# Growing Good Habits:
# A Garden-Based Approach to Fourth & Fifth Grade Learning

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## Introduction

In an increasingly globalized environment, American children will inherit a variety of unprecedented, complex environmental problems. One strategy to prepare them to address these large problems is to help learners recognize the challenges and solutions associated with *localized issues.* The links between diet, public health, sustainability and individual choices make food an attractive "localized" issue. Unlike most places in the world, many American children struggle to maintain a healthy lifestyle due to overeating and limited physical activity. Childhood obesity rates have more than tripled over the past 30 years (Ogden 2010). This may suggest that school programs, which are at least partially responsible for nutritional (and physical) education, are grossly insufficient. Furthermore, parents, who also contribute to their child's health, lack basic "health literacy", meaning they are unable/unwilling to obtain, possess and understand basic health information (Kutner et al. 2006). One consequence is that most adolescents do not follow critical dietary guidelines resulting in the under consumption of fruits, vegetables, and whole grains and overconsumption of sodium (CDC 2012). These health concerns, along with health literacy deficiency, may be a product of children's limited relationship with their food. Children today also experience nature-deficit-disorder, a term to describe a lack of outdoor values in children (Louv 2006). As children lose touch with their natural environment, they also distance themselves from their food. Many children in urban centers have never grown a plant or cared for an animal (Hess 2011). This project explores strategies to help children understand their relationship to food and, more generally, the natural environment.

Garden Based Learning (hereafter GBL) can enhance a child's connections with their food even as it provides the opportunity to learn in nature while improving achievement in math and science (Boynton 2006, Blair 2009, Derks 2008, Higgins-D'Alessandro *et al.* 1997, Morris *et al*. 2010), the arts (Blair 2009; Pascoe *et al*. 2013) and overall attitudes towards learning (Blair 2009; Pascoe *et al*. 2013). For example, seven qualitative studies of elementary school gardening projects demonstrate that all garden sites encouraged environmental stewardship, math, and science-education opportunities including activities like overseeing and experimenting with natural and plant processes (Blair 2009). Emerging research also documents the connections between physical activity, good nutrition, physical education, nutrition programs, and academic performance (CDC 2004). Hence, food-related curriculum may also bridge the gaps between academic performance and health literacy.

Despite widespread reports successes, resource constraints can limit a school's ability to create and support a permanent, physical school garden. Although GBL typically assumes schools have access to an outdoor garden, it is a multi-dimensional tool that can be adapted indoors. For example, some teachers engage students in the planting, observing, and measuring of flora, as well as investigating soils and discussing the concept of weathering as part of their earth science lesson. These are all considered GBL, even though they lack a physical, outdoor garden (Ashbrook 2010). Given these criteria, and many regions' cold climate during school months, it is possible to adapt these lessons indoors (Derks 2008; Scherr *et al*. 2011). Moreover, GBL can incorporate physical resources beyond an outdoor school garden (e.g., in-classroom hydroponics, aquaponics, vermicomposting, seed germination stations, and EarthBoxes; see Rye 2012).

The central roles of observation and experimentation in GBL encourage the child to make connections between science material and everyday life qualitatively different than a lecture-style format. As a result, curriculum materials that encourage inquiry-based knowledge can be critical to implementing an effective GBL program into a school. Proper curriculum materials are crucial resources for elementary teachers across subject areas. Full curriculums and pressure to prepare students for standardized testing seem to decrease the use of improved teaching materials for educators. Two national organizations, the National Resource Council (NRC 1998) and the American Association for the Advancement of Science (AAAS 1993), identified content and performance standards necessary for the United States to develop a scientifically literate society and to gain an international reputation in science (Wilcox 2008). The National Science Education Standards asserts that all students should experience quality science instruction rooted in authentic, inquiry-based (I-B) experiences, however, evidence shows that most teachers are not implementing I-B science outlined in these standards, and instead focus on fulfilling all of the required material (Martin *et al.* 2004). Additionally, inadequate school resources and time inhibit teachers' efforts to implement inquiry-based education. Due to these limitations, the majority of student's lessons involve worksheets and stories rather than experiments and interactive exercises (Craft 1996). Integrating an experiential, food-based curriculum into extracurricular activities may allow more leeway while also providing inquiry-based experiences.

Extracurricular activities (ECA) within an afterschool program serves as an alternative-learning domain that offers free-choice experiences that are open-ended, self-directed, hands-on, and evaluation-free. Further, the implementation of an after-school, interdisciplinary GBL program could be another avenue to support basic goals that don't have an obvious curriculum. Additionally, the "promotion of physical activity and healthy eating have long been a fundamental component of the American educational experience"(CDC 2004), so after-school, GBL programs would only enrich these enduring goals. Overall, ECA's have improved student's social, cognitive, and physical development while exposing children to new experiences that may foster interest in skills otherwise absent from a standard school-day (Simoncini *et al.* 2012). An assessment of science-related ECA's also correlates involvement with better student performance, self-confidence in handling science-related tasks, and more enjoyment in learning science (OECD 2012). These observed correlations remain strong despite differences in socio-economic backgrounds of students and schools, suggesting that all children can benefit from science-related ECA's by enhancing science skills.

Here, we develop a series of extra-curricular modules that encourage knowledge development, interactions with, and explorations of, food, gardening, and food sustainability. Our work targeted 4$^{th}$ and 5$^{th}$ graders and we delivered the curriculum to 20 students over a 2-month span in February-March 2013. We use a combination of approaches (student journals, observations, interviews and surveys) to address the following questions: 1) Is student knowledge about gardening, food and the environment measurably affected after a four-week voluntary, experiential after-school gardening program? 2) How have perceptions of one's food changed o'ver the course of the program, and 3) Have the students altered certain actions regarding food choices during and after participating in the program? We also assessed the understanding and perceptions of "food" and "gardens" in the larger student population.

**Methods**

To assess the reported effectiveness and explore variations of experiential, GBL curriculums, we used a mixed methods approach by gathering qualitative and quantitative data. We primarily utilized a longitudinal panel study design by administering an after-school, garden-based, experiential curriculum to fourth and fifth graders at St. Mary's Elementary school in Ballston Spa, NY. We offered our GBL program once a week for five weeks (Table 1; see also Appendix A). Each lesson involved 90 minutes of interacting with the students. We worked with fourth and fifth graders because their current curriculums are the most relevant for our purposes, which include, but are not limited to, the physical, earth, and life sciences.

The adaptability of GBL (Ashbrook 2010) was incorporated into our indoor, winter curriculum by using germinated and non-germinated seed starters. The children measured growth and recorded the overall health of their plant in group, field-journals, which facilitated hands-on learning and an opportunity to track their progress. We then learned about different types of soils, composting, plant anatomy, and the logistics of building a garden at their school. Every lesson concentrated on one topic, and each subsequent lesson consisted of re-capping what we learned the previous week and holding mini-discussions about our favorite fruits/vegetables/food, the global water supply, and definitions of organic produce. To maintain student participation and interest, we provided snacks such as carrots and apples, as well as a less healthy option– popcorn. In addition to feeding the children, this gave us the opportunity to quantify their food choices over time based on the change in mass of food consumed throughout the program. To measure this, we weighed each snack item before and after each lesson. We also brought in less known, local vegetables like sunflower sprouts to expose them to new foods and potentially foster curiosity in the range of available produce items grown within the Northeast.

To obtain a baseline of the children's experience with and knowledge of food-related themes, we administered a 10-question pre-assessment to the treatment group (participants in the after-school program) and to the rest of the fourth and fifth graders, whom served as our control. Two members of our group taught the curriculum, while the third team member recorded notes at each lesson while maintaining limited contact with the treatment group. The treatment group also participated in in-depth interviews, which provided a deeper and open-ended assessment of the GBL program. The third team member conducted the interviews while the other two "teachers" facilitated an activity with the rest of the students. This technique was implemented to minimize bias in interview responses from the treatment group (e.g., minimizing a student's desire to report exaggerated or inaccurate reactions to the program). Two weeks after the program was completed, the treatment and control group took a post-assessment, which was identical to the pre-assessment. The pre- and post-assessments were used to measure any changes in environmental perceptions, knowledge, or behaviors in relation to food that the treatment group may have experienced as a result of the four-week, after-school, experiential GBL program.

To learn more about the current, local, after and in-school programs in place, we also gathered data from regional schools about whether they had a garden or an environmental education program.

To build rapport with St. Mary's elementary school, our team accepted an offer to teach a section of the fifth grade watershed model curriculum. After completion, we discussed the possibility of working with Sue Reiter's fifth grade science class and sent a proposal to Sister Ranah, the elementary school's principal. Once our proposal was accepted, we administered the pre-assessment to all fifth graders before beginning the program and held the first lesson the following week on February 25th. Due to increased interest in the program, we opened up the next three lessons (3/4, 3/18, 3/25) to all fourth graders. The final lesson on 4/8 served as an opportunity to interview all participants in the treatment group while engaging them in a fun, semi-structured activity.

Each module contains a theme, a discussion, a couple activities, snack time, and garden/journal time (Table 1). A full description of each session, including teacher's guides and activity handouts can be found in Appendix A.

**Table 1: Four-Week Curriculum Outline**

| Module | Module #1 (February 25th, 2013) | Module #2 (March 4th, 2013) | Module #3 (March 18th, 2013) | Module #4 (March 25th, 2013) |
|---|---|---|---|---|
| Title | People and Plants | The Dirt on Soil: Soils and Decomposition | Plant parts | Planning a Garden |
| Activity #1 | Brainstorming chart | Discuss origin and composition of soil | Discuss basic plant parts | Map and theoretical garden |
| Activity #2 | Decorate jars and plant seeds | Importance of composting and reducing waste | Write what they think would happen if one part was not working | Snack time- discuss processed foods |
| Activity #3 | Snack time: compost snack items | Examine three types of soil | Snack time- eating edible parts of plants | Create poster to encourage more fruit and veggie consumption |
| Activity #4 | Garden/journal time | Snack time | Outside time: identify and record different plant parts | Garden/journal time |
| | -- | Garden/journal time | -- | -- |

**Sampling**

Our team surveyed fourth and fifth grade participants from St. Mary's elementary school with a pre- and post-program assessment. We distributed the same pre and post-assessment to all other fourth and fifth graders whom served as our control. We collected a total of 35 pre-assessments and 40 post assessments from all fourth and fifth graders, including participants and non-participants. Almost half (19/40 of the fourth and fifth graders participated in our after-school program.) The survey's collected, including participants on non-participants, comprised of 17 girls (60.7%) and 11 (39.3%) boys.

