges

Predictors	B	Std. Deviation	t-value	p-value	Decision on H_0	Interpretation
(Constant)	1.393	0.283	4.920	0.000		
Attitude	-0.036	0.114	-0.319	0.750	Failed to Reject	Not Significant
Behavior	0.38	0.136	2.780	0.006	Reject	Significant
Knowledge	0.118	0.133	0.887	0.376	Failed to Reject	Not Significant

Model Summary: $R=0.438$; $R^2=0.191$; $F=13.733$; $p=0.000$

Dependent Variable: Perceived Challenges

The findings presented in Table 15 reveal the significant effect of various factors influencing teachers' ability to integrate environmental awareness into their science teaching, particularly in terms of perceived challenges. The results indicate that among the three predictors—teacher behavior, teacher

knowledge, and teacher attitude—only teacher behavior had a significant effect on perceived challenges, as indicated by its computed p-value of 0.006. In contrast, teacher knowledge ($p = 0.376$) and teacher attitude ($p = 0.750$) were found to be statistically insignificant in predicting perceived challenges.

The strongest predictor, teacher behavior ($B = 0.38$, $t = 2.780$, $p = 0.006$), suggests that how teachers act and implement environmental education in their classrooms significantly impacts their perception of challenges. This implies that teachers who actively engage in environmentally responsible practices and integrate environmental topics into their science lessons may experience greater challenges, possibly due to the additional effort required to overcome resource limitations, curricular constraints, or institutional barriers. This aligns with the study by Nguyen et al. (2023), which identified that teachers who actively incorporate environmental education often face difficulties related to a lack of materials, training, and student engagement strategies. Similarly, Mashaba et al. (2022) found that teachers who attempted to integrate environmental topics faced institutional barriers, such as a lack of professional development opportunities and limited support from school administrations.

On the other hand, teacher knowledge ($B = 0.118$, $t = 0.887$, $p = 0.376$) did not have a statistically significant effect on perceived challenges. This suggests that while knowing environmental issues is important, it does not necessarily determine how teachers perceive the challenges they face in integrating environmental awareness into their teaching. Teachers may possess adequate environmental knowledge but still struggle with external constraints, such as lack of institutional support or curricular rigidity. This finding is consistent with the study by Husamah et al. (2022), which found that even teachers with strong environmental knowledge often struggled to align these topics with rigid subject curricula due to a lack of flexibility in lesson planning.

Similarly, teacher attitude ($B = -0.036$, $t = -0.319$, $p = 0.750$) also did not show a significant relationship with perceived challenges. This indicates that having a positive attitude towards environmental education does not necessarily impact how teachers perceive challenges in integrating environmental awareness. While a favorable attitude may encourage teachers to incorporate environmental topics, the practical difficulties they face in terms of time constraints, lack of resources, and institutional barriers remain unchanged. This is supported by the findings of Liao et al. (2022), which emphasized that environmental education was often seen as supplementary, leading to fewer opportunities for teachers to engage with such topics regardless of their attitudes.

The overall model summary shows an R-value of 0.438, indicating a moderate correlation between the predictors and perceived challenges. The R^2 value of 0.191 suggests that approximately 19.1% of the variance in perceived challenges can be explained by the three factors examined. The F-value of 13.733, with

a p-value of 0.000, confirms that the regression model is statistically significant. This means that while individual factors like teacher behavior play a significant role, other unexamined variables may also contribute to the challenges teachers face.

In summary, the study highlights that among the factors examined, teacher behavior is the most influential predictor of perceived challenges in integrating environmental awareness into science teaching. This finding underscores the need for greater institutional support, professional development, and resource allocation to assist teachers who actively engage in environmental education. Addressing these challenges through targeted interventions can enhance teachers' ability to promote environmental awareness effectively, ultimately benefiting students' environmental knowledge and engagement.

