# Promoting Psychological Well-Being and Sensory Abilities with Biophilic Horticulture Training

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Abstract: Biophilic Horticulture integrates nature into urban spaces, encouraging human well-being through plant life. It enhances psychological well-being and fosters sustainable living by connecting people with natural environments. The purpose of this research is to promote individuals' psychological well-being and sensory abilities with biophilic horticulture training. This study establishes an instructional framework for artistic experiential education and horticulture instruction for high school learners. For the gardening educational initiative, the instructional material was chosen according to the goals. Both direct and indirect experiences with nature were recognized during the program's development and implementation processes for experience qualities. Group A consisted of 64 participants chosen from three distinct classes. Group B was chosen from a class that shared similar characteristics with the participants in group A, including previous educational qualifications and residence arrangements. Pre and post-test survey questionnaires were performed and analyzed. A 5-point Likert scale is used to evaluate the survey responses. The findings of this research demonstrated how effectively biophilic horticulture instructional framework promoted learners' multisensory understanding. Every multisensory area in group A had substantial statistical variations. Although a directive dietary instructional framework was not incorporated into the established initiatives, the dietary impact area showed a lower variance than other areas.
Keywords: Biophilic Horticulture Training, Psychological Well-Being, Sensory Abilities, Horticulture Instruction

## 1. INTRODUCTION

The fundamental humanity's desire to be in connection with nature is commonly explained by psychologists using the concept of biophilia (Barbiero & Berto, 2021). The biophilia concept is an extensively recognized crucial idea that maintains that, despite urbanization, individuals have an inherent desire to value life and maintain equilibrium by desiring relationships with nature. The environments and characteristics (Serra-Majem et al., 2020) that are linked to changes or their existence, like

the availability of necessities like food, water, and safe havens, typically attract and hold the liking, consideration, or examination reactions in humans. As an innate human trait, biophilia persists in contemporary people.

### 1.1 Horticulture Activity

A biophilia form of recreation that facilitates contemporary people's easy intimate connection to nature is horticulture. In horticulture, intense cultivation of plants occurs for human consumption. It includes both persons and plants, as both actively and passively engaging in "the garden" (Boffi et al., 2021) advantages humans as well as the cultures and communities that they inhabit. Because they provide a wide range of products and services (including medicine, food, clothes, housing, celebrations, or memorials), plants are essential to human survival (Greenfield et al., 2021). Horticulture as a recreational activity includes a variety of outdoor pursuits, including gardening, floral artwork, growing, and watching the natural world. Additionally, it gives visitors the chance to engage with live things, including creatures that live in the gardens. Horticultural activities are known to improve the well-being of people and have long been believed to be advantageous to physical surroundings, based on personal experience.

### 1.2 Enhancing Sensory Abilities through Horticulture

The senses of sight, smell, touch, and hearing are among the most important in determining how people perceive and engage with their surroundings (Petty, 2021). These senses are frequently dulled by urban living because of the continual contact with synthetic stimulation. Reinvigorating sensations (Jaššo et al., 2023) by learning about biophilic horticulture assist with solutions. Wealthier senses include the feel of dirt under the fingers, the sight of different shapes and hues of plants, the smell of sweet flowers, and the sound of songbirds and rustling leaves. Multimodal engagement not only has advantages but also fosters healing and improves a person's bond with nature.

### 1.3 Plant selection

The five senses like touch, taste, smell, sound, and vision are considered while choosing plants (Ryan & Browning, 2020). Five categories were chosen to group the plants utilized in sensory horticulture based on their ability to arouse the senses of taste, smell, touch, sound, and

vision. The smells of fresh grass, earthy tones, and lovely flowers entice the sense of smell. Flowers and herbs with powerful scents are produced by flowers, including mint, sage, and jasmine. Aside from wind sounds, green bottles, and plants hanging at varying heights, sensory horticulture also has a variety of noises produced by vegetation, foliage from plants, leaves from trees, bending stems, and other elements. Touch offers a sensory experience; the sensory garden incorporates a variety of textures, noises, and architectural aspects. Tree branches, bamboo leaves, plants, wind sounds, green containers, and plants with diverse textures and frequencies are all featured at various levels. By growing an assortment of flowers with vivid blooms, attracting reproduction butterflies and bees, as well as utilizing different types of shrubs, trees, and other plants to develop geometric shapes and structures, a garden offers a visual feast for youngsters who are partially blind or visually impaired (Katuk & Köseoğlu, 2022) and (Spence, 2020).

### 1.4 Challenges Faced by Biophilic Horticulture

Obstacles to biophilic horticulture (Dushkova & Ignatieva, 2020) include restricted access to green spaces in cities, a lack of knowledge and expertise, expensive upkeep, and possible opposition to incorporating natural activities into traditional therapeutic and educational contexts. Increased funding for biophilic efforts, legislation reforms, and community support are all necessary to remove these obstacles. The objective of the study is to determine how biophilic horticulture training affects high school students' psychological health and sensory capacities using an educational framework that blends horticultural instruction with creative experiential learning.The structure of the article is listed as follows. Part 2 describes the related work, part 3 illustrates the material and method of biophilic horticulture, part 4 represents the experimental findings, and part 5 represents the conclusion of the article.

