

IMPACT OF YOUTH GARDENING ON  
EMOTIONAL WELLBEING

by

Morgan Dorcheus

A thesis submitted to the faculty of  
The University of Utah  
in partial fulfillment of the requirements for the degree of

Master of Science

in

Human Development and Social Policy

Department of Family and Consumer Studies

The University of Utah

May 2016

Copyright © Morgan Dorcheus 2016

All Rights Reserved



## **ABSTRACT**

There is mounting evidence for the effectiveness of youth gardening programs in increasing fruit and vegetable consumption among children who consistently attend such programs. Unfortunately, existing research does not address whether youth gardens can influence the emotional wellbeing of program participants. Changes in emotional wellbeing may be an important outcome for youth with infrequent garden attendance. This is a significant gap in research that presented an opportunity for this study.

Wasatch Community Gardens (WCG), located in Salt Lake City, Utah, has developed partnerships with community agencies (e.g., Boys & Girls Club) to provide their City Roots youth gardening programs. In weekly 1-hour classes, youth learn how to harvest and prepare fresh fruits and vegetables grown in WCG gardens. Although classes are offered on a weekly basis, participants from each agency differ week-to-week. This project assessed whether the City Roots youth gardening program impacts the short-term emotional wellbeing of youth ages 8-18 years old. This study had a total of 65 participants in summer and fall of 2015.

Outcomes were measured through surveys given at the beginning of youth gardening classes, surveys given at the end of classes, and through a photo art project. Using components of existing food consumption surveys, a self-regulation tool, and other measures adapted specifically for evaluating youth gardening programs, we expected to see improvements in emotional wellbeing with some variation also attributable to

sociodemographic variables. Results from our data show generally positive emotional states for youth gardening participants at the beginning of classes and at the end, with significant change shown on some emotional wellbeing measures between pre- and posttesting varying by sociodemographic characteristics.

Unlike previously conducted gardening research, this study assessed participants up to the age of 18, participants with infrequent garden attendance, had an explicit focus on the emotional state of children, and included a separate qualitative collection focusing on influences of children's vegetable preferences. This study is unique in comparison to published works, which gives it an important role in informing the format and curriculum used in community youth gardening programs as well as future youth gardening evaluation research.

## TABLE OF CONTENTS

ABSTRACT .....	iii
LIST OF TABLES .....	vi
INTRODUCTION .....	1
LITERATURE REVIEW .....	3
METHODS .....	10
Data .....	12
Measurement .....	13
Ethical Considerations .....	14
Sample .....	15
Analytic Strategy .....	16
Hypotheses .....	18
RESULTS .....	19
Demographics .....	19
Vegetable Preferences and Vegetable Consumption .....	19
Emotional Wellbeing .....	21
DISCUSSION .....	34
LIMITATIONS .....	38
CONCLUSION .....	40
Appendices	
A: FULL SURVEY SAMPLE .....	41
B: SELECTED EXAMPLES FROM PHOTO ART PROJECT .....	43
C: ADDITIONAL ANALYSES .....	46
REFERENCES .....	48

## LIST OF TABLES

### Tables

1. Demographic Characteristics ( $N=65$ ) .....	24
2. Results Observed for Attendance.....	25
3. Results Observed for Vegetable Preference and Vegetable Consumption Measures...	26
4. Selected Quotes From Photo Art Project .....	27
5. Results Observed for Measures of Emotional Wellbeing.....	28
6. Selected Quotes From Open-ended Survey Items .....	29
7. Summary of OLS Regression Analysis for Five-face Pictorial Scale Posttest Scores ( $N=49$ ) .....	30
8. Summary of Logistic Regression Analyses for Five-face Pictorial Scale, Model 1 ( $N=50$ ).....	31
9. Summary of Logistic Regression Analyses for Five-face Pictorial Scale, Model 2 ( $N=47$ ).....	32
10. Summary of Logistic Regression Analyses for Five-face Pictorial Scale, Model 3 ( $N=46$ ).....	33
11. Summary of $t$ -test Analysis for Pre-Post Grump Meter Scores .....	47
12. Summary of $t$ -test Analysis for Pre-Post Five-face Pictorial Scores .....	47
13. Summary of OLS Regression Analysis for Five-face Pictorial Scale Pretest Scores.....	47

## INTRODUCTION

Of youth aged 2-19 years old in the United States, approximately 17% are considered obese (Childhood Obesity Facts, 2014). Childhood obesity is a serious problem, especially for those living in low-income housing (Childhood Obesity Facts, 2014). Rising obesity rates in the United States have facilitated the development and implementation of obesity-fighting initiatives across the country. Numerous agencies have begun combating this problem because of the severe health risks that accompany this disease. Although obesity is a widely recognized issue, there is little consensus on how the disease should be best addressed.

In the past decade, schools and nonprofits have recognized the benefits of gardening-based education for elementary-school-aged children. Existing evaluative research has consistently shown that using gardening as a form of experiential education can increase the willingness of young children to try new fruits and vegetables. Additionally, many of these established school gardens and other gardening programs have nutrition education components that have allowed participants to learn about how food is grown and the importance of eating a variety of healthy foods (Blair, 2009; Gatto, Ventura, Cook, & Gyllenhammer, 2012; Heim, Stang, & Ireland, 2009; Langelotto & Gupta, 2012; McAleese & Rankin, 2007; Parmer, Salisbury-Glennon, Shannon, & Struempfer, 2009). Although existing research drives the continued implementation of gardening programs in both schools and communities, there is little research addressing



the positive impacts on youth with intermittent gardening attendance or regarding the socioemotional effects the gardening experience may have on child participants. This gap in existing research led to the development of this study.

Wasatch Community Gardens (WCG) is a nonprofit organization that has partnered with social service agencies in the Salt Lake Valley for over 20 years. WCG's City Roots youth program serves children aged 4-18 living in primarily low-income households. A quasi-experimental research design known as pretest posttest single group evaluation design was used in this study to assess how WCG City Roots classes impact the emotional wellbeing of participants age 8 or older with attention given to measuring differences by sociodemographic characteristics and attendance. This evaluation included assessing the self-reported attitudes of participants as they began and as they completed a City Roots class. Additional survey questions regarding taste preferences and home availability of vegetables were also asked. Given sporadic program attendance in WCG programs, vegetable preference and consumption questions were still important to assess and provided an additional opportunity to expand current literature.

After an in-depth review of peer-reviewed journal articles, it appears this is the first study that explicitly assesses effects on attitude and emotion during gardening program experiences for children. Previous studies assessing the impact of gardening programs on youth's fruit and vegetable consumption have primarily focused on younger age groups (under 11 years old), school-based gardens, and participants with consistent garden attendance over an extended period of time. This study assesses youth up to 18 years old and includes class participants with both consistent and sporadic program attendance.

## LITERATURE REVIEW

Unhealthy eating behaviors associated with overweight and obesity are alarmingly common among American youth, especially those considered at-risk or living in low-income households. In 2012, nearly 1 in 3 children under the age of 18 years old were considered overweight or obese with rates expected to continue increasing in the future (Childhood Obesity Facts, 2014; Ogden, Carroll, Curtin, Lamb, & Flegal, 2013), making childhood obesity one of the top health concerns in the U.S. Children with high BMIs<sup>1</sup> are more likely to be obese as adults and suffer severe health consequences, including stroke, heart attack, cancer, kidney disease, osteoarthritis, chronic stress, anxiety, and depression (Garasky, Stewart, Gunerson, Lohman, & Eisenmann, 2009; Ogden et al., 2013; Stunkard, 2003). People with excess body fat may also struggle with type II diabetes and become insulin-dependent for a large portion of their lives. With a health crisis as severe as the obesity epidemic, there are growing concerns that children are not receiving adequate food-related education and lack an understanding of good nutrition, food preservatives, and produce production.

