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Research Article

Hanging Green Space: Assessing the Relationship between Students' Horticultural Involvement and Environmental Awareness

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ABSTRACT

The world is experiencing various environmental issues which pose serious threat to human health and well-being. These problems must be introduced to the classroom to raise environmental awareness among the students. In relation to the strategies in teaching environmental education, schools utilize gardens to provide students with hands-on learning. This study aimed to determine the relationship between Grade 11 STEM students' horticultural involvement and their environmental awareness through Hanging Green Space Project at Pasig National High School during the second semester of the school year 2024-2025. The study employed descriptive correlational research design and gathered data from selected 81 Grade 11 STEM students through survey questionnaires. Descriptive statistics revealed that students strongly agreed on their active involvement in horticulture and demonstrated high levels of environmental awareness after conducting the Hanging Green Space Project. Meanwhile, inferential statistics using Pearson's correlation showed a significant relationship between students' horticultural involvement and environmental awareness, correlation values ranging from 0.221 to 0.371 ($p<0.05$), indicating weak to moderate positive relationship. These results imply that students who are actively engaged in horticultural activities tend to be more aware of the environmental issues. Furthermore, the study recommends incorporating horticultural or gardening activities various discipline to connect the practical activities with theoretical and ethical reflections. In addition, incorporating gardening into a broader curriculum framework is encouraged to sustain development of horticultural involvement and promote awareness of environmental issues among wider groups of learners.

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Introduction

The rapid expansion of population and industrial development contribute to various environmental issues, which pose serious threats to human health and the environment. Air and water pollution and poor waste management serve as the major environmental challenges in the Philippines. As cited by Regmi (2018), Metro Manila is considered as one of the rapidly urbanizing megacities, which led to the emergence of environmental problems such as air and water pollution and poor waste management.

As these problems continue to rise, it is necessary to understand their causes, impacts, and potential solutions. These problems must be introduced to the classroom to raise environmental awareness among the students. In relation to the strategies in teaching environmental awareness to students, schools utilize gardens to provide students with hands-on learning. This also helps the students raise a sense of responsibility which they can utilize in real-life situations. As stated by Aikaterini et al. (2020), the school garden improves not only their cognitive skills but also their social and psychological health and well-being. The children become more creative, learn how to interact better among themselves and with the natural environment, and to cooperate better toward a shared goal.

Similarly, as cited by Amiri et al. (2021) that school gardens not only improve students' health but also add to the attractiveness of the educational spaces and encourage experimental learning. Through exposing students to gardening, they can learn valuable lessons about the interconnectedness of all living things.

Despite the growing recognition of the role of gardening in developing environmental awareness, however, there is still lack of comprehensive analysis on its correlation on horticultural involvement of the students. Moreover, many studies focus on traditional school gardens or large green spaces. Limited studies explore the impact of the hanging garden or hanging green space. Unlike the traditional gardens, hanging green spaces are suitable for small spaces and easily implemented indoors and outdoors. Although they serve aesthetic and environmental functions, their educational value remains unexamined, especially in relation to students' engagement and environmental awareness.

In line with the given premises mentioned above, this study wants to determine the relationship between horticultural involvement and environmental awareness of grade 11 Science, Technology, Engineering and Mathematics (STEM) students in the context of the Hanging Green Space Project during the school year 2024-2025. Specifically, the objectives are to: (1) describe the horticultural involvement of Grade 11 STEM students in terms of horticultural: skills, commitment, and perceived benefits; (2) describe their environmental awareness in terms of: air quality awareness, water conservation, and waste management; and (3) determine the significant relationship between horticultural involvement and environmental awareness.

Methods

This chapter presents the methods and techniques used in the study. It includes research design, sampling procedure, research instrument and data analysis scheme.

Research Design

This study utilized descriptive correlational research design. In the conduct of this study, the gathering of data was done through survey questionnaires. Through this survey, the students' horticultural involvement and environmental awareness after participating in the hanging green space project in terms of sub variables were obtained and measured based on their responses.

Sequentially, the relationship between students' horticultural involvement and environmental awareness through hanging garden space projects were assessed.