## 2. LITERATURE SURVEY

In this section, prior studies have investigated that biophilic horticulture might benefit people of different ages by fostering sensory stimulation and psychological well-being. The beneficial effects of nature on mental health and sustainability in cities were examined in (Guo, 2024). It discussed and highlighted the advantages of naturopathy, being outside, and biophilic design. Although there were practical obstacles, incorporating nature into

city planning enhances well-being and resilience to climate change. Pandita & Choudhary 2024 examined that adding biophilic features inside assisted living facilities might improve senior citizens' quality of life (Pandita & Choudhary, 2024), with a particular emphasis on baby boomers. It emphasized the possibility of biophilic design to enhance their mental and physical well-being by reviewing 39 papers. Through the use of biophilic concepts, Pretorius attempted to bring back nature to the commercial core while improving the quality of life for walkers and everyday commuters (Pretorius, 2021). To enhance mental, physical, and spiritual well-being, techniques include developing urban parks and traditional areas. By measuring tryptophan compounds in urine, Buru et al. attempted to evaluate the effect of nature on depression (Buru et al., 2021). It indicated that therapeutic horticulture was useful for lowering depression, improving well-being, and improving the quality of social life. However, there could be limits in terms of individual reactions and the suitability of the sample size. Hähn et al., found that adding and removing plants from work environments had a favorable influence on workers' reported health (Hähn et al., 2021), well-being, and efficiency. It also found that plants improved workers' focus, innovation, efficiency, and job satisfaction. A small number of samples and a narrow focus on metrics were two limitations. Li et al., measured the psychophysiological and intellectual advantages of adding edible plants (Li et al., 2022), strawberries in particular, to biophilic small-space situations. The outcomes demonstrated favorable benefits on mental and emotional states, including enhanced heart rate variability (HRV), neurological duties, and decreased stress indicators. Barnaby et al., investigated the potential benefits of incorporating biophilic design into workplace environments for workers' overall well-being and the state of the economy (Barnaby et al., 2023). More specifically, issues with reduced healthcare costs, higher productivity, lower absenteeism, and improved retention of workers were tackled (Jo et al., 2022) the impacts of a senior's gardening hobby on their emotional health and connection with the environment, and environmentally friendly behavior of older adults. Results indicated substantial gains in all three domains following the training, indicating the beneficial effects of horticulture on seniors' environmental awareness and general health. To promote sustainable actions that align with Sustainable Development Goals (SDGs) 11, Walimbe & Nandineni intended to investigate the patterns of biophilic design in school facilities that might strengthen kids' connections with nature (Walimbe & Nandineni, 2023). To address childhood obesity, Tseng et al., evaluated how horticulture activities affect kids' eating habits (Tseng

et al., 2023), health, and quality of life. The findings suggested using natural components in school architecture and horticulture activities as they enhanced physical activity, the connection to nature, and general health. Aminpour, determined children's choices for biophilic design in vertical schools (Aminpour, 2023). The results showed that adding natural components, such as rooftop horticulture, steps, and inside décor can enhance the psychological well-being of the students by increasing their interaction with nature while having restricted outside access.

## 3. MATERIALS AND METHODS

### 3.1 Data Collection

In this research, 300 elementary school students who indicated a willingness to participate in horticultural activities had information gathered. However, after giving it some consideration, 172 participants of information were eliminated in the study. The main causes for elimination were insufficient participation, learners not participating in the horticultural activities as planned, and other elements that would undermine the quality and reliability of the information. The 128 individuals were chosen for the final assessment after satisfying the inclusion requirements. Because they actively participated in the horticultural activities, the research was able to precisely evaluate how the biophilic horticulture training affected the participants' psychological well-being and sensory capacities. By concentrating on this particular group of children, the research intended to offer a more precise and trustworthy comprehension that interacting with nature via organized gardening activities might improve several cognitive areas in students in elementary school.

### 3.2 Selection Criteria

The selection criteria are an essential component of the research. It could be classified into two distinct groups. They set forth criteria for both inclusion and exclusion. The selection criteria's classes are described in the following. Primary school learners had to indicate a willingness to take part in horticultural activities and actively participate in the program to qualify for the inclusion criteria for this study. Learners who were not involved as planned had insufficient involvement, or had any other characteristics that would jeopardize the quality and reliability of the information were excluded.