Although controversial, several studies have suggested that the childhood obesity epidemic could result in severe consequences for life expectancy in the U.S. Olshanky et

---

<sup>1</sup> Body Mass Index (BMI) is calculated by dividing weight in kilograms by square of height in meters. It is used as a screening tool for body fatness and multiple diseases, but it is not diagnostic. (CDC website)

al. (2005) predict that if childhood obesity rates continue to rise, life expectancy will level off or even begin to decline within the next half century, despite more optimistic projections made by agencies such as the Social Security Administration. With this prediction, Olshanky et al. (2005) assume that as obese children reach adulthood, they will develop severe health conditions that will significantly threaten longevity. A more recent study has examined obesity-related effects on life expectancy with similar conclusions (Preston & Stokes, 2011), noting that differences in life expectancy between the U.S. and other countries may be attributable to factors related to the obesity epidemic in both children and adults.

Early experiences with food influence healthy eating habits in later life (Cooke, 2007; Gluckman, Hanson, Cooper, & Thornburg, 2008) and although legislation is beginning to respond accordingly, much of the responsibility for combating obesity and its related health consequences falls on the population at a community level. There have been numerous initiatives in schools and communities launched to address many of the prominent health issues related to childhood overweight and obesity, some of which have had essential positive outcomes that will inform future initiatives. For example, youth gardening programs provide the opportunity for students to learn about the importance of food in relation to human health, teach essential skills in growing and preparing healthy food, provide access to fruits and vegetables, enhance science curricula, and implement nutrition curriculum in an applied, hands-on context.

Gardening programs offer education with curricula covering a variety of topics, depending on the goals of the school- or community-based program. Knowledge regarding fruit and vegetables, gardening and harvesting, food preparation and cooking,

and outdoor nature experiences are often included. Additional subject areas include environmental stewardship, connections between communities and food systems, healthy food access, and the importance of exercise. Extensive evaluation research has been performed regarding the effectiveness of these initiatives showing generally positive results (Gatto et al., 2012; Heim et al., 2009; Langellotto & Gupta, 2012; McAleese & Rankin, 2007).

As a form of experiential education, gardening has proven useful in a variety of settings aimed toward childhood obesity prevention and food education (Parmer et al., 2009). Many programs establish partnerships with nonprofit community organizations to aid in making nutritional science more pertinent and relevant to young participants (Ozer, 2007), particularly low-income and minority youth. Many of these gardening programs are based on evidence suggesting a relation between community and school food environments and fruit and vegetable intake among children and adolescents (Ding et al., 2012). A correlation between these variables suggests a continuing importance for the establishment and improvement of gardening programs at both school and community levels.

There is mounting evidence regarding the effectiveness of garden-based education in schools. In response, both school and community gardening programs are increasing in popularity across the country. Studies have shown that children's knowledge about healthy eating behaviors significantly improves along with their general attitudes toward eating fruits and vegetables after participating in these programs (McAleese & Rankin, 2007). In addition to these benefits, students in one study reported extremely high levels of satisfaction with participation in gardening classes and nutrition intervention

programs, suggesting children enjoy participating in gardening experiences (Heim et al., 2009). Similar results have been shown in gardening programs established specifically for at-risk youth groups (Gatto et al., 2012; Rush & Knowlden, 2014).

Additional benefits of youth gardening programs have been well documented in academic literature. Children taking classes in a garden are required to partake in a certain level of physical activity by weeding and harvesting fresh produce, providing added exercise benefits crucial to fighting obesity (Ozer, 2007). Other benefits of gardening education include positive academic outcomes such as higher test scores on standardized science achievement exams (Klemmer, Waliczek, & Zajicek 2005) and increased social skills after program participation (Draper & Freedman, 2010). Gardening programs are largely outdoor programs, which could also offer potential benefits found in outdoor- and nature-related research. For example, programs utilizing experiential education in outdoor environments found that landscapes have a significant impact on a participant's social engagement, level of physical activity, environmental attitudes, and stress levels (Abraham, Sommerhalder, & Abel, 2010; Ewert, Place, & Sibthorp, 2005). As an outdoor experience, garden-based education has the potential to offer the same psychosocial benefits.

Although the studies listed above have reported generally positive results regarding the effectiveness of garden-based education programs, there are limitations to consider. A meta-analysis of peer-reviewed youth gardening studies found that many of the studies evaluating gardening education reported positive results, but that statistically these results may not be as significant as suggested (Langaletto & Gupta, 2012). Small sample sizes and lack of long-term data were identified as a problem in previous

gardening studies, and it was recommended that future studies work to combat these common problems.

Of the health impacts resulting from childhood obesity, one of the most under-addressed topics is social-emotional wellbeing. Those suffering from overweight or obesity are more likely to be anxious or depressed (Levi et al., 2009) resulting in increased isolation from peer groups, less psychosocial wellbeing, lower self-esteem (Mellin, Neumark-Sztainer, Story, Ireland, & Resnick, 2002), and low work productivity (Gates et al., 2008). Obese and overweight children and adults are often discriminated against in healthcare, work, and education settings due to weight bias (Puhl & Latner, 2007) and medical concerns. It is conceivable that these psychosocial variables are of equal importance to the physical health disparities defining poor health.

Although there have been a variety of positive outcomes for garden-based education opportunities, recent literature has not adequately addressed the effect gardens have on the psychosocial wellbeing of program participants. In the past, evaluations have predominately focused on the effects gardening has on children's and adolescent's fruit and vegetable preferences or consumption. This is a significant gap in existing research that needs to be investigated for garden programming to be well informed and to create well-rounded approaches to both improved curriculum in existing programs and new programs. Several studies utilizing anecdotal evidence have called for evaluative research that further examines psychosocial development, cooperation with peers, behavioral engagement, and other related variables (McCormack, Laska, Larson, & Story, 2010; Ozer, 2007).

In addition to the problems around statistical significance and the lack of

psychosocial variables in garden education studies, there are few studies that have assessed the impact these programs have on middle-school-aged students. Published gardening research is often conducted in elementary schools, which leaves the potential effects on adolescents unassessed.

Existing youth gardening research often assesses changes in fruit and vegetable consumption in children who attend gardening classes regularly. Youth gardening education programs may also have participants who attend classes intermittently. It is unlikely consumption of, or attitudes towards, fruits and vegetables will change among participants who do not consistently attend programs. Nevertheless, it does provide a unique opportunity to assess whether gardening programs can impact the temporary emotional state of young participants.

Wasatch Community Gardens (WCG), located in Salt Lake County, Utah, has a variety of education-based gardening programs aimed at improving access to healthy, fresh food. The City Roots program utilizes community partnerships to bring youth groups into WCG locations to participate in 1-hour classes instructed by female youth educators. These partners include Young Women's Christian Association, Boys & Girls Club of Greater Salt Lake, Housing Authority, and Youth City. During the garden experiences, youth under 18 years of age have opportunities to taste new foods and learn how to grow, harvest, and prepare seasonal fresh foods. The effectiveness of similarly modeled programs in positively changing healthy eating behaviors is well documented. WCG provided an opportunity for extending existing analyses to observe how youth gardening programs impact the short-term emotional wellbeing of participants. This included assessing emotional wellbeing and changes in emotional wellbeing over the

course of youth gardening experiences, including changes among participants with intermittent attendance.



## METHODS

This study aimed to fill a meaningful gap in existing gardening education research. The University of Utah partnered with WCG to assess the program's success in improving the participants' short-term attitudes and emotional wellbeing. This study collected data from City Roots participants aged 8-18 to answer the following research questions:

- a. Is time in the garden associated with a child's interest in trying new vegetables?
- b. Is time in the garden associated with changes in a child's emotional state?
- c. Do changes in emotional state vary by gender, race/ethnicity, household income, and time spent in the garden?

In order to address these changes, the research team designed a study that used a quasi-experimental research design known as the pretest posttest, single group design. Using this design, short surveys were given to each participant as s/he arrived at the garden and as s/he left the garden. The survey contained three main components: (1) pictorial scales to assess emotional state, (2) semantic word pairings, and (3) questions regarding vegetable preference and availability of healthy foods at home. These surveys were linked to administrative data on the youth's socio-demographics and class attendance, which was used to describe the youth and as independent variables in multivariate analyses focused on assessing the participant's changing emotional state

over the course of her/his time in the garden.