Sampling Procedure

The respondents of the study include Grade 11 STEM students at Pasig National High School.

Slovin's Formula was utilized to determine the number of student-respondents. According to Anurgraheni et al. (2023) this formula is used to calculate an appropriate sample size from a population. Based on the given 101 population, the researchers utilized random sampling technique which determines 81 total respondents from calculation using the Slovin's formula with 0.05 margin of error.

Table 1. Respondents of the Study

Respondents	Number of Students	Sample Size
STEM 11 – Diamond	34	27
STEM 11 – Ruby	33	27
STEM 11 – Sapphire	34	27
Total	101	81

Research Instrument

The researchers utilized five-scale survey questionnaires to determine students' horticultural involvement and environmental awareness in the context of hanging green space projects. The survey questionnaire intended for student-respondents is composed of three parts. Part I of the questionnaire is about the demographic profile of respondents. Meanwhile, Part II of the questionnaire deals with the students' horticultural involvement, which is adapted from the study of White (2022) entitled Perceptions of Middle School Students on Gardening. On the other hand, Part III of the questionnaire deals with their environmental awareness, which is adapted from the study of Yilmaz and Erkal (2016) entitled Determining Undergraduate Students' Environmental Awareness and Environmental Sensitivity. These parts of the questionnaire were modified by the researchers to fit the study.

Validity and Reliability of the Instrument

To ensure the validity and reliability of the instrument, a pilot test was conducted with 30 students from the other strand. Based on the result, the questionnaire was refined for clarity and consistency. Moreover, the researchers utilized Cronbach alpha to verify the internal consistency of the instrument. The result of the test is .881 indicating good reliability of the instrument.

Data Analysis

In depth analysis of the collected data, the researcher utilized both descriptive and inferential statistics. The following statistics were used to ensure accuracy and reliability in the analysis and interpretation of data:

Descriptive statistics such as weighted mean and standard deviation were computed to describe the students' horticultural involvement in terms of skills, commitment and perceived benefits. In addition, these were also utilized to describe students' environmental awareness in terms of air quality awareness, water conservation, and waste management.

Meanwhile, inferential statistics such as Pearson's correlation was utilized to determine the relationship between students' horticultural involvement and their environmental awareness. Although the data gathered use Likert-scale responses, composite scores were computed for each variable through summing responses across multiple items leading them to be treated as interval scale. Moreover, to determine the strength of correlation between variables, the researchers utilized the correlation coefficient and strength of relationship as outlined by Ahmad et al. (2019), as presented in table 2.

Table 2. Correlation Coefficient and Strength of Relationship

Correlation Coefficient	Strength Relationship
± 1	Perfect
$\pm 0.7 < r < \pm 1$	Strong
$\pm 0.3 < r < \pm 0.7$	Moderate
$0 < r < \pm 0.3$	Weak
0	Zero

Results and Discussion

This chapter deals with the presentation, analysis and interpretation of the data collected and the results of the statistical treatment employed in the study with the purpose of determining the relationship between grade 11 STEM students' horticultural involvement and their environmental awareness through hanging green space project.

Students' Horticultural Involvement

Horticultural involvement is crucial for students since it provides hands-on learning, fosters love for nature and promotes valuable life skills.

The assessment of students' horticultural involvement in terms of horticultural skills, commitment and perceived benefits are presented in Tables 3 to 5.

Horticultural Skills

Skill is component of students' horticultural involvement which focuses on the practical abilities developed through gardening, contributing to enhance student participation and support academic achievement.

Table 3. Students' Horticultural Involvement in terms of Horticultural Skills

Item Statement	Mean	Verbal Description
1. I feel confident in maintaining a hanging garden.	4.21	SA
2. I enjoy gardening as it helps me develop skills in taking care of plants.	4.44	SA
3. I regularly water the plants in the hanging garden.	4.28	SA
4. I ensure that hanging plants receive adequate sunlight.	4.36	SA
5. I feel confident in selecting suitable plants for hanging garden.	4.17	A
Overall Mean	4.29	SA

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 3 presents the assessment of the students' horticultural involvement in terms of horticultural skills with an overall mean of 4.29 which possesses a verbal description of "Strongly Agree." Analysis of the data showcases the item "I enjoy gardening as it helps me develop skills in taking care of plants" received the highest mean of 4.44 and a verbal description of "Strongly Agree".