3.3 Questionnaire Design

The surveys were created with the initial as greater than the other to record population characteristics under controlled circumstances and the second as shorter to exclude those same demographic elements. Under treatment conditions, the second questionnaire was utilized. Pedagogy, curriculum creation, and instructional design were among the artistic industries that employed a large number of the people who completed the surveys. Thus, it is believed that the respondents would have gained a decent understanding of the inventiveness they were feeling at the time of replying, even if creativity might not be traditionally assessed by employing a survey as an essential component to achievement. The initial survey was intended to require no more than ten minutes to complete, and the subsequent one, no more than five minutes. Testing with school students was performed to ensure that time and comprehension were satisfied. Demographic information, teacher availability and lengths of vacations, direct or tangible utilization of botanical life, well-being and perceived health, performance indicators, and general satisfaction with school design were all included in the questionnaires. An evaluation was performed to determine the necessary 128 number of participants, which this research had because the data were numerical. Table 1 depicts a list of questionnaires involved in this research.

Table 1: List of Questionnaires

| S. No | Questionnaires |
|---|---|
| 1 | How often do you engage in growing edible crops at home or in a community garden? |
| 2 | How has participating in horticultural activities influenced your dietary habits? |
| 3 | Can you describe any specific environmental practices you have adopted as a result of your horticultural experiences? |
| 4 | Have you noticed any changes in your dietary preferences after participating in gardening programs? |
| 5 | What challenges have you faced in creating an optimal growth environment for your plants? |
| 6 | What benefits have you observed from using plant division methods in your gardening? |
| 7 | Can you provide examples of how gardening has helped you think more creatively or holistically? |
| 8 | How effective do you find gardening activities in managing stress and improving mental health? |
| 9 | How often do you use gardening as a tool for stress management? |
| 10 | What aspects of gardening do you find most fulfilling in terms of personal growth and cultivating humanity? |

3.4 Splitting of Participants

128 individuals were split into two groups for the research: Group B (64 participants) was the experimental group and got the biophilic horticulture program to evaluate its impacts, while group B served as group A (64 participants) with a lack of intervention.

3.5 Pre-test and post-test experiment

To establish an intimate connection between learners and the natural world, the biophilic horticulture program immerses them in nature-centered activities. It used Bayesian paired t-tests for pre-post data analysis for group B (B1) to examine variations in results P1 and P2 to determine its influence. Pre-student t-tests were also performed to make sure that groups A and B had comparable beginning positions (P1, P3), and post-student t-tests were performed to validate their comparison, after the intercession (P2, P4). For group A (P3, P4), Bayesian paired t-tests were used to estimate any modification that would have occurred in the lack of the biophilic horticulture program. This systematic technique gives an absolute consideration of the program's value to realize both the direct cost and its qualified control when compared to group A.

3.6 Instrumentation

The tools designed for measurement employed in this study were selected depending on several preceding examines about the subject matter of horticulture learning and the objectives of learning, as indicated by Tables 2 and 3. For this research, they were further separated into sub-items, resulting in the development of a total of 35 questions. The following 7-point Likert scale was used for each inquiry's response: Strongly Agree (1 point), Agree (2 points), Somewhat Agree (3 points), Neutral (4 points), Somewhat Disagree (5 points), Disagree (6 points), and Strongly Disagree (7 points) are the possible responses. The biophilic value of the horticultural domains cognitive, sensory, therapeutic, emotion, nutrition, and psychomotor rises with a decrease in the total question score.

Table 2(a): Horticultural Development Domains

| **Domain** | **Division** | **Contents** |
|---|---|---|
| Nutritional | Recognizing the nutritional benefits | Growing eatable crops and encouraging a balanced diet |
| Psychomotor | Diet and health development | Cleansing of the environment |
| Sensory | Sensory experiences | Associated with horticulture and plants |

Table 2(b): Horticultural Development Domains

| Domain | Division | Contents |
|---|---|---|
| Cognitive | Function development and Intelligent ability | Plant cultivation abilities and literacy in horticulture |
| Therapeutic | Therapeutic advantages | Stress management, horticultural treatment, and mental health |
| Emotional | Development of attitudes, beliefs, and values | Humanity, emotion, and tension |

Table 3(a): Multifaceted Horticultural Domain Analysis

| Domain | Category | Contents | Cronbach's $\alpha$ |
|---|---|---|---|
| Nutritional | Growing eatable crops | Understanding of nutritional value | 0.730 |
| | Encouraging a balanced diet | Cultivating edible crops | |
| | | Promoting healthy eating habits | |
| Psycho-Motor Domain | Environmental effect | Evaporation and vegetation | 0.734 |
| | | Flower and woodland rainfall | |
| | | Plants and purification of air | |
| | Dietary effect | A passion for agricultural products | 0.718 |
| | | Modification of dietary habits | |
| | | Knowledge of the nutrients of agricultural produce | |
| Sensory | Associated with horticulture and plants | Sensory experiences related to plants and gardening | 0.740 |
| Cognitive | Growth environment | Knowledge of irrigation for plants | 0.709 |
| | | Knowledge of light's intensity | |
| | | Recognizing the need for water | |
| | Plant division | Knowledge of outside plants | 0.691 |
| | | Knowledge about indoor plants | |
| | Increment of integrative thinking | A dedication to refining plants | 0.764 |
| | | A desire to improve botanical art | |
| | | Interest in plant science refinement | |
| | | Interest in people-plant relationship | |
| Therapeutic | Horticultural treatment | Therapeutic benefits | 0.750 |
| | | Horticultural therapy | |
| | Stress management | Stress reduction | 0.706 |
| | Mental health | Mental well-being | 0.730 |