The pretest posttest, single group design is not an ideal experimental study design. As participants completed the pretest, it is possible they became more aware of being studied and therefore changed their behavior or attitude. It is also possible that community partners allowed youth to choose from a variety of activities, and only youth interested in an outdoor experience like the WCG City Roots program opted in, whereas youth who preferred another type of activity opted out. Both internal and external validity may be impacted by these factors. Despite these concerns, sporadic garden attendance by participants made it impossible to utilize a more sophisticated research design.

Data were compared to a previously conducted study: The Wisconsin Farm to School Evaluation. These benchmark comparisons aided in showing how our sample's answers to vegetable preference and vegetable availability survey questions and sociodemographics compare to a larger, more nationally representative sample. Benchmarking also aided in addressing concerns of external validity in study design and enhancing generalizability of results.

Unlike previously conducted gardening research, this study assessed participants up to the age of 18, participants with infrequent garden attendance, and had an explicit focus on the emotional state of children, and included a separate qualitative collection focusing on influences of children's vegetable preferences. This study is unique in comparison to published works, which gives it an important role in informing the format and curriculum used in community youth gardening programs.

## Data

Primarily, I collected data with help from WCG staff. At the beginning of each City Roots class during the summer and fall class sessions, all eligible participants were given a survey and pencil attached to a clipboard. Before regular class activities began, the survey was completed and turned in to me. This process took only 5-10 minutes. Afterward, WCG staff continued with regular lesson plans. In the last 10 minutes of the class, each participant completed relevant survey questions a second time. This collection made up the quantitative data component of the study. All data were collected between July and September of 2015, spanning both the summer and fall WCG class sessions.

In four selected City Roots classes, contextual data were also gathered. Participants were asked to take a picture of their favorite fruit or vegetable growing in the garden using a Polaroid camera. After the picture had developed, they glued it to a piece of art paper and wrote a sentence or two about why it is their favorite vegetable. I took digital photos of the completed projects for later review. Most participants for this project were between ages 8 and 13 years old because of an age cutoff set for study participation. Classes for this project were chosen based on the younger age of attendees. Some of the art project participants were also included in the survey sample. The art projects were collected to elaborate and provide insights regarding the findings from survey items.

WCG was granted access to demographic information collected by partnering agencies that bring participants to City Roots classes each week. These data were transferred from the community agencies directly to WCG staff. Once survey data entry was complete, WCG staff linked the available demographic information with each participant's survey responses, including variables such as household income,

race/ethnicity, age, and gender. Variables regarding garden attendance were also included. Once the demographic data were entered to create a final data set, personal identifiers were stripped and the data were returned to me for analysis.

### Measurement

To assess how the emotional state of study participants changed throughout the course of a City Roots class, the Grump Meter (Kaufman & Kaufman, 2011) and an additional pictorial scale with five faces was used. The Grump Meter assessment tool was originally developed to give children and adults a visual aid to identify the intensity of their feelings, prevent negative and/or harmful behaviors, and serve as a reminder to self-regulate. The tool was adapted in this study to assess whether or not the garden may have impacted children's emotional state, and specifically whether the experiences of being in the garden helped children to regulate their moods. The additional pictorial scale used a series of five faces that indicated the children's current emotional state. These types of measures are frequently used with youth to reduce verbal demands in order to obtain information from children and adolescents that would be difficult to obtain otherwise. Similar measures have been tested for evidence of test-retest reliability, construct validity, and criterion validity with positive results (Oros & de Minzi, 2015). Each of these scales was followed by an open-ended question asking why the participant felt that way.

Additionally, the survey included a series of three semantic differential pairings to determine how each child felt when entering and exiting the garden. These included Good/Bad, Energetic/Lazy, and Interested/Bored. These word combinations were chosen

based on relevance to emotional wellbeing as it relates to overall attitude, level of arousal, and interest in the gardening experience. Please see Appendix A for the full survey.

Upon arriving at the garden and at the conclusion of the class, participants were asked to rate themselves on the above scales and provide an explanation of their emotional experience. In addition to these scales, participants were asked a series of questions to assess how frequently they eat vegetables at home and their willingness to try new vegetables, which were adapted from the 2012 Wisconsin Farm to School Evaluation and the 2004 Early Childhood Longitudinal Study. This information was collected from 66 participants during the summer and fall class sessions.

Each measure was pilot tested on 10-15 youth between 8 and 11 years old. Pilot test participants were attending WCG summer camps in the same community gardens that City Roots programs take place. They were not included in the City Roots sample for this study. Observations and feedback from pilot testing informed the layout and order of questions on the final survey.

### Ethical Considerations

In the planning phase of this study, the anonymity of study participants was a main concern. I collected data from City Roots class participants in person. The appropriate nondisclosure paperwork to ensure privacy and confidentiality of all study participants was signed by me prior to data collection. As previously mentioned, once the dataset with survey information and the datasets with demographic data were linked together, anything specifically identifying each participant was stripped from the data and

replaced with unique identification numbers.

An information letter and notice of study participation was sent to participants' parents at least 1 week before study participation. The letter included a description of the study, examples of what would be asked of participants, and my e-mail address. The e-mail was included to answer any questions and to provide an opportunity for parents to opt their children out of the study if desired.

In meeting ethical standards and including appropriate protections of privacy and confidentiality, this evaluation project was declared exempt by the University of Utah IRB on July 2, 2015.

### Sample

Over 90% of the approximately 300 children each year who attend WCG City Roots classes live in federally designated low-income households. Nearly 70% of the participants live in single female head-of-household families. Research suggests low-income households headed by a single female tend to have lower access to healthy foods. Since low-income groups are often more obese and suffer more health problems than those with higher socioeconomic status, the City Roots youth program serves an at-risk community in Salt Lake City, Utah. Each eligible child attending WCG City Roots classes was assessed only once to prevent repeated participants from carrying more weight within the data than others.

Only 66 survey responses were obtained due to both an age cut off for participation and sporadic attendance. Youth aged 8 years and older were included to ensure adequate reading and writing comprehension for surveys to be taken

independently. Of the 10 available classes in each City Roots session, most participants attended class only a few times. Both the age cut-off and sporadic attendance made it difficult to reach all City Roots participants.

### Analytic Strategy

The central research question in this study examined whether or not the garden experience impacted the emotional state of the children participating in WCG City Roots classes. After children filled out surveys at the beginning and end of class, I entered the data into a spreadsheet that included the children's names. Afterwards, the demographic data provided by WCG community partners were linked to the children's survey responses. When all of the information had been linked, the participants' names were stripped from the data and replaced with unique identification numbers. One study participant was not included in data analysis due to missing information on key variables, resulting in a sample of 65. Statistic Package for the Social Sciences (SPSS) was used to analyze the data.

Descriptive statistics were used to make benchmark comparisons with the 2012 Wisconsin Farm to School Evaluation to determine how our sample answered questions relative to a previously conducted larger scale study. Change scores were used to assess the changes in emotional states over the course of the youths' time in the garden. This was done by calculating difference scores for each item assessing the children's emotional state, including the Grump Meter, three semantic differentials, and the additional five-face scale. A similar analysis was planned to determine whether time spent in the garden impacts children's willingness to try new vegetables. However, low

variance in responses combined with low statistical power did not support initial plans for vegetable preference variables.

Multiple regression and logistic regression models were used to estimate the relationship between changing emotional state and sociodemographic covariates, race/ethnicity, gender, household income, attendance, and others. The dependent variable tested in these models included emotional state from posttest scores, as well as dummy variables coded for positive changes in emotional state.

Dummy variables were used in regression models to control for participants who were Non-Hispanic White vs. those were not, participants living in households earning 30% MFI<sup>2</sup> or below vs. those living in households earning above 30% MFI, males vs. females, whether it was the participant's first year attending City Roots, class attendance, and for pretest scores on the lazy/energetic semantic pairing. Collinearity diagnostics revealed that multicollinearity was not a problem. A 90% confidence level was used for all regression models due to the exploratory nature of this study.