This finding implies that the students find satisfaction in gardening activities. This also indicates that they perceived gardening not just as an activity but as a learning experience that enhances their skills toward plant care.

This is cited in the study of Amiri et al. (2021) stated that gardening activities can simultaneously build the skills associated with gardening as well as the ability to work cooperatively with others on real tasks. They also emphasized that gardening helps students' understanding and appreciation of how the natural world works. Additionally, incorporating gardening into the classroom influences positive attitudes towards healthy and productive habits.

Horticultural Commitment

Commitment is a crucial component of students' horticultural involvement as it fosters a sense of responsibility and accomplishment.

Table 4. Students' Horticultural Involvement in terms of Horticultural Commitment

	Item Statement	Mean	Verbal Description
1	I am planning to have a hanging garden in my home.	4.62	SA
2	I want to learn more about the proper maintenance of hanging garden.	4.63	SA
3	I believe it is important to incorporate hanging gardens in urban spaces.	4.64	SA
4	I would encourage others to create and maintain a hanging garden.	4.60	SA
5	I see myself engaging in gardening activities, including hanging gardens, in the future.	4.54	SA
Overall Mean		4.61	SA

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 4 presents the assessment of the students' horticultural involvement in terms of horticultural commitment with an overall mean of 4.61 which possesses a verbal description of "Strongly Agree." The item "I believe it is important to incorporate hanging gardens in urban spaces" gained the highest mean of 4.64 and a verbal description of "Strongly Agree".

This implies that the students recognize not only the environmental benefits of the hanging garden but also its value in improving urban spaces. This reflects the students' strong commitment to gardening as a form of sustainable action.

This is supported by Alaimo et al. (2024), the act of caring for plants led to increased competence and self- efficacy for gardening, resulting in feelings of accomplishment and pride. Thus, making them incorporate into their daily lives.

Horticultural Perceived Benefits

The perceived benefit is a significant component of students' horticultural involvement as it provides learning experiences, connection with nature, improved well-being.

Table 5. Students' Horticultural Involvement in terms of Horticultural Perceived Benefits

	Item Statement	Mean	Verbal Description
1	Hanging gardens contribute to a cleaner and greener environment.	4.72	SA
2	Taking care of hanging garden has made me more environmentally responsible.	4.56	SA
3	The hanging garden enhances the beauty of surrounding.	4.69	SA
4	Engaging in gardening activities helped me develop patience and responsibility.	4.52	SA
5	Hanging gardens provide a more relaxing and refreshing atmosphere.	4.73	SA
Overall Mean		4.64	SA

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 5 presents the assessment of the students' horticultural involvement in terms of horticultural perceived benefits with an overall mean of 4.64 which possesses a verbal description of "Strongly Agree." The grade 11 STEM students rated the item "Hanging gardens provide a more relaxing and refreshing atmosphere" as the statement with the highest mean of 4.73 and a verbal description of "Strongly Agree".

This implies that the students acknowledge the mental and emotional benefits of hanging garden. This also highlighted the different aspects of horticulture, where environmental aesthetics and psychological benefits are perceived significant outcomes of participating in this activity.

This is emphasized in the study of Koay and Dillon (2020) stated community gardening is linked with evident mental health benefits, such as lower levels of depression, anxiety, and stress. Moreover, being involved in gardening has been found to promote higher level of resilience and optimism among individuals.

Students' Environmental Awareness

Environmental awareness is crucial for students, which may help them to understand and address the impact of human activities on the environment.

The assessment of students' environmental awareness in terms of air quality awareness, water conservation and waste management are presented in Tables 6 to 8.

Air Quality Awareness

Air quality awareness is a component of environmental awareness which focuses on understanding and addressing air pollution, its sources and its impact.

