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Summer Research Poster

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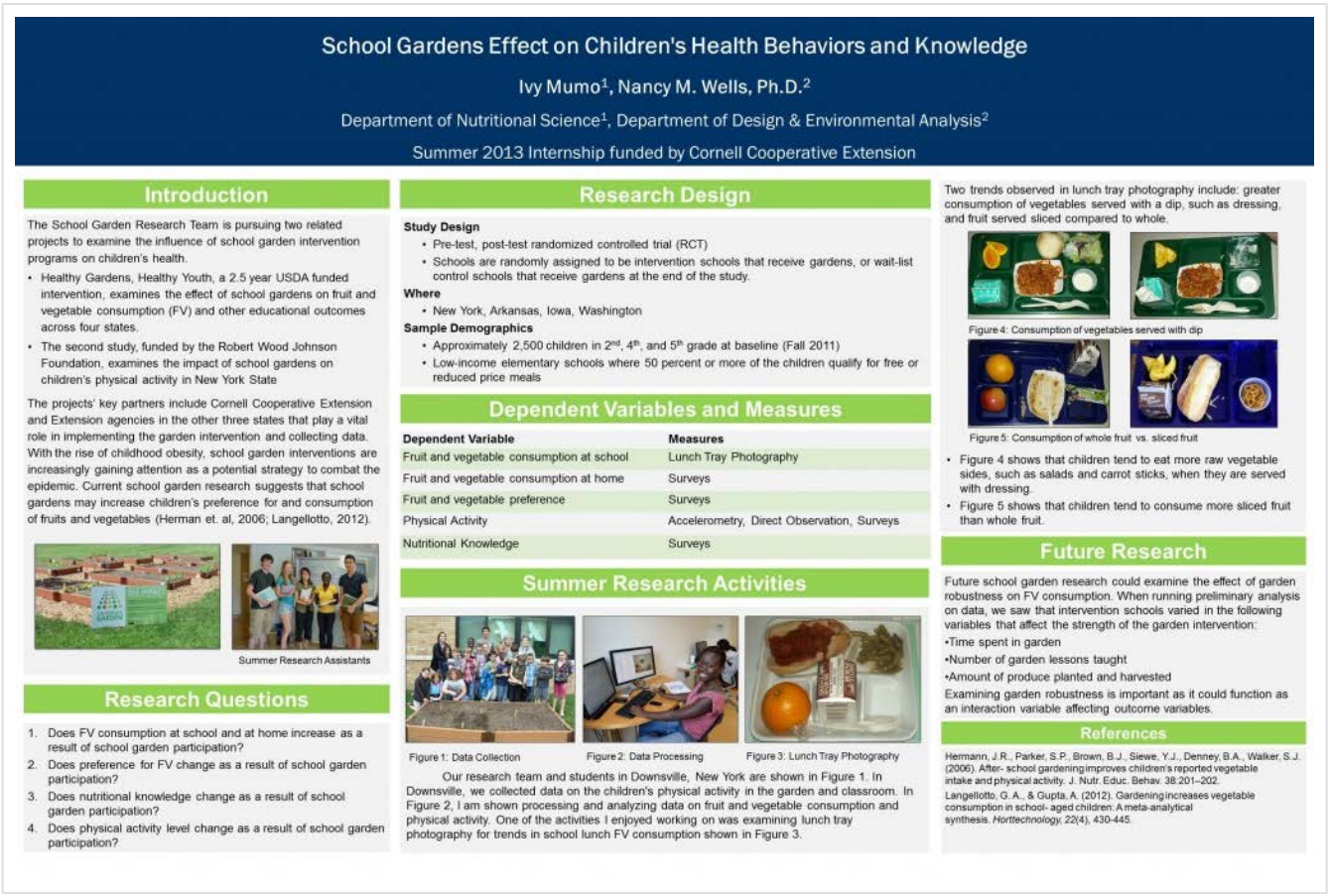

School Gardens Effect on Children's Health Behaviors and Knowledge

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Introduction

The School Garden Research Team is pursuing two related projects to examine the influence of school garden intervention programs on children's health.

- Healthy Gardens, Healthy Youth, a 2.5 year USDA funded intervention, examines the effect of school gardens on fruit and vegetable consumption (FV) and other educational outcomes across four states.
- The second study, funded by the Robert Wood Johnson Foundation, examines the impact of school gardens on children's physical activity in New York State

The projects' key partners include Cornell Cooperative Extension and Extension agencies in the other three states that play a vital role in implementing the garden intervention and collecting data. With the rise of childhood obesity, school garden interventions are increasingly gaining attention as a potential strategy to combat the epidemic. Current school garden research suggests that school gardens may increase children's preference for and consumption of fruits and vegetables (Herman et. al, 2006; Langellotto, 2012).