Pre- and post-assessments were distributed during homeroom class for fourth and fifth graders. The pre-assessment was distributed the same day we begun our first lesson on 3/4/13, and the post-assessment was distributed on 4/10/13, exactly two weeks after the programs last lesson.

**Semi-Structured Interviews**

Our team also conducted seventeen semi-structured interviews with the fourth and fifth grade participants in the after-school gardening program to obtain a deeper and more open-ended assessment of their experience.

We conducted one semi-structured interview with Mrs. Sue Reiter, a St. Mary's science teacher and our supervisor for the duration of the program.

21 semi-structure phone interviews were conducted with regional elementary and high schools to learn about any existing gardening or outdoor programs.

**Qualitative Data analysis**

Participant responses were thematically coded for trends. Coded themes were represented as quotes on a table that were divided into six themes (Table 2), with the most representative quotes of each theme placed below. To address validity, we identified and displayed deviant cases to provide a more complete understanding of the program. The open-ended, qualitative pre-post assessment questions were displayed using word clouds to act as an accessible, visually appealing way to present the data.

**Quantitative data analysis**

The pre and post assessment responses were averaged to describe responses for a variety of groups (e.g., 4$^{th}$ vs. 5$^{th}$ graders, participants vs. non-participants, girls vs. boys) For the purpose of presentation and analysis, results from the pre-post assessment were re-valued as follows, 5= superior/correct understanding, 3=unsure, 1=less understanding. To maintain consistency, results from Question #5 and Question #8 were re-configured to represent the new values, as a score of 1 would normally present a superior/correct understanding.

**Results**

We identified and tallied seven themes in the interviews: Intergenerational communication, Peer-to-Peer communication, Decreased consumption of "junk" food/increase consumption of fruits and vegetables, Previous experience with gardens, and connections between the program and science/math class (Table 2).

**Interviews: Reactions and Experiences of Students**

**Table 2: Themes in Treatment Group Interviews**

| Post Interviews n =17 | 2013 Treatment Number of Students |
|---|---|
| No Change in Food Behavior Due to Previous Healthy Eating | 4/17 (24%) |
| Intergenerational Communication | 11/17 (65%) |
| Peer-to-peer Communication | 10/17 (59%) |
| Decreased Consumption of "Junk" Food | 13/17 (76%) |
| Previous Experience with Gardening | 12/17 (71%) |
| Desire to Grow Plant Independently | 10/17 (59%) |
| Connections between Program and Science/Math Class | 10/17 (59%) |

Sixty-four percent (11/17) of fourth and fifth grade participants talked to their parents about our after-school program (Table 2). Sean said: "Yeah…I told them about how we might make a garden here and asked them if they might be able to help." Another student, Michael, said: "…I told them about what we did each day…my friends asked and I told them. They wanted to be in it, but they had to do other stuff, so they asked about what we're going to do and if we were doing it next year and if they want to join. Most of them said they did want to join. They thought it would be fun to plant their own plants, bring them home and actually grown them."

Fifty-eight percent (10/17) reported that they discussed the program with their peers (Table 2). Overall, most students had conversations with parents, friends or both about the activities. It is interesting to note the high level of support received by parents and friends about the activities and the interest they had in either building a school garden or participating in an after-school program similar to the one we designed.

Seventy-six percent (13/17) of students talked about nutritional behavior changes, mostly about the unhealthiness of certain snacks and their decrease in consumption of “junk” food like chips, ice cream, popcorn, etc. (Table 2). Michael said: “Yeah, I’ve eaten more fruit everyday. Fruits and vegetables because I heard how bad the other stuff was like chips and other foods that people eat. So now, I eat mostly fruits and vegetables as a snack when I get home. Many students noted the unhealthiness of snacks and the unhealthy habits of other friends. Another student responded: “Yes because I was always eating junk food and it’s not good for you and it’s not healthy.” Another student, Karen, explains: “When I get home I used to have five bowls of ice-cream…but my mom said, “you are eating too much ice-cream, you should take some advice from the people at Green Club” and now I only have a bowl and have a carrot with it.” Twenty-three percent (4/17) of students did not admit to changing any of their eating habits because their parents already provided healthy snacks and meals (Table 2).

Fifty-nine percent (10/17) of students talked about their desire to grow something on their own now that they have been apart of the after-school program (Table 2). Sandy said: “Yeah. Because growing new things is kind of exciting and the more stuff you plant the more better your health would probably be.” Sarah replied: “Yes, because I used to think that dirt was kind of disgusting and now I think that its kind of fun to plant in the ground.” Another student, Sam, responded: “Yes. Because learning, and from science class, learning that roots keep the soil in place from erosion and all different things and its like better for you to grow that stuff then to go to the store and buy ones where they could have added chemicals.” Interestingly, seventy-one percent of students already had experience growing a plant with their family at their home, meaning our program attracted experienced gardeners (Table 2). The mention of knowledge about soil issues is notable here, and was also a key topic in the fifth grades' science class this semester. Also, Sam's dubious sentiment about ingredients in store-bought foods is interesting because it demonstrates curiosity and interest in different kinds of food items available.

Fifty-nine percent (10/17) of participants saw connection between their science or math class and the after school program (Table 2). Karen said: "Kind of. Cause we are learning about life and death it kind of relates to when you grow a plant and it dies from something like too much water." Alyssa explained: "Yes, science. We talk about rocks and minerals in science and we talk about some of them in green club." Susan discussed the connection between math and the after-school program: "Well it would kind of go with math because we are doing measurements in math and we are measuring things in Green Club. Like how much soil do we need, how tall it is, so they kind of go together." These three responses are all distinct, insightful and display knowledge. These quotes were also chosen because they were our favorite. Students discussed science concepts they had learned in Mrs. Reiter's class and using this knowledge in planting their vegetable in the after school program. One student also noticed that the math skills she learned in class were applicable to the activities in the after school program when they had to record changes in plants and map out a summer/fall garden.

**Interview with Mrs. Sue Reiter**

Sue Reiter, a fifth grade science teacher at St. Mary's elementary school and our supervisor for the duration of the program, provided her own reactions to the success of the program. Overall, Sue felt the program left a positive mark on the school. Our program spurred a larger movement within the school to begin planning an outdoor garden on the campus, with the support of their principle, Sister Ranah. A copy of this interview schedule can be found in Appendix B.

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*How effective do you think our program was?*
“It made us want to start a garden with the basil, cilantro, tomato, and pea plants that you all had brought in. We plan to start gardening next week and I am getting help from Ruby’s mom.”

*Were there any positive responses from parents?*
“Yes, because now their children have a hand in starting gardens at home!”

*Do you think that it is more likely that a garden will be implemented at St. Mary’s?*
“Yes, there is strong support from faculty, including Sister Debby and Sister Ranah, as well as the support of some parents.”

*Do you personally have any recommendations that would enhance the project?*
“I think that (adding) an additional hour would help.”

*Do you think this could be integrated into the curriculum?*
“Yes, it kind of is already. The concepts are in the curriculum, but the extra activities boosted the experience for the children. Other kids grew jealous because of the fun/special responsibilities the Green Club students—responsibilities of Green Club students included watering and tending to their plants.”

**Pre and Post-Program Assessments**

Pre- and post program assessments were gathered from all fourth and fifth graders to determine if any learning had occurred as a result of our five-week program. A score of five represents “strongly agree”, a three represents “unsure” and a one represents “strongly disagree.” Two questions on the assessment revealed sharp differences in perceptions and knowledge of food systems, while all other questions showed about the same level of understanding, with the treatment generally holding slightly stronger agreements with each statement (Figure 1). The first question asks the students if they believe they know all of the ingredients that make up the foods they buy at the grocery store. The treatment group, or participants, held a stronger belief that they knew all the ingredients that make up the foods they buy, while the control was less certain (Figure 1). Question #5 represents another point of notable difference, where the control group held a stronger belief that all food at a grocery store came from within 200 miles of the store. The treatment group still "agreed" that this statement was true, but less strongly. Overall, both treatment and control groups are relatively similar, with the two exceptions noted above.