Table 3(b): Multifaceted Horticultural Domain Analysis

| Domain | Category | Contents | Cronbach's $\alpha$ |
|---|---|---|---|
| Emotional | Emotional stability | Knowledge of plants' therapeutic properties | 0.722 |
| | | Improvement concerning growing plants | |
| | Stress | Adoration of life | 0.707 |
| | | The connection between recreation and gardening | |
| | Humanity cultivation | The link between mental stability and plant | 0.710 |
| | | Plants and feelings of duty are correlated | |
| | | The inclination toward plant preservation | |
| | | Concern for the welfare of animals | |
| | | Passion for the environment | |
| | | Considering plants | |

3.7 Statistical Analysis

The internal consistency of the survey questions is measured by Cronbach's alpha, which varied from 0.69 to 0.76, showing the resilient reliability of the survey instrument. To provide reliable statistical evaluations and detect significant differences across groups, we employed Tukey's Honestly Significant Difference (HSD) test, Student t-tests, and Bayesian paired t-tests for data analysis. Using this trustworthy tool, questionnaire surveys were distributed both before and after the experiment. After gathering the data from these surveys, the researcher used the statistical software program DataMaster Pro 3.0 to explore the effects of the procedure or therapy on the research variables and to assess the importance of any changes or differences that were identified.

## 4. EXPERIMENTAL FINDINGS

The traits and components of biophilic behavior as well as the components and attributes of biophilic architecture were examined to identify the biophilic aspects that were used as a program framework for this research. The features of this research, environmentally friendly design components for primary schools were also implemented. Biophilic experiencing components were separated into direct and indirect experiences of nature based on the outcomes of the study. The twelve on-

site sessions are specifically crafted to provide participants with immersive and interactive experiences that cultivate more meaningful relationships with nature via a range of captivating activities. Table 4 lists 12 sessions, every single one of which offers a unique experience connected to nature and is divided into four seasons: spring, summer, fall, and winter. Activities that directly incorporate nature in the springtime include writing life notes and creating natural signs, while others tangentially use science, the arts, or the national language. Throughout the summer, one may directly integrate art and science through projects like building a large tree or recycling water. Fall classes consist of learning how to make a plant pot, as well as combining science, and art with nature and medicinal plants. The wintertime crafts, like creating an ecosphere or painting a wicker pot blend, scientific and practical art instruction to provide a variety of year-round opportunities to engage with the environment.

Table 4: Seasonal Nature Engagement Sessions

| S.No | Session | Direct Experience of Nature | Indirect Experience of Nature |
|---|---|---|---|
| 1 | | Building a large tree | Art |
| 2 | Summer | recycling of water | Science |
| 3 | | assembling collages of plants | Science, art, and applied art |
| 4 | | Creating an Ecosphere | Useful science and art education |
| 5 | Winter | constructing a rainbow garden | Instruction in art and practical art |
| 6 | | Decorating a wicker pot | Useful science and art education |
| 7 | | writing life notes | Language, science, and art of the country |
| 8 | Spring | Creating an organic signal | Classroom administration |
| 9 | | Using plants to create a curtain | Education in science and practical art |
| 10 | | Constructing a planter | Education in art and practical art |
| 11 | Fall | Recognizing therapeutic herbs | Education in science and practical art |
| 12 | | Reusing and recycling garden | Ethics, creativity, and the arts |

Before the software was applied, an initial evaluation was given to both groups A and B, and the findings were broken down into sub-items (QV). The research examines different kinds that contain QV1 = growing edible crops, QV2 = encouraging a balanced diet, QV3 = environmental and QV4 = dietary effects, QV5 = horticulture and QV6 = plant growth

environments, QV7 = plant division, QV8 = integrative thinking, QV9 = horticultural treatment, QV10 = stress management, QV11 = mental health, QV12 = emotional stability, and QV13 = humanity cultivation, QV14= all associated with horticulture and plants. In the areas of growing conditions, plant categorization, fostering integrative pondering, psychological wellness, stress, building character, external factors, and nutritional effects, it was discovered that the two groups were identical. This outcome can be explained by the fact that learners with similar ages and generally uniform experiences in educational settings took the preliminary exam at the beginning of the school year, as shown in Table 5 and Figure 1.