Summer Research Assistants

Research Questions

1. Does FV consumption at school and at home increase as a result of school garden participation?
2. Does preference for FV change as a result of school garden participation?
3. Does nutritional knowledge change as a result of school garden participation?
4. Does physical activity level change as a result of school garden participation?

Research Design

Study Design

- Pre-test, post-test randomized controlled trial (RCT)
- Schools are randomly assigned to be intervention schools that receive gardens, or wait-list control schools that receive gardens at the end of the study.

Where

- New York, Arkansas, Iowa, Washington

Sample Demographics

- Approximately 2,500 children in 2nd, 4th, and 5th grade at baseline (Fall 2011)
- Low-income elementary schools where 50 percent or more of the children qualify for free or reduced price meals

Dependent Variables and Measures

Dependent Variable	Measures
Fruit and vegetable consumption at school	Lunch Tray Photography
Fruit and vegetable consumption at home	Surveys
Fruit and vegetable preference	Surveys
Physical Activity	Accelerometry, Direct Observation, Surveys
Nutritional Knowledge	Surveys

Summer Research Activities

Figure 1: Data Collection

Figure 2: Data Processing

Figure 3: Lunch Tray Photography

Our research team and students in Downsville, New York are shown in Figure 1. In Downsville, we collected data on the children's physical activity in the garden and classroom. In Figure 2, I am shown processing and analyzing data on fruit and vegetable consumption and physical activity. One of the activities I enjoyed working on was examining lunch tray photography for trends in school lunch FV consumption shown in Figure 3.

Two trends observed in lunch tray photography include: greater consumption of vegetables served with a dip, such as dressing, and fruit served sliced compared to whole.

Figure 4: Consumption of vegetables served with dip

Figure 5: Consumption of whole fruit vs. sliced fruit

- Figure 4 shows that children tend to eat more raw vegetable sides, such as salads and carrot sticks, when they are served with dressing.
- Figure 5 shows that children tend to consume more sliced fruit than whole fruit.

Future Research

Future school garden research could examine the effect of garden robustness on FV consumption. When running preliminary analysis on data, we saw that intervention schools varied in the following variables that affect the strength of the garden intervention:

•Time spent in garden

•Number of garden lessons taught

•Amount of produce planted and harvested

Examining garden robustness is important as it could function as an interaction variable affecting outcome variables.

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Summer Reflections

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It's hard to believe that summer is coming to an end and the beginning of academic year is quickly approaching. Working in the school garden lab has been my first research experience and through it I have learned so much about how research is conducted.

Through my internship, I have gained insight on the thought process, high level of detail, and organization that goes into planning and executing a research project. For example, when designing a project, you must consider how the sampling methods will affect the generalizability of the findings to the intended population. Also understanding the significance of random assignment and how it affects internal validity of the study is important. What was most helpful in increasing my understanding was looking at research methods through the example of the garden study, in which I am currently immersed. With the knowledge I have gained in research methods, I feel more confident in my ability to interpret literature and examine the strengths and weaknesses of a study, which is an essential skill in my future career as a dietitian.

I particularly realized the importance of the high level of detail and organization necessary to successfully execute a project while working on the data entry. For example, what appears to be the simple task of collecting and organizing participants' demographic information, is more like the organization of hundreds of puzzle pieces into an excel spreadsheet. These excel sheets then go through double and triple checks as the results of the study are dependent on the accuracy of the data collected. Though it seems like a tedious task, it can be engaging when working with the perspective of a detective finding gaps, putting together a story and understanding the information provided.

I am interested in nutrition education and from working on the school garden project, I came to see it from a new perspective. As nutrition major, I know nutrition education as guiding people to make healthy food choices by teaching them how to prepare healthy meals, read nutrient labels, and become aware of the amount of empty calories in common snacks and fast foods. In the school garden project, children learn about how their food is grown in addition to nutrition concepts. Teaching kids about the food system and building the connection between the source of food they eat and nature is a unique way to positively change their food choice. My view of nutrition education has expanded and I am now thinking of ways garden based learning activities can be incorporated into short term nutrition education lessons and creative ways to connect people to their food system to change their food choice.

The experiences mentioned above are only a glimpse of what I have learned this summer. I am very thankful for the

experience I had working in the school gardens lab. Thank you CCE, Professor Nancy Wells, and the school gardens research team for this internship opportunity!

— Data Collection in Downsville, NY
Source: Healthy Gardens, Healthy Youth Facebook Page

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Observations in Lunch Photos

Posted on **July 30, 2013** by **inm3@cornell.edu**

In the school gardens research lab this summer, one of our tasks is to process lunch tray photos so they can be analyzed to determine how many grams of fruit and how many grams of vegetables are consumed by each child and whether school gardens affect these outcomes.