The qualitative data gathered with the Polaroid camera art project were used to further explain the findings of the study. For example, these data were useful in illustrating youth's fruit and vegetable preferences, and elaborating on descriptive benchmark comparisons. Similarly, the open-ended questions answered on the survey regarding the children's emotional state were useful in describing why children reported the attitudes they did.

---

<sup>2</sup> Median Family Income (MFI) indicates the point in which half of the income distribution is above that amount and half is below that amount. In the case of WCG, MFI is adjusted for household size.



## Hypotheses

We expected to find that low-income groups and minority groups had relatively less access to vegetables available at home, and benefited the most from a WCG gardening experience in terms of emotional wellbeing. Overall, we expected that time in the garden would be associated with positive changes in the emotional state of participants across all demographic groups and for youth with both consistent and inconsistent garden attendance.

## RESULTS

### Demographics

The demographic characteristics of the sample are shown in Table 1. Sixty-nine percent of the sample was female, and 33% was Non-Hispanic White. Most of the sample was between 8 and 12 years of age at the time of data collection (87%), with the average age being 11 years old. Although data were collected for youth up to age 18 years, the 2 oldest participants (15 and 18 years old) were paired with younger age groups due to the presence of a disability. Fifty-eight percent lived in households with incomes of 30% MFI or less, and 62% lived in single-female headed households.

Forty-six percent of the sample had participated in City Roots youth gardening programs in years prior to data collection. Participants in the sample attended an average of 3 out of 10 possible classes during the sessions in which data collection took place. Sixty-nine percent attended between 1 and 3 classes, with only 2 participants attending all 10 sessions available (see Table 2).

### Vegetable Preferences and Vegetable Consumption

Of the 65 study participants, 22% had eaten a green salad more than 4 times in the week prior to study participation, and 62% had eaten other vegetables in the same time period. Twelve out of 65 study participants (18%) reported eating both a green salad and other vegetables more than 4 times in the week prior to study participation.

Of the 3 specific vegetables included in vegetable preference measures, squash was the least likely to have been tried by study participants with only 60% reporting they had ever eaten it. Ninety-five percent reported previously eating tomatoes and 94% reported previously eating broccoli. For those who had tried the 3 vegetables, a majority reported they liked them (see Table 3).

Measures of vegetable preferences were adapted from a survey used in the Wisconsin Farm to School Evaluation (WFSE) study. The WFSE study found that youth had been exposed to an average of 83% of the fruits and vegetables surveyed, and of those who had been exposed, an average of 82% reported liking them (LaRowe et al., 2012). In the current study, 68% of youth surveyed reported liking the vegetables they had been exposed to, on average. The differences between these numbers may be a result of differing sample sizes. However, the WFSE evaluation reports a very different sample composition in terms of sociodemographics. Eighty-one percent of WFSE participants were White, the mean age was 10 years old, and the study had relatively more males (53%) in their sample. Additionally, WFSE participants averaged 1.41 prior years of gardening program attendance (LaRowe et al., 2012). Differing sample compositions make implications from these benchmarking results difficult.

Youth who participated in the photo art project were able to provide examples of why they choose and enjoy certain plants, fruits, and vegetables. In examining the explanations of their choices, three themes were identified regarding vegetable choices: (1) social; (2) outdoor; and (3) plant-specific. These themes were identified based on participants' mention of spending time with friends, spending time in nature, and both the aesthetics of plants and positive past experience with plants. Meaningful examples of

these explanations are shown in Table 4. These examples indicate that seeing fruits and vegetables in their natural state may be significant to influencing healthy eating choices. Please see Appendix B for pictured examples of the photo art project.

There are some additional observations from data collection worth noting. Youth in the same class often chose to take a photo of the same fruit or vegetable as a class member who had gone before them. This may indicate peers can have a strong influence on children's fruit and vegetable choices. Additionally, some class participants chose plants they had interacted with during an activity in a previous gardening class, suggesting the gardening classes may influence participant's willingness to try new foods.

### Emotional Wellbeing

Survey results revealed little variation between pre- and postscores on emotional wellbeing measures. Eighty-two percent of study participants reported a 4 or 5 on the five-face pictorial scale at the beginning of City Roots classes, indicating feeling more happy than sad, and 86% reported feeling the same at the conclusion of classes. Although most participants reported some degree of 'happy' on the pictorial scale, 20 participants moved from a lesser position on the scale to 'very happy' (5) on the scale from pretest to posttest. Similarly, 91% of participants reported feeling 'calm' at the beginning, and 88% reported feeling calm at the conclusion of classes (see Table 5). *T*-tests for mean differences in Grump Meter and other pictorial scale measures revealed no statistically significant differences from pre- to posttest (see Appendix C). An open-ended question ("What makes you feel that way?") was asked after both the Grump Meter and additional

five-face scale. Meaningful examples of open-ended responses are shown in Table 6.

Similar results were also observed for two of the semantic word pairings. Ninety-eight percent felt more good than bad at the beginning of classes and 95% felt more good than bad at the conclusion of classes. Eighty-three percent felt more interested than bored at the beginning and 84% felt the same at the end. More variation was observed in the last word pairing, with 63% feeling more energetic than lazy at the beginning of classes and 72% feeling energetic at the conclusion of classes (see Table 5).

Two emotional measures were the focus of multivariate analyses: (1) positive change in mood and (2) the mood observed for all students at posttest using the five-face pictorial scale. These outcome variables were chosen based on the variability shown from pre- to posttests. A multiple linear regression was calculated to predict posttest scores on the five-face pictorial scale based on gender, race/ethnicity, income, whether participants had attended City Roots classes in prior years, how many classes participants attended, and lazy/energetic semantic scores at pretest. A significant regression equation was found ( $F(6,43)=2.95, p<.05$ ), with an  $R^2$  of .29. Gender, income, and whether it was a participant's first year attending classes were all significant predictors of mood observed at posttest (see Table 7). That is, being female and having higher income were associated with higher posttest scores, and being in the 1st year of the City Roots program was associated with lower posttest scores. A parallel regression model was calculated to predict pretest scores on the five-face pictorial scale with no significant findings (see Appendix C).

Three binary logistic regressions were calculated to assess positive change in mood. Two dummy variables were created for these models. The first dummy variable

indicated participants who began classes as “very happy” and ended “very happy” as well as those who experienced positive changes in mood from pre- to posttest. Using this variable, the first logistic regression model found that females were 530% more likely than males to have indicated their mood as “very happy” at pretesting and at posttesting, or to have indicated improvement in mood over the course of a gardening class.

Participants who had not attended City Roots classes in prior years were 80% less likely than those who had attended in prior years to have indicated the same maintenance in mood or positive change in mood (see Table 8).

The second dummy variable used in logistic regression models indicated positive change in mood from pre- to posttest, and excluded youth who experienced a negative change in mood. The first model using this dummy variable found no significant differences between covariates (see Table 9). However, a third logistic regression was calculated by adding a covariate for lazy/energetic semantic pair pretest scores. In this final logistic regression, it was shown that participants who had not attended City Roots programs in prior years were 76% less likely than those who had previously attended to have experienced positive change in mood through the course of a gardening class. Additionally, participants who indicated “lazy” at pretest were 370% more likely to have experienced positive changes in mood than those who indicated “energetic” from pre- to posttest (see Table 10).