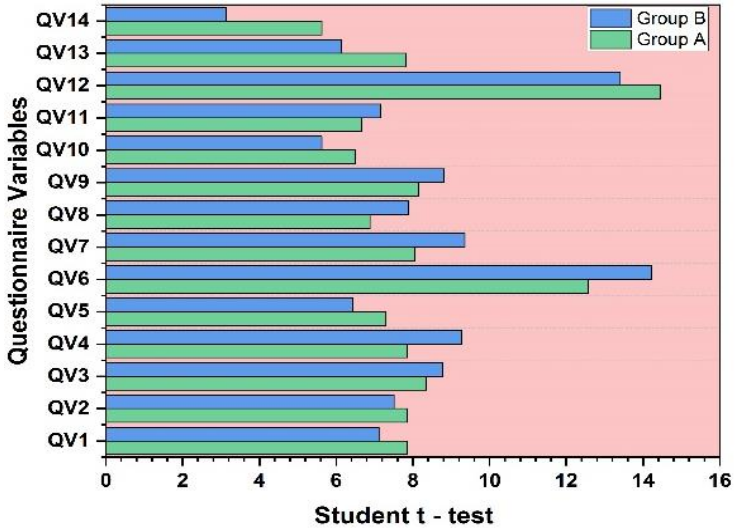


**Figure 1:** Graphical Representation of Student t-test

Table 5(a): Student t-test for Group A and B

| Questionaries Variables | Student T-Tests | M | Se | T | P |
|---|---|---|---|---|---|
| QV1 | Group A | 7.851 | 2.889 | -2.720 | 0.109 |
| | Group B | 7.121 | 2.867 | | |
| QV2 | Group A | 7.851 | 3.093 | -1.426 | 0.753 |
| | Group B | 7.513 | 2.628 | | |
| QV3 | Group A | 8.343 | 3.347 | 1.448 | 0.535 |
| | Group B | 8.770 | 2.904 | | |
| QV4 | Group A | 7.844 | 3.530 | 2.350 | 0.221 |
| | Group B | 9.268 | 3.443 | | |
| QV5 | Group A | 7.309 | 2.945 | 2.350 | 0.221 |
| | Group B | 6.444 | 2.585 | | |
| QV6 | Group A | 12.569 | 5.442 | -2.933 | 0.075 |
| | Group B | 14.222 | 3.974 | | |
| QV7 | Group A | 8.053 | 3.442 | 2.762 | 0.086 |
| | Group B | 9.36 | 4.093 | | |
| QV8 | Group A | 6.883 | 3.893 | 2.861 | 0.098 |
| | Group B | 7.883 | 3.860 | | |

Table 5(b): Student t-test for Group A and B

| Questionaries Variables | Student T-Tests | M | Se | T | P |
|---|---|---|---|---|---|
| QV9 | Group A | 8.148 | 2.512 | 2.635 | 0.087 |
| | Group B | 8.814 | 2.574 | | |
| QV10 | Group A | 6.498 | 3.014 | 3.325 | 0.132 |
| | Group B | 5.628 | 2.365 | | |
| QV11 | Group A | 6.673 | 3.214 | 2.634 | 0.217 |
| | Group B | 7.168 | 1.254 | | |
| QV12 | Group A | 14.462 | 5.448 | 1.345 | 0.075 |
| | Group B | 13.412 | 3.875 | | |
| QV13 | Group A | 7.832 | 4.251 | 0.635 | 0.221 |
| | Group B | 6.148 | 1.254 | | |
| QV14 | Group A | 5.628 | 2.025 | 1.240 | 0.021 |
| | Group B | 3.141 | 2.365 | | |

Questionnaires were conducted on both pre-test and post-test evaluations to examine how the designed program affected participants' levels of horticulture expertise, their familiarity with nature, and their psychological well-being. An analysis of substantial variations between groups A and B was conducted using the Bayesian t-test. Except for integrative cognitive abilities and emotional stability, there was no discernible change between the pre-experiment questionnaire outcomes and the post-experiment questionnaire responses conducted after a decade for group A, which did not take part in the training program represented in Table 6 and Figure 2.

