PROVIDING GARDEN-ENHANCED NUTRITION EDUCATION TO INCREASE NUTRITION AND GARDEN KNOWLEDGE IN ELEMENTARY GRADE STUDENTS

A graduate project submitted in partial fulfillment of the requirements for the degree of Master of Science in Family and Consumer Sciences

by

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DEDICATION

This graduate project is dedicated to:

My parents, Khanh Trieu and Tu Tran, for supporting me in all my endeavors and teaching me the meaning of strength and perseverance. The sacrifices you have made to provide your children with a better future will never be taken for granted or forgotten. You have made me into the person I am today. And for that, I am eternally grateful. Thank you for all that you have done.

My friends and family who have always been by my side. I look forward to the years ahead.

Lastly, I would like to thank all of those involved with this project. Each and every individual involved with this project has made it a memorable experience. This project would not be successful without all of your dedication and support.
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ABSTRACT

PROVIDING GARDEN-ENHANCED NUTRITION EDUCATION TO INCREASE NUTRITION AND GARDEN KNOWLEDGE IN ELEMENTARY GRADE STUDENTS

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Childhood obesity in the United States is a growing problem and has reached epidemic proportions. Health promotion from the early stages of life has been shown to have a major impact on the well-being of an individual during childhood and in the later stages of life. One intervention that has been utilized to facilitate nutrition education is the school garden. The purpose of the project is to develop a garden and a garden-based curriculum that can be applied to the elementary school setting. The objective is to create an edible garden that can be utilized to provide hands-on nutrition education to increase students’ knowledge of nutrition and provide the students with basic gardening skills. An evaluation of 41 first grade students was conducted to assess changes in knowledge between pre- and posttest. A panel of two experts was selected to review the curriculum and provide feedback for improvements. An interview of the participating educators and principal was conducted to reveal in-depth information. Although the findings from the pre- and posttest were not statistically significant, the in-depth interviews revealed that the students had increased their knowledge of nutrition and gardening. The educators also
noted dietary changes among the students, such as an increase in consumption of fruits and vegetables as snacks. Further research is suggested to evaluate the effectiveness of a garden-enhance nutrition education program. This project can serve as a tool to assist facilitation of nutrition education that can be used to combat childhood obesity.
CHAPTER I
INTRODUCTION

Proper nutrition is an essential building block for academic achievement (Glewwe, Jacoby, & King, 2001; Sigfúsdóttir, Kristjánsson, & Allegrante, 2007). Healthy, active, and well-nourished children are more likely to attend school and are more prepared and motivated to learn (Geier et al., 2007; Taras, 2005). There is concern about the growing number of obese children and the impact the condition will have on their health in the future (WHO, 2000). Diet plays a major role in weight management and overall health (Swinburn, Caterson, Seidell, & James, 2004). A diet high in whole, plant-based foods can have positive effects on health, such as a reduction in risk for developing chronic diseases (Christian, Evans, Nykjaer, Hancock, & Cade, 2014). A longitudinal study by Skinner, Carruth, Wendy, and Ziegler (2002) found that dietary and lifestyle habits are formed early in life and are carried throughout one’s life. Therefore, the promotion of fruit and vegetable consumption at an early age is essential in reinforcing desirable dietary and lifestyle habits. To develop these habits, we must employ many resources and components such as increased availability of and exposure to healthy foods, parental involvement and modeling, community involvement, hands-on exposure, and nutrition education (Robinson-O’Brien, Story, & Heim, 2009; Swinburn, Caterson, Seidell, & James, 2004; Waters et al., 2011).

The school environment is a novel arena for providing nutrition education (Bradley, 2007; Hoffman, Franko, Thompson, & Stallings, 2010). One method that has been used to promote healthy lifestyle and dietary habits is the school garden (Blair, 2009; McAleese & Rankin, 2007; Parmer, Salisbury-Glennon, Shannon, & Struempler,
nutrition education, educators and community members can expose children to healthy, whole foods, which may facilitate improvement of dietary choices among children (Patrick & Nicklas, 2005). Capturing children's interest with school gardening can help improve their attitudes toward fruit and vegetable consumption and reinforce healthy dietary choices (Ratcliffe, Merrigan, Rogers, & Goldberg, 2011). It has been shown that children who plant and harvest their own fruits and vegetables are more likely to eat them (Morris, 2001). School gardens can provide a learning environment that enhances the students’ knowledge and skills regarding healthy dietary habits.