As I flip through lunch tray photography in the lab, I am thinking of the story these images tell about what kids eat. What foods do the majority of kids consume at school and which foods consistently remain untouched on their trays? What are some common factors that influence children's consumption of school lunch? Observing trends in children's consumption has me thinking of possible changes that can be made to school lunches to increase consumption of fruits and vegetables and possible research questions to quantitatively assess observed trends.

For example, something we see frequently is whole fruits, such as apples and oranges, untouched or nibbled at in post-lunch photos. Do kids not eat the apples because they don't like them or is there another factor that is affecting their consumption?

— whole fruit let on lunch trays

Interestingly, when apples or other fruits are sliced, we see fewer untouched fruit portions in post lunch photos. This observation makes me wonder if serving sliced fruit can increase consumption. Could it be that the ease of eating a sliced apple or orange compared to biting into or peeling the whole fruit is influencing consumption? A study conducted by Brian Wansink at the Cornell University Food and Brand Lab illustrated that indeed children select and consume more fruits in school when they are sliced. The study introduced a fruit slicer in 6 middle schools and measured the daily apple sales and food waste in the intervention and control schools. The study concluded that children prefer sliced fruit because it is much easier to eat with their braces, smaller mouths, and is also neater (Wansink et al, 2013). Fruit slicers are an inexpensive investment that can be made by school districts to impact children's health.

— sliced fruit consumed compared to whole fruit

— side salad served with dressing

Another interesting observation is that kids tend to eat more raw vegetables, like salads and carrot sticks, when they are served with dressing. Though creamy dressings are higher in fat and calories, if they can increase kids' consumption of vegetables, it may be worth offering these dressings with vegetables to increase intake of essential nutrients. A study conducted by Jennifer Fischer at Temple University on pre-school children sensitive to bitter taste found that serving bitter vegetables, such as broccoli, with a dip increased consumption by 80 percent (Fisher et al,

2012). From these results, schools could consider offering dressing or other healthier alternatives such as yogurt based dips, or hummus with vegetables to increase consumption. Because this study was carried out on preschoolers, further research could be done to examine the same effect of dips and vegetable consumption with elementary school aged children in the general population.

— side salad consumed when served with dressing

Other research questions to consider based on our observations on consumption include:

- Does design or color of the lunch tray affect how much children eat?
- Does color contrast of foods served on the lunch tray affect consumption?
- Since children drink 100% fruit juices would fruit and vegetable juices blends or smoothies be effective in increasing fruit and vegetable consumption?
- Does the use of canned compared to fresh fruit and vegetables in school lunches affect consumption?
- Does having the child select fruit and vegetable sides affect how much children consume?
- Is there a significant difference in consumption of pre-packaged meals and freshly made meals?

It is important questions to consider and evaluate these research questions for school lunches to continue to evolve based on children's preferences with the underlying goal of promoting health.

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Posted in **Healthy Gardens, Healthy Youth**

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Working in a lab has been a new and exciting experience for me. In this post, I hope to give you a glimpse at what life is like working in the lab.

To start off, I am working with four other enthusiastic and energetic interns this summer. We are all undergraduates at Cornell and for most of us, this our first research experience. Chris, Alvin, Emily, Mindy and I bring to the table a variety of majors including Design and Environmental Analysis, Human Biology Health and Society, Nutrition, and Policy Analysis and Management. The diversity of our academic backgrounds is a reflection of the multidisciplinary nature of the Healthy Gardens, Healthy Youth project. It is also our strength because it allows us to not only contribute in our area of expertise, but learn from each other.

— Left to Right: Chris, Emily, Mindy, Ivy, and Alvin

Our days are filled with a variety of tasks, primarily coding of data collected by Cooperative Extension educators. In the picture below, I am looking through some of the hundreds of lunch tray photos we receive from schools in New York, Iowa, Arkansas, and Washington, ensuring that the ID tags are readable, properly renamed, and ready to be sent out for analysis.

We have also been training on how to use SPSS statistical software to analyze processed data. Statistical analysis is fairly new to me and so far I am finding it quite interesting. Some of the analysis we have conducted include: demographics of the sample population to ensure that they are comparable at baseline, and t-tests to determine statistical significance of the impact of gardens on physical activity.

Finally, hard work in the lab is balanced out with weekly fun activities! This past Friday afternoon we visited the gallery exhibit of DEA “design generation” summer college students to admire their phenomenal paper light pieces. The lights were all incredibly creative. Reading the descriptions of their design process from their inspiration to creation of the piece and its packaging further increased my appreciation of their work. The future generation of designers is exceptional and bound to do great things.

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Physical Activity and School Gardens

Posted on **July 8, 2013** by **inm3@cornell.edu**

Today, one in every three kids is overweight or obese ("Childhood Obesity", 2013). This staggering statistic has several health consequences including an increased risk of developing cardiovascular disease and diabetes. In addition overweight and obese children are more likely to have a low self-esteem, and have a negative body image ("Childhood Obesity", 2013). As childhood obesity continues to rise, it is important to evaluate new approaches to combat it.