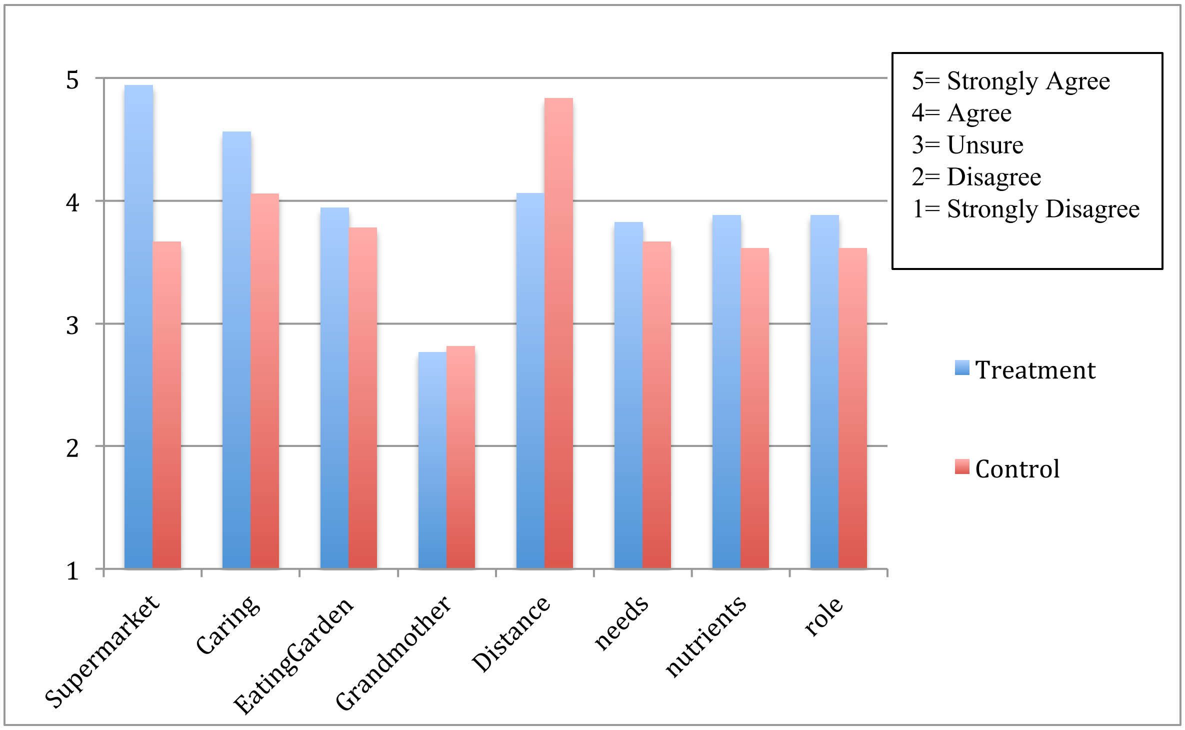


Figure 1: Comparison of responses by participating (n = 22) and non-participating students (n = 25) prior to the onset of Green Club afterschool program. Responses of participants and non-participants are pooled. Questions can be found in Appendix B.

Fourth and fifth grade participants held similar knowledge, perceptions and behaviors towards gardening, nutrition, and the environment, although marked differences can be observed in question #2 (caring for a garden) and question #6 (plants need different levels of water and sun) (Table 2). Fifth graders held a stronger desire to care for their own garden, while fourth graders were less sure (Table 2). Fifth graders only moderately agreed that all plants require different amounts of sun and water, while fourth graders strongly agreed with this statement (Table 2).

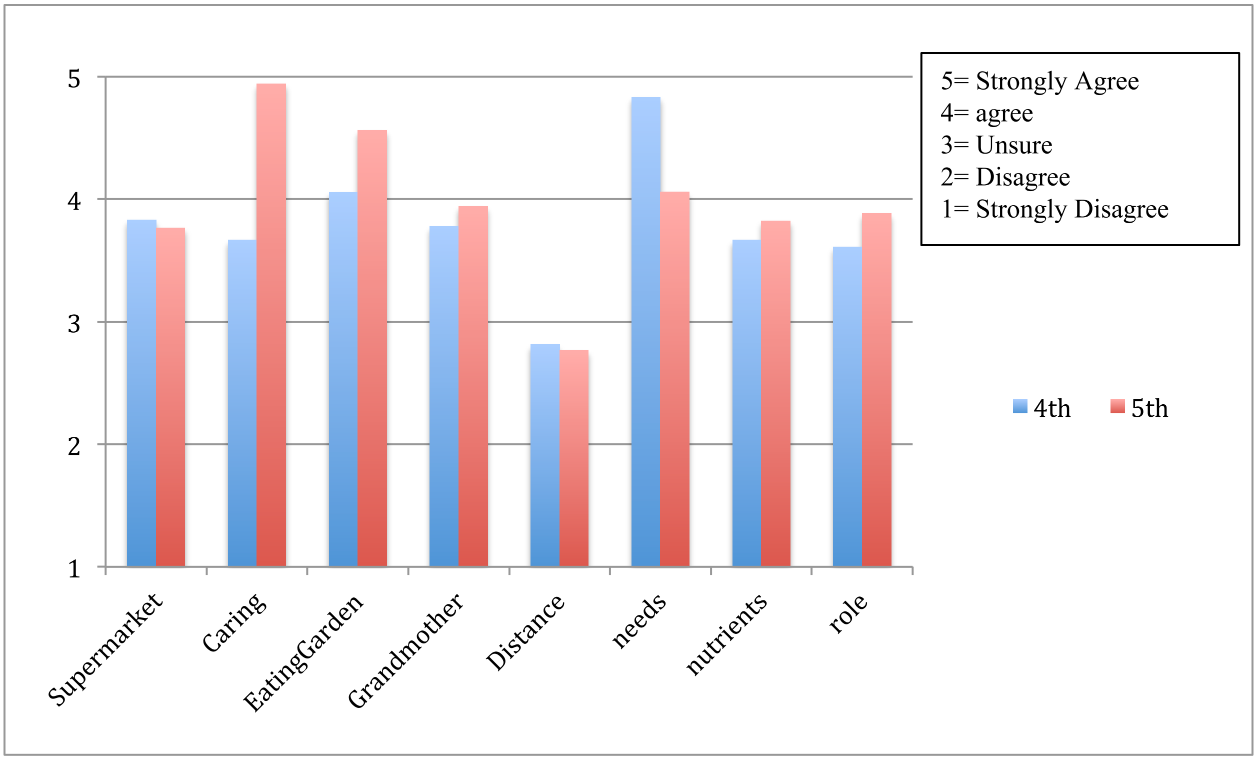

Figure 2: Comparisons of responses of Fourth and Fifth grade Participants (n=22) and non-Participants (n=25) prior to the onset of Green Club afterschool program. Responses of 4th and 5th graders are pooled. Questions can be found in Appendix B.

Two weeks after the conclusion of the five-week program, post-assessments were gathered from the treatment and control groups. Both the treatment and control exhibited more strongly agreeing responses about each question in the post-assessment, with the control holding slightly stronger "agreeing" beliefs than the treatment in questions #1, #3, #4, #6, #7, and #8 (Figure 3). After the program, the treatment group was less certain about the contents of the foods they buy at the market (Supermarket) than the control. Both treatment and control held strong desires to care for gardens. The control held a slightly stronger desire to eat vegetables from their own garden after the completion of the program (+0.4), and the treatment group was less certain whether their grandmother would recognize all of the foods they buy as "real" (Figure 3). The control tended to disagree with the assertion that all food from the supermarket came from less than 200 miles away, while the treatment was unsure. The control consistently held stronger beliefs that each plant in a garden requires different amounts of water and sun, that pasta and bread has fewer nutrients than vegetables, and that post-flowering plants still served a purpose in a garden (Figure 3).

Overall, the treatment group more strongly agreed with every statement after the program, compared to their pre-program assessment results. While most participants believed that they knew all the ingredients that make up the foods they bought before the program, more participants tended to be unsure after the program was completed (Figure 3).

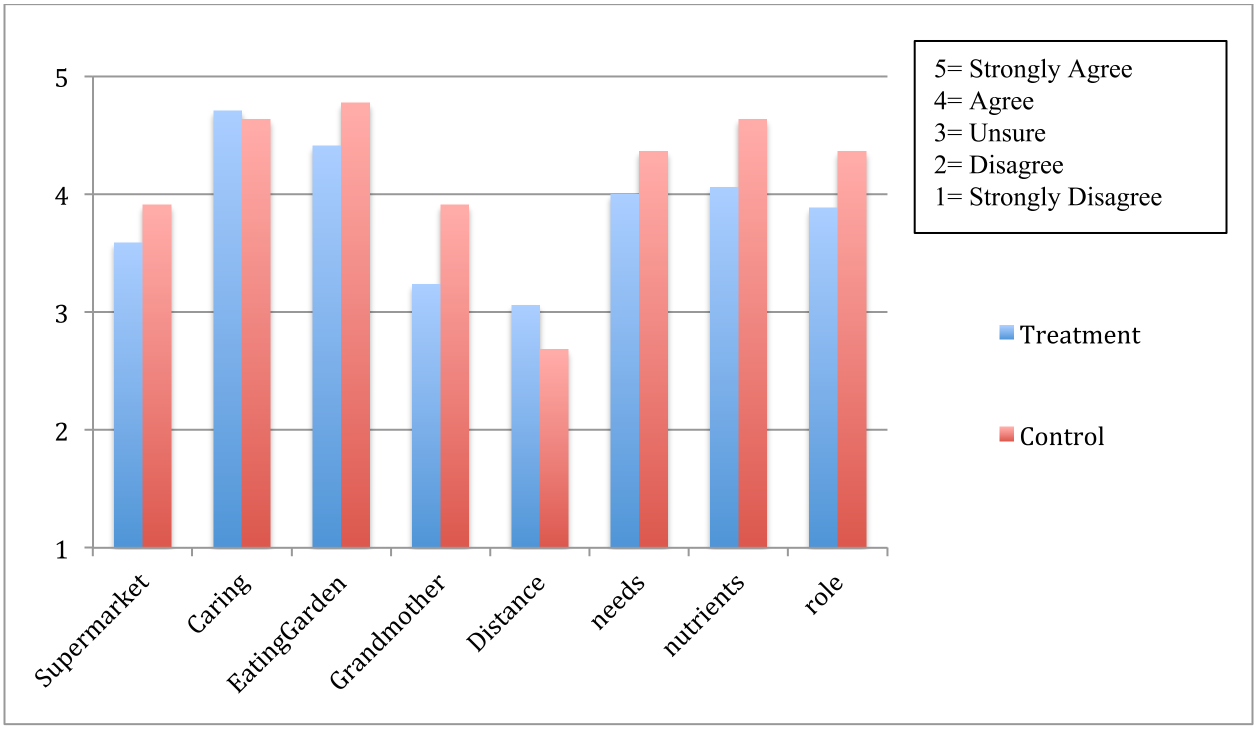


Figure 3: Comparisons of responses of Participants (n=22) and Non-Participants (n=25) after the completion of the program. Questions can be found in Appendix B.