Table 6. Students' Environmental Awareness in terms of Air Quality Awareness

	Item Statement	Mean	Verbal Description
1	I avoid aerosol spray and other chemical products to help maintain clean air.	4.38	SA
2	I support the green space activities, such as hanging garden, to improve air quality.	4.73	SA
3	I recognize the role of plants in filtering air pollutants and producing oxygen.	4.59	SA
4	I encourage others to grow plants in their homes to reduce air pollution.	4.33	SA
5	I participate in gardening activities to promote better air quality.	4.42	SA
Overall Mean		4.49	SA

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 6 presents the assessment of the students' environmental awareness in terms of air quality awareness with an overall mean of 4.49 which possesses a verbal description of "Strongly Agree". It can be assessed from the data that the item "I support the green space activities, such as hanging garden, to improve air quality" acquired the highest mean of 4.73 and verbal description of "Strongly Agree".

This implies that the students acknowledge the importance of hanging gardens in improving the air quality of the area, and participating in the activities related to horticulture contribute to environmental well-being.

This is supported by Khanpoor-Siahdarka and Masnavi (2025), which stated that gardens offer effective solutions to address the air quality in an area. Their ability to absorb and filter air pollutants, convert carbon dioxide into oxygen, and reduce air pollution make them an asset in creating healthier environments.

Water Conservation

Water conservation is a component of environmental awareness which focuses on addressing the nature of water resources and its impact on the environment.

Table 7. Students' Environmental Awareness in terms of Water Conservation

	Item Statement	Mean	Verbal Description
1	I utilize water efficiently when irrigating the hanging garden to promote conservation.	4.38	SA
2	I collect (rainwater) and reuse water to irrigate plants.	4.31	SA
3	I avoid overwatering the hanging garden to prevent wasting water and damaging the plant.	4.42	SA
4	I water the hanging garden during cooler hours of the day to reduce evaporation.	4.38	SA
5	I encourage others to use sustainable watering methods for their plants and gardens.	4.23	SA
Overall Mean		4.34	SA

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 7 presents the assessment of the students' environmental awareness in terms of water conservation with an overall mean of 4.34 which possesses a verbal description of "Strongly Agree". Scrutiny of the data reveals that the item "I avoid overwatering the hanging garden to prevent wasting water and damaging the plant" garnered the highest mean of 4.42 and a verbal description of "Strongly Agree".

This implies that the students practice responsible and sustainable watering habits in their hanging gardens. Moreover, this also indicated the awareness of the students on the importance of water conservation in caring for their gardens.

This is supported by Valenzuela-Morales et al. (2022) stated that implementing environmental education programs such as school gardening helps students to learn about efficient water use and gain a deeper appreciation for nature. Moreover, watering is an essential aspect of horticulture that significantly impacts the plant health and productivity; thus, effective use of water in gardening is considered as the key aspect for plant production (Geilfus et al., 2024).

Waste Management

Waste management is a component of environmental awareness which focuses on the consequences of improper disposal and promoting sustainable practices to mitigate pollution.

Table 8. Students' Environmental Awareness in terms of Waste Management

	Item Statement	Mean	Verbal Description
1	I compost biodegradable waste (e.g., food scraps, dried leaves) to create organic fertilizer.	4.05	A
2	I reduce plastic waste by using eco-friendly pots or recycled materials for gardening.	4.41	SA
3	I use both sides of writing paper and recycled paper to reduce unnecessary tree cutting.	4.06	A
4	I ensure that all gardening waste is properly segregated and disposed of.	4.35	SA
5	I regularly clean and maintain the gardening area to prevent litter build up and promote a clean environment.	4.38	SA
Overall Mean		4.25	SA

Legend: 4.21 – 5.00 [Strongly Agree (SA)]; 3.41 – 4.20 [Agree (A)]; 2.61 – 3.40 [Moderately Agree (MA)]; 1.81 – 2.60 [Disagree (D)]; 1.00 – 1.80 [Strongly Disagree (SD)]

Table 8 presents the assessment of the students' environmental awareness in terms of waste management with an overall mean of 4.25 which possesses a verbal description of "Strongly Agree". It can be noted that the item "I reduce plastic waste by using eco-friendly pots or recycled materials for gardening" obtained the highest mean of 4.41 and a verbal description of "Strongly Agree".