Statement of the Problem

Childhood obesity in the United States is a growing problem and has reached epidemic proportions since the 1960s (Hedley et al., 2004; Loeb, 2009). About 12.7 million or 17% of children and adolescents are affected by obesity (Kit et al., 2014). Childhood obesity can have harmful effects on the body that can place children at a higher risk for a number of diseases and chronic conditions (Ebbeling, Pawlak, & Ludwig, 2002). Obese and overweight children have a greater risk for high cholesterol, hypertension, insulin resistance, type II diabetes, and many other physiological, psychological, and social problems (CDC, 2012a). Children who are obese are more likely to become obese adults (Hedley et al., 2004). Adult obesity is associated with a number of serious health conditions including heart disease, diabetes, metabolic syndrome, and cancer (CDC, 2015a; Cole, Bellizzi, Flegal, & Dietz, 2000). Although the Centers for Disease Control (CDC) (2012a) reported that the prevalence of obesity among children aged 2 to 5 years decreased significantly from 13.9% in 2003-2004 to
8.4% in 2011-2012, the rates of obesity among school-aged children in Los Angeles increased from 18.9% in 1999 to 23% in 2008 (Los Angeles County Department of Public Health [LACPH], 2011). While obesity is problematic for children of every race or ethnicity, there is a marked disparity when comparing Latinos to other races or ethnicities (LACDPH, 2011). This is especially a concern because 48.4% of the population in Los Angeles County is Latino (U.S. Census Bureau, 2014).

**Purpose and Significance**

The purpose of the project is to develop an edible garden and a garden-based curriculum that can be applied to the elementary school setting. The objective is to create a garden space that can be utilized to implement curriculum that may increase students’ knowledge of nutrition and provide them with basic gardening skills. More specifically, the goal is to increase the students’ knowledge of fruits and vegetables, their preferences, amount consumed, willingness to try different fruits and vegetables, and ability to grow fruits and vegetables. By developing a curriculum that is applicable in the school setting, educators can provide hands-on, school-based nutrition education and garden education to the student population. The five-week program will cover several topics, such as parts of plants, serving sizes, plant growth, and recommended servings. The curriculum can be used as a tool in the fight against childhood obesity.

**Hypothesis and Research Questions**

It was hypothesized that providing garden-enhanced nutrition education would increase elementary students’ knowledge of nutrition and gardening. The following research questions were developed to analyze the effectiveness of the program and guide the study.
1. Are there significant differences in nutrition and gardening knowledge between pre- and posttest after completion of the intervention?

2. Is there a significant difference in fruit and vegetable consumption between pre- and posttest after completion of the intervention?

3. What feedback and suggestions do the experts have to improve upon the curriculum?

4. What feedback, suggestions, or changes do the elementary school teachers and principal have regarding the program?

Definitions

1. Garden-enhanced nutrition education (GENE)—A nutrition education program that utilizes a garden space to provide students with a hands-on learning experience.

2. Body Mass Index (BMI)—A person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fat. BMI can be used to screen for weight categories that may lead to health problems, but it is not diagnostic of the body fat or health of an individual (CDC, 2015b).

3. Obese child—A child with a BMI above the 95th percentile based on gender and age (Mahan & Escott-Stump, 2012) or one with excess body fat (Krebs, 2007).

4. Title 1 school—A school that receives financial assistance due to its high number or percentage of children who belong to low-income families (U.S. Department of Education, 2015).
Assumptions

This project was created based upon the following assumptions.

- The project will be implemented at a local elementary school in the San Fernando Valley.
- Participants will be elementary grade students.
- Participants will attend all five lessons in the program.
- Participants will be actively involved in the activities that take place in the classroom and garden.
- Participants who participate in the formative evaluation will have completed or attended all the lessons in the program before being evaluated.
- Participants can read and understand the items and questions on the survey.

