

**Improving Vegetable Preferences  
through Gardening and Cooking Education**

Final Full Paper

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### **Abstract**

Garden-based education programs have been suggested as a way to increase children's preferences for vegetables, yet no studies have explored the effect of a short-term, intensive farming and cooking program. In the summer of 2012, Stanford partnered with Full Circle Farm (FCF) in Sunnyvale, California to run four weeklong sessions of a farming and cooking camp for 8-14 year olds. Throughout the camp, Stanford researchers studied the impact of the program on participants' vegetable preferences and attitudes. Pre-post surveys, focus groups, participant journals, and field notes were utilized as data collection tools.

Fifty-one children completed this program, 42 of whom received full or partial scholarships. Of the 15 vegetables included in the pre-post survey, study participants reported a statistically significant increase in preferences for 13 of those vegetables. Five general questions about vegetables attitudes were also included in the survey (e.g. "I like trying new vegetables"). Each of these surveyed attitudes also showed a statistically significant, positive change in attitudes about vegetables. Qualitative coding of the focus groups, camper journals, and field notes shows that the frequent physical interactions with vegetables required by many camp activities (e.g. harvesting and cooking) and a consciously produced camp culture of personal exploration and empowerment helped to promote this positive change in vegetable preferences. These results suggest that a weeklong summer farming and cooking camp can have a positive impact on children's reported vegetable preferences.

*Keywords:* farm-based education, vegetable preferences, nutrition, cooking, and children

## I. Introduction

Although eating a diet rich in vegetables has been shown to greatly enhance health (CDC, 2012), less than 27% of children reach the USDA's recommended three or more servings of vegetables a day (CDC, 2010). Many factors—such as availability, reported vegetable preference, and peer pressure—have been identified as causes of low childhood vegetable consumption (Lorson, 2009). Novel approaches are needed to address these causes of low vegetable consumption among children.

This study evaluates whether or not a weeklong farming and cooking camp can increase children's preferences and attitudes for vegetables. While a number of studies have already investigated the effect of garden-based education on vegetable preferences (Gatto, 2012; Heim, 2009; McAlesse, 2007; Robinson-O'Brien, 2009), each of these studies implemented programs consisted of short, but repeated, interventions. For example, in her article study "LA Sprouts" (2012), Gatto examines the positive effect on vegetable preferences of a three-month garden program that engaged children in weekly, 90 minute gardening and cooking sessions.

While such studies have shown gardening and cooking education to be a promising means of increasing vegetable preference, the effects of a short-term, high-intensity program—such as a weeklong summer camp—has yet to be investigated. By requiring only short periods of time to implement, short-term, high-intensity programs may be more logistically feasible to implement in many communities than the more traditional long-term, low-intensity models. Consequently, this different model warrants academic investigation. The Stanford-FCF collaboration, "FCF Summer Farm Camp," aims to explore whether or not such an alternative exposure structure can increase reported vegetable preferences.

The FCF Summer Farm Camp model is additionally novel in its use of “farm education” rather than “garden education.” FCF Summer Farm Camp was run on Full Circle Farm, an 11-acre sustainable community farm in Sunnyvale, California. Through its location on a production-scale farm, the research setting of FCF Summer Farm Camp differs significantly from the setting of traditional garden education research. Participants in FCF Summer Camp were able to see full-scale food production on the research site. As the research took place on a production farm, farm machinery, a harvest storage area, food packing areas, a farm stand, and farm animals played a major role in the participants’ experience. These features of the research setting make the FCF Summer Camp model and example of “farm”—rather than “garden”—education. For a visual overview of the FCF farm facilities, as well as a detailed image of the “Education and Community Garden” where the majority of camp activities occurred—see Appendix A.

While many of the learning goals and activities utilized by FCF Summer Camp are similar to those of traditional garden-based education, its different setting is significant. FCF Summer Camp provided participants with a very different education experience that what smaller-scale, traditional garden programs provide. The full implications of this different research setting are discussed in Section IV.

## **II. Literature Review**

Over the past two decades, gardening and cooking education programs have increased in prevalence across the U.S. (Storey et al., 2009). These programs are widely viewed as a promising means of increasing childhood vegetable consumption (Robinson-O’Brien, 2009). However, while the positive effects of gardening and cooking are widely reported in the

anecdotes of teachers and parents alike, only a small number of studies have rigorously assessed the outcomes of these interventions (Robinson-O'Brien, 2009).

A summary of the studies that have explored the impact of gardening and cooking education on vegetable preferences is provided by Robinson-O'Brien et al. in "Impact of Garden-Based Youth Nutrition Intervention Programs: A Review." This article explains that between 1990 and 2007, there were 11 peer-reviewed studies published in the U.S. that discussed the relationship between gardening and cooking education and vegetable preference. Of these 11 studies, five took place on school gardens and were integrated into the school curriculum. Three were conducted as part of an afterschool program, and the final three studies were conducted within community-run facilities. Each of the studies consisted of long-term, low-intensity interventions in which children were given short lessons one to two times a week for eight to 17 weeks. The studies included youth ranging in age from five to 15 years.

Viewed cumulatively, the results of these studies suggest that the anecdotal link between gardening and cooking education and increased vegetable preference holds true. Improvements in vegetable consumption rates and/or reported preference were found in the vast majority of studies reviewed (Robinson-O'Brien, 2009). Increased willingness to try new vegetables and increased knowledge of nutrition were also widely reported (Robinson-O'Brien, 2009). For a full summary of the studies reviewed by Robinson-O'Brien et al, see Appendix B.

While the Robinson-O'Brien review suggests a causal relationship between gardening and cooking education and increased vegetable preferences, the review also makes clear that more rigorous analysis is needed. Of the 11 studies reviewed, only two utilized a control group, and convenience samples were routinely relied upon to supply participants. Additionally, externally validated pre/post surveys were rarely used, and qualitative data was only gathered by

one of the studies. In light of these limitations, Robinson-O'Brien recommends that further rigorous research design and investigation is needed.

Since the Robinson-O'Brien review was published in 2009, a small number of more rigorous garden and cooking education studies have emerged. One of these studies, "LA Sprouts: A Garden-Based Nutrition Intervention Pilot Program Influences Motivation and Preferences for Fruits and Vegetables" (Gatto, 2012) investigates the impact of 12 weekly hour-long lessons on a community garden on the vegetable consumption patterns of Latino youth in Los Angeles. The study found that participants experienced a 16% increase in their vegetable preferences compared to control subjects.

An additional study published after the Robinson-O'Brien review, "The Effects of School Garden Experience on Middle-School Aged Student's Knowledge, Attitudes, and Behaviors Associated with Vegetable Consumption" (Ratcliffe et al, 2009), reports similarly promising findings. In this study, 170 sixth graders received weekly hour-long garden sessions for a four-month long period of time. Compared to their control group, the sixth graders in this study were more able to identify vegetables and more willing to try new vegetables.

The study also found that the gardening and cooking programs did not increase vegetable availability in the students' homes. In other words, while the youth's vegetable preferences increased, parents did not respond to this increased preference. The authors suggest that this finding calls for garden and cooking programs to be more integrated with home and community programs that aim to increase caregivers' vegetable purchasing patterns (e.g. sponsored Community Supported Agriculture programs or partnerships with local grocers).