Participants in the treatment group revealed a stronger desire to care for a garden than before the program, and a stronger desire to eat vegetables from their own garden (Figure 4). Participants tended to disagree with the idea that their grandmother would recognize the foods they buy as "real" before, and tended to more strongly agree after the program. Participants before the program held a strong belief that all food at the grocery store came from less than 200 miles away, however post-program they tended to slightly disagree (Figure 4). Changes in scores for Question #6 reveal students increased understanding about needs for plants, recognizing that all vegetables require different amounts of sun and water. Similarly, but less strongly, participants after the program understood that pasta and bread contained less nutrients then vegetables. Finally, more participants agreed that post-flowering plants still served a role in a garden (Figure 4).

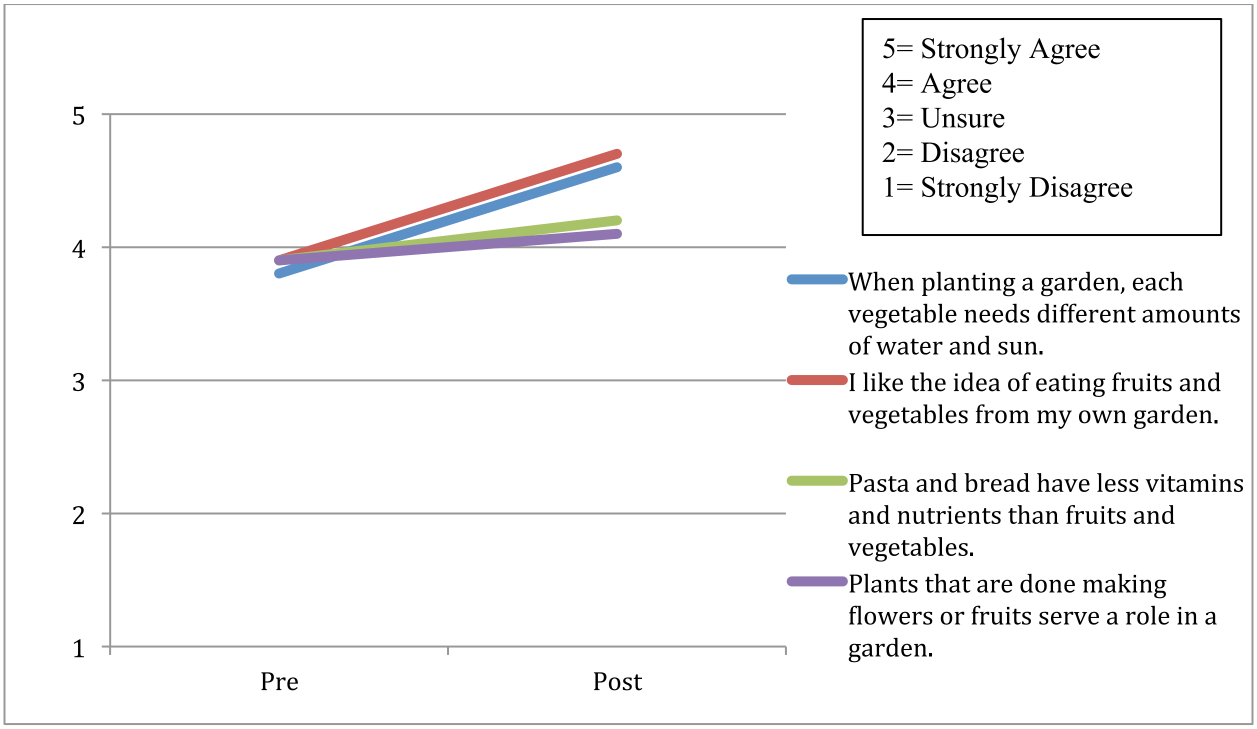


Figure 4: Pre- and post- responses of Participants (n=22) of questions #3, #6, #7, #8. Questions can be found in Appendix B.

Non-participants improved less in some questions, compared to the participants, and more than the participants in other questions. For example, non-participants did not agree as strongly as the participants that each vegetable requires different amounts of water and sun (Figure 5). On the other hand, non-participating student's more strongly agreed that pasta and bread have fewer nutrients than fruits and vegetables compared to the participating students (Figure 5). Before the program, non-participants were less interested in consuming fruits and vegetables from their own garden, but were more interested after the completion of the program (Figure 5). Before the program, non-participating students were less certain that post-flowering plants served a role in a garden compared to participating students, however, in this case, they exhibited more learning than the participating students (Figure 5).

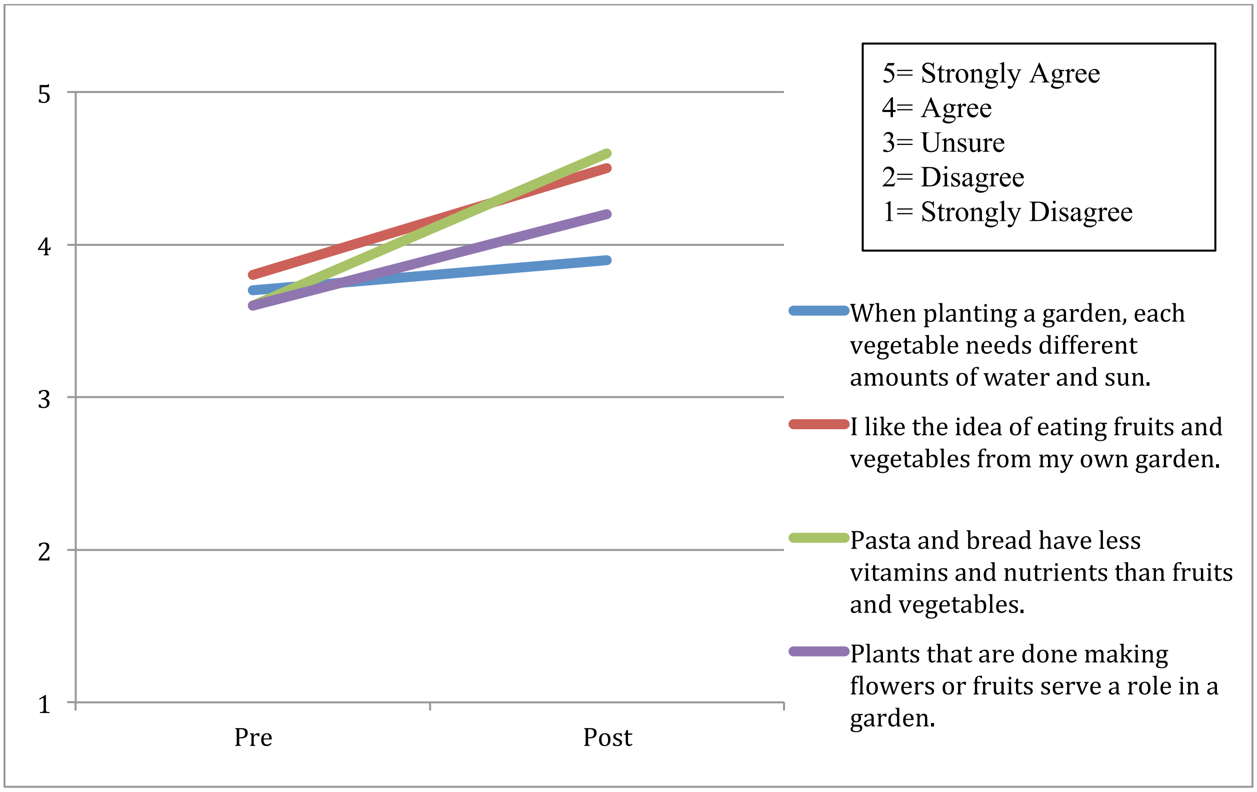


Figure 5: Pre- and post- responses of Non-Participants (n=25) of questions #3, #6, #7, #8. Questions can be found in Appendix B.

The pre-post-assessment also contained open-ended questions to allow participants more freedom in discussing what they knew prior to the program and what they may have learned as a result of it. When asked what words came to mind when they thought of the word "organic", 25% of the treatment group labeled "natural" before the program; 18.75% responded "fresh" and only two students (12.5%) from the treatment group mentioned chemicals (Figure 6). After the program, 44.44% of the treatment group answered with "no man-made chemicals", 5.5% answered "natural" and 5.5% answered "fresh" (Figure 6).

**Table 5: Pre-program Responses to: "Some plant products, including many foods, are labeled as being "organic". What does organic mean to you?"**
**N=16**

| | |
|---|---|
| Natural | 4/16 (25%) |
| Fresh | 3/16 (18.75%) |
| I don't know | 2/16 (12.5%) |
| Less/No chemicals | 2/16 (12.5%) |
| No hormones | 1/16 (6.25%) |
| No factory | 1/16 (6.25%) |
| Grown in a garden | 1/16 (6.25%) |

**Table 6: Post program Responses to: "Some plant products, including many foods, are labeled as being "organic". What does organic mean to you?"**
**N=18**

| | |
|---|---|
| No man-made artificial chemicals | 8/18 (44.44%) |
| Fresh | 2/18 (11.11%) |
| No answer | 2/18 (11.11%) |
| Healthy | 1/18 (5.5%) |
| Fresh | 1/18 (5.5%) |
| Natural | 1/18 (5.5%) |
| Nutrients | 1/18 (5.5%) |
| Difficult to describe | 1/18 (5.5%) |
| No other products added | 1/18 (5.5%) |