Table 1. Demographic Characteristics (N=65)

Gender	
<b>Male</b>	31%
<b>Female</b>	69%
Age	
<b>8-12 years old</b>	87%
<b>13-18 years old</b>	13%
Ethnicity	
<b>Not Hispanic</b>	60%
<b>Hispanic</b>	40%
Non-Hispanic White	33%
Family Income	
<b>30% MFI</b>	58%
<b>50% MFI</b>	17%
<b>60% MFI</b>	3%
<b>80% MFI</b>	9%
<b>100% MFI</b>	12%
Single-female headed household	62%

Table 2. Results Observed for Attendance

---

<b>First year attending City Roots program</b>	46%
<b>Attended 1-3 classes</b>	69%
<b>Attended 4-6 classes</b>	23%
<b>Attended 8-10 classes</b>	9%
<b>Average number of classes attended</b>	3.2

---



Table 3. Results Observed for Vegetable Preference and Vegetable Consumption Measures

<b>Question Asked</b>	<b><i>n</i></b>	<b>%</b>
Have you ever eaten tomatoes?	62	95%
Did you like them?	43	70%
Have you ever eaten squash?	39	60%
Did you like them?	26	63%
Have you ever eaten broccoli?	61	94%
Did you like them?	43	69%
In the past 7 days, have you eaten a green salad?	14	22%
In the past 7 days, have you eaten other vegetables?	40	62%

Table 4. Selected Quotes From Photo Art Project

---

"I like the [raspberry] plant because it looks good and I want to taste it."

"I chose tomato because it is my favorite vegetable and it tastes good."

"I like artichoke because of the way it looks!"

"I chose tomato because it is healthy and good and tasty."

"I chose Swiss chard because it is so colorful!"

"I chose watermelon because it tastes good and I like the design."

"I chose the artichoke because they are yummy and they are really pretty."

---

Table 5. Results Observed for Measures of Emotional Wellbeing

<b>Five-face pictorial scale</b>	<b>Pre</b>	<b>Post</b>
Very Happy (5)	45%	69%
Happy (4)	37%	17%
Neutral (3)	15%	9%
Sad (2)	3%	0%
Very Sad (1)	0%	5%
<b>The Grump Meter</b>		
Calm (1)	91%	88%
Grumpy (2)	3%	3%
Caution (3)	5%	3%
Stop (4)	0%	0%
Explode (5)	2%	6%
<b>Semantic Pairings</b>		
Good (vs. Bad)	98%	95%
Interested (vs. Bored)	82%	84%
Energetic (vs. Lazy)	63%	72%

Table 6. Selected Quotes From Open-ended Survey Items

---

**Examples of reasons given for feeling "calm":**

"I love gardening and nature."

"I'm surrounded with nature."

"I feel relaxed in the garden."

"We ate cucumber and tomatoes."

"I had fun with plants."

"I had a fun time hanging with friends."

"I'm having fun."

---

**Examples of reasons given for feeling "happy" or "very happy":**

"I'm spending time with my friends."

"Because it is a nice day."

"Coming to the garden for the first time this year."

"I drank an awesome shake."

"I had some good veggies at the garden today."

"I got to dig out potatoes."

"Cause I ate something healthy."

---

Table 7. Summary of OLS Regression Analysis for  
Five-face Pictorial Scale Posttest Scores ( $N=49$ )

Variable	<i>B</i>	<i>t</i>
<b>Gender</b> 1=female	.68	2.36**
<b>Race/Ethnicity</b> 1=non-Hispanic White	-.35	-1.02
<b>High Income</b> 1=above 30% MFI	.65	2.07**
<b>First Year Attending CR</b> 1=first year, attending	-.65	-2.14**
<b>Number of Classes Attended</b> 1=attended one class	-.44	-1.46
<b>Lazy at Pretest</b> 1=lazy, 0=energetic	.07	.26
<b>Intercept</b>	4.24	12.37**
<b><math>R^2</math></b>	.291	
<b><i>F</i></b>	2.95**	

\* $p < .10$     \*\* $p < .05$

Table 8. Summary of Logistic Regression Analyses for  
Five-face Pictorial Scale, Model 1 (N=50)

DV: 1='very happy' at pre and post, or positive change		
Variable	OR	95% CI
<b>Gender</b> 1=female	6.3**	(1.4-27.2)
<b>Race/Ethnicity</b> 1=non-Hispanic White	.66	(.1-4.3)
<b>High Income</b> 1=above 30% MFI	1.9	(.4-9.7)
<b>First Year Attending CR</b> 1=first year, attending	.2**	(.03-.9)
<b>Number of Classes Attended</b> 1=attended one class	.74	(.2-3.8)
<b>Lazy at Pretest</b> 1=lazy	.78	(.17-3.5)
	$\chi^2$	45.69
	<b>Cox &amp; Snell <math>R^2</math></b>	.24

\* $p < .10$  \*\* $p < .05$

Table 9. Summary of Logistic Regression Analyses for  
Five-face Pictorial Scale, Model 2 ( $N=47$ )

1=positive change, 0=stayed same (negative change excluded)		
Variable	OR	95% CI
<b>Gender</b> 1=female, 0=male	3.4	(.76-15.2)
<b>Non-Hispanic White</b> 1=non-Hispanic White, 0=other	1.7	(.4-8.2)
<b>High Income</b> 1=above 30% MFI, 0=below 30% MFI	3.8	(.8-18.6)
<b>First Year Attending CR</b> 1=first year, 0=not first year	.39	(.1-1.6)
<b>Number of Classes Attended</b> 1=attended one class	.48	(.1-2.3)
	$\chi^2$	53.46
	Cox & Snell $R^2$	.20

\* $p < .10$     \*\* $p < .05$

Table 10. Summary of Logistic Regression Analyses for  
Five-face Pictorial Scale, Model 3 ( $N=46$ )

1=positive change, 0=stayed same (negative change excluded)		
Variable	OR	95% CI
<b>Gender</b> 1=female	3.6	(.69-18.4)
<b>Race/Ethnicity</b> 1=non-Hispanic White	2.2	(.4-12.7)
<b>High Income</b> 1=above 30% MFI	3.1	(.6-16.9)
<b>First Year Attending CR</b> 1=first year, attending	.24*	(.04-1.3)
<b>Number of Classes Attended</b> 1=attended one class	.44	(.1-2.5)
<b>Lazy at pretest</b> 1=lazy	6.5**	(1.3-32.0)
	$\chi^2$	47.11
	<b>Cox &amp; Snell <math>R^2</math></b>	.29

\* $p < .10$     \*\* $p < .05$



## **DISCUSSION**

The central aim of this study was to determine if participation in a youth gardening program impacts a youth's emotional wellbeing, as well as attitudes towards trying new fruits and vegetables. Analyses presented generally positive results in terms of emotional state at the beginning of youth gardening classes, at the end of classes, and in terms of how emotional state changed over the course of the gardening classes. Although our survey included measures of vegetables consumption and preferences, gardening influence was not able to be assessed due to low statistical power.

Children in this study were similar to children in another study (WFSE) in terms of vegetable preferences. The photo art project revealed that both the aesthetics of the plants and positive past experiences with the plants may influence vegetable preferences, as well as social experiences and the outdoor aspect of gardening programs. These findings indicate that seeing vegetables in a natural state may be an important part of influencing healthy eating habits among youth enrolled in youth gardening programs.

Current outdoor experiential education research indicates landscapes have a significant impact on social engagement, level of physical activity, environmental attitudes, and stress levels (Abraham et al., 2010; Ewert et al., 2005). Our findings suggest that, being outdoors and providing diverse landscapes, youth gardening classes have the same potential. Emotional wellbeing is a critical measure when assessing the effects of childhood obesity. Current obesity research has shown that individuals who are

obese are more likely to be anxious or depressed (Levi et al., 2009), and are more likely to be isolated from their peers and have lower self-esteem (Mellin et al., 2002). Outdoor gardening programs offer opportunities that may improve the socio-emotional wellbeing of all youth, especially those at risk for obesity and its associated diseases.

The uniqueness of this study made the data analyses exploratory in nature. While generally positive results were found in terms of the emotional state of youth gardening program participants, future studies have a wide array of possibilities for assessing the effects of gardening experiences on emotional wellbeing. Continued exploration of the relationship between emotional wellbeing and youth gardening experiences is needed to better understand the influences and specific outcomes of participation in such programs. In doing so, researchers should consider collecting long-term data and gathering larger sample sizes when feasible.