Table 16

Significant Effect of the Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness to their Teaching their Level of Integration of Environmental Awareness in Teaching Science in terms of Professional Development

Predictors	B	Std. Deviation	t-value	p-value	Decision on Ho	Interpretation
(Constant)	0.552	0.292	1.889	0.060		
Attitude	-0.091	0.117	-0.780	0.437	Failed to Reject	Not Significant
Behavior	0.521	0.141	3.695	0.000	Reject	Significant
Knowledge	0.321	0.137	2.338	0.021	Reject	Significant

Model Summary: $R=0.609$; $R^2=0.371$; $F=34.143$; $p=0.000$

Dependent Variable: Professional Development

The results of the study indicate that among the factors influencing teachers' ability to integrate environmental awareness into their teaching, behavior had the most significant effect, followed by knowledge, while attitude was found to be not significant. Specifically, behavior obtained a coefficient of $B = 0.521$ with a t-value of 3.695 and a p-value of 0.000, indicating a strong and statistically significant relationship. This suggests that teachers who actively engage in environmentally conscious behaviors are more likely to integrate environmental awareness effectively into their teaching practices. These findings align with previous studies, such as Vladova (2023), which highlighted that teachers who received training and demonstrated proactive environmental behaviors were more successful in incorporating environmental education into their lessons. The study further emphasized the importance of professional development in enhancing these behaviors, as teachers who underwent continuous training were better equipped with strategies to integrate environmental topics effectively.

Similarly, knowledge was also found to have a significant effect, with a coefficient of $B = 0.321$, a t-value of 2.338, and a p-value of 0.021. This result suggests that teachers with higher environmental knowledge are more capable of integrating environmental awareness into their lessons. The study by Estrada-Araoz et al. (2023) supports this finding, as it demonstrated that teachers who attended environmental education workshops developed a deeper understanding of sustainability issues, which enhanced their ability to incorporate these topics into their teaching. The results imply that increasing teachers' knowledge through structured professional development programs can significantly improve their ability to teach environmental topics in an engaging and meaningful way.

Conversely, attitude was found to be not significant, with a coefficient of $B = -0.091$, a t-value of -0.780, and a p-value of 0.437. This indicates that teachers' attitudes towards environmental education do not significantly influence their integration of environmental awareness into teaching. This finding contrasts with the study of Tsami et al. (2019), which suggested that teachers with positive attitudes toward environmental education were more likely to incorporate these topics into their lessons. However, the current study suggests that while attitudes may reflect personal beliefs, they do not necessarily translate into action without adequate knowledge and behavioral engagement.

The overall model summary reveals an R-value of 0.609 and an R-squared value of 0.371, indicating that the independent variables explain approximately 37.1% of the variance in professional development related to environmental awareness integration. Furthermore, the F-value of 34.143 and a p-value of 0.000 confirm the model's statistical significance. These findings underscore the importance of professional development in equipping teachers with the necessary skills and behaviors to integrate environmental awareness into their teaching. The study reinforces the need for targeted training programs that enhance teachers' environmental knowledge and behaviors, ensuring more effective environmental education in junior and senior high schools.

In summary, the study highlights that behavior and knowledge are crucial factors in determining teachers' ability to integrate environmental awareness into their teaching, while attitude alone does not significantly impact their teaching practices. Professional development programs should focus on improving teachers' environmental knowledge and encouraging proactive environmental behaviors to enhance their ability to teach environmental topics effectively.

Table 17

Significant Effect of the Factors Influencing Teachers' Ability to Effectively Integrate Environmental Awareness to their Teaching their Level of Integration of Environmental Awareness in Teaching Science in terms of Student Engagement

Predictors	B	Std. Deviation	t-value	p-value	Decision on Ho	Interpretation
(Constant)	0.523	0.248	2.114	0.036		
Attitude	0.086	0.099	0.868	0.387	Failed to Reject	Not Significant
Behavior	0.31	0.119	2.594	0.010	Reject	Significant
Knowledge	0.427	0.116	3.674	0.000	Reject	Significant

Model Summary: $R=0.685$; $R^2=0.469$; $F=51.265$; $p=0.000$

Dependent Variable: Student Engagement

The results of the study revealed that among the factors influencing teachers' ability to integrate environmental awareness into their teaching, knowledge had the most significant effect on student engagement. The computed coefficient ($B = 0.427$) indicated that teachers who possessed greater knowledge of environmental issues were more effective in engaging students. The significance level ($p = 0.000$) further confirmed this relationship. This finding aligns with existing literature, such as the study by Husamah et al. (2023), which emphasized that teachers with formal training in environmental science were more confident in integrating environmental topics, resulting in higher student engagement. When teachers have a strong grasp of environmental concepts, they are better equipped to design meaningful and interactive lessons that resonate with students.