Limitations

Some limitations of the study include:

- the curriculum is geared toward elementary-aged students, grades K-5;
- the students were selected to participate by the principal. There was no choice in the selection of the group;
- the participants were not randomly selected and were chosen based upon grade level;
- the sample size may not be representative of the general population;
- in this study, first grade students received the education. The results may not be generalized to other grade levels;
• the data may not be applicable or accurate since they were limited to first grade students; and
• the evaluation was created by nutrition students. Different experts may have different views about the structure of the evaluation.
CHAPTER II
REVIEW OF LITERATURE

Over the past several generations, the life expectancy of humans has been characterized by a slow but steady increase (National Institute on Aging, 2011; Olshansky et al., 2005). Past ailments are no longer death sentences. Improvements on the standards of living, access to clean water, and advanced health care are only a few of the changes that contribute to the increase in life expectancy (Mathers et al., 2015; Olshansky et al., 2005). However, due to the rise in obesity, it is predicted that for the first time in United States history, the life expectancy of the current generation will not surpass that of their parents (Olshansky et al., 2005). Unless action is taken to combat the rise in obesity, its negative effects will continue to affect future generations. Interventions must be taken to ensure that the health of future populations is preserved (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008).

This chapter will examine the existing research regarding childhood obesity, the problems and causes associated with childhood obesity, school-based interventions, and garden-enhance nutrition education. The literature will provide information that will facilitate the development and application of a garden-enhanced nutrition education curriculum.

Childhood Obesity

Childhood obesity has reached epidemic proportions since the 1960s (Hedley et al., 2004; Loeb, 2009). The number of children and adolescents with obesity has more than doubled and quadrupled, respectively, in the past 30 years (Kit et al., 2014). About 17% or 12.7 million children and adolescents are affected by obesity (Kit et al., 2014).
Obesity is not only a national problem, but also an issue in Los Angeles County. Despite the data from the CDC (2012a), which show a significant decrease in obesity among children aged 2-5 from 13.9% in 2003-2004 to 8.4% in 2011-2012, data from LACDPH show that rates of obesity among school-aged children in Los Angeles increased from 18.9% in 1999 to 23% in 2008 (LACDPH, 2011). Even further, obesity rates among children in grades 5, 7, and 9 are at a high of 22.4% (LACDPH, 2013).

Obesity is a concern for children of all races and ethnicities, but there is a significant disparity when comparing Latinos to other races and ethnicities (LACDPH, 2011). This is concerning because 48.4% of the population in Los Angeles County is Latino (U.S. Census Bureau, 2014).

A study conducted by Shih, Dumke, Goran, and Simon (2013) analyzed records from 298,485 students in Los Angeles to determine the association between economic hardship and childhood obesity. Shih et al. (2013) found that of all the students, 68.8% were Latino. Furthermore, the researchers reported that Latino children (26.9%) had the highest prevalence of obesity, followed by Black students (20.7%), while Asians (10.1%) had the lowest prevalence (Shih et al., 2013). The rates of childhood obesity are alarming, and action is needed to combat the rise of childhood obesity.

**Problems and Causes**

Childhood obesity can have a number of harmful effects on the body that can increase their risk of chronic disease as adults (Ebbeling, Pawlak, & Ludwig, 2002). Obese and overweight children have a greater risk for high cholesterol, hypertension, insulin resistance, type II diabetes, and other physiological, psychological, and social problems (CDC, 2012a). Children who are obese are more likely to become obese adults
Adult obesity is associated with many serious health conditions including heart disease, diabetes, metabolic syndrome, and cancer (CDC, 2015a; Cole, Bellizzi, Flegal, & Dietz, 2000). Although the CDC reported that the prevalence of obesity among children aged 2 to 5 years decreased significantly from 13.9% in 2003-2004 to 8.4% in 2011-2012, the number is still unsettling. Childhood and adolescent obesity can be caused by several factors, such as the head of household’s education level, socioeconomic status, activity levels, and the community environment, to name a few (Ogden, Carroll, Kit, & Flegal, 2014). Some of these factors are enduring, while others can be changed through appropriate interventions. One contributor to childhood and adult obesity is lack of fruit and vegetable intake (Ledoux, Hingle, & Baranowski, 2011).

**Lack of Fruit and Vegetable Intake**

Many complex factors contribute to the growing obesity epidemic (Ebbeling, Pawlak, & Ludwig, 2002). Fruit and vegetable intake plays a critical role in the overall health of an individual (Hung et al., 2004). Eating fruits and vegetables adds vital nutrients to the diet, helps curb weight gain, and reduces the risk for many chronic issues, such as cardiovascular disease, cancer, and other illnesses (Kim et al., 2014; Ness & Powles, 1997; Neumark-Sztainer, Wall, Perry, & Story, 2003; Steinmetz & Potter, 1996; Van Duyn & Pivonka, 2000).