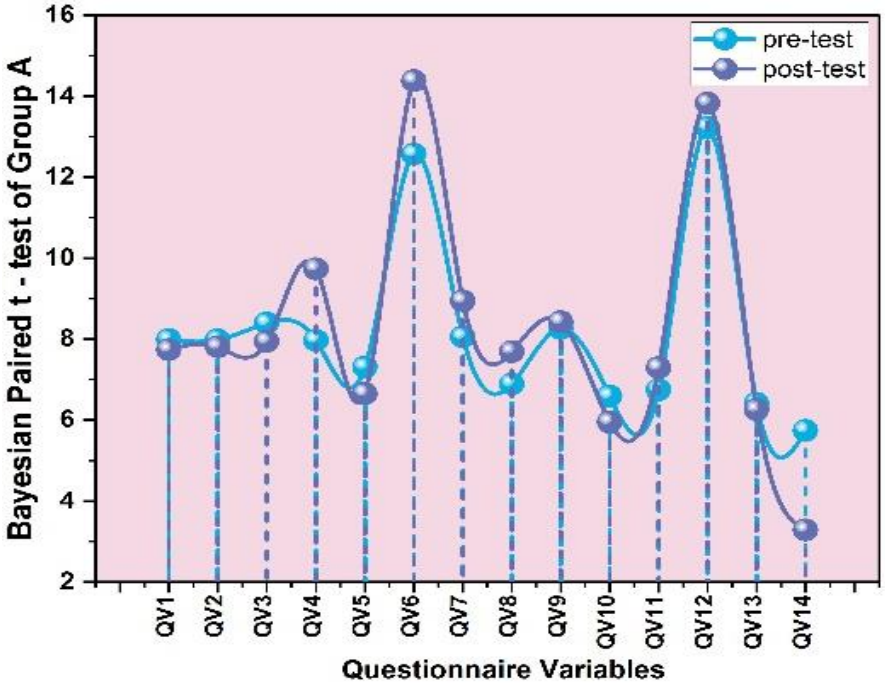


**Figure 2:** Bayesian Paired T-Tests for Group A

Table 6: Bayesian paired t-tests for Group A

| Questionaries Variables | Group A | M | SE | t | p |
|---|---|---|---|---|---|
| QV1 | Pre-test | 7.986 | 2.888 | 2.586 | 0.162 |
| | Post-test | 7.736 | 2.549 | | |
| QV2 | Pre-test | 7.986 | 3.082 | 1.254 | 0.405 |
| | Post-test | 7.809 | 2.547 | | |
| QV3 | Pre-test | 8.393 | 3.254 | 3.547 | 0.013* |
| | Post-test | 7.944 | 2.542 | | |
| QV4 | Pre-test | 7.969 | 1.254 | -3.698 | 0.017* |
| | Post-test | 9.736 | 1.365 | | |
| QV5 | Pre-test | 7.309 | 4.325 | 2.654 | 0.115 |
| | Post-test | 6.653 | 3.254 | | |
| QV6 | Pre-test | 12.569 | 4.564 | -3.065 | 0.052 |
| | Post-test | 14.383 | 3.698 | | |
| QV7 | Pre-test | 8.053 | 3.254 | -2.654 | 0.127 |
| | Post-test | 8.944 | 3.214 | | |
| QV8 | Pre-test | 6.893 | 1.265 | -2.753 | 0.264 |
| | Post-test | 7.694 | 2.365 | | |
| QV9 | Pre-test | 8.259 | 2.658 | 2.489 | 0.257 |
| | Post-test | 8.428 | 1.365 | | |
| QV10 | Pre-test | 6.593 | 2.896 | -0.254 | 0.125 |
| | Post-test | 5.948 | 3.218 | | |
| QV11 | Pre-test | 6.749 | 3.159 | 1.659 | 0.236 |
| | Post-test | 7.294 | 3.256 | | |
| QV12 | Pre-test | 13.231 | 4.156 | 1.895 | 0.254* |
| | Post-test | 13.828 | 3.214 | | |
| QV13 | Pre-test | 6.415 | 2.654 | -2.789 | 0.052 |
| | Post-test | 6.259 | 1.325 | | |
| QV14 | Pre-test | 5.738 | 3.260 | -1.254 | 0.212* |
| | Post-test | 3.282 | 1.065 | | |

Note: $*= p < 0.05$

To enhance these outcomes, it will thus be required to consider the requirement of the nutritional program represented in Figure 3 and Table 7. The group B findings revealed a significant reduction in their mean score in the 14 regions and it appeared that curriculum-based initiatives were crucial. In addition to basic plant expertise, related to stress topics like personality growth and psychological equilibrium, as well as the impact on environmental issues, collaborative thinking capacity and biological education demonstrated comparatively more impacts than other domains. Results confirmed the program's educational significance and showed that biophilic features were effectively communicated. The outcomes of the environment-related locations can be specifically linked to the program's

consideration of a variety of biophilic experience activities, such as upcycling recyclable materials, tasks applying pictures of the environment, and indirect experiences of nature. Due to the scheme's implementation in schools previously thought of as learning environments, respondents' physiological difficulties associated with learning were lessened, which is why the outcomes of the stress-related regions may be linked to this. The study's composition, which aimed to include biophilic experience aspects into traditional planting-examined horticultural activities, can also be credited to their enhanced coherence. In comparison to other regions, the nutritional effect area's average value showed a comparatively lower variation. The utilization of vegetable plants appeared to be the cause; nevertheless, in contrast to traditional horticulture pursuits, only indirect experiences grounded in biophilic theory were included, excluding direct dietary-related activities. Additionally, it appeared challenging to modify the habits of sixth graders whose eating habits had already been established via the use of the horticulture program.