Following knowledge, behavior was also found to significantly impact student engagement, with a coefficient of $B = 0.31$ and a p-value of 0.010. This result suggests that teachers who actively model environmentally responsible behavior and incorporate sustainable practices into their teaching methods foster greater student interest and participation. This finding is consistent with the study of Tovar-Gálvez (2021), which highlighted that students are more engaged when they see their teachers demonstrating commitment to environmental issues. When educators practice what they teach, students are more likely to internalize the lessons and apply them to real-life situations.

In contrast, attitude was found to have no significant effect on student engagement ($B = 0.086$, $p = 0.387$), as the null hypothesis failed to be rejected. This result implies that while a positive attitude towards environmental education is essential, it is not a strong predictor of student engagement. This aligns with the findings of Tsami et al. (2019), who noted that while teachers' attitudes toward environmental education were generally positive, their ability to effectively integrate these topics depended more on their knowledge and access to institutional support rather than just their enthusiasm.

The overall model summary ($R = 0.685$; $R^2 = 0.469$; $F = 51.265$; $p = 0.000$) indicated that the predictors collectively explained 46.9% of the variance in student engagement. This suggests that while knowledge and behavior play significant roles, other factors not included in the model may also contribute to student engagement in environmental education.

In summary, the study underscores the importance of enhancing teachers' knowledge and reinforcing their environmentally responsible behavior to improve student engagement in environmental education. Professional development programs focusing on environmental literacy, practical applications, and sustainable teaching practices should be prioritized to equip teachers with the necessary tools to engage students effectively. Additionally, institutional support, access to resources, and interactive teaching strategies must be further explored to optimize the integration of environmental awareness in science education. These findings highlight the need for a comprehensive approach that extends beyond attitude and focuses on knowledge acquisition and behavioral modeling to foster meaningful student engagement in environmental topics.

4. Based on the findings, what model or framework is most applicable for integrating environmental awareness into teaching Science subjects in Junior and Senior High School students?

The conceptual framework for integrating environmental awareness into science teaching in junior and senior high school aligns with the overall findings of the study. It highlights four key components—institutional support, teacher development, teaching strategies, and student engagement leading to environmental awareness and action—which collectively create a structured and effective approach to environmental education.

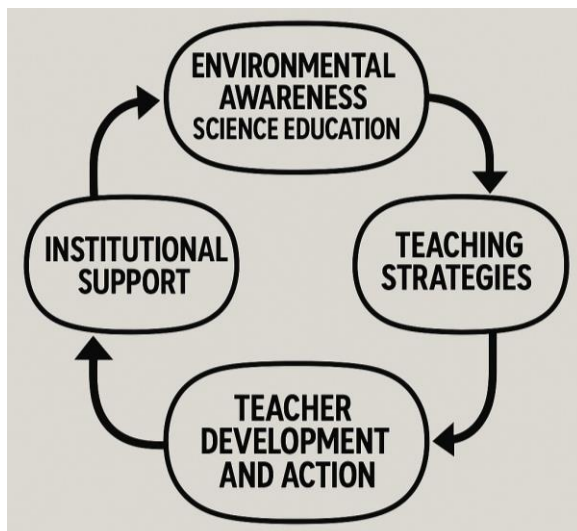


Figure 2. Structured Framework for Integrating Environmental Awareness into Science Education

Institutional Support as the Foundation

Institutional support serves as the backbone of environmental education. The study found that teachers who had strong administrative backing, access to resources, and a supportive school culture were more effective in integrating environmental topics into their lessons. This means that schools must implement policies that prioritize sustainability education, allocate financial and material resources, and encourage interdisciplinary approaches to environmental learning. Without institutional support, teachers may struggle to implement best practices due to curriculum constraints, lack of professional development, or inadequate teaching materials. Schools that promote environmental programs, provide sustainability-focused extracurricular activities, and collaborate with local environmental organizations can create an environment where teachers feel empowered to integrate environmental awareness into their science instruction.