One of the key target behaviors for the prevention of childhood obesity is to increase fruit and vegetable consumption (Epstein et al., 2001; Stevens-Edouard & Cavallaro, 2005). Recommendations are based on a child’s age, gender, and activity level and range from 1-2 cups of fruit per day and 1-3 cups of vegetables per day (CDC, 2014). Despite the growing body of research verifying benefits of fruit and vegetable
consumption, most children and adults fall short of the recommended intakes (Kim et al., 2014; Moore & Thompson, 2015).

Kim et al. (2014) analyzed data from the National Health and Nutrition Examination Surveys from 2003 to 2010 to determine the contributions of fruits and vegetables in the diets of children aged 2-18 years old. The study included a total of 12,459 participants. Kim et al. (2014) found that fruit intake among children increased from 0.55 cup-equivalents per 1,000 calories (CEPC) in 2003-2004 to 0.62 in 2009-2010, while total vegetable intake did not change (0.54 to 0.53 CEPC). The researchers concluded that no socio-demographic group met the Healthy People 2020 target of 1.1 CEPC vegetables, and only children aged 2-5 years met the target of 0.9 CEPC fruits (Kim et al., 2014).

Similarly, the CDC (2014) reports that U.S. children aged 2-18 are consuming more fruit, but both fruit and vegetable consumption is still low. About 60% of children consume fewer fruits than recommended, and about 93% consume fewer vegetables than recommended (CDC, 2014).

Several factors influence overall fruit and vegetable intake and dietary choices for children, such as parental education level, socioeconomic status, peer influence, availability, food cost, media and advertising, and nutrition knowledge. (Neumark-Sztainer, Wall, Perry, & Story, 2003; Pollard, Kirk, & Cade, 2002; Subar, 1995; Wardle, Parmenter, & Waller, 2000). One way to address these factors is to increase nutrition knowledge through nutrition education (Wardle, Parmenter, & Waller, 2000)

**Lack of Nutrition Education and Knowledge**

Nutrition education is a vital component in many disease prevention and health
promotion programs (Briggs, Safaii, & Beall, 2003). Research has shown that dietary habits during infancy and childhood play a significant role in overall growth and development (Birch & Fisher, 1998). Early intervention can greatly affect the health outcomes of children (Bellows, Cole, Anderson, & Gabel, 2006; Bradley, 1997). Health promotion and the formation of healthy dietary habits from the early stages of life can have a major impact on the well-being of an individual during childhood and the later stages of life (CDC, 1996). Perez-Rodrigo and Aranceta (2001) note that nutrition education is a key element in the promotion of lifelong healthy behaviors (Perez-Rodrigo & Aranceta, 2001).

According to Wardle, Parmenter, and Waller (2000), those with high nutrition knowledge are 25 times as likely as those with low nutrition knowledge to consume a healthy diet. The study evaluated 1,040 participants who were assessed for nutrition knowledge and food intake using validated questionnaires and surveys.

Similarly, Wagner, Rhee, Honrath, Blodgett-Salafia, and Terbizan (2016) examined the effects of nutrition education on fruit and vegetable consumption. The study evaluated 54 adults and found that nutrition education was helpful in improving the consumption frequency of antioxidant-rich fruits and vegetables among overweight and obese adults (Wagner et al., 2016). The results support the value of nutrition knowledge as a target for health education programs. One place that can be used to implement nutrition education is the school environment (Bradley, 1997).

**School-based Nutrition Education**

The school setting is critical to the social environment of the child because it can have a large role in shaping their overall dietary habits (Bradley, 1997; Hoffman, Franko,
Children and youth spend an average of 900-1,000 hours or 180 days per year in the school setting (Education Commission of the States, 2011). Schools are an ideal arena for providing nutrition education to youth (Briggs, Fleischhacker, & Mueller, 2010). The school classroom can be a novel place to incorporate nutrition education, and there are many opportunities to improve upon dietary habits (Knai, Pomerleau, Lock, & McKee, 2006).