Considering the growing popularity of gardening education across the U.S., the results obtained from this study may be generalizable to others serving similar groups in experiential gardening settings. Existing studies have assessed whether gender is a significant determinant of a youth's vegetable consumption and preferences, but show mixed results (Rasmussen et al., 2006). One study specific to youth gardening showed no statistically significant gender differences in science achievement associated with gardening curriculum (Klemmer et al., 2005). Another study found results similar to those presented here, and recommended additional outreach to young males (Lekies & Sheavly, 2007). The results of this study also support a need for ways to generate gardening interest in young males with multivariate models revealing gender as a significant predictor of emotional wellbeing. In considering this effect, the gender of

youth educators is important to consider. In WCG classes, all educators were female, which may be a contributor to the female participants feeling more positive emotions.

Whether it was participant's first year attending City Roots was also found to be a significant predictor of emotional wellbeing at posttest and in changes in emotional wellbeing observed from pre- to posttest. These findings suggest that increased exposure to gardening programs may be associated with increased benefits. Gardening programs, in addition to generating interest in young males, should find ways to generate interest in 1st year students to continue coming, even if attendance is sporadic. Research opportunities include identifying specific opportunities for engaging low-income groups and minority groups, who are most at-risk for obesity, in gardening programs to establish commitments among youth and encourage more consistency in attendance.

Previous youth gardening studies have primarily focused on impacts on youth's fruit and vegetable consumption and preferences. This study, although exploratory, has begun a discussion on the socio-emotional impacts of youth gardening programs and provides sufficient evidence for continuing research. Continued exploration of wellbeing measures is needed. Future studies should integrate measures of emotional wellbeing into study design and continue establishing what impacts youth gardening programs, both school-based and community-based, have on participants. Researchers evaluating other types of obesity-fighting initiatives should also consider integrating measures of emotional wellbeing. In addition to emotional wellbeing, future studies should also consider assessing the effects of the gender of youth educators and continue assessing of youth with inconsistent attendance.

This study had both strengths and limitations. Compared to other studies where

programs required attendance for all participants, this study had a more representative sample and results may be more generalizable as a result. In addition to being the first study to assess youth's emotional wellbeing in a gardening context, this study assessed emotional wellbeing using a variety of measures. Other meaningful gaps in existing research were filled by incorporating older youth and those who attend gardening classes sporadically.

## LIMITATIONS

The results of this analysis should be interpreted with caution for several reasons. First, the study has a clear selection bias. Youth attending WCG City Roots classes with partnering community agencies in the valley have a choice of activities to participate in throughout the day. It may be that those who enjoy outdoor experiences like the classes provided by WCG self-select into them, resulting in a biased sample.

Second, a limited amount of time was available for surveying in each class. As a result, only participants age 8 and older were included in survey data collection so surveys could be completed independently. In addition to an age cut-off, youth's sporadic attendance made it difficult to capture a larger sample. The small sample size may minimize statistical power, especially in interpreting the observed multivariate models.

Third, the pretest was administered after children had entered the garden. This may have skewed the results based on the excitement associated with arrival to a new activity, and on the anticipation effects for those who had already been to the garden in the past. Although chi square tests revealed no significant association between pretest scores and number of classes attended, or between pretest scores and 1st year attending, results may have differed if children were instead assessed prior to coming to the garden. The limitations discussed here limit the generalizability of the study to other youth gardening programs in other geographic locations. To minimize the given external validity issues, descriptive benchmarking was used to compare this study's results to the

results of studies with larger sample sizes for both vegetable consumption and five-face pictorial scales.

## **CONCLUSION**

Existing research has established the potential for youth gardens to influence healthy eating choices. The photo art project included in this study revealed that positive past experiences with plants and aesthetics of the plants growing in the garden, as well as social and nature-related garden aspects influenced children's choices of fruits and vegetables. This is an important extension to existing findings and can be used by gardening programs to inform and improve curriculum. To the best of our knowledge, this is the first study to assess short-term emotional wellbeing during the course of a youth gardening program. A variety of emotional wellbeing measures were used and both older youth and youth with inconsistent garden attendance were included in the sample. As a result, this study was able to fill meaningful gaps in previously conducted youth gardening research. This study found that at both the beginning and end of WCG youth gardening experiences participants reported feeling more positive than negative emotions. Changes in short-term emotional wellbeing were significantly predicted by gender, income, whether it was a youth's 1st year attending City Roots programs, and self-reported level of psychological arousal at the beginning of class. However, given the limitations described above, these results should be interpreted carefully.

**APPENDIX A**

**FULL SURVEY SAMPLE**



Before you begin class today, please circle your answers to the following questions. There are no right or wrong answers. We just want to know about your experiences with vegetables and how you are feeling today.

1. Based on how you feel right now, please circle how happy or sad you are based on the pictures below.



2. What makes you feel that way? \_\_\_\_\_

3. Based on how you feel right now, please circle where you are on the Grump Meter below.









4. What makes you feel that way? \_\_\_\_\_

5. For each set of words below, please circle which word best describes how you feel right now.

Good / Bad

Interested / Bored

Energetic / Lazy

  <p>6. Have you ever eaten tomatoes?</p> <p>Yes      No</p> <p>↓                  ↓</p> <p>Did you like them?      Would you try one?</p> <p>Yes No                  Yes No</p>	  <p>7. Have you ever eaten squash?</p> <p>Yes      No</p> <p>↓                  ↓</p> <p>Did you like them?      Would you try one?</p> <p>Yes No                  Yes No</p>	  <p>8. Have you ever eaten broccoli?</p> <p>Yes      No</p> <p>↓                  ↓</p> <p>Did you like them?      Would you try one?</p> <p>Yes No                  Yes No</p>
--	--	--