Teacher Development as a Key Influencer

The next critical component is teacher development, which directly influences how well educators integrate environmental awareness into their lessons. The study found that teachers' knowledge and behavior had a significant effect on student engagement, while attitude alone was not enough to drive meaningful change. Professional development programs should focus on enhancing teachers' content knowledge and pedagogical skills rather than simply fostering a positive attitude toward environmental education. Schools should provide workshops, continuous training, and access to updated environmental education resources to ensure that teachers feel confident in their ability to teach sustainability topics effectively. Without proper training, even the most motivated teachers may struggle to deliver engaging lessons that connect environmental concepts to students' real-world experiences.

Teaching Strategies as a Bridge to Student Engagement

Teaching strategies act as the bridge between teacher preparedness and student engagement. The study highlighted that student-centered, inquiry-based, and project-based learning approaches were essential in fostering environmental awareness. Teachers who incorporated interactive methods—such as group discussions, debates, field trips, and sustainability projects—reported higher levels of student participation and interest. These findings align with previous studies that emphasized the importance of making environmental education relevant to students' daily lives. For instance, integrating hands-on activities like community clean-ups, recycling programs, and nature-based excursions helps students see the real-world impact of environmental issues. Moreover, technology-enhanced learning, such as the use of digital simulations and multimedia presentations, was found to increase student curiosity and engagement. By

adopting innovative and experiential teaching strategies, educators can ensure that environmental education is not only informative but also inspiring and action-driven.

Environmental Awareness and Action as the Ultimate Goal

The outcome of this framework is fostering environmental awareness and action among students. The study's findings indicated that when students were engaged through structured and interactive teaching strategies, they were more likely to develop a sense of responsibility toward the environment. Knowledge-based and behavior-driven approaches were found to be the most effective in enhancing student engagement, suggesting that environmental education should go beyond theoretical discussions and encourage real-life application. Schools can facilitate this by integrating sustainability projects into the curriculum, partnering with community organizations for environmental initiatives, and encouraging students to take part in conservation efforts. The goal is to cultivate environmentally responsible behaviors that extend beyond the classroom, ensuring that students develop a lifelong commitment to sustainability.

A Holistic Approach to Environmental Education

In summary, this conceptual framework presents a holistic approach to integrating environmental awareness into science education. Institutional support creates the necessary foundation, teacher development equips educators with essential knowledge and skills, effective teaching strategies enhance student engagement, and ultimately, these efforts lead to increased environmental awareness and action. By systematically addressing these components, schools can ensure that science education not only imparts environmental knowledge but also inspires students to become proactive agents of change in their communities.

4. Findings, Conclusions and Recommendations

4.1. Summary of Findings

The findings showed the statistical results of the treatment of data. For the specific research questions, the findings are as follows:

1. The respondents showed diversity in teaching experience, educational attainment, and gender, with many being early-career teachers who could benefit from targeted training in environmental education. A good number held advanced degrees, suggesting a foundation for sharing best practices in teaching environmental topics. The predominance of female teachers may also contribute to more nurturing and sustainability-oriented classroom approaches.