Hoffman, Franko, Thompson, and Stallings (2010) examined the effects of a school-based program on kindergarten and first grade children’s fruit and vegetable consumption. The program implemented a school-wide nutrition education approach utilizing the classroom, lunchroom, and family components to promote fruit and vegetable consumption. The researchers found that children in the experimental group consumed more fruits and vegetables at the end of year 1 compared to the control group.

Similarly, Panunzio, Antoniciello, Pisano, and Dalton (2007) concluded that nutrition education intervention by teachers may promote fruit, vegetable, and legume consumption in elementary school-age children. The study evaluated 471 fourth-grade students over 36 weeks. The students were assigned to be instructed by one of two groups, teacher or nutritionist. Upon completion, the data showed that the teacher intervention group increased consumption of fruit, vegetable, and legumes in 47%, 58% and 32% children, respectively; the nutritionist intervention group reported an increase in fruit and vegetable consumption by 26% and 18.2%, respectively (Panunzio, Antoniciello, Pisano, & Dalton, 2007). The study implies that nutrition education can promote fruit, vegetable, and legume consumption in elementary school-aged children.

The classroom can function as a tool to integrate food and nutrition concepts in
daily learning activities. Along with in-class nutrition education, educators can provide other opportunities for students to learn healthy habits. One platform that has been utilized to facilitate nutrition education is the school garden (Wijesinha-Bettoni, Orito, Lowik, Mclean, & Muehlhoff, 2013).

**Garden-enhanced Nutrition Education**

Nutrition education conducted in the garden may impact children’s fruit and vegetable consumption and their attitudes towards fruits and vegetables (Blair, 2009; Ratcliffe, Merrigan, Rogers, & Goldberg, 2011; Skelly, & Zajicek, 1998; Wijesinha-Bettoni et al., 2013). Robinson-O’Brien, Story, and Heim (2009) found that garden-enhanced nutrition education programs can have a significant effect on fruit and vegetable intake, preference, willingness to try fruits and vegetables, and an increase in nutrition knowledge.

Researchers found similar results in an evaluation of a garden-enhanced nutrition education program that included 97 first-grade students (Morris, Neustadter, & Zidenberg-Cherr, 2001). Two schools were selected to participate in the study; the intervention group (n=48) was provided with nutrition education in the classroom, and the students also planted, maintained, and harvested gardens. Morris, Neustadter, and Zidenberg-Cherr (2001) found that first-grade students who grew vegetables in their garden were more willing to taste certain vegetables.

Similarly, a study conducted by Barnidge et al. (2013) in a rural setting found that participation in a garden was associated with higher fruit and vegetable consumption compared to individuals who did not participate. Another study concluded that sixth-grade students who participated in a nutrition education program and garden-based
activities had higher intakes of fruits and vegetables compared to the control (McAleese & Rankin, 2007). Another review of garden-based nutrition programs concluded that such programs may promote increased fruit and vegetable intake among youth and an increased willingness to taste fruits and vegetables among younger children (Robinson-O’Brien, Story, & Heim, 2009). The evidence supports garden-based nutrition education and its positive effects on the eating habits and behaviors.

Not only does garden-enhanced nutrition education affect dietary habits, but it can also have an effect on reducing or maintaining weight. Castro, Samuels, and Harman (2013) recruited 95 children aged 2-15 years to participate in a seven-week cooking and nutrition workshop that included gardening components. Of the 95 participants, 36 were classified as obese or overweight. About 60% of the participants who enrolled were Latino. BMIs were calculated, and food surveys were collected pre- and post-program. The study, which evaluated a community-based gardening program, found that 17% of the obese or overweight children improved their BMI classification, and 100% of the children with normal BMI classification remained the same (Castro, Samuels, & Harman, 2013). Castro et al. (2013) also found that the participants increased their intake of fruits and vegetables by 28% and 33%, respectively.