One way the school garden study addresses the issue of childhood obesity is by examining the impact of gardens on physical activity. Physical activity along with a balanced diet plays an essential role in supporting weight loss and weight maintenance. From conducting literature reviews on physical activity in schools and the impact of gardens on physical activity this past few weeks, I found that the amount of physical activity offered in schools in the form of recess or physical education has decreased over the years. For example, up to 40 percent of school districts in America have decreased or eliminated the time spent in recess (Robert Wood Johnson Foundation, 2010). One of the causes of the decrease in physical activity in schools is the increase in time spent on English language arts, and math to improve standardized test scores as a result of the No Child Left behind Act (Center for Education Policy, 2008).

When researching articles on the impact of gardens on physical activity, I came across few articles on this topic. Though these articles had some methodological weaknesses (e.g., relied primarily on survey responses to measure physical activity), the findings suggest that gardening may increase children's activity level (Hermann, Parker, Brown, Siewe, Denney, & Walker). Since garden lessons incorporate subjects such as math, they show great potential as an approach of increasing physical activity in schools while reviewing fundamentals taught in the classroom. This way, students can be active and continue to develop their academic skills that are important for their success in school. In our study, one of the hypotheses is that school gardens increase the time children spent outdoors which leads to higher physical activity levels.

The school garden study is pioneering the research on how gardens affect physical activity. To measure physical activity, we use accelerometry, direct observation, and surveys which other studies have shown to be valid and reliable measures. From accelerometry, we are able to obtain data on the intensity of a child's movement throughout the school day. Through direct observation, we are able to obtain data on children's activity level as they work in the garden and how interactions with others around them affect their activity level. Survey data will indicate whether children's participation in various kinds of physical activities increase following garden participation.

Through-out the process of lit reviews and physical activity data collection over the past few weeks, I have become

more interested in how our environments impact our physical activity. Before this experience my thoughts on physical activity were from a more individualized perspective; how can we get more kids to play outside or get involved in activities they enjoy where they are more active? Now I'm thinking about physical activity on the broader scale of how we can change the *environment* to one that promotes more activity. Whether it is through completely redesigning a landscape to include more green areas, and safe play space or adding a garden to the current space, such environmental changes can impact kids' movement and contribute to the fight against childhood obesity.

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Posted in **Healthy Gardens, Healthy Youth**

Week 1-2

Posted on **June 10, 2013** by **inm3@cornell.edu**

I am excited to be working on the Healthy Gardens, Healthy Youth Project team this summer and will be spending my time collecting, processing, and analyzing data. The Garden Project is a two year study examining the impact of school gardens on kids' fruit and vegetable consumption, in four states (NY, IA,AR, WA), and physical activity (NY only). The project is in its final stages of data collection and soon we will begin to analyze all the data to see if the gardens have made a significant impact on the kids healthy behaviors.

During the past 2 weeks, we have been collecting data on kids physical activity in the classroom and in the gardens

through direct observation and accelerometry.We visited an elementary school in Downsville and Rochester, New York. Since it is late spring, it is the planting season! In Downsville, NY, a master gardener brought in a variety of vegetables for the kids to plant including: lettuce, zucchini, and pumpkin. The third grade students were eager to plant their seeds. The garden lesson not only taught the students how to plant seeds, but also incorporated math skills, for example the use of fractions when dividing the garden into equal parts.

During our second day, the kids in 5th grade rotated through four stations including: composting, bees, MyPlate, and healthy smoothies. At the composting station, the teacher led a lesson on how to start a compost bin using newspapers, food scraps, and worms. Though some were wary about touching worms, they all participated and were very engaged. At the MyPlate station, the teacher discussed portion distortion. She had students measure into a bowl how much cereal, and pasta they typically eat then compared their serving to an actual serving size. They were amazed by how large their portions were compared to the serving sizes. At the healthy smoothies station, the ingredient on center stage was kale. The smoothie was so delicious, all the kids asked for seconds. Finally at the bees station, they learned about the importance of bees in pollination for food production and got to examine the bees up-close and even had the unique opportunity to feed them.

Spending time in the field watching the kids, teachers, and extension educators in their different roles was a great experience. I have a much better understanding of how the project is carried out in the field and some of the challenges that come with executing pieces of the project such as lunch tray photography and physical activity observations. From participating in the trips, I have developed a deeper understanding and personal connection with the data I input into large excel spreadsheets. From watching the kids in the gardens, I believe the gardens are making a positive impact on the kids behaviors.I hope our data shows a significant impact on kids' food consumption and physical activity.

— Three generations of CCE Interns
Left to right: Alex, Ivy, Peter