2. Teachers encountered several challenges in integrating environmental awareness, especially limited administrative support, lack of assessment tools, and low student engagement. Time constraints, outdated materials, and large class sizes also made hands-on activities difficult to implement. Despite this, peer collaboration and real-world applications through professional development helped teachers build confidence and improve strategies.
3. Environmental awareness was commonly integrated through real-life issues and multimedia, with teachers involving students in campaigns and assessing ecological understanding. Strategies such as discussions, interdisciplinary links, and problem-solving enhanced critical thinking and engagement. However, hands-on and project-based learning were less frequent, likely due to logistical and resource-related constraints.
4. Teachers showed a strong commitment to environmental education, especially through positive attitudes, active teaching behaviors, and foundational knowledge. They used technology, community projects, and examples from real life to foster student learning, though resource limitations and lack of support remained concerns. Some gaps in knowledge, such as environmental laws and interdisciplinary strategies, suggest the value of continued professional learning.
5. There were no significant differences in environmental awareness integration based on teaching experience or gender, but teachers with higher educational attainment were more proactive in training and student engagement. Advanced education may boost initiative in integrating environmental topics. Still, resource and institutional barriers were present across all groups, pointing to broader systemic challenges.
6. A strong relationship was found between teachers' integration strategies and influencing factors, with behavior having the most noticeable impact, followed by knowledge and attitude. Teachers who modeled sustainable practices were more successful in fostering environmental awareness. Better knowledge also helped teachers implement effective lessons, while positive attitudes supported but did not directly drive integration.
7. Teacher behavior had the greatest effect on addressing challenges and engaging in professional development, while knowledge most influenced student engagement. This indicates that proactive behavior helps teachers manage obstacles, while strong knowledge enables them to involve students more effectively. Attitude, though important, showed less direct influence, suggesting a focus on practical skill-building in future training.

8. The proposed framework centers on four components—institutional support, teacher development, teaching strategies, and student engagement—to strengthen environmental awareness. Supportive policies and resources empower teachers to apply what they learn, while interactive teaching methods connect lessons to real-life issues. Together, these elements guide students toward understanding and practicing sustainability both in and out of school.

4.2. Conclusions

In the light of the above findings, the following conclusions were drawn:

1. The diverse backgrounds of science teachers in the Division of Laguna call for targeted professional development that supports varying experience levels and teaching approaches to enhance environmental education.
2. Effective integration of environmental awareness in science teaching depends on stronger administrative support, better assessment tools, and improved student engagement strategies.
3. Teachers commonly use real-life applications, multimedia, and interdisciplinary collaboration to integrate environmental topics, though more hands-on and project-based learning could boost student engagement.
4. Teachers show a strong commitment to environmental education, but addressing gaps in legal knowledge and interdisciplinary teaching through ongoing support could enhance their effectiveness.
5. While teaching experience and gender did not affect integration efforts, higher educational attainment significantly influenced professional growth and student engagement in environmental education.
6. Teachers who model environmentally responsible behavior are most effective in promoting awareness, with knowledge and attitude also contributing to successful integration.
7. Teacher behavior and knowledge strongly impact their ability to address challenges and engage students, emphasizing the need for professional development that promotes both.
8. The proposed framework focuses on institutional support, teacher growth, teaching strategies, and student engagement to build a structured and impactful approach to environmental education.

4.3. Recommendations

Based on the foregoing findings and conclusions, the following recommendations are hereby endorsed:

1. For school administrators, establish clear school-wide policies and allocate sufficient resources—including updated instructional materials, sustainability programs, and support for interdisciplinary efforts—to empower teachers in integrating environmental education effectively.
2. Teachers participate in regular training and workshops focused on practical strategies, interdisciplinary teaching, and current sustainability trends to enhance knowledge and instructional skills related to environmental education.
3. For students, engage in hands-on activities such as environmental field trips, school-wide sustainability campaigns, and inquiry-based projects to develop a deeper understanding and long-term commitment to environmental responsibility.
4. For curriculum developers and science coordinators, design and implement standardized assessment tools that accurately measure students' environmental awareness, attitudes, and behavior, allowing for informed adjustments in teaching strategies.
5. For school leaders and external stakeholders, build partnerships with environmental organizations, government agencies, and local communities to provide students with meaningful, real-world learning experiences that strengthen environmental awareness and action.