In another study, researchers examined the association of participation in a community garden with healthy body weight (Zick, Smith, Kowaleski-Jones, Uno, & Merrill, 2013). Zick et al. (2013) gathered BMI data from 198 community gardening participants in Salt Lake City, Utah, in relationship to BMI data from three comparison groups: neighbors, siblings, and spouses. The researchers concluded that individuals involved in community gardens program had significantly lower BMIs than those who
were not involved in a program (Zick, Smith, Kowaleski-Jones, Uno, & Merrill, 2013). Zick et al. (2013) also found that community gardeners had lower odds of being overweight or obese than did their neighbors. Consequently, utilizing the garden environment to facilitate nutrition education may have a significant effect on fruit and vegetable intake and can possibly impact the weight status of those involved (Barnidge et al., 2013; Castro, Samuels, & Harman, 2013; McAleese & Rankin, 2007; Morris, Neustadter, & Zidenberg-Cherr, 2001; Robinson-O’Brien, Story, & Heim, 2009; Zick, Smith, Kowaleski-Jones, Uno, & Merrill, 2013)

The literature reviewed in this chapter shows that the rise in obesity, specifically childhood obesity, is a major concern (Hedley et al., 2004; Kit et al., 2014; Loeb, 2009). Many factors contribute to the growing epidemic, including dietary habits, socioeconomic status, activity levels, and community environment (Ogden, Carroll, Kit, & Flegal, 2014). While some factors are difficult to address, a garden-based nutrition intervention in the school setting is one tool that has been used in the fight against childhood obesity (Robinson-O’Brien, Story, & Heim, 2009).

Most of the literature includes rural populations who are predominately non-Hispanic. This project aimed to work with a highly Latino population in an urban area, Los Angeles, where few garden-enhanced nutrition education programs exist. The development of the garden and curriculum presented in this project was intended to provide educators and students the opportunity to implement hands-on nutrition education to students. The garden and curriculum were designed to be easily utilized in the educator’s day-to-day activities and could be used in future classrooms. The project was done to add to the literature by creating and providing garden-enhanced nutrition
education to children in a school setting to help fight childhood obesity.
CHAPTER III
METHODOLOGY

The purpose of this project was to develop a garden and curriculum that could be implemented in an elementary school setting. The curriculum was developed with elementary-level students and educators in mind. The goal of this project was to create a gardening space and curriculum that educators could easily access and utilize in their day-to-day activities. The focus of the current curriculum was on the elementary grade population. The lessons were designed to be interactive both inside and outside the classroom. The students engaged in nutrition education through discussions in the classroom and gained hands-on experiences growing food in the garden.

The garden lessons were conducted at a local Los Angeles Unified School District (LAUSD) elementary school in the San Fernando Valley. The participating elementary school is a Title 1 school with a population of greater than 95% Latino students and greater than 75% of students who take part in the free or reduced lunch program. This garden-enhanced nutrition education (GENE) program was intended for students grades K-5. First grade students were selected by the principal to participate in the program. All students participating received a pre-test evaluation at week 0, prior to the start of the program to assess their knowledge of nutrition and gardening. The same evaluation was administered during the posttest period, which occurred at week 5. During this time, the students were instructed on subjects such as nutrition, plant science, and basic gardening skills. Instruction each week consisted of different topics and ended with a review of the day’s lesson (see Appendix C). On the first week of the curriculum, the students were introduced to the garden environment and given a set of rules and instruction on garden
safety. In the second lesson, students were taught how to plant seeds and seedlings in the garden beds. The students were also taught the various parts of the plants along with their functions. The third lesson consisted of garden maintenance, including weeding, watering, and planting more crops. The students were also introduced to the serving sizes of various fruits and vegetables. For the fourth lesson, the students presented a skit that depicted the lifecycle of the plant. The students were assigned roles such as farmers, seeds, sun, and rain. Then each group was instructed to act out the roles. For the final lesson, the students were instructed on the recommended servings of fruits and vegetables one should consume daily. The students were shown various examples of fruit and vegetable servings.

**Participants**

One elementary school in the LAUSD was selected to participate in the study. The student population of this school consists of more than 95% Latino students, and more than 75% of the students participate in the free or reduced meal program. The principal selected three first-grade classrooms to participate in the GENE program; there was no choice in the selection of the group. A total of 41 students participated in the program. All of the students in the selected classrooms were included in the program. Only complete pre- and posttest evaluations were used in the statistical analysis.

