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

Introduction

In an increasingly globalized environment,

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assessment of science-related ECA’s also correlates involvement with better student performance, self

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

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Semi-Structured Interviews

Our team also conducted seventeen semi-structured interviews with the fourth and fifth grade

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 learn

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

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.

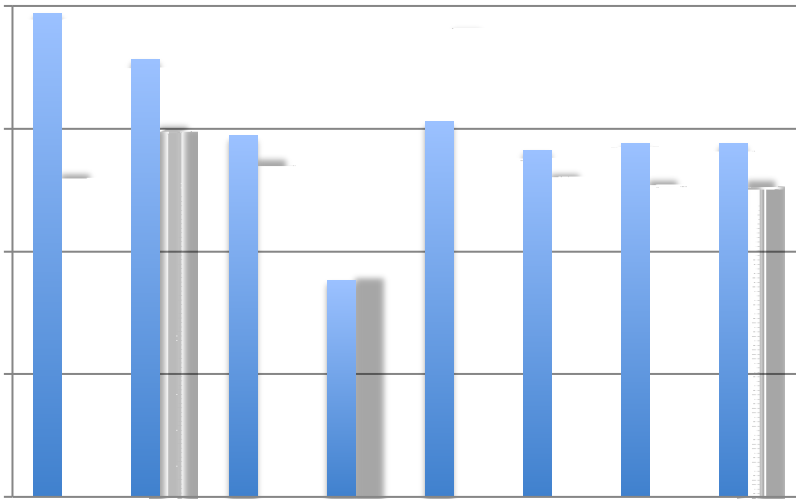

Figure 1: Comparison of responses by participating (n = 22) and non-participating students (n = 25) prior to the onset of Green Club afterschool program. Responses of participants and non-participants are pooled. Questions can be found in Appendix B.

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).

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 r

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

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-flowe

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%)

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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.

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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

and “plants”, which are all products of a garden. After the program, however,

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

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

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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.

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.

Pre-

analyze these results. In both the pre- and post-

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

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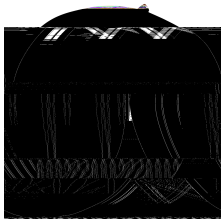
Appendix A: Overview, Teacher's Guides, and Handouts to GBL Curriculum

Overview of Four-Week Curriculum



Breakdown of Curriculum

Week 1: People and Plants

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- 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

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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

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Week 2: The Dirt on Soil

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 (l) 0.2 1d-0.2 (not) 0.2 (e) 0.2 (ns) -0rrntnsn orga (l) 0.2 onslns.5 (

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-

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

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

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Table 1:
Fall Crops

Name	Picture	Spacing

Cauliflower	1 per sq ft 18in-24in	14 wks

Potato	1 per sq ft
	12in

				strawberries or tomatoes.
Leeks		12 per q ft 6-12in	30 wks	Full Sun Sow leeks indoors in late winter for fall harvest. Start more leeks in August for spring harvest. Grow them in soil that has plenty of compost and

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

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Which Sample was your favorite?

Table II: Summer Crops

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Appendix B: Interview Schedules and Pre

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