References:

- Aikens, K., & McKenzie, M. (2021). A comparative analysis of environment and sustainability in policy across subnational education systems. *The Journal of Environmental Education*, 52(2), 69–82. <https://doi.org/10.1080/00958964.2021.1887685>
- Alabdallat, B., Alkhamra, H., & Alkhamra, R. (2021). Special Education and General Education Teacher Perceptions of Collaborative Teaching Responsibilities and Attitudes Towards an Inclusive Environment in Jordan. *Frontiers in Education*, 6. <https://doi.org/10.3389/feduc.2021.739384>
- Basheer, A., Sindiani, A., Gulacar, O., Eilks, I., & Hugerat, M. (2022). Exploring Pre- and In-service Science Teachers' Green Chemistry and Sustainability Awareness and Their Attitudes Towards Environmental Education in ISRAEL. *International Journal of Science and Mathematics Education*, 21(5), 1639–1659. <https://doi.org/10.1007/s10763-022-10318-x>
- Bercasio, R. R. O. (2021). Assessment of Practices in Integrating Environmental Education in the Teacher Education Program. *Randwick International of Education and Linguistics Science Journal*, 2(4), 625–636. <https://doi.org/10.47175/rielsj.v2i4.359>
- Carcelén, A. P., Monzonís, N. C., Martín, A. R., & Méndez, V. G. (2021). Promotion of Environmental Education in the Spanish Compulsory Education Curriculum. A Normative Analysis and Review. *Sustainability*, 13(5), 2469. <https://doi.org/10.3390/su13052469>
- Corpuz, A. M., Andres, T. C. S., & Lagasca, J. M. (2022). INTEGRATION OF ENVIRONMENTAL EDUCATION (EE) IN TEACHER EDUCATION PROGRAMS: TOWARD SUSTAINABLE CURRICULUM GREENING. *Problems of Education in the 21st Century*, 80(1), 119–143. <https://doi.org/10.33225/pec/22.80.119>
- Eneji, C. O., Otu, B. D., Ita, C. I., Onnoghen, U. N., Ojong, A. A., Esuabana, S. B., Petters, J. S., Arop, L. O., Essien, C. K., Omini, E. E., & Monity, M. F. M. (2023). Products Evaluation of Environmental Education Curriculum/Program Implementation in the University of Calabar, Nigeria. *International Journal of Learning Teaching and Educational Research*, 22(4), 377–413. <https://doi.org/10.26803/ijlter.22.4.22>
- Estrada-Araoz, E. G., Ramos, N. a. G., Valverde, Y. P., Herrera, R. Q., & Bazán, J. M. (2023). Examining the Relationship between Environmental Education and Pro-Environmental Behavior in Regular Basic Education Students: A Cross-Sectional Study. *Social Sciences*, 12(5), 307. <https://doi.org/10.3390/socsci12050307>
- Haßler, B., Eso, O., Villavicencio, X., Jengo, E., & McBurnie, C. (2024). *The impact of climate change on education: An evidence synthesis focused on classroom experience in hot climates*. <https://doi.org/10.53832/opedevd.1139>
- Husamah, H., Suwono, H., Nur, H., & Dharmawan, A. (2022). Environmental education research in Indonesian Scopus indexed journal: A systematic literature review. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 8(2), 105–120. <https://doi.org/10.22219/jpbi.v8i2.21041>
- Husamah, H., Suwono, H., Nur, H., Dharmawan, A., & Chang, C. (2023). The existence of environmental education in the COVID-19 pandemic: A systematic literature review. *Eurasia Journal of*

Mathematics Science and Technology Education, 19(11), em2347.
<https://doi.org/10.29333/ejmste/13668>

Husin, A., Maharani, S. D., Nbsp, Y., & Sumarni, S. (2020). Teachers' Perceptions of Environmental Care Education in Elementary Schools. *Creative Education*, 11(9), 1802–1811.
<https://doi.org/10.4236/ce.2020.119132>

Hussain, Ijaz & Saifi, Dr-Imran & Farooqi, Ahsan-Ul-Haq & Khakwani, Sofia & Parveen, Asifa. (2023). Classroom Management Practices and Students' Performance: A Causal Perspective of Secondary Level Students. 10.52223/JSSA22-030301-38.
https://www.researchgate.net/publication/371399159_Classroom_Management_Practices_and_Students'_Performance_A_Causal_Perspective_of_Secondary_Level_Students