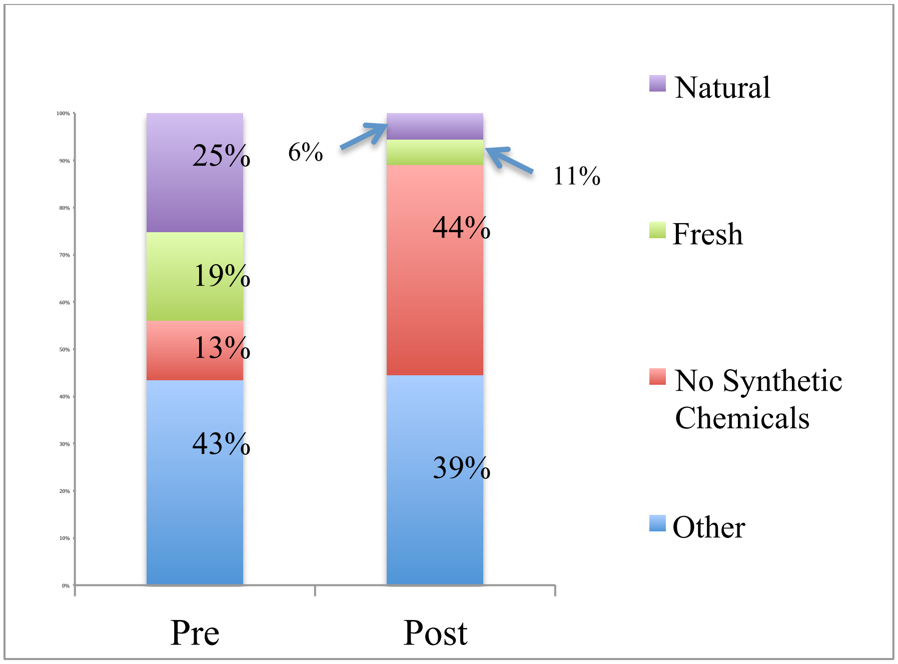

Figure 6: Treatment responses (n=22) to the open-ended question: What does the word "Organic" mean to you?" before and after the completion of the program. Question can be found in Appendix B.

To understand current garden initiatives in the larger Saratoga County, twenty-one schools were surveyed by phone. Fifteen responded to questions and six chose not to participate. Some themes represented in the table below are simply answers to the questions from our interview schedule; others were coded from observed trends (Table 7).

**Table 7: Regional Schools Survey**
**N=15**

| | |
|---|---|
| **Has a Campus Garden** | **10/15 (66.6%)** |
| **Campus Garden for Food Production** | **6/15 (40%)** |
| **Average age of Garden** | **Four years** |
| **Garden in a school program** | **1/10 (10%)** |
| **Availability to all students** | **5/15 (33.3%)** |
| **Managed Through P.T.A** | **5/10 (50%)** |

**Word Cloud Results for Question #10**

The last question on the pre- and post-program assessment asked students to list the first three words they thought of when they read the word “garden”. Before the program, most participants wrote “fruits”, “plants”, “vegetables”, and “organic” (Figure 7). The word cloud format displays the most frequently used words as the largest, and represents less frequently used terms as incrementally smaller text.


Figure 7: Participant responses (n=19) to the open-ended question: “What are the first words that come to your mind when you think of a garden?” before the onset of the program. Question can be found in Appendix B.

After the program, participants’ responses tended to describe gardens in different ways than before. After the program, students used terms like “bees”, “water”, “food”, “sun”, and “green.” (Figure 8) It is notable that after the program, participating students wrote the word “organic” less frequently. After the program, participating students wrote the word “water” more frequently and seemed to shift their terminology from “dirt” to “soil” after the completion of the program. Before the program, participating students discussed words like “fruits”, “vegetables” and “plants”, which are all products of a garden. After the program, however, participating students also emphasized “sun”, “bees” and “butterflies”, which are all components that are crucial for the survival of a garden.


Figure 8: Participant responses (n=19) to the open-ended question: “What are the first words that come to your mind when you think of a garden?” after the completion of the program. Question can be found in Appendix B.

**Discussion**

We designed a GBL program that asked students to think critically about their knowledge, perceptions and behaviors of gardening, nutrition, and the environment. Below, we interpret responses from students, teachers, and surrounding schools with the pre- and post-program assessment, interviews, and the regional school survey. Then, we discuss the dynamics of teaching different age levels, how this influenced our analysis of the results, and the feasibility of offering a program like this in the future.

**1. Is student knowledge about gardens, food and the environment measurably affected after a four-week voluntary, experiential, after-school garden program?**

Student knowledge over the five-week program noticeably improved in some areas, and less in others. Overall, the treatment group began with relatively high levels of knowledge about gardening, hence our ability to improve that knowledge was, in some respects, constrained by a "ceiling effect" within our assessment instrument. For example, when the treatment group was asked post-program whether plants that had finished flowering still served a role in a garden, more students strongly agreed than before (+0.2, Figure 3), however most students already agreed with this statement before the program. Similarly, when asked whether pasta and bread had less vitamins and nutrients than fruits and vegetables, more students in the treatment strongly agreed with this statement (+0.3, Figure 3), though most participating students agreed with this statement.

Improvements of student knowledge is more noticeable in question #6, where more students strongly agreed that each plant in a garden requires different amounts of water and sun (+0.8, Figure 3). Question #1 may also represent significant learning. When asked if they knew all the ingredients that made up the particular food their family buys at the grocery store, more students were unsure after the program (-1.1, Figure 1). We interpret this as learning because it suggests participating students are now more aware of their ignorance than before the program. When asked whether all food in a grocery store came from less than 200 miles away, more students were unsure post-program and slightly disagreed (-1.2, Figure 2). In both these cases, it may be necessary to re-assess the homogeneity in the way these questions are interpreted. For example, student responses that shift from agree to strongly agree may not be the only measure of learning. These shifts from agree to unsure and/or slightly disagree exhibit qualitatively different kinds of learning. Participating student's increased uncertainty of the locality of foods in their grocery store reveal a higher level of reflection that should count as an improvement– even though their shift in thinking does not represent the "best" possible answer.

Other results from questions on the assessment may show increased levels of knowledge (Figure 6). Question #9 allowed students to write freely about their understanding of the word "organic" when labeled on a food item. Though the intention of this question was knowledge-based, it also asked students to discuss their perceptions of this term and the ways it has been defined for them by others (e.g., teachers, parents, advertising, etc) After the program, thirty-two percent more students replied with "no man-made chemicals." This distinct shift may not reveal appreciation for the complexity of defining organic foods, but it does mark a change in their knowledge of the concept. Students that disassociated the term "organic" with "fresh" and "natural" should be interpreted as an improvement. "Fresh" and "natural" are typical, miss-used terms that generally have vague and inaccurate connotations. Furthermore, "no man-made chemicals" more closely adheres to the USDA's definition of organic. It also reflects a level of scientific understanding of the concept, while simultaneously shying away from claims with little factual support.

**2. How have perceptions of one's food changed over the course of the program?**

Changes in perceptions of food were measured with two statements in the pre- and post-program assessment. The first question asked participants to reflect on their interest in eating vegetables from their own garden. After the program, participants more strongly agreed with this statement (+0.7, Figure 3). The second question asked if they liked the idea of caring for their own garden. Before the program, students already had a strong interest in caring for their own garden (avg.=4.6). Because participant's perceptions could not be improved drastically, only modest increases were observed for the second question (+0.3, Figure 3). We expected these results to be higher, but because our program was voluntary, it attracted students who already had a strong interest in gardening. For example, seventy-one percent (12/17) of our students had previous experiences with gardening. In order to reach a wider scope of learners, GBL programs should be implemented in the in-class curriculum. Consequently, students that have less experience and interest in gardening may show more evidence of learning.

Although an analysis of the pre-post assessments did not result in any drastic changes, semi-structured interviews provided an alternative domain for participating students to share their perceptions of gardening. As a result of this open-ended format, some students voiced a notable change in perceptions of gardens. For example, when asked if her interest in gardening had changed since being apart of the program, Sarah answered, "Yes, because I used to think that dirt was kind of disgusting and now I think that it's kind of fun to plant in the ground." The third question asked students to name ten words (nouns, adjectives, or verbs) that came to their minds when they read the word "garden." By compiling these words into an online word cloud generator, we noticed that the treatment students placed a higher emphasis on water, soil, fertilizers, pollinators, and sunlight after the program (Figure 8). We interpreted this change as an increase in knowledge. For example, the pre-program word cloud showed no mention of pollinators, however, after the program, many students' identified the word "garden" with pollinators like butterflies and bees.

Unlike the word cloud generator results, not all shifts in perceptions can be easily qualified as learning. After the completion of the program, the treatment group was less certain about the contents of the foods they buy at the supermarket than the control (Figure 3). As mentioned above, not all recorded changes in answers can be interpreted the same way. For other questions, a shift from agree to strongly agree is interpreted as learning, however, the post results of this question reveal a shift from agree to unsure. This uncertainty demonstrates participating student's altered perception of the foods they buy at the supermarket. In other words, students admit they are not as aware as they thought they were prior to starting the program. Along these lines, participating students also tended to disagree with the idea that their grandmother would recognize the foods they buy as "actual" before, and tended to more strongly agree with this statement after the program (Figure 4). It is unlikely that their families purchasing habits changed within the month we worked with the students, and this shift may instead represent a change in perceptions. Students likely re-evaluated what the term "actual" meant to them, though it is impossible to discern how this definition has changed specifically.

**3. Have the students altered certain actions regarding food choices during and after participating in the program?**

When asked if students are aware of the ingredients that make up the particular foods they buy, the control group more strongly agreed that they knew all the ingredients that made up their food compared to the treatment (Figure 3). This may be explained by treatment students increased awareness of the vast number of ingredients and high levels of processing that goes into the majority of foods at a conventional supermarket. We observed similar results in the question asking students if their grandmothers would recognize most of the food they buy as "actual food." Both the treatment and the control recorded higher responses, but the control group more strongly agreed with this statement than the treatment group. It is unlikely that the control group actually altered any purchasing behaviors during and after the program; it is more likely that control respondents grew wary of answering the same survey and tended to circle "Strongly Agree" across the board more frequently than the pre-program assessment.