While the Gatto and Ratcliffe studies display an incorporation of the scientific rigor recommended by Robinson-O'Brien, there is still a great deal of research that must be done

before the impact of gardening and cooking education on vegetable preferences can be fully understood. The FCF Summer Farm Camp study is different from previous studies in that it is a short-term and high-intensity farm education program. Both the studies reviewed by Robinson-O'Brien and the more rigorous recent studies investigated programs that meet in small gardens weekly or bi-weekly for no more than two hours at a time. Alternatively, the FCF Summer Farm Camp model immerses participants on a production-scale farm for six hours of farming and cooking education a day for five consecutive days. The effects of such a short-term, high-intensity farming and cooking program is yet to be academically investigated.

### **III. Research Methods**

#### **Selection of Methodology**

This study seeks to both investigate if a short-term, high-intensity farming and cooking education program can increase children's vegetable preferences and understand why such changes do or do not occur. Consequently, a mixed methods approach is most appropriate. Quantitative data was collected so that changes in vegetable preferences could be concretely tracked. The collection of qualitative data allowed for investigation into the causes of quantitatively documented changes in vegetable preferences. The results of this mixed methods approach allows for both the relationship between farming and cooking education and vegetable preferences to be understood and for best practices to be identified.

#### **Camp Overview**

Four weeklong sessions of FCF Summer Farm Camp were held during July 2012: two for 8-10 year olds and two for 11-14 year olds. Each week of camp lasted for five days from 9 AM

to 3 PM. The time participants spent at camp was filled with educational games and hands-on learning activities. Each day of camp had its own unique theme (e.g. soil, seeds, or ecosystems). Unifying these daily themes was the overarching objective of using hand-on learning experiences and a farm environment to teach participants where food comes from.

Each day was based around the same daily activity schedule, beginning with garden chores. During this time, campers were given a garden task (e.g. feed the chickens, water the greenhouse, or weed raised beds) to complete in small groups. Garden chores were followed by an educational activity oriented around the day's theme. Campers would then make lunch, working in teams to harvest seasonal vegetables from the farm and then washing, chopping, and cooking them into the day's lunch. Although some lunch ingredients had to be purchased from a grocery store, the vast majority were freshly harvested from the farm. To promote an appreciation for cultural diversity, lunch recipes were specifically chosen from different parts of the world (Mexico, Japan, Thailand, and the US). A mini-lesson on each culture's culinary traditions was given before each lunch.

After eating and cleaning up lunch, campers participated in a hands-on learning activity that aimed to engage campers physically with the day's theme. For example, when the day's theme was "soils," campers visited a worm compost bin and learned to turn a compost pile. Each day concluded a "sit-spot." During this time campers were free to find a place alone on the farm and spend 20-30 minutes with their journal (which all campers made on the first day of camp). Once in their sit-spot, campers were encouraged to reflect on and write about their day.



### **Formation of Research Partnership**

Utilizing FCF as a research site is the result of a community-based partnership between Stanford University and FCF. This partnership formed in the fall of 2010 when representatives of FCF came to the Stanford Food Summit. At the Food Summit, FCF expressed a desire to utilize the education and community portion of their farm during the summer months to provide a summer camp for Sunnyvale youth. Meanwhile, Stanford faculty and student researchers were interested in researching childhood formation of vegetable preferences. This led to a community-based partnership between Full Circle Farm and Stanford University wherein Full Circle Farm provides a research location while Stanford provides camp staff and student researchers.

### **Population Sample and Selection**

Participants were recruited through two main efforts: informational flyers at local community centers and food banks and community center and local school email lists. All residents of Sunnyvale aged eight to 14 were eligible to participate in the study. Other than age and location of residence, no exclusion criteria were utilized. This lack of exclusion criteria was employed for primarily pragmatic reasons. Recruitment of participants was difficult, and using ethnicity or socio-economic status as exclusion criteria would have resulted in a very small sample size.

These efforts resulted in the recruitment of 51 participants. Of these participants, 81% (n=41) received full or partial scholarships. Full scholarships (n=38) were given to all campers who qualified for free or reduced lunch. Partial scholarships (n=3) were determined on a case-by-case basis for all who expressed financial need but did not qualify for free or reduced lunch.

Ethnographically, the participant population was 35.7% white (n=18), 23.2% Latino (n=12), 25.8% Asian (n=13), 12.5% multiracial (n=6), and 3.6% other (n=2). In terms of gender, participants were 58.8% female (n=30) and 41.2% male (n=21). See Appendix C for a display of the participant population's full demographic information.

Prior to participant recruitment, the study was approved by the Stanford University Institutional Review Board (IRB). On the first day of participation in the study, all participants provided written consent and the legal guardians of all participants provided written assent.

### **Data Collection**

Quantitative data was collected through pre/post surveys. These surveys measured participants' self-reported preferences for 15 vegetables on a five-point Likert Scale. A question mark ("?") option was also included in the scale. This option was included so that if participants did not know their preference for a given vegetable, they could still complete the survey. In order to investigate a possible relationship between vegetable exposure frequency and changes in preference, vegetables were selected for the survey to ensure a mix of low, medium, and high vegetable exposure frequencies. For a list of the vegetables included in the survey, organized from lowest exposure level to highest exposure level, see Table 1 in Section VI. The survey also measured five more general attitude questions about vegetables (e.g. "I like trying new vegetables."), also on a 5-point Likert Scale. A full copy of the utilized pre-post survey is included in Appendix D.

Qualitative data was collected through focus groups, participant journals, and field notes. Focus groups lasted 15-20 minutes and were conducted in groups of five-six participants. These focus groups were semi-structured and designed to generate candid, honest remarks regarding

how the participants felt they were affected by camp. Four focus groups were conducted in total, one on the last day of each week's camp session. Each of these focus groups were recorded and transcribed verbatim. The focus group questions were based around four of the main components of camp: farming, cooking, learning about where food comes from, and frequent exposures to vegetables.

Focus groups were complemented by the collection of camper journals. Campers composed these journals when writing in their "sit-spots" at the end of each day. As was previously mentioned, journal prompts were open-ended and simply asked campers to reflect on their day at camp. In addition to these two qualitative data sources, the research team recorded field notes throughout each week of camp, documenting any key participant quotes or actions related to vegetable preferences or camp more generally.

## **V. Data Organization & Analysis**

The collected data was analyzed of a six-month timeframe during the fall and winter of 2012. Over this time, two main phases of analysis were conducted: quantitative analysis and qualitative analysis. Data analysis was conducted primarily by the first author (an undergraduate in Urban Studies and Earth Systems). Her work was overseen by the principal investigator, Christopher Gardner, an Associate Research Professor in the Stanford Prevention Research Center.

### **Quantitative Analysis**

The collected quantitative data was analyzed using Statistical Package for the Social Sciences (SPSS). Using the pre-post survey data, a two-tailed paired sample t-test was used to

determine whether or not specific vegetable preferences and more general vegetable attitudes improved over the duration of camp. SPSS was also utilized to investigate if the level exposure per vegetable (e.g. exposure to a vegetable daily vs. only once) influenced changes in preferences. Quantitative analysis was additionally utilized to understand how camper age is related to the magnitude of change in vegetable preference. While these three separate quantitative analyzes were conducted, this paper will only discuss the first analysis (two-tailed paired sample t-test) in detail.