9. In the past 7 days how many times have you eaten a green salad?

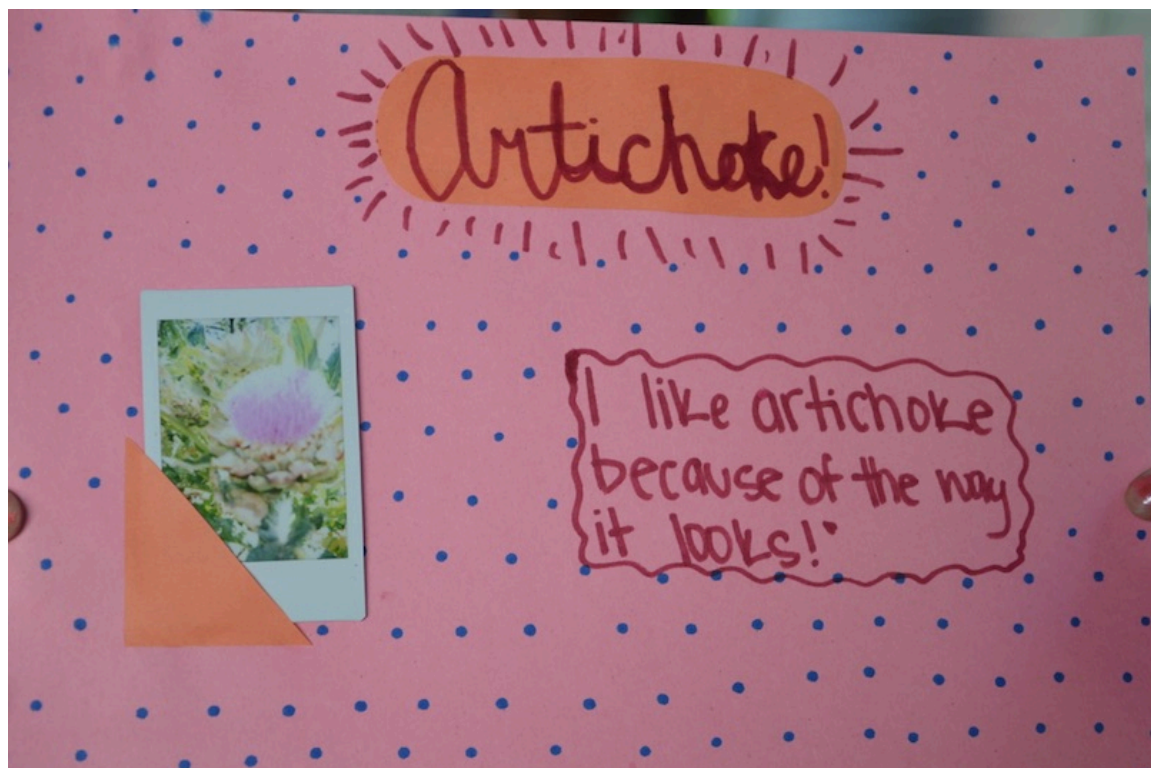
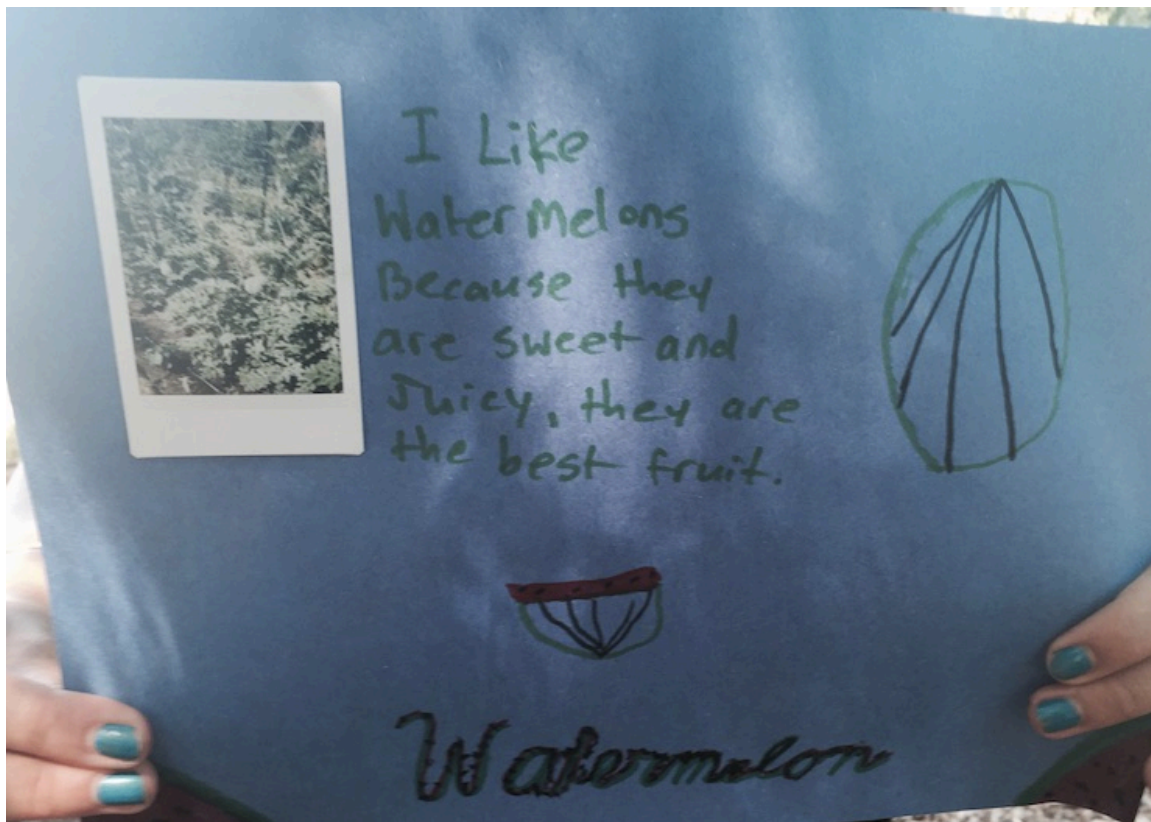
0 times      1-3 times      4 or more times

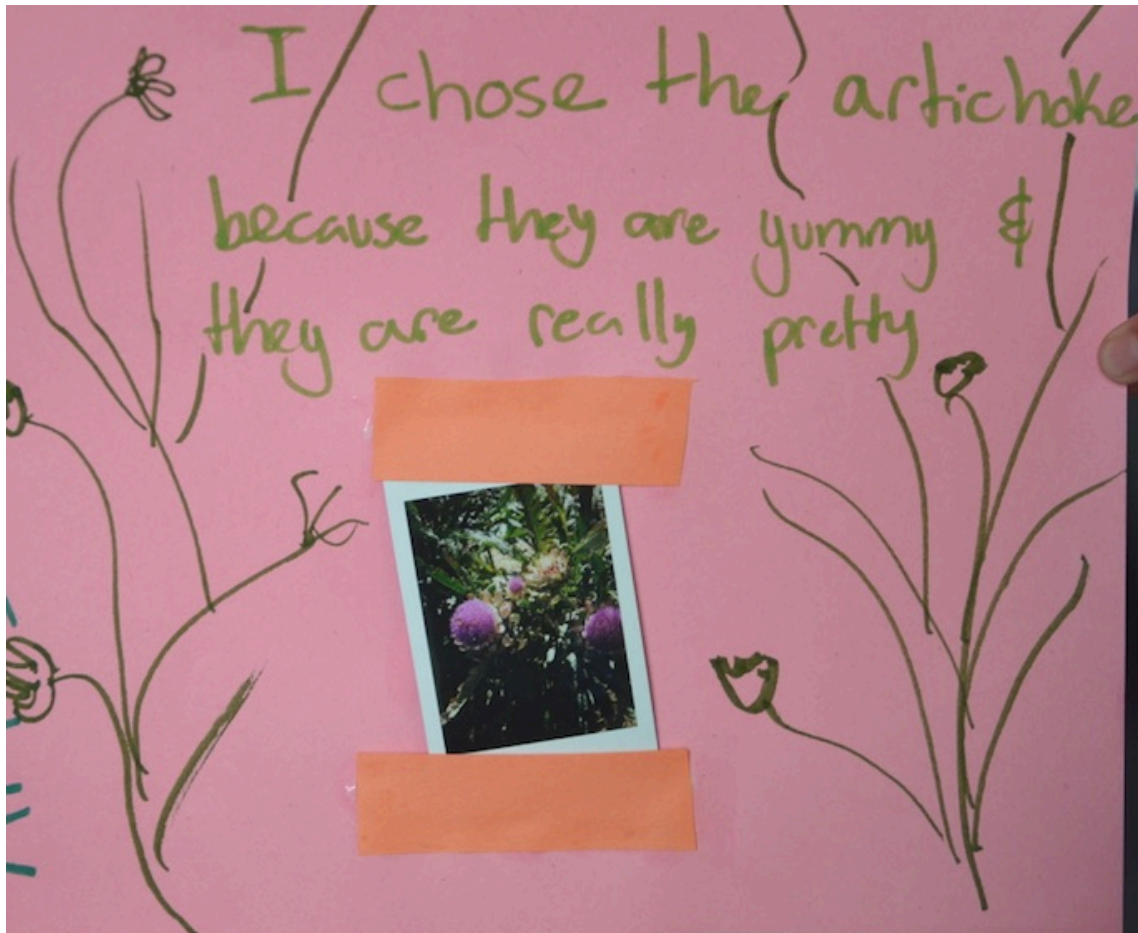
10. In the past 7 days how many times have you eaten other vegetables?