From the interviews, seventy-six percent (13/17) of participating students reported decreased consumption of "junk" food. One student answered when asked if they have noticed any changes in their food consumption, “Yeah, I’ve eaten more fruit everyday… because I heard how bad the other stuff was like chips and other foods that people eat.” In terms of changing food behaviors, we believe students may have exaggerated their claims. Triangulating this data is one way we could have combatted this issue. The validity of these responses would be strengthened if we had interviewed their peers and parents and asked them if they have noticed these changes in the student’s behavior. Due to limited time, we did not have the opportunity to triangulate the interview data. Another student answered, “When I get home I used to have five bowls of ice-cream because I was like, “give me more sugar!” but my mom said, “you are eating too much ice-cream, you should take some advice from the people at Green Club” and now I only have a half of a bowl and have a carrot with it.” The humorous nature of this student’s response suggests she did not make any major change in her eating habits and did not take the question seriously. Overall, it was encouraging to observe a high percentage or participants reporting decreased consumption of junk food, but the validity of their responses should be further researched.

**Regional Survey**

The small regional survey we conducted revealed several interesting factors in whether a school has a garden or not, and how it is used at the school. Roughly fifty-percent of the surveyed schools have gardens, however, very few are implemented within the school curriculum (1/10) (Table 7). Due to the brief nature of the survey, it is not clear why the existing gardens are not currently used in any classes. Some gardens are open to all students but are not integrated in the curriculum, and another school has an afterschool garden club that limits the number of children that can participate. It is likely that integrating outdoor, hands-on activities are either (a) not obviously connected to any topic (b) too time consuming for teachers (c) it is only meant to be a fun, relaxing activity or (d) it is mainly operated and maintained through parent support and teachers may have little control and/or interest in the garden. To provide evidence for (d), we found that fifty-percent of these school garden are managed through the Parent Teacher Association (PTA) (Table 7). It is not clear what role teachers play in these gardens, and it would be important to study this further. Throughout our personal experience working with St. Mary's, a teacher's interest and dedication to the idea of GBL, or even his or her desire to create an outdoor garden, is crucial in integrating the concept into the classroom.

**Dynamics of Teaching 4th & 5th graders**

Overall, teaching the same curriculum for both fourth and fifth graders is feasible, but it also has disadvantages. It seems that all students were able to grasp the concepts discussed in each session; no one was particularly struggling with any topics. However, it was apparent that the fifth graders participated more often and offered more in-depth explanations to questions. This is probably due to the overlap in their current curriculum: the week we studied nutrients and soil was the same week the fifth graders were tested on erosion and geology.

Every week, it was challenging to teach both grade levels because the fourth graders were clearly less mature and more hyperactive than the fifth graders. There was a group of fourth grade boys that consistently had so much energy that it was difficult for them to concentrate, minimize side conversations, and engage in the activities thoroughly. Often, the fifth graders seemed bothered by a few fourth graders behavior and reported this to Sue Reiter, Duke and Anna-Beth. To avoid these issues, Duke separated the group of fourth grade boys into different teams to minimize their ability to socialize and mess around with one another. Duke and Anna-Beth used different techniques to gather the attention of the room (like clapping or turning the lights off) and this usually re-focused the group.

**Analysis of Data from 4th vs. 5th Graders**

Pre-program responses from all fourth and fifth graders, regardless of whether they participated in the program or not, reveals similar responses to all questions except #2 and #6 (Figure 2). Because fourth and fifth grade responses were so similar, it does not seem their age difference made an important impact on our results. Because of this, our figures mainly discussed the differences between the treatment and control students. It is possible, however, that our method of assessment was not sensitive enough to discern learning abilities between both age groups and it would be necessary to study this variable more in depth.

**Feasibility of offering program in the future**

Given the immense, positive feedback from students, Sue, parents, and the principle, Sister Ranah, it is feasible that another groups of students could work with St. Mary's. Proposing a similar project to other schools will be more challenging, but there are a few ways students could minimize resistance from schools. First, if a school provides opportunities to volunteer at an event, chaperone a field trip, or help out during after-school programs, interested seniors must take advantage of these relation-building activities. From our experience, we learned that it is difficult for schools to trust outside student teachers without physically seeing them interact with their students. Second, if a student can locate a teacher ally, *and* if the teacher already values this kind of learning, implementing a program like has much higher chance of success. Third, we cannot speak to the difficulties of implementing a program like this to a larger public school, but suspect the barriers are even greater than implementing a GBL program in small, private schools. Overall, it is important to be flexible with the schools needs and understand their learning goals for their students.

Future researchers should also consider the importance of control data in assessing a program similar to ours. We gathered a lot of fifth grade control data, but did not thoroughly analyze these results. In both the pre- and post-program assessment, we received answers from unknown students, which made it impossible to know whether we were comparing the same control students before and after the program. To improve validity of results, it would be important to keep better track of this data and the students.

## Conclusions

### Adaptability

Garden-based learning is an adaptable tool that can fit into many different kinds of schools with different levels of resources and geographical regions. The extra curricular learning domain serves as an alternative path to integrating environmental education into schools without directly battling state learning standards. Still, integrating this kind of experiential learning into the school's curriculum, if properly developed in conjunction with learning standards, has the potential to spark greater positive changes in students learning, health, and relationship with nature. As we have seen with our program, it is not necessary to build an outdoor garden to convey the desired material and allow the students to experience gardening. With some creativity, it is possible to transform a science class into a mini-garden, with potted, edible plants and a few supplies to keep them going. If a teacher or parent is looking to create this kind of environment outside, but cannot obtain the resources of permission for a full-blown vegetable garden, it may be worth starting small, like placing a few potted herbs outside, even if many students in the beginning cannot use it. If student interest is peaked, it may decrease the barriers to expanding an outdoor, garden-based program.

### Foundations

While developing our curriculum, it was challenging to gauge student's level of knowledge and experience with garden-related topics. We knew that the fifth graders were in the midst of studying the watershed model, erosion, run off, and plant cycles, but nothing could have prepared us for their previous experience with gardening. If we had known that nearly 50% of our students already gardened at home, our curriculum could have been more advanced. Additionally, we designed our curriculum for fifth graders because of the commonalities between garden-based learning and the topics they were learning their science class. If we had known we would also be teaching fourth graders, our curriculum could have attempted to integrate topics they were learning as well.

**Access**

At least one study showed that gardens are more effective in promoting positive change for under-served communities (Hess 2010). This may be the case because students in these schools typically have less experience with the natural world and may be unfamiliar with the concepts covered in garden-based curriculums. Targeting schools that could benefit more from these experiences is important, but it does not mean that private schools such as St. Mary's do not also benefit from these types of programs.

**Allies**

Taking advantage of a previously established relationship with St. Mary's and Skidmore students was invaluable. It was also helpful to gain trust from Sue Reiter by teaching a section of her fifth grades' watershed model curriculum. Without Mrs. Reiter's enthusiasm for a program like this, it is likely that we would have been unable to teach our curriculum. Even with all of this support, the process of proposing the idea took many months and at some points it was unclear whether we would move forward with the project at all. With that in mind, starting a program like this as an outside community member requires administrative and teacher allies within the school. When our project was put on hold, we needed Mrs. Reiter to help us connect with the principal and vouch for us that our curriculum design was valuable to their students.

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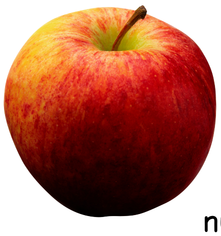
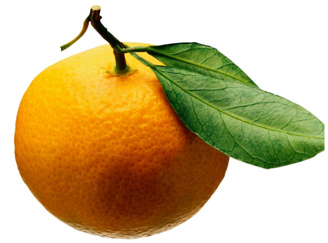
**Overview of Four-Week Curriculum**



## People and Plants
### After-school program for 4th and/or 5th graders



Often, the majority of student's lessons involve worksheets and stories rather than experiments and interactive activities. This afterschool program would provide the class with numerous hands on activities that allow them to develop as young scientists. Our program will focus on the life processes of plants. Specifically about the needs of plants, the life cycles, physical parts, and adaptations that benefit survival.

Lesson 1: People and Plants

This lesson highlights that everything we eat and most things we use come directly or indirectly from plants. Additionally we will touch on plant needs and start our indoor garden.

Lesson 2: The Dirt on Soil

Soil is one of Earth's most important natural resources and we often forget how precious it is. In this lesson we will learn how soil is formed, characteristics of healthy soil, and the importance of composting. Our activities include observing decomposition or different organic matter in sealed bags and examining different types of soil. We will also start our field journals and take notes on our new garden.

Lesson 3: Plant Parts

We will discuss the six basic plant parts--roots, stems, leaves, flowers, fruits and seeds. Our activities include going outside and having students identify a root, stem, leaf, and flower in a race style and having a snack time with only plant parts. During this lesson we also intend to touch upon nutrition and the importance of fresh fruits and vegetables.

Lesson 4: Planning a Garden

We will plan our own outdoor farm considering space, seasonality, sunlight, and symbiotic relationships between different plants. We will then make advertisements for eating fruits and vegetables.

**Breakdown of Curriculum**

Week 1: People and Plants

| |
|---|
| Materials: Soil, seeds, misting bottles, shovels, a container for every child/group, journals, pencils |

- Begin the class with learning names and favorite vegetables,
- Snack Time- discuss composting and put all waste in bin
- Brainstorming chart: What do we need plants for? Food, shelter, materials, medicines, clothing, oxygen.
  Oxygen, medicine, houses, clothes, food, clean water
- Decorate jars and plant seeds: Discuss plant needs and how to properly care for plants
- Garden/Journal Time- give students journals and tell them to make observations on both our mature plants and our newly planted seeds

Teacher's Guide

Plants need **soil**. Water and minerals are taken from the soil through roots. Soil also provides support for the plant and an anchor for the roots to grow in. Decaying plants and animals leave behind minerals in the soil that are essential for future plant growth.

Plants need **sunlight** in order to grow properly. They use light energy to change the materials - carbon dioxide and water into food substances (sugars). This process of food productions is called photosynthesis. Only in light can a green plant make food.