### **Qualitative Analysis**

Data from focus groups, camper journals, and field notes was analyzed with the goal of understanding what specific aspects of camp promoted the quantitatively observed changes in vegetable preferences. Throughout the qualitative data analysis process, the following analysis strategies were utilized: line-by-line coding, memo writing, and the production of matrices.

The first phase of this analysis process, line-by-line coding, involved the application of both grounded codes (codes developed out of the raw data during the analysis process) and external codes (codes imported from the relevant literature prior to coding). The application of both grounded and external codes was an intentional coding decision made by the researchers. This decision was based on the understanding that the topic at hand is culturally familiar enough and well enough established in the literature not to require the application of solely grounded codes (Miles and Huberman, 1994). Instead, recognizing the value of previously identified themes and conceptual frameworks from the relevant literature (Miles and Huberman, 1994), a combination of grounded and external codes were applied.

To facilitate coding, all focus group transcripts, camper journals, and field notes were uploaded into NVivo, a qualitative data analysis program that facilitates the application of codes, retrieval of related codes, and comparison between codes. Both grounded and external codes were applied in NVivo as they were identified. The first author applied codes in three passes. A portion of this data was cross-coded by other undergraduate student researchers to check for analysis discrepancies.

Grounded codes were developed through the identification of relevant and salient themes, properties, and conditions. Subject matter, language usage, and camper expressions of general importance determined relevancy and salience. As grounded codes emerged, they were listed in a coding chart, defined, and applied to subsequently analyzed data.

External codes were gathered from the relevant vegetable preference and garden education literature (Gatto, 2012; Heim, 2009; Koch, 2006; Ratcliffe et al., 2009; Robinson-O'Brien et al, 2009) and listed in a coding chart prior to the initial round of coding. Throughout the coding process, the first author intentionally sought to identify whether or not these imported codes were present within the gathered data.

As grounded and external codes were applied to the data, memo writing was utilized as an initial tool of analysis. Memos were utilized as an analytic “sense-making tool” that allowed for the relevance of key themes to be identified and for interrelations amongst themes to be explored (Miles and Huberman, 1994). For example, one memo detailed the relation between new cooking skills (a frequently applied grounded code) and feelings of empowerment (an infrequently applied grounded code). Memos were produced through the entirety of the line-by-line coding process.

Upon the completion of three rounds of line-by-line coding and memo writing, matrices were produced. The production of matrices was utilized as an analytic practice in identifying possible “explanatory frameworks” that exist within the coded data, and testing each of these frameworks for validity (Miles and Huberman, 1994). Through the use of matrices, key themes were compared across individual participants in order to understand the distribution and diversity of identified themes as they applied to individual participants.

## **VI. Results**

### **Camper Retention**

While 51 campers completed the study, 54 initially enrolled. This resulted in a participant retention rate of 94.44%. Of the three participants that did not complete the study, two cited family issues as their reason for withdrawal, while the third did not provide a reason for withdrawal. With only three of 51 participants failing to complete the study, the researchers consider the rate of participant retention to be very satisfactory.

### **Quantitative Results**

Study participants reported a net increase in preference for all 15 of the vegetables included in the pre-post vegetable preference survey. Of these, a statistically significant increase in preference was found for 13 (see Table 1 on the following page). The two vegetables for which participants did not report a statistically significant increase in preference for were carrots (which had a high mean preference rating of 4.20 in the pre survey, and therefore a likely “ceiling” effect with little room for an increase) and jicama (for which the baseline familiarity

was the lowest of any of the 15 vegetables, leading to the smallest sample size of available pre-post change among the set).

**Table 1.** Paired t-test displaying the pre-post change in campers' vegetable preferences.

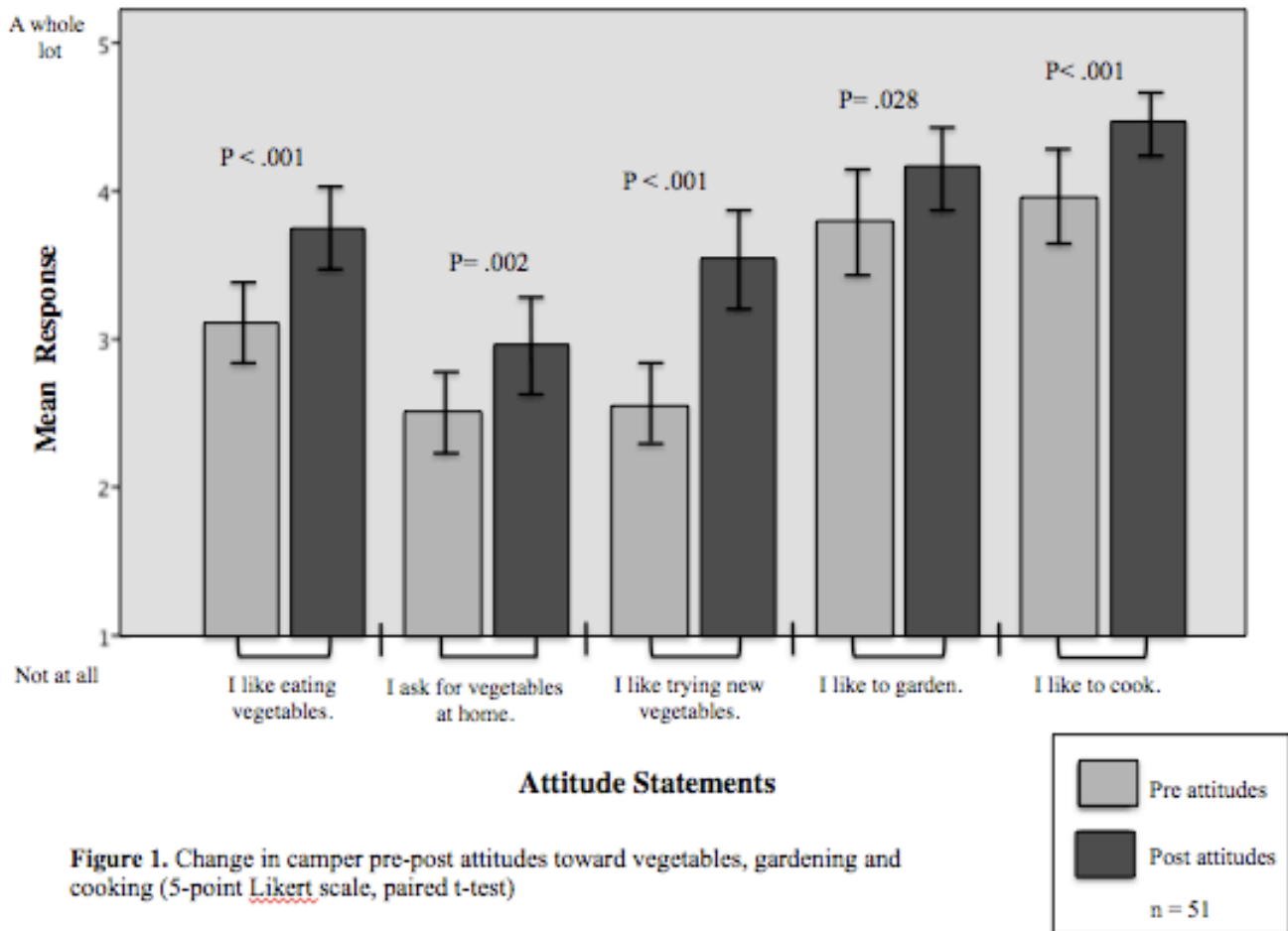
Vegetable*	N**	Baseline ± SD	Change ± SE	P-value
Eggplant	44	1.48 ± .76	.76 ± .16	<.001
Mushrooms	50	2.76 ± 1.48	.55 ± .17	.002
Beets	44	2.09 ± 1.27	.52 ± .16	.003
Bell Peppers	47	3.02 ± 1.28	.68 ± .20	.001
Jicama	30	2.30 ± 1.66	.68 ± .33	.06
Avocado	49	2.90 ± 1.30	.45 ± .16	.01
Garbanzo	45	2.18 ± 1.21	1.69 ± .25	<.001
Cauliflower	49	2.80 ± 1.24	.63 ± .17	.001
Chard	34	1.68 ± 1.01	.91 ± .25	.001
Spinach	51	2.69 ± 1.56	.40 ± .17	.02
Potatoes	49	2.61 ± 1.54	.50 ± .19	.02
Kale	34	1.97 ± 1.00	1.10 ± .26	<.001
Carrots	51	4.20 ± 1.04	.10 ± .08	.23
Zucchini	49	2.65 ± 1.49	.58 ± .21	.01
Green Beans	50	2.96 ± 1.41	.92 ± .20	<.001