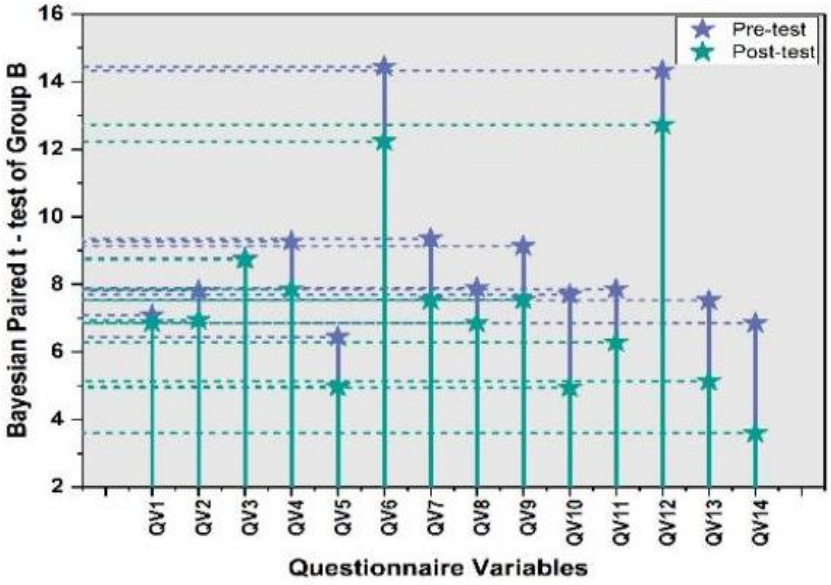


**Figure 3:** Mean Value of Bayesian Paired t-tests for Group B

Table 7(a): Bayesian paired t-tests for Group B

| Questionaries Variables | Group B | M | SE | T | P |
|---|---|---|---|---|---|
| QV1 | Pre-test | 7.084 | 1.548 | 5.475 | 0.000** |
| | Post-test | 6.864 | 2.365 | | |
| QV2 | Pre-test | 7.809 | 1.547 | 6.356 | 0.000* |
| | Post-test | 6.944 | 2.365 | | |
| QV3 | Pre-test | 8.778 | 3.056 | 0.145 | $0.064^{NS}$ |
| | Post-test | 8.736 | 2.365 | | |
| QV4 | Pre-test | 9.278 | 1.265 | 4.256 | 0.002** |
| | Post-test | 7.86 | 23.6 | | |

Table 7(b): Bayesian paired t-tests for Group B

| Questionaries Variables | Group B | M | SE | T | P |
|---|---|---|---|---|---|
| QV5 | Pre-test | 6.444 | 1.256 | 6.325 | 0.000*** |
| | Post-test | 4.968 | 1.254 | | |
| QV6 | Pre-test | 14.444 | 2.365 | 2.365 | 0.001* |
| | Post-test | 12.236 | 1.365 | | |
| QV7 | Pre-test | 9.360 | 1.786 | 1.235 | 0.013 |
| | Post-test | 7.528 | 2.355 | | |
| QV8 | Pre-test | 7.893 | 2.999 | -1.325 | 0.001 |
| | Post-test | 6.860 | 4.365 | | |
| QV9 | Pre-test | 9.134 | 4.256 | -2.789 | 0.012* |
| | Post-test | 7.539 | 2.478 | | |
| QV10 | Pre-test | 7.694 | 4.632 | -1.254 | 0.032 |
| | Post-test | 4.938 | 1.365 | | |
| QV11 | Pre-test | 7.859 | 2.658 | -2.489 | 0.012 |
| | Post-test | 6.283 | 3.145 | | |
| QV12 | Pre-test | 14.334 | 2.478 | -2.987 | 0.013* |
| | Post-test | 12.727 | 3.149 | | |
| QV13 | Pre-test | 7.526 | 3.157 | -2.364 | 0.069 |
| | Post-test | 5.134 | 3.149 | | |
| QV14 | Pre-test | 6.849 | 3.187 | 1.325 | 0.053* |
| | Post-test | 3.598 | 1.856 | | |

Note: $* p < 0.05, ** p < 0.01, and \ *** p < 0.001$ indicate non-significant (NS).

The post-experiment questionnaire responses for groups A and B were compared using Turkey's Honestly Significant Difference (HSD) test. The group B mean rating was decreased by a significant percentage in all areas except integration ability. The domains of psychological wellness and knowledge of the environment, in particular, represent a relatively large variable in the mean, which can be caused by group B's continued access to biophilic spaces in Figure 4 and Table 8. The rationale appeared to be twofold: initially, instructors regularly offered learners biophilic horticultural operations in the classroom as part of an educational curriculum designed after examining the content areas and components in their curricula; and second, the instruction was designed with a biophilic perspective in mind, allowing learners to regularly engage with locations and enhance their ecological awareness in addition to experiencing general horticultural activities like planting. Giving students in primary school programs that consider the features of the classroom-based biophilic program recommended in this research will thus be extremely important,

as displayed in Figure 4 and Table 8.