Plants most also have **clean air**. Green plants take in carbon dioxide from air and use it during photosynthesis to make food. Dirty, smoggy air blocks sunlight that plants must have.

Plants need **water**. Water is essential to all life on earth. No known organism can exist without water. Plants use water to carry moisture and nutrients from the roots to he leaves and food from the leaves back down to the roots.

Plants must also have **space** in order to grow. Plants are found everywhere - deserts, mountains, arctic regions, forests, jungles, oceans, and even in cracks of sidewalks of busy cities. If the space is small, the plants will be small and stunted. Big plants need big spaces for their roots and branches.

Use back of seed bag and explain what this particular plant needs to thrive.

Week 2: The Dirt on Soil

> **Materials: 3 different soils in large containers, magnified glasses, crayons, soil worksheets, compost/bin, seeds, 3 jars, rulers, bagged organic waste.**

Snack Time Discussion: What does the term 'organic' mean?

- Break down the word in the most simple terms
- No synthetic chemical
  - Pesticides (pests)
  - Herbicides (weeds)
  - Fungicides (fungus)

- Does this mean organic is always fresher?
  Local?
  Healthier?
  Tastier?
  - Make it clear that organic does not ensure any of these, but that people have different opinions on the issue (some think it is healthier or tastier or fresher etc.)
  - Conclude that it is a complicated issue that is not black and white, but that theoretically organic chemicals break down more rapidly in the environment than synthetic ones, which is the general argument for using organic farming methods.

- Soil Discussion
  - What would the world be like without soil?
  - Where does soil come from?
  - Importance of composting and reducing waste

Teacher's Guide

- **What is Soil?**
  - Soil is a complex mix of materials: minerals, air, water, and organic matter.
  - An average soil sample is 45 percent minerals, 25 percent water, 25 percent air, and five percent organic matter. However, Soil has varying amounts of organic matter (living and dead organisms), minerals, and nutrients.

- **Three Soil Classifications**
  - Sand: large, round particles with relatively large spaces of air between them.
  - Silt: intermediate-sized particles with moderate spaces of air between them.
  - Clay: microscopic, flattened mineral particles with very little space between them.

- **What are the main nutrients in soil?**

- **Primary nutrients** are nitrogen (N), phosphorus (P), and potassium (K). These major nutrients usually are lacking from the soil first because plants use large amounts for their growth and survival.
- **Secondary nutrients** are calcium (Ca), magnesium (Mg), and sulfur (S). There are usually enough of these nutrients in the soil so fertilization is not always needed. Also, large amounts of Calcium and Magnesium are added when lime is applied to acidic soils. Sulfur is usually found in sufficient amounts from the slow decomposition of soil organic matter, an important reason for not throwing out grass clippings
- Soil pH is one of the most important soil properties that affect the availability of nutrients. Macronutrients tend to be less available in soils with a low pH. Micronutrients tend to be less available in soils with high pH.

- **Paper plate activity: How much soil is there in the world?**
  - Look at the paper plate and imagine that this paper plate represents a one-dimensional view of the surface of the Earth. As you read the statements below, use the scissors to cut away the parts of the Earth's surface that have unusable soil.
  - Cut away three-fourths of the paper plate. This represents the fact that 75 percent of the Earth is water.
  - Of the one-fourth remaining, half is composed of deserts, mountains, bogs, cities, and other areas that do not have usable soil. Cut away one-half of the slice that remains.
  - Of the small slice you have left, 75 percent has temperatures and weather conditions that prevent it from being used for cultivation. Cut away three quarters of the remaining plate.
  - Remember that 10% of the world's entire land is available for agricultural production and what we depend on for the world's food supply. This portion of the Earth competes with all other human needs – houses, cities, schools, hospitals, shopping centers, etc.

- **Where does soil come from? (Importance of composting and reducing waste)**
  - During decomposition, both above and below the ground, rock chemically reacts with water and other acidic solutions to produce "rotten" rock that falls apart more easily.
  - Chemicals released during rock decomposition are sources of the nutrients that help plants grow. The list of nutrients includes nitrogen (N), phosphorous (K), potassium (P), and many others. Although wind and water reduce rock into sand, silt, and clay, these particles alone do not produce fertile soil. The particles mix with organic matter - the decayed remains of plants and animals. Decay keeps the soil fertile, able

- **Soil Examination**
  - Look at three types of soil (potting soil, soil from school, and sandy soil) and note the color of the soil (dark brown, reddish brown, tan, etc.), the texture

(soft, hard clumps, a lot of pieces, etc.), how it feels (smooth, gritty, wet, damp, dry, etc.), and how is smells (rotten, musty, like dirt, etc.)

            - Use *Soil Observation Worksheet* below
    - Decide which soil would be best suited for growing a vegetable garden
- Garden/Journal Time

Soil Observation Chart

Part I: Record your observations of each soil sample. Note each sample's: color, smell, and feel. You may also want to draw a picture of the soil particles.
Part II: Determine what type of soil you are examining: sand, silt, or clay, and place an 'X' next to the type

| Sample #________ | | |
|---|---|---|
| Color: | Smell: | Feel: |
| Sand________ | Silt_________ | Clay________ |

Picture:

| Sample #________ | | |
|---|---|---|
| Color: | Smell: | Feel: |
| Sand________ | Silt_________ | Clay________ |

Picture:

| Sample #_______ |
|---|

| Color: | Smell: | Feel: |
|---|---|---|
| Sand________ | Silt_________ | Clay________ |

Picture:

Week 3: Plant Parts

> **Materials: potted plants for each group, magnifying glasses, and notebooks.**

Teacher's Guide

- Discuss the four organs that are found on plants: roots, stems, leaves, and flowers.
  - Roots:
    - Take in water, minerals, and nutrients from the soil
    - Store nutrients for the plant
    - Transport food and water to other parts of the plant
    - Hold the plant in the soil
  - Stems:
    - Support the plant
    - Expose the leaves to sunlight
    - Transport food and water to other parts of the plant
    - Sometimes conduct photosynthesis to produce food
  - Leaves:
    - Conduct photosynthesis (take in carbon dioxide and release oxygen to produce food)
    - Conduct respiration (take in oxygen and release carbon dioxide to produce energy for the plant)
  - Flowers:
    - Sexual reproduction
    - Flowers can be divided into four basic parts: sepals, petals, carpels, and stamen
    - The sepal is the outer green part that is at the base of the flower and protects the flower before budding.
    - The carpel is the female part of the flower. It is made up of the ovary, which holds the eggs, the style, and the stigma, which is at the top of the style and is the part that receives pollen.
    - The petals are the colorful pieces of the flower that attract insects

- The stamen is the male part of the flower that produces pollen

Garden and Journal Time

- Ask students to write a short paragraph about what would happen to the plant if one of its parts were not working correctly. For example, what would happen to the plant if the leaves were removed or the flowers were cut off? Students' answers should reflect that they understand the importance of each plant part.

Snack Time

- Snack Time EXTREME- snack time will include only plant parts and students will have to identify each fruit and vegetable and identify the functions of the parts we eat.
- Go outside and have students identify a root, stem, leaf, and flower in a race style.

Week 4: Planning a Garden

**Materials: duck tape, 40 sheets of paper, spoons, worksheets (crop guides, tasting worksheets, and *if I were a farmer*), yard stick/rulers, blindfolds**

Teacher's Guide

- Using Mel Bartholomew's Square Foot Gardening Technique, we will plan a winter and summer garden. One 4x4 Square Foot Garden Box will supply enough produce to make a salad for one person everyday of the growing season.
- Present PowerPoint: http://www.suwanee.com/pdfs/Square%20Foot%20Gardening%20PP%20031610.pdf
- Divide Class into two teams to plant a fall and summer garden.
  - Using tape, draw out a 4ft x 4ft box. Then make 1x1 boxes.
  - Choose 16 seasonally appropriate crops to plant in your garden. (Each square is planted with one type of vegetable or herb)
  - Use *Table I: Fall Crops and Table II: Summer Crops* as a guide.
- Exotic Taste Test
  - Divide students into groups of three: one taste, one recorder, and one feeder.
  - Use *Test Tester Worksheet* below

**Group Name:**

**Name of Taste Tester:**

## Describe the experience of Sample #1 (Taste, Smell, Texture)

➢ ____________________________________________________________

- ______________________________________________________________

- ______________________________________________________________

**Describe the experience of Sample #2 (Taste, Smell, Texture)**

- ______________________________________________________________

- ______________________________________________________________

- ______________________________________________________________

**Describe the experience of Sample #3 (Taste, Smell, Texture)**

- ______________________________________________________________

- ______________________________________________________________

➢ ____________________________________________________________

| Table 1: Fall Crops | | | | |
|---|---|---|---|---|
| Name | Picture | Spacing and Height | Weeks Till Harvest | Maintenance |
| Broccoli |  | 1 per sq ft<br><br>18in-24in | 16 wks | Full sun<br>Transplant<br>Needs constant moisture<br>Contains vitamins A, B, and C as well as calcium and iron |
| Cabbage |  | 1 per sq ft<br><br>18in-12in | 16 wks | Full Sun<br>Transplant (don't let transplants become too large before planting)<br>Lots of water in the beginning. Once head has formed cut back on the watering.<br>Rich in vitamin C. |
| Carrot |  | 16 per sq ft<br><br>12in | 10 wks | Full sun but can stand partial shade<br>Plant directly in soil.<br>Lots of water in the beginning. Then cut back on the watering.<br>Rich in vitamin A, B1, and calcium |

| | | | | |
|---|---|---|---|---|
| Cauliflowe r |  | 1 per sq ft<br><br>18in-24in | 14 wks | Full sun but will tolerate partial sun.<br>Never let plants dry out<br>Transplant |
| Chard, Swiss |  | 4 per sq ft<br><br>12in-18in | 8 wks | Full sun but can stand partial shade<br>Transplant or plant directly in soil (pre soak seeds)<br>Water weekly or twice weekly in hot weather<br>Rich in vitamin A, C calcium and iron |
| Lettuce |  | 4 per sq. ft<br><br>6in-12in | 7 wks | Full sun to partial shade<br>Transplant when they are half grown or plant directly<br>Water daily preferably early in the day, and do not let the leaves get wet<br>Contains vitamin A and B, calcium, and iron |
| Pea, Sugar Snap |  | 8 per sq. ft<br><br>vine | 10 wks | Full Sun<br>Plant directly<br>Water daily<br>Rich in vitamin A, B1, and C, and iron |