\* Vegetables are listed in order of exposure frequency, with eggplant as the least exposed and green beans as the most exposed.

\*\*Any N<51 indicates that one or more campers selected a question mark symbol rather than a vegetable preference rating. Such responses were excluded analysis by analysis. To see the pre-post change for the campers who selected question marks rather than preference ratings, see Table 2.

Interestingly, while kale also started out with a low baseline familiarity, unlike jicama it was able to achieve a statistically significant increase in preference. This is likely due to the difference in exposure levels between kale and jicama. While campers were only exposed to jicama once throughout the week, they were exposed to kale every day, often multiple times a day. This increased level of exposure likely enabled kale preferences to overcome a low baseline familiarity and increase in a statistically significant manner. Alternatively, when jicama's low level of exposure is considered alongside its low baseline familiarity, it is not surprising that jicama preferences failed to reach a statistically significant increase.

In addition to an increased preference for specific vegetables, the quantitative results also show a statistically significant improvement in all five of the more general vegetable attitudes (“I like vegetables”, “I ask for vegetables at home”, “I like trying new vegetables”, “I like to garden”, and “I like to cook”) that were included in the pre-post survey. Figure 1 below displays these results.



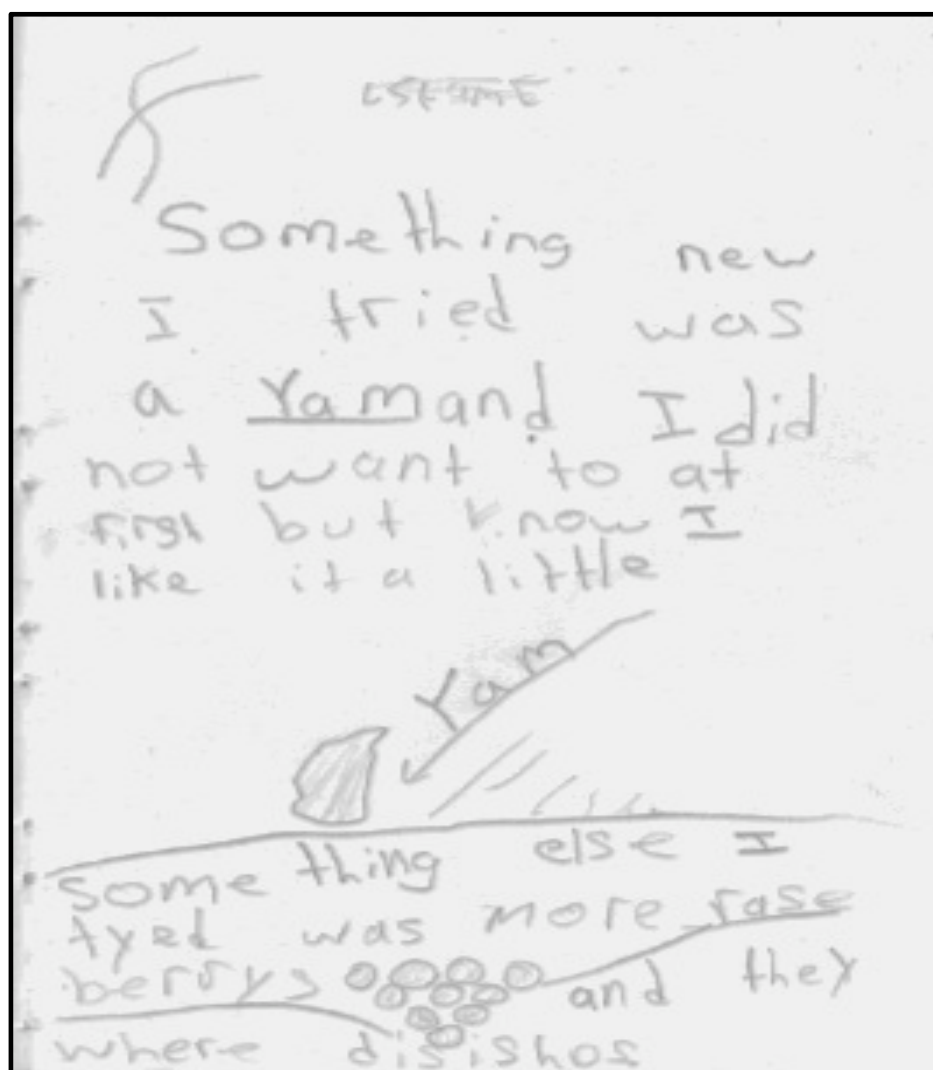
**Qualitative Results**

Camper journals, focus group transcripts, and counselor field notes were analyzed in order to investigate why the documented change in camper vegetable preference might have occurred. The following three themes were identified through this qualitative analysis:



- i. Frequent physical interaction with vegetables promoted vegetable familiarity prompted an increase in vegetable preferences.
- ii. Camp culture fostered feelings of empowerment to make personal food production and consumption choices that, in turn, increased preferences for vegetables.
- iii. Campers gained an increased appreciation for and understanding of nature that may or may not have influenced their vegetable preferences.

Concerning the first of these themes, throughout camp, many activities required participants to physically interact with vegetables. These physical actions—such as planting, harvesting, and cooking—promoted feelings of comfort and familiarity with vegetables. For example, after harvesting and cutting yams for lunch, one camper recorded in his journal, “Something new I tried today was a yam and I did not like it at first but now I like it a little.”