This finding implies that the students practice minimizing plastic waste through adopting sustainable alternatives in their hanging gardens. This demonstrates a proactive approach to reducing non-biodegradable waste and provides insights into the students' awareness of the environmental impact of plastic waste.

This is emphasized by Hofman et al. (2023) the sustainable use of plastics in horticulture require alignment with the 3Rs' waste hierarchy concept of reducing, reusing, and recycling plastics as preferred options over disposal after use. This encourages reducing plastic wastes by repurposing them for plant starting or other garden projects.

The Relationship between the Students' Horticultural Involvement and Their Environmental Awareness through Hanging Green Space Project

Table 9 summarizes the results of the correlation analysis which was performed to determine significant relationship between the students' horticultural involvement and environmental awareness of Grade 11 STEM students after conducting the hanging green space project.

Table 9. Results of the Correlation Analysis Between the Students' Horticultural Involvement and Their Environmental Awareness

Horticultural Involvement	Environmental Awareness		
	Air Quality Awareness	Water Conservation	Waste Management
Skills	0.298*W (0.007)	0.223* W (0.045)	0.311* M (0.005)
Commitment	0.294* W (0.008)	0.296* W (0.007)	0.226* W (0.042)
Perceived Benefits	0.371* M (0.001)	0.229* W (0.040)	0.221* W (0.047)

Legend: * = significant (p≤0.05) Numbers in the upper entry are correlation values (r-values)
Numbers enclosed in parentheses are probability values (p-values)

Strength of Correlation:	
±1	Perfect (P)
±0.7 < r < ±1	Strong (S)
±0.3 < r < ±0.7	Moderate (M)
0 < r < ±0.3	Weak (W)
0	Zero (Z)

The perusal of the table reveals that significant relationship was found between students' horticultural involvement in terms of horticultural skills, commitment and perceived benefits and their environmental awareness in terms of air quality awareness, water conservation and waste management. This significant relationship is manifested by the computed probability values that ranged from 0.001 to 0.047 for these variables which are less than the 0.05 significance level. Further examination of the table correlation coefficient between these variables ranging from 0.221 to 0.371, indicating weak to moderate positive correlation.

These findings disclosed that as the level of students' horticultural involvement increases, the level of their environmental awareness also increases. Moreover, these results imply that students who are actively engaged in horticultural activities, which contribute to the development of their skills, an increased level of commitment and the recognition of benefits of horticulture, tend to be more aware of environmental issues, such as air quality, water conservation and waste management.

In accordance with the present findings, Stevenson III (2024) found out that the students involved in the garden-based learning project showed far deeper awareness of their connection to nature. The findings of the author's study revealed the connection between the engagement of the students and their nature connectedness. Moreover, involving in horticulture exposes students to environmental issues and conservation practices.

Conclusion

The Grade 11 STEM students exhibited a high level of horticultural engagement through Hanging Green Space Project. This involvement was evident in their demonstrated horticultural skills, commitment and perceived benefits. Moreover, the students showed a high level of environmental awareness as a result of their participation in horticultural activity. Specifically, they reported a high level of awareness regarding air quality, water conservation and waste management. Furthermore, a significant relationship was found between horticultural involvement and environmental awareness of Grade 11 STEM students after conducting the hanging green space project.

Recommendations

This study suggested that teachers may incorporate gardening across various curriculum disciplines, such as Science and Values Education. This may help the students to connect the gardening activity with theoretical understanding and ethical reflection. Teachers may also incorporate environmental reflection exercises such as journals, research works and group discussions to help students express their environmental insights and internalize the lesson. Meanwhile, school administrators may incorporate horticultural activities into a broader curriculum framework to sustain development of horticultural involvement and promote awareness of environmental issues among wider groups of learners. Moreover, future researchers may conduct longitudinal studies to examine the long-term effects of horticultural involvement on students' environmental awareness and attitudes. Conducting comparative studies across different school settings may also help to validate the consistency of the findings.

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