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|---|---|---|---|---|
| Potato |  | 1 per sq ft<br><br>12in -24in | 12 wks | Full Sun<br>Transplant only (cut potatoes into small pieces and let eyes sprout, then plant those)<br>Increase watering after it flowers<br>Protect from frost |
| Radish |  | 16 per square<br><br>6in-12in | 4 wks | Full sun to parital shade<br>Plant directly<br>Never let dry out |
| Mint (grows all year) |  | 1 per square<br>1ft-3ft | | Sun to partial shade<br>Water weekly, don't get leaves wet<br>Transplant only |
| Oregano |  | 1 per square ft<br><br>1-2 ft | 16 wks | Full sun<br>Transplant or plant directly<br>Water weekly (too much watering will cause root rot) |

| | | | | |
|---|---|---|---|---|
| Spinach |  | 1 per sq<br><br>6-12in | 6 wks | Full Sun or partial shade<br>Water once a week |
| Beets |  | 4 per sq ft<br><br>12in | 6 wks | Plant directly<br>Only water for first week and then only during drought conditions |
| Brussels Sprouts |  | 1 per sq ft<br><br>12in-24in | 7 wks | Transplant only<br>Only water during transplanting |
| Kale |  | 1 per square<br><br>12in | 4-20 wks | Full Sun<br><br>Keep Soil Moist<br><br>Kale enjoys companion plants such as beets, celery, herbs, onions and potatoes, but does not enjoy being planted near beans, |

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| | | | | strawberries or tomatoes. |
| Leeks |  | 12 per q ft<br><br>6-12in | 30 wks | Full Sun<br><br>Sow leeks indoors in late winter for fall harvest. Start more leeks in August for spring harvest.<br><br>Grow them in soil that has plenty of compost and nitrogen.<br><br>Don't let leeks lack for water. Soak soil twice a week<br><br>Once leeks start growing, hill them up every 2 weeks to get more of the white par |
| Kohlrabi |  | 3 per sq ft<br>6in-12in | 8-10 wks | Keep plants well watered and free of weeds; put down a mulch to help accomplish both tasks |

## Describe the experience of Sample #4 (Taste, Smell, Texture)

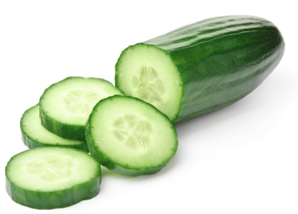
- ______________________________________________________

➢ ____________________________________________________________

➢ _____________________________________________________________

**Which Sample was your favorite?**

Table II: Summer Crops

| Name | Picture | Spacing and Height | Weeks Till Harvest | Maintenance |
|---|---|---|---|---|
| Tomato |  | 1 per square ft<br><br>bush/vine | 17wks | Full Sun<br>Prune Dead Leaves<br>Very compatible with basil plants<br>Keep water off leaves<br>Water twice weekly (more in hotter weather) |
| Corn |  | 4 per sq. ft<br><br>5-6 ft | 9-13 wks | Full Sun, locate where it will not shade other crops<br>Plant directly<br>Water weekly, twice weekly in hot weather |
| Cucumber |  | 2 per sq. ft<br><br>vine | 9wks | Full sun, but will tolerate partial shade<br>Transplant or plant directly (soak seeds)<br>Water weekly, twice weekly in hot weather |

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|---|---|---|---|---|
| Basil |  | 4 per sq. ft<br><br>1-2 ft | 12wks | Full Sun<br>Transplant of plant directly<br>Keep well watered<br>The more leaves you pinch off the faster it will grow |
| Cilantro |  | 1 per sq. ft<br><br>1 ft | 12wks | Full Sun or partial shade<br>Plant directly<br>Keep soil moist (the drier the plant, the more bitter the taste)<br>Shelter plants from wind |
| Chives |  | 16 per sq.ft<br><br>6 in-12 in | 16wks | Full Sun<br>Transplant of plant directly<br>Keep soil moist<br>Protect from wind |
| Bean |  | 9 per sq. ft<br><br>12in-15in | 10wks | Does not transplant well.<br>Plant directly in soil.<br>Presoak seed for 30 min before planting for faster growth.<br><br>Full sun<br><br>Water regularly, do not allow the soil to dry out but keep leaves dry<br><br>Weed weekly |

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|---|---|---|---|---|
| Eggplant |  | 1 per sq. ft<br><br>24in-30in | 19 wks | Full sun and lots of heat<br><br>Transplant and keep transplants warm<br><br>Needs constant moisture |
| Lettuce |  | 4 per sq. ft<br><br>6in | 7 wks | Full sun to partial shade<br>Transplant when they are half grown or plant directly<br>Water daily preferably early in the day, and do not let the leaves get wet<br>Contains vitamin A and B, calcium, and iron |
| Okra |  | 1 per sq. ft<br><br>18in-24in | 12 wks | Full Sun<br>Plant directly (after soaking seeds overnight) or transplant into ground after soil has warmed<br>Keep soil moist (mulch in summer) |
| Onion |  | 16 per sq. ft<br><br>12 in | 20 wks | Sun or shade<br>Transplant of plant directly<br>Water daily until the tops show through the soil (then stop watering) |

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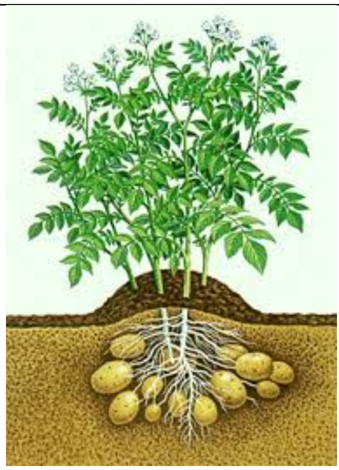
| Parsley |  | 4 per sq. ft<br><br>6in-12in | 14 wks | Full sun to partial shade<br>Plant directly but it is better to transplant<br>Never let parsley dry out |
| Pepper |  | 1 per sq ft<br><br>1 ft | 19 wks | Full Sun<br>Transplant<br>Don't let leaves get wet<br>Rich in vitamin A and C |
| Potato |  | 4 per sq ft<br><br>12in-24in | 12 wks | Full Sun<br>Transplant only (cut potatoes into small pieces and let eyes sprout, then plant those)<br>Increase watering after it flowers<br>Protect from frost |
| Radish |  | 16 per sq ft<br>6in-12in | 4 wks | Full Sun to partial shade<br>Plant directly<br>Never let dry out |

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|---|---|---|---|---|
| Summer squash |  | 1 per 2 sq ft vine | 8 wks | Full sun<br>Plant directly<br>Keep soil moist |
| Oregano |  | 1 per sq ft<br><br>1ft-2ft | 16 wks | Full sun<br>Transplant or plant directly<br>Water weekly (too much water will cause root rot) |

Week 5: Posters and Interviews

- Draw advertisements to put up around school promoting gardens, vegetable and fruit consumption, and anything else interesting that student's learned.
- Conducted interviews while students drew posters.

**Pre-Post Program Assessment**

Name: __________________

Grade: __________________

Please circle one response. 1= strongly disagree, 2= somewhat disagree, 3= I don't know 4= somewhat agree 5= strongly agree

1. When I go to the supermarket with my family, we are aware of the ingredients that make up the particular foods we buy.

1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

2. I like the idea of caring for my own garden.
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

3. I like the idea of eating fruits and vegetables from my own garden.
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

4. If my great grandmother were to inspect most the food we buy at a grocery store or market, she would recognize most of it as "actual food"
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

5. Most of the food at the grocery store was created at a farm or factory no more than 200 miles of the grocery store..
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

6. When planting a garden, each vegetable needs different amounts of water and sun.
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

7. Pasta and bread have less vitamins and nutrients than fruits and vegetables.
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

8. Plants that are done making flowers or fruits serve no role in a garden.
1 (strongly disagree) 2 3 (unsure) 4 5 (strongly agree)

9. Some plant products, including many foods, are labeled as being "organic". What does that word (organic) mean to you?

10. If I say "garden", what are 10 other words (nouns, adjectives, verbs) that come to your mind?

**Treatment Group Interview Schedule**

1. Have any of your food choices changed? Why or why not?
    a. Do you think your friends would try this food?
2. Are you more likely to try and grow something than you were before Why or why not?
    b. Do you think your friends would try this food?
3. Did you talk to your parents, friends or classmates about the activities we did?
4. What connections do you see between this afterschool program and the sorts of things you are learning about in school?
5. What will you remember from this experience?

**Regional Middle School Survey/Questionnaire**

1. Do you have a garden? (If no, skip to question #5)
2. Is its use restricted to certain groups? (Grades, science class, clubs…etc)
3. Does it produce food?
3 a. Is the food consumed by the students or faculty?
4. How old is the garden?
5. Do you have an outdoor program? (If no, skip to question #8)
6. If you have an outdoor program, do all students eventually participate in it? (example: only 5th grade engage in an outdoor program, but eventually all students that reach 5th grade participate)
7. Is it used after-school or is it integrated into the curriculum?
8. If your school has neither, has there ever been interest in developing an outdoor program and/or garden?
9. If yes, was it a parent, teacher, administrator or student?

**Interview Schedule with Sue Reiter**

1. How effective do you think our program was?
2. Were there any positive responses from parents?
3. Do you think that it is more likely that a garden will be implemented at St. Mary's?
4. Do you personally have any recommendations that would enhance the project?
5. Do you think this could be integrated into the curriculum?