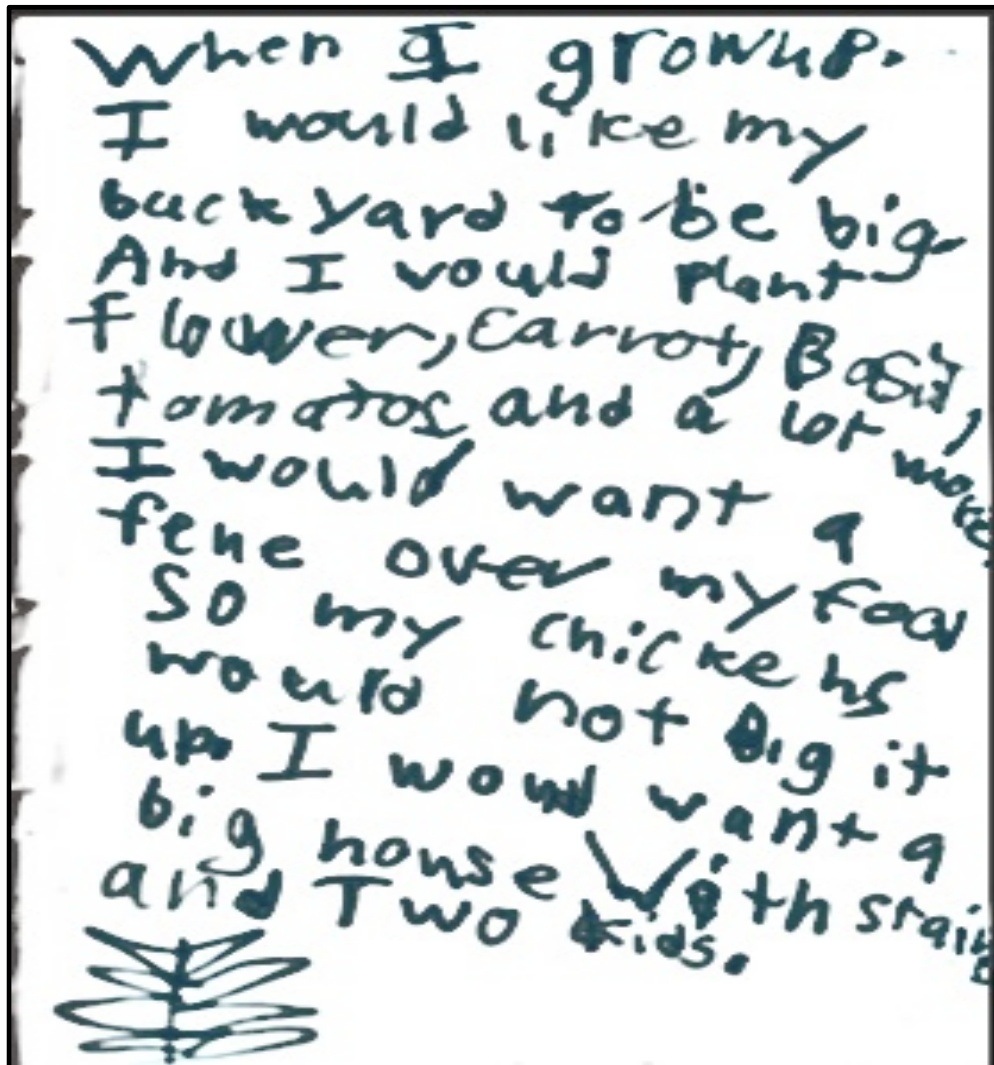


**Image 1.** Vegetable interactions

In a similar manner, another camper discussed her changed preference for chard by explaining in a focus group, “I thought it would be weird to eat some big green leaf, but then I harvested it and it was really pretty looking down by the stem. So I ate the leaf I harvested! And it was good!” As this quote illustrates, physically interacting with vegetables helped our campers to feel more familiar and comfortable with vegetables. As a result of this increased familiarity, many campers began to view the vegetables they had interacted with as a more inviting food source.

This qualitative finding is supported by the literature on vegetable preference formation. As previous studies have shown, the number of vegetable exposures children experience greatly shapes their formed vegetable preferences (Gatto, 2012; Robinson-O’Brien et al, 2009). Supporting this finding of prior research, our campers illustrated that the mere act of being exposed to vegetables made them more comfortable with vegetables and increased their vegetable preferences.

The second qualitative theme identified—the creation of a camp culture that fostered feelings of empowerment to make personal food production and consumption choices that, in turn, increased preferences for vegetables —was largely fostered by the promotion of a food and farming skill set. Through teaching campers how to compost, grow vegetables, harvest, chop, use spices, and follow a recipe, FCF Summer Farm Camp aimed to cultivate food production and preparation skills. As a result of this new skill set, campers reported feeling empowered to make their own food production and consumption choices. For example, the camper journal on the following page displays the reflections of a young camper thinking about how she wants to interact with food production as an adult.



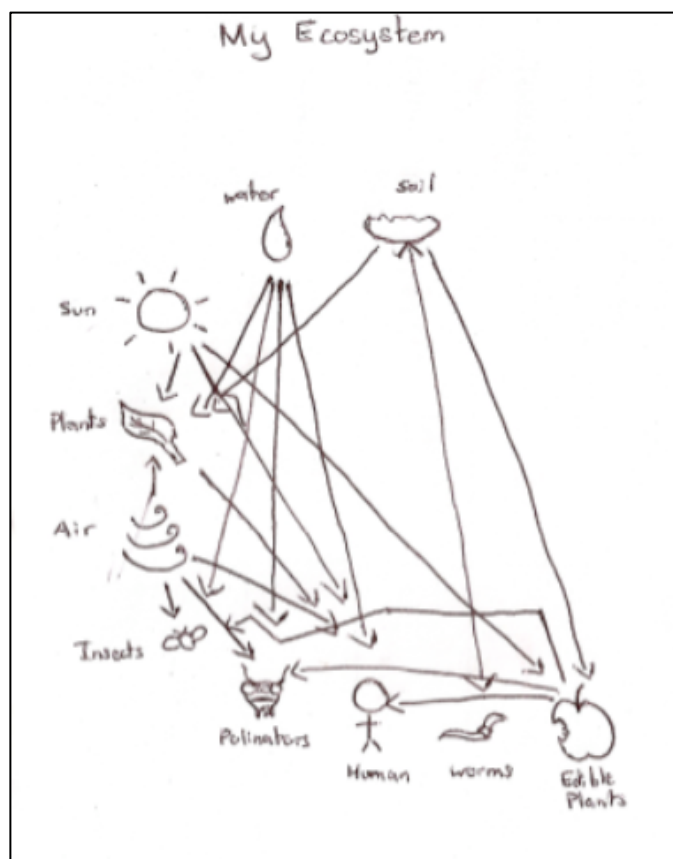
**Image 2.** Empowerment through gained farming and cooking skills

In this excerpt, the participant writes about planting a variety of vegetables in her backyard and having her own chickens—which she would work hard to keep safe. This participant feels comfortable with the idea of producing a portion of her own food. She seems confident about having the skills such a task would require and is excited about employing those skills. This feeling of empowerment was echoed by many other campers. One such camper explained her newly acquired skills by stating, “On this farm I learned how to harvest vegetables. I learned how to chop things—something my mom told me I would not be able to do. I learned how to do

a lot of things like grow and cook my own food.” As campers grew to feel capable of growing and preparing their own vegetables, their vegetable preferences correspondingly increased.