0 times      1-3 times      4 or more times

**APPENDIX B**

**SELECTED EXAMPLES FROM PHOTO ART PROJECT**





## **APPENDIX C**

### **ADDITIONAL ANALYSES**

Table 11. Summary of *t*-test Analysis for Pre-Post Grump Meter Scores

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Grump Meter pretest	64	1.19	.66	-1.37	.18
Grump Meter posttest	64	1.4	1.03		

Table 12. Summary of *t*-test Analysis for Five-face Pictorial Scores

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Five-face pictorial pretest	65	4.23	.82	-1.61	.11
Five-face pictorial posttest	65	4.46	1.0		

Table 13. Summary of OLS Regression Analysis for Five-face Pictorial Scale Pretest Scores

Variable	<i>B</i>	<i>t</i>
Gender 1=female	-.04	-.19
Race/Ethnicity 1=non-Hispanic White	.01	.04
High Income 1=above 30% MFI	-.27	-1.14
First Year Attending CR 1=first year, attending	.26	1.11
Attendance 1=attended one class	.22	.98
Lazy at pretest 1=lazy, 0=energetic	-.64	-3.00**
Intercept	4.41	16.99**
<i>R</i> <sup>2</sup>	.23	
<i>F</i>	2.12	

## REFERENCES

- Abraham, A., Sommerhalder, K., & Abel, T. (2010). Landscape and well-being: A scoping study on the health-promoting impact of outdoor environments. *International Journal of Public Health, 55*, 59-69. doi: 10.1007/s00038-009-0069-z
- Blair, D. (2009). The child in the garden: An evaluative review of the benefits of school gardening. *Journal of Environmental Education, 40*(2), 15-38.
- Childhood obesity facts. (2014). Retrieved from <http://www.cdc.gov/obesity/data/childhood.html>
- Cooke, L. (2007). The importance of exposure for healthy eating in childhood: A review. *Journal of Human Nutrition & Dietetics, 20*(4), 294-301. doi: 10.1111/j.1365-277X.2007.00804.x
- Ding, D., Sallis, J. F., Norman, G. J., Saelens, B. E., Sion Kim, H., Kerr, J., . . . Glanz, K. (2012). Community food environment, home food environment, and fruit and vegetable intake of children and adolescents. *Journal of Nutrition Education & Behavior, 44*(6), 634-538.
- Draper, C., & Freedman, D. (2010). Review and analysis of the benefits, purposes, and motivations associated with community gardening in the United States. *Journal of Community Practice, 18*(4), 458-492. doi: 10.1080/10705422.2010.519682
- Ewert, A., Place, G., & Sibthorp, J. I. M. (2005). Early-life outdoor experiences and an individual's environmental attitudes. *Leisure Sciences, 27*(3), 225-239.
- Garasky, S., Stewart, S., Gunderson, C., Lohman, B., & Eisenmann, J. (2009). Family stressors and child obesity. *Social Science Research, 38*(4), 755-766. doi: 10.1016/j.ssresearch.2009.06.002
- Gates, D., Succop, P., Brehm, B., Gillespie, G., & Sommers, B. (2008). Obesity and presenteeism: The impact of body mass index on workplace productivity. *Journal of Occupational & Environmental Medicine, 50*(1), 39-45. doi: 10.1097/JOM.0b013e31815d8db2
- Gatto, N. M., Ventura, E. E., Cook, L. T., & Gyllenhammer, J. N. (2012). LA Sprouts: A garden-based nutrition intervention pilot program influences motivation and

- preferences for fruits and vegetables in Latino youth. *Journal of the Academy of Nutrition and Dietetics*, 112(6), 913-920. doi: 10.1016/j.jand.2012.01.014
- Gluckman, P., Hanson, M., Cooper, C., & Thornburg, K. (2008). Effects of in-utero and early life conditions on adult health and disease. *The New England Journal of Medicine*, 359, 61-73.
- Heim, S., Stang, J., & Ireland, M. (2009). A garden pilot project enhances fruit and vegetable consumption among children. *Journal of the American Dietetic Association*, 109(7), 1220-1226. doi: 10.1016/j.jada.2009.04.009
- Kaufman, L., & Kaufman, J. (2011). The Grump Meter: A family tool for anger control.
- Klemmer, C. D., Waliczek, T. M., & Zajicek, J. M. (2005). Growing minds: The effect of a school gardening program on the science achievement of elementary students. *HortTechnology*, 15(3), 448-452.
- LaRowe, T., Yoder, A., Knitter, A., Meinen, A., Liebhart, J., & Scholler, D. (2012). Wisconsin farm to school evaluation: One year report. *Wisconsin Prevention of Obesity and Diabetes*. Retrieved from <http://www.fammed.wisc.edu/farm-to-school-evaluations-in-wisconsin/>
- Lekies, K., & Sheavly, M. E. (2007). Fostering children's interest in gardening. *Applied Environmental Education & Communication*, 6(1), 67-75. doi: 10.1080/15330150701319362
- Levi, J., Vinter, S., Richardson, L., St. Laurent, R., & Segal, L. (2009). F as in fat: How obesity policies are failing in America. *Trust for America's Health* <http://healthyamericans.org/reports/obesity2009/Obesity2009Report.pdf>
- Langellotto, G. A., & Gupta, A. (2012). Gardening increases vegetable consumption in school-aged children: A meta-analytical synthesis. *HortTechnology*, 22(4), 430-445.
- McAleese, J. D., & Rankin, L. L. (2007). Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *Journal of the American Dietetic Association*, 104(4), 662-665. doi: 10.1016/j.jada.2007.01.015
- McCormack, L. A., Laska, M. N., Larson, N. I., & Story, M. (2010). Review of the nutritional implications of farmers' markets and community gardens: A call for evaluation and research efforts. *Journal of the American Dietetic Association*, 110(3), 399-408. doi: 10.1016/j.jada.2009.11.023
- Mellin, A., Neumark-Sztainer, D., Story, M., Ireland, M., & Resnick, M. (2002). Unhealthy behaviors and psychosocial difficulties among overweight adolescents: The potential impact of familial factors. *Journal of Adolescent Health*, 31, 145-



153.

- Ogden, C. L., Carroll, M. D., Curtin, L. R., Lamb, M. M., & Flegal, K. M. (2013). Prevalence of high body mass index in US children and adolescents, 2007-2008. *The Journal of the American Medical Association, 303*(3), 242-249. doi: 10.1001/jama.2009.2012
- Olshansky, S. J., Passaro, D. J., Hershow, R. C., Layden, J., Cames, B. A., Brody, J., . . . Ludwig, D. S. (2005). A potential decline in life expectancy in the United States in the 21st century. *The New England Journal of Medicine, 352*, 1138-1145. doi: 10.1056/NEJMSr043743
- Oros, L. B., & de Minzi, M. C. R. (2015). A review study of psychometric functioning of a picture scale to assess joy in childhood. *Psychology, 6*, 223-233.
- Ozer, E. J. (2007). School gardens on students and schools: Conceptualization and consideration for maximizing healthy development. *Health Education & Behavior, 34*(846), 846-863. doi: 10.1177/1090198106289002
- Parmer, S. M., Salisbury-Glennon, J., Shannon, D., & Struempfer, B. (2009). School gardens: An experiential learning approach for a nutrition education program to increase fruit and vegetable knowledge, preference, and consumption among second-grade students. *Journal of Nutrition Education & Behavior, 41*(3), 212-217. doi: 10.1016/j.jneb.2008.06.002
- Preston, S., & Stokes, A. (2011). Contribution of obesity to international differences in life expectancy. *American Journal of Public Health, 101*(11), 2137-2143.
- Puhl, R., & Latner, J. (2007). Stigma, obesity, and the health of the nation's children. *Psychological Bulletin, 133*(4).
- Rasmussen, M., Krolner, R., Klepp, K., Lytle, L., Brug, J., Bere E., & Due, P. (2006). Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part I: Quantitative studies. *International Journal of Behavioral Nutrition and Physical Activity, 3*(22). Retrieved from <https://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-3-22>
- Rush, S. E., & Knowlden, A. P. (2014). Systematic review of school and community-based fruit and vegetable interventions for minority children. *Pediatric Health, Medicine & Therapeutics, 5*, 111-126. doi: 10.2147/PHMT.S56206
- Stunkard, A., Faith, M., & Allison, K. (2003). Depression and obesity. *Biological Psychiatry, 54*(3), 330-337. doi: 10.1016/S0006-3223(03)00608-5