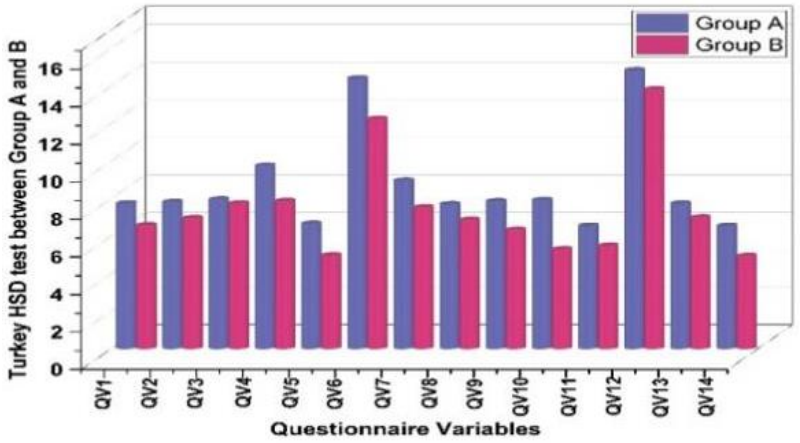


**Figure 4:** Mean value of Turkey's HSD test between Group A and B

Table 8: Turkey's HSD test between Group A and B

| Questionaries Variables | Group | M | SE | T | P |
|---|---|---|---|---|---|
| QV1 | Group A | 7.736 | 2.643 | -2.720 | 0.009** |
| | Group B | 6.569 | 2.548 | | |
| QV2 | Group A | 7.809 | 2.080 | -2.013 | 0.050* |
| | Group B | 6.944 | 2.939 | | |
| QV3 | Group A | 7.944 | 2.898 | 1.448 | $0.154^{NS}$ |
| | Group B | 7.736 | 2.994 | | |
| QV4 | Group A | 9.736 | 2.958 | -2.943 | 0.005** |
| | Group B | 7.860 | 3.627 | | |
| QV5 | Group A | 6.653 | 2.402 | -3.859 | 0.000*** |
| | Group B | 4.969 | 2.643 | | |
| QV6 | Group A | 14.393 | 2.473 | -2.599 | 0.013* |
| | Group B | 12.236 | 4.360 | | |
| QV7 | Group A | 8.944 | 3.403 | -1.918 | 0.061 |
| | Group B | 7.528 | 3.893 | | |
| QV8 | Group A | 7.694 | 2.900 | -1.209 | 0.233 |
| | Group B | 6.860 | 3.969 | | |
| QV9 | Group A | 7.849 | 3.999 | -1.562 | 0.013* |
| | Group B | 6.325 | 2.589 | | |
| QV10 | Group A | 7.909 | 3.452 | -1.254 | 0.050 |
| | Group B | 5.295 | 1.642 | | |
| QV11 | Group A | 6.541 | 2.769 | -1.458 | 0.042 |
| | Group B | 5.482 | 1.987 | | |
| QV12 | Group A | 14.832 | 3.789 | -2.987 | 0.013* |
| | Group B | 13.813 | 2.365 | | |
| QV13 | Group A | 7.732 | 3.256 | -2645 | 0.069 |
| | Group B | 6.985 | 2.154 | | |
| QV14 | Group A | 6.541 | 2.014 | 1458 | 0.053 |
| | Group B | 4.932 | 2.986 | | |

Note: $* p < 0.05, ** p < 0.01, and \ *** p < 0.001$ indicate non-significant (NS).

## 5. DISCUSSION

The article developed a curriculum, which had 12 sessions overall and was implemented in primary school classrooms. Direct and indirect interactions with nature were chosen as biophilic experience components. Direct experiences of nature were made up of straight growing herbs (culture in water, recognizing biotope, creating an environment, etc.), while indirect experiences of nature were primarily made up of artistic creation activities (developing a life note, ensuring plant blinds, creating cushions with leaves that have fallen, making a perfume with plants, etc.). Consequently, compared to ordinary horticultural operations, biophilic horticulture activities appear to provide a wider range of learning impacts by enabling individuals to encounter different biological aspects and natural habitats. After the created software was used in the field, the subsequent outcomes were observed. Initially, the mean rating across all fourteen multisensory regions decreased statistically significantly in group B. Specifically, the scheme was shown to be beneficial in enhancing psychological wellness, horticultural language arts, and acquaintance with nature. In particular, it was demonstrated that the program improved students' psychological well-being, horticultural language skills, and natural awareness. Therefore, offering these activities to primary school learners will often have great significance.

## 6. CONCLUSION

This research made a prediction that exposing primary school learners to ecological settings and engaging in biophilic horticulture activities with plants would effectively improve their multisensorial learning. It was conducted to develop an ecologically friendly horticultural schooling scheme, based on the fundamental idea of diverse biophilic design features and characteristics. This included examining biodiversity types, eco-friendly design components, and biodiversity experience properties and components in primary schools that can be linked to ecological schooling. Furthermore, correlated issues and modules were examined to enhance the program's suitability for on-site implementation. The program's lack of particular food plans or culinary activities and the difficulty in changing the eating habits of sixth graders who had already developed their habits via the application of the horticulture school appeared to be the cause. Initially, as part of an educational strategy created after examining the themes and

divisions in their curriculum, instructors regularly gave their pupils access to biophilic horticulture projects inside the classroom. Additionally, the curriculum was designed with a biophilic perspective in mind, allowing kids to engage in classroom surroundings and ecological awareness in addition to typical horticultural tasks like planting.

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