Concerning the third identified theme—an increased appreciation for and understanding of nature—FCF Summer Farm Camp was the first time many of the participants had spent an extended period of time outside in nature. For example, in one focus group a camper explained, “Here at camp I learned how life is on the farm. Instead of watching TV or playing Wii like I’ve done every other summer, I learned that I love this place a lot.” For this camper, FCF Summer Farm Camp helped to introduce the idea of being outdoors as means of entertainment and enjoyment.

In addition to a gained appreciation for nature, campers also demonstrated an increased understanding of nature. For example, the image below displays an ecosystem drawn by a camper in his journal.



**Image 3.** Increased understanding of nature

In this drawing, the participant correctly illustrates the roles that humans, animals, plants, soil, and other natural resources play within an ecosystem. Many campers echoed similar new understanding of how nature functions and their personal role within natural systems. Other campers expressed a more fact-oriented increased understanding of nature. Illustrating this alternate type of increased understanding one camper explained, “I learned about fruits and vegetables and bees. I learned that they stored honey for the winter. I also learned about what parts of a plant I can harvest. I learned about how to harvest them, and I learned about the role of pollinators.” In this way, many campers displayed a gained in both abstract knowledge of natural cycles and new knowledge nature-related facts.

While this type of increased knowledge of and appreciation for nature was a prevalent theme in the qualitative data, it is unclear whether or not this theme directly influenced camper vegetable preferences. No direct link was found in the coded data; however, the prevalence of the theme makes it evident that a gained appreciation for and understanding of nature greatly shaped how participants experienced FCF Summer Farm Camp.

## **VI. Discussion**

### **Limitations**

Similar to many previously studied gardening-based nutrition interventions, this study was limited by a small convenience sample size and a lack of a randomized control group (Robinson-O’Brien, 2009). As a result, it was not possible to measure the impact of the summer camp based on variables such as age and race/ethnicity. The discussion to conduct the research at hand in the absence of a control group was made intentionally by the researchers. FCF Summer Farm Camp is a project still in its developmental stages. As a new camp curriculum

was piloted during the experiment and as the collaboration between FCF and Stanford is very new, the research team felt that it was more pressing to organize and implement a successful program (in both academic data collection and community-based terms) before organizing control groups. As the FCF-Stanford collaboration is ongoing, there will be opportunities to organize control groups in the future.

Given the age of the participants, response bias could also have limited this study, as studies involving youth must take into account youth's tendency to provide socially desirable answers rather than honest responses. Some participants could have reported an increase in preference simply because they believed that is what the camp counselors (who were continually modeling a positive attitude towards vegetables) wanted to see. It is unknown whether or not such a response bias occurred in the study, but due to the age of participants and their close relation with the counselors/researchers, the potential for such a bias is high.

The study was additionally limited by seasonality and vegetable availability on the farm. These two factors prevented each camp session from having identical vegetable exposure counts. Consequently, each week of camp provided slightly different vegetable exposures. While such variance could not realistically be avoided, it does present the potential that the collected data should not have been condensed and analyzed as a whole, across four different weeks of camp. However, since the variance of vegetables across weeks was relatively low, the research team does not feel that condensing the four weeks of data jeopardized any of the analysis.

Finally, the study only measured the change in participant preferences after one week of camp. The results of the intervention could be strengthened if a follow-up survey was implemented to determine whether the increased preferences for vegetables persisted over time. Such a survey could also have measured whether increased reported vegetable preferences

actually correlated with increased vegetable consumption. While the research team tried to implement such a survey, time and logistical constraints made such attempts unsuccessful. However, as the FCF-Stanford collaboration is ongoing, this is one of many available venues for continued research.

### **Implications of Results**

The results of the study show farming and cooking education to be a promising means of increasing children's vegetable preferences. While this makes farming and cooking education just one of many possible approaches for increasing vegetable preferences, the research team feels that the potential to successfully replicate the FCF Summer Farm Camp model is great. Over the past decade, local governments across the U.S.—from Philadelphia, to San Francisco, to Detroit—have begun to convert empty lots into areas of food production (Choo, 2011). This conversion serves to increase surrounding property values, spur economic exchange, and enhance community food security (Santos 2012). The rapidly growing number of urban and suburban farms across the U.S. are ideal potential locations for the FCF Summer Farm Camp model to be replicated.

If the FCF Summer Farm Camp model is replicated, several key features of camp would need to be maintained in an attempt to preserve the documented increase in vegetable preferences. These key components of camp are drawn from the qualitative data analysis findings. Of these findings, perhaps the most essential is a high number and frequency of vegetable exposures. While the unique resources (e.g. bees, orchard, cobb oven) of the FCF Summer Farm Camp site did not appear to affect vegetable preference, frequent physical interactions with vegetables were essential. It is during these interactions that campers became familiar with vegetables and consequently became more comfortable with consuming them.

While the specific form and duration of these vegetable exposures does not appear critical, access to a large number and variety of growing vegetable crops is necessary.

Another key component of the FCF Summer Farm Camp model that, should the program be replicated, needs to be taken into consideration is the creation of camp culture of personal empowerment and exploration. This culture was intentionally cultivated so that campers could practice the new farming and cooking skills they learned during camps. As the qualitative data shows, this culture helped campers to feel capable of growing and preparing their own vegetables, which lead to an increase in vegetable preferences. If the FCF Summer Farm Camp model is replicated and these two components of the FCF Summer Farm Camp can be ensured, the qualitative data suggests that an increase in reported vegetable preferences would follow.

One fundamental component of the FCF Summer Farm Camp model that remains in need of research is its use of farm-based (rather than garden-based) education, and how such an alternative education approach influences vegetable preferences. While the qualitative themes discussed were identified as causes of increased vegetable preference, the research team did not investigate how strongly these themes were a product of the FCF farm setting. Nor did the research team investigate which of the themes could have emerged in more traditional garden settings. This is an important area for further research, as answers such a questions would allow farming and gardening education curriculums to more reflectively utilize the resources available in their particular settings.

## **VII. Conclusion**

The FCF Summer Camp model shows that a weeklong high-intensity farming and cooking education program has the potential to increase children's preference for vegetables.