Liao, C., Liao, Y., Chen, B., Tseng, Y., & Ho, W. (2022). Elementary Teachers' Environmental Education Cognition and Attitude: A Case Study of the Second Largest City in Taiwan. *Sustainability*, 14(21), 14480. <https://doi.org/10.3390/su142114480>

Llopiz-Guerra, K., Ruiz, D. U., Hernandez, R. M., Mejia, V. L. V., Del Rocío Jara Nunayalle, J., & Sanchez, K. R. (2024). Importance of Environmental Education in the Context of Natural Sustainability. *Natural and Engineering Sciences*, 9(1), 57–71. <https://doi.org/10.28978/nesciences.1473461>

Lutfauziah, A., Al-Muhdhar, M. H. I., Suhadi, N., & Rohman, F. (2024). Does Environmental Education Curriculum Affect Student's Environmental Culture in Islamic Boarding School. *Revista De Gestão Social E Ambiental*, 18(5), e05621. <https://doi.org/10.24857/rgsa.v18n5-079>

Marques, R., & Xavier, C. R. (2020). The Challenges and Difficulties of Teachers in the Insertion and Practice of Environmental Education in the School Curriculum. *International Journal on Social and Education Sciences*, 2(1), 49–56. <https://files.eric.ed.gov/fulltext/EJ1264000.pdf>

Mashaba, E. K., Maile, S., & Manaka, M. J. (2022). Learners' Knowledge of Environmental Education in Selected Primary Schools of the Tshwane North District, Gauteng Province. *International Journal of Environmental Research and Public Health*, 19(23), 15552. <https://doi.org/10.3390/ijerph192315552>

McKenna, E. C. (2020). The Revolution Will Be Organized: Power and Protest in Brazil's New Republic, 1988-2018. *UC Berkeley Electronic Theses and Dissertations*.
<https://escholarship.org/uc/item/6pq3q5jj>

Mongar, K. (2022). Alignment of the Environmental Science Textbooks, Examinations and Curriculum Framework to Achieve the Teaching Objectives. *Journal of Turkish Science Education*, 19(1 (2022)). <https://www.tused.org/index.php/tused/article/view/1682>

Mongar, K. (2023). The impacts of environmental science on Bhutanese students' environmental sustainability competences. *Australian Journal of Environmental Education*, 39(4), 437–451.
<https://doi.org/10.1017/ae.2023.2>

Nguyen, T. A., Le, T. T., Vang, M. D., Phuong, Y. H., Huynh, T. T. A., Nguyen, T. H., & Pham, T. T. (2023). Vietnamese EFL high school teachers' perceptions of difficulties when implementing competency-based English teaching curriculum and their proposed solutions. *Forum for Linguistic Studies*, 5(2), 1863. <https://doi.org/10.59400/fls.v5i2.1863>