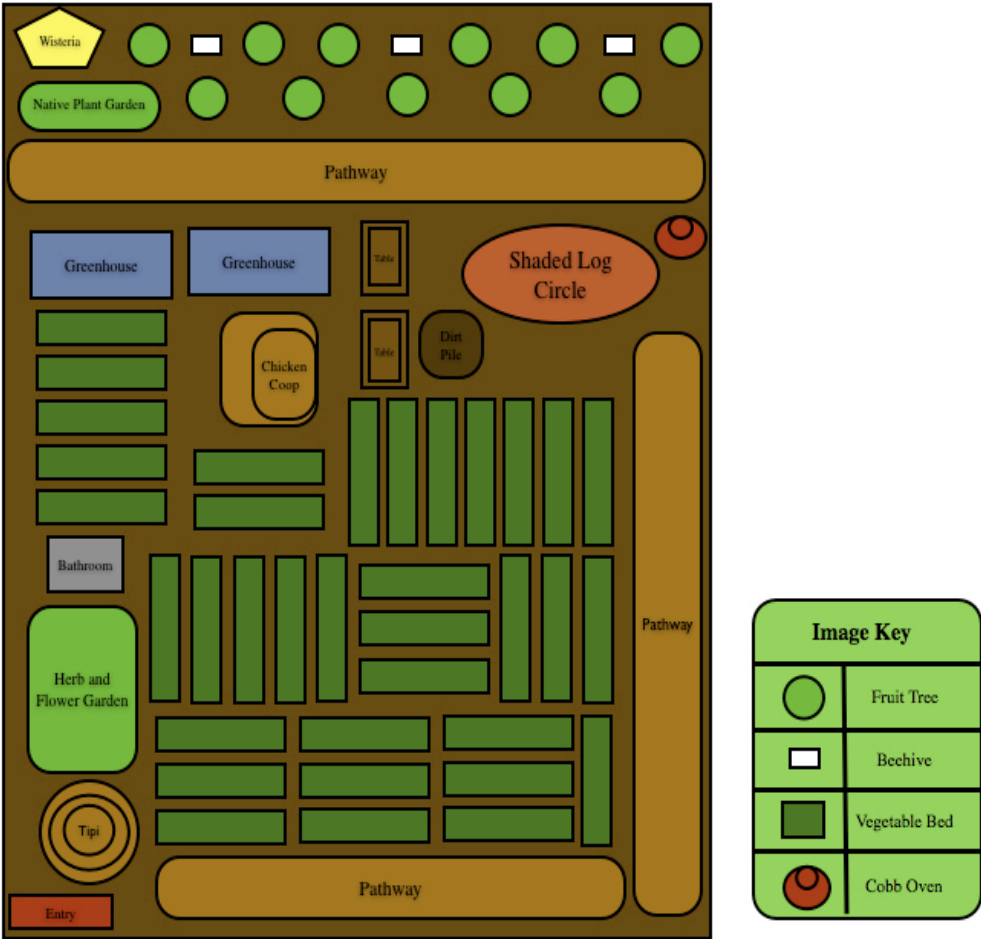
Frequent vegetable exposures and the cultivation of farming and cooking skills appear to be key causes of this potential. When these findings are considered alongside the growing number of urban and suburban farms across the United States, the potential to replicate the FCF Summer Camp model seems great.

The need to conduct further research in this area is also great. An understanding of how site size influences what participants gain from farming and gardening education programs, as well as further scientifically rigorous studies of how farming and gardening education influences long-term vegetable preference and vegetable consumption patterns, are both areas in need of continued research.

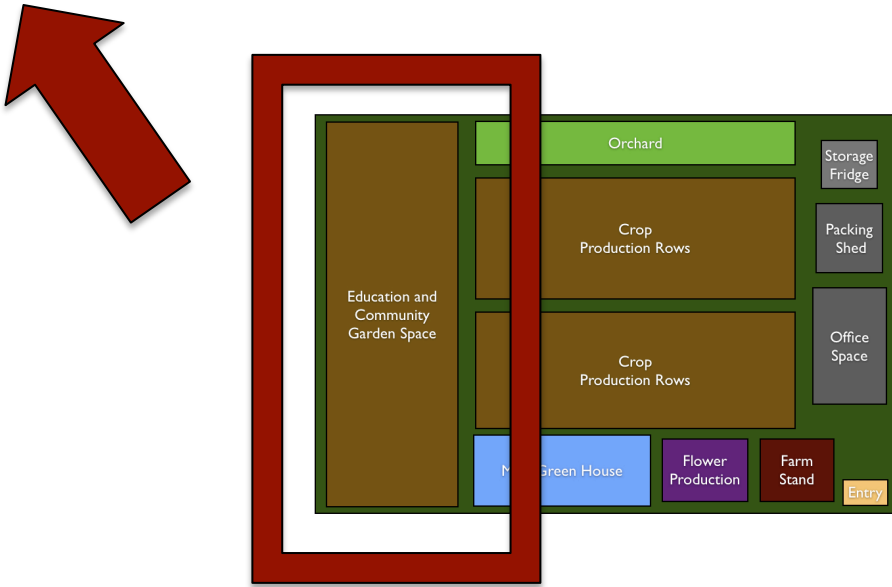
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Appendix A



Education and Community Garden Space, Detailed Map



Full Circle Farm, Full Site Overview

Appendix B

Author, year	State	Study population (n)	Design (duration)	Measures	Measurement tools	Nutrition outcomes
In-School McAleese and Rankin, 2007 (14)	ID	Sixth-grade male/female (99) Garden + nutrition education (45) Nutrition-education only (25) Control (25)	Pre-post, intervention/control (12 weeks)	FV <sup>a</sup> intake	3-day 24-hour recall workbooks	Significant increase in FV intake among garden + nutrition-education group above nutrition-education only and control group. Significant increase in vitamin A, vitamin C, and fiber among garden + nutrition-education group.
Morris and Ziebers-Cheer, 2002 (15)	CA	Fourth-grade male/female (213) Garden + nutrition education (81) Nutrition-education only (71) Control (61)	Pre-post, intervention/control (8 lessons in 17 weeks; 6-month follow-up data)	Vegetable preferences, willingness to taste vegetables, nutrition knowledge	Questionnaires	Posttest preference scores for carrots and broccoli were significantly greater for garden + nutrition education and nutrition education only groups above control group. Posttest preference scores for snow peas and zucchini were significantly greater for garden + nutrition-education group above nutrition-education only and control group. At 6 months, garden + nutrition-education group retained a significantly greater preference for broccoli, snow peas and zucchini. There were no differences between groups in willingness to taste vegetables. Significant increase in general nutrition knowledge among garden + nutrition-education group and nutrition-education only group above control group.
Morris and colleagues, 2001 (16)	CA	First-grade male/female (97) Intervention (48) Control (49)	Pre-post, intervention/control (lessons throughout school year)	Vegetable preferences, willingness to taste vegetables, nutrition knowledge	One-on-one interviews	No significant improvement in vegetable preferences. Intervention students were more willing to taste spinach, carrots, peas, broccoli, zucchini, and red bell pepper. Significant improvements in knowledge to identify food groups, but not ability to identify vegetables.
Lineberger and Zajack, 2000 (17)	TX	Third- to fifth-grade male/female (111)	Pre-post (10 lessons, delivered to accommodate classroom schedules)	FV intake FV preferences	24-Hour recall journal, preference questionnaire	No increase in FV intake. Significant increases in vegetable preference, but not fruit preference. Significant increase in FV snack preference.
Cason, 1999 (18)	SC	Kindergarten (in not reported)	Pre-post (weekly lessons, duration not reported)	Willingness to taste FV FV identification	Interviewer-led survey	Increase in willingness to taste FV. Increase in number of students able to identify fruits and vegetables.
Afterschool O'Brien and Shoemaker, 2006 (19)	KS	Fourth-grade male/female (38) Intervention (17) Control, no intervention (21)	Pre-post, intervention/control (10 weeks)	FV Preferences, nutrition knowledge, self-efficacy to consume FV	Questionnaires	No improvements in FV preferences or knowledge. Increased self-efficacy to consume FV, statistical significance not reported.
Herrmann and colleagues, 2006 (20)	OK	Third- to eighth-grade male/female (43)	Pre-post (1 day per week, duration not reported)	Vegetable intake	Single-item survey question	Significant increase in report of daily vegetable intake.
Poston and colleagues, 2005 (21)	KS	Third- to fifth-grade male/female (29) Intervention (18) Comparison, nutrition-education only (11)	Pre-post, intervention/control (8 lessons 1/week)	FV preferences, nutrition knowledge, and self-efficacy to consume FV	Questionnaires	No significant improvements in FV preference, knowledge, or self-efficacy among participants in intervention or comparison groups.
Community Lautenschlager and Smith, 2007 (22)	MN	8-15 y male/female (96- pre, 66-post)	Pre-post (10 weeks, 3 days/week)	FV intake	24-hour recall and survey	Significant increases in FV intake, boys only.
Lautenschlager and Smith, 2007 (23)	MN	9-15 y male/female (40) Gardeners (26) Nongardeners (14)	Focus groups (3 gardeners/3 nongardener groups)	Beliefs, knowledge, and values with regard to nutrition and cooking	Focus groups	Youth gardening program participants were more willing to eat nutritious food, try ethnic and unfamiliar food, greater likelihood to cook and garden, and expressed a greater appreciation for other individuals and cultures.
Koch and colleagues, 2006 (24)	TX	Second- to fifth-grade male/female (56)	Pre-mid-post (duration ranged from 1 day/week for 12 weeks to daily for 1 week)	FV Preferences, consumption of healthy snack, knowledge of the benefits of FV	Preference questionnaire, multiple choice exam, and interview	No significant differences in FV preferences. Significant improvements in healthy snack consumption and knowledge of the benefits of FV.

Appendix C

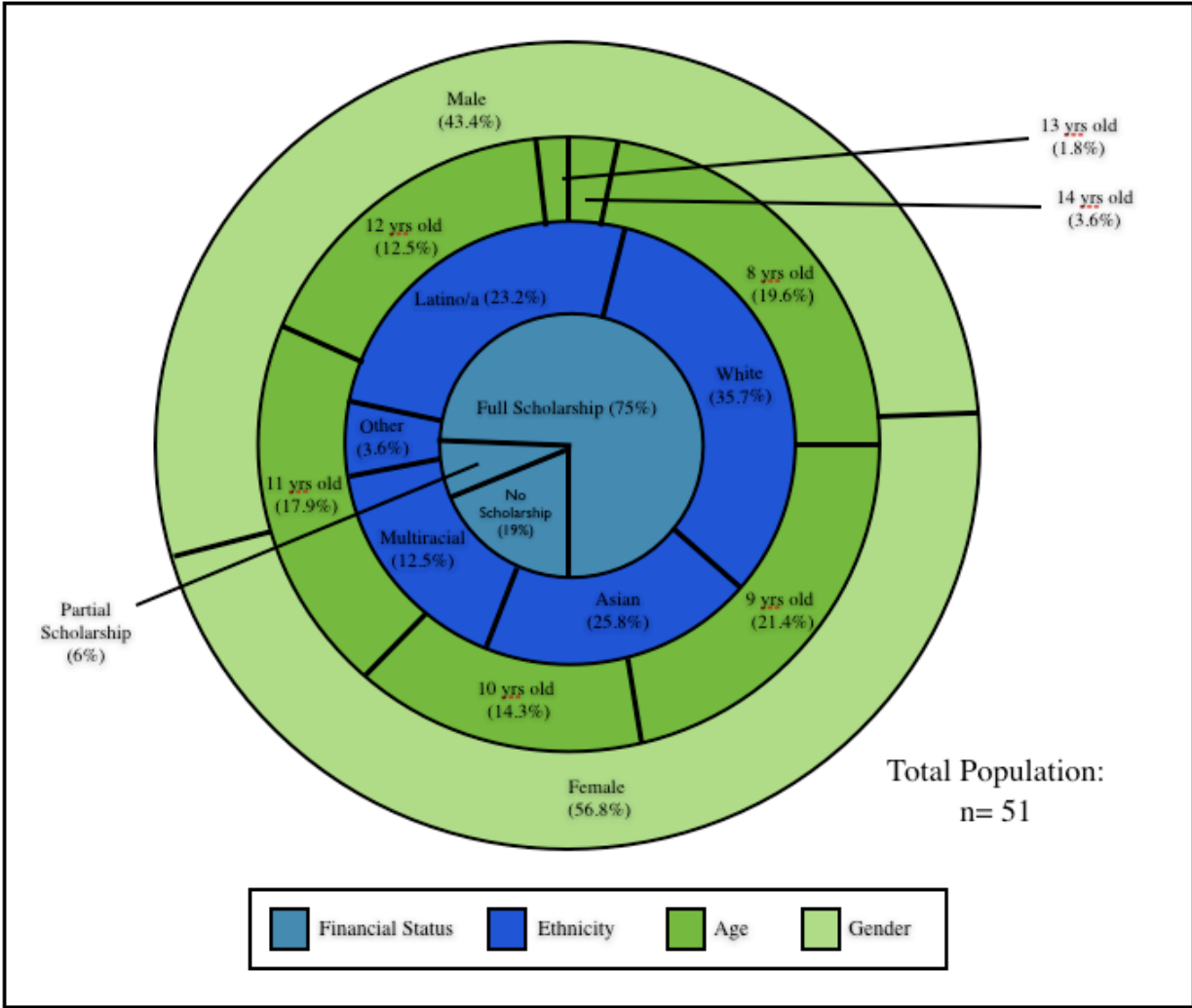


Figure 2. Display of participant population demographic information





























































**Appendix D**

Name: \_\_\_\_\_

**Vegetable Survey**

All of your answers will be private, and no one will know what you write. Please answer the questions based on what you really do.

How much do you like these vegetables? Circle the answer that best describes you.

VEGETABLE	Not at all 	A little bit 	Some 	A lot 	A whole lot 	?
Avocados						?
Garbanzo Beans						?
Beets						?
Bell Peppers						?
Carrots						?
Cauliflower						?
Chard						?
Eggplant						?
Green Beans						?
Jicama						?
Kale						?

<b>Mushrooms</b>						?
<b>Potatoes (not fries)</b>						?
<b>Spinach</b>						?
<b>Zucchini</b>						?

For each sentence below, circle the answer that describes you the best

1. I like eating vegetables.

Not at all      A little bit      Some      A lot      A whole lot

2. I ask for vegetables at home.

Not at all      A little bit      Some      A lot      A whole lot

3. I like trying new vegetables.

Not at all      A little bit      Some      A lot      A whole lot

4. I like to garden.

Not at all      A little bit      Some      A lot      A whole lot

5. I like to cook.

Not at all      A little bit      Some      A lot      A whole lot