- O'Hare, A., Powell, R. B., Stern, M. J., & Bowers, E. P. (2020). Influence of educator's emotional support behaviors on environmental education student outcomes. *Environmental Education Research*, 26(11), 1556–1577. <https://doi.org/10.1080/13504622.2020.1800593>
- Olawumi, K., & Mavuso, M. P. (2023). Integration of Environmental Ethics Education in the Classroom: A of Related Literature. *International Journal of Environmental Sustainability and Social Science*, 4(4), 1249–1252. <https://doi.org/10.38142/ijesss.v4i4.741>
- Paramanathan, T., & Syed-Abdullah, S. I. S. (2022). Integration of Environmental Education into English Writing Lessons in A Malaysian Chinese Independent High School. *International Journal of Academic Research in Progressive Education and Development*, 11(4). <https://doi.org/10.6007/ijarped/v11-i4/14755>
- Santos, C., Rybska, E., Klichowski, M., Jankowiak, B., Jaskulska, S., Domingues, N., Carvalho, D., Rocha, T., Paredes, H., Martins, P., & Rocha, J. (2023). Science education through project-based learning: a case study. *Procedia Computer Science*, 219, 1713–1720. <https://doi.org/10.1016/j.procs.2023.01.465>
- Santos, F. a. D., Da Silva Leite, E., Amorim, R. J. R., & Amorim, D. G. (2020). Environmental Education in Brazil: Socio-Historical Perspectives in Formal Teaching for Sustainability. *Creative Education*, 11(10), 2053–2068. <https://doi.org/10.4236/ce.2020.1110150>
- Seroussi, D., Rothschild, N., Kurzbaum, E., Yaffe, Y., & Hemo, T. (2019). Teachers' Knowledge, Beliefs, and Attitudes about Climate Change. *International Education Studies*, 12(8), 33. <https://doi.org/10.5539/ies.v12n8p33>
- Shabalala, N. P. (2023). Environmental Education as a Catalyst to Teach Students About Their Economy and Politics. *Jurnal Pendidikan Indonesia Gemilang*, 3(2), 306–322. <https://doi.org/10.53889/jpig.v3i2.229>
- Suarlin, S. (2023). Integrating Environmental Education to Form Environmental Care Characters in Schools. *Advances in Community Services Research*, 1(2), 47–56. <https://doi.org/10.60079/acsr.v1i2.335>
- Sun, M., & Sun, W. (2022). A Study to Explore Environmental Education in the Curriculum Development in China. *International Journal for Cross-Disciplinary Subjects in Education*, 13(2), 4685–4691. <https://doi.org/10.20533/ijcdse.2042.6364.2022.0576>
- Tal, T., Levin-Peled, R., & Levy, K. S. (2019). Teacher views on inquiry-based learning: the contribution of diverse experiences in the outdoor environment. *Innovation and Education*, 1(1). <https://doi.org/10.1186/s42862-019-0004-y>
- 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-In Progress), e2236. <https://doi.org/10.21601/ijese/9606>
- Tran, N. H., Truong, T. D., Dinh, H. T., Thi, L., DO, Tran, T. T., & Phan, M. T. (2020). SIGNIFICANCE OF TEACHER PROFESSIONAL DEVELOPMENT IN RESPONSE TO THE CURRENT GENERAL EDUCATION REFORMS IN VIETNAM: PERCEPTIONS OF SCHOOL PRINCIPALS AND TEACHERS. *Problems of Education in the 21st Century*, 78(3), 449–464. <https://doi.org/10.33225/pec/20.78.449>

- Tsami, E., Zachariou, F., Voulgari, I., & Bersimis, S. (2019). Exploring the Attitudes of Secondary Education Students on Environmental Education in Relation to their Perceptions on Environmental Problems: The Case of the Prefecture of Viotia. *Interdisciplinary Journal of Environmental and Science Education*, 16(1). <https://doi.org/10.29333/ijese/6442>
- Vladova, I. (2023). Towards a More Sustainable Future: The Importance of Environmental Education in Developing Attitudes towards Environmental Protection. *SHS Web of Conferences*, 176, 01009. <https://doi.org/10.1051/shsconf/202317601009>
- Yeşilyurt, M., Balakoğlu, M. O., & Erol, M. (2020). The Impact of Environmental Education Activities on Primary School Students' Environmental Awareness and Visual Expressions. *Qualitative Research in Education*, 9(2), 188. <https://doi.org/10.17583/qre.2020.5115>
- Yolcu, H. H. (2023). Using project-based learning in an environmental education course and revealing students' experiences: A case study. *Science Activities*, 60(3), 119–125. <https://doi.org/10.1080/00368121.2023.2205825>
- Zhao, X., Mao, Y., Qian, Y., & Lin, Q. (2022). The Promoting Effect of Mass Media on Participatory Landscape Revitalization—An Analysis from Newspaper Coverages of Participatory Urban Gardening in China. *Land*, 12(1), 66. <https://doi.org/10.3390/land12010066>
- Zwolińska, K., Lorenc, S., & Pomykała, R. (2022). Sustainable Development in Education from Students' Perspective—Implementation of Sustainable Development in Curricula. *Sustainability*, 14(6), 3398. <https://doi.org/10.3390/su14063398>