**Garden Development**

The garden was developed in cooperation with a local LAUSD elementary school and other community partners, such as Sylmar High School and California State University, Northridge. The garden was partly funded by the Whole Kids Foundation, which provided a $2,000 grant. The grant was used to purchase materials to build and
maintain the garden (see Appendix A). Seeds, irrigation, hand tools, and other materials were donated by various supporting companies such as Drip Depot, Johnny’s Selected Seeds, and Territorial Seed Company. Garden development included garden and plot planning, construction of raised garden beds, soil preparation, and irrigation installation (see Appendix B).

Figure 1.1 shows the steps to the development of the garden and curriculum, the implementation of the project, and outcome goals. The logic model was created using the Human Ecological Theory (Bronfenbrenner, 1977). The theory provides a frame work for the study of human beings and their environments through a series of systems: the microsystem, mesosystem, exosystem, and the macrosystem. The microsystem is the child and the school environment. The mesosystem are the educators and the entities that support the program. The exosystem is the development and implementation of the program to the students. And, the macrosystem is the change that occurs in the children after the completion of the project.
Curriculum Development

The development of a garden curriculum was part of this project. The lessons were created in collaboration with nutrition students from California State University, Northridge. The project included the development of a five-week curriculum. Each lesson incorporated nutrition education along with hands-on gardening experiences. The lessons were created using the Whole Kids Foundation garden curriculum and were modified to fit the programs’ needs. The lessons consisted of lessons on garden safety, parts of the plants, garden maintenance, plant needs, recommended fruit and vegetable servings, and food groups (see Appendix C). The lessons were intended for students K-5th grade and designed to be easily administered by the classroom educator.
Curriculum Delivery

Garden-enhanced nutrition education was delivered in a series of five lessons. Three first-grade classrooms from a local elementary school were selected by the principal to participate in the garden lessons. Classes were held on Friday mornings and lasted approximately 45 minutes. The lessons were split between the classroom and the school garden. The students were instructed by a nutrition graduate student along with volunteers. The lessons consisted of a short lecture followed by interactive, hands-on education with reinforcement of the topics discussed in the garden. During the final week, students were given a review of all topics discussed over the course of the intervention and sent home with a pot and plant of their own. Nothing else was sent home with the students.

Evaluation

A one group, pretest, posttest design (pre-experimental) was administered to the subjects or students who participated in the garden lessons. The test included questions regarding food groups, current consumption of fruits and vegetables, servings of fruits and vegetables, parts of the plant, and plant needs (see Appendix D). The pre-test was administered at week 0, and the posttest was completed at week 5. Complete evaluations were coded and entered into Excel, and the Statistical Package for the Social Sciences (SPSS 20.0, IBM Corp., Armonk, NY) was used to organize and analyze the data on Macintosh computer. SPSS is computer software designed to conduct social science statistical analyses. The pre- and posttest data were analyzed using a paired sample t-test.

Evaluation by Participants

An evaluation was created to assess the participants’ knowledge of nutrition and
gardening prior to the initiation of the program and following the completion of the five-week curriculum (see Appendix D). The first portion of the test included nine questions that assessed the student’s knowledge and ability to recognize the various food groups. This was be done by having the students visually identify various images and match them to one of three groups (grains, fruits, and vegetables). Next, the evaluation included three multiple choice questions regarding fruit and vegetable intake. The students were asked to identify the recommended servings of fruits and vegetables needed per day. The participants also stated the amount of servings of fruits and vegetables that they had consumed the day before. The next portion of the evaluation tested the student’s knowledge of the various parts of the plant or plant anatomy. An image of a plant was displayed, and students were asked to label the four different parts in the image. Lastly, the students were assessed on their knowledge of basic plant needs. The evaluation included six images, and the students were asked to identify the correct images regarding the basic needs of a plant such as water, sunlight, and soil. The evaluations were collected and analyzed for significance.

**Evaluation by Experts of the Curriculum**

Experts were chosen to evaluate the curriculum based upon their knowledge and expertise in the areas of education, nutrition, and gardening. Expert #1 was selected based on his/her knowledge as a garden coordinator and educator. The expert member has been involved with the development and administration of garden-enhanced nutrition education for many years with several different programs and schools. Expert #2 was chosen based on his/her knowledge as a master gardener and an agricultural educator for a local high school. This expert member has educated and worked with hundreds of
students, providing them with knowledge in many areas such as urban agriculture and nutrition. The experts were asked to examine the five-week curriculum and fill out an evaluation (see Appendix E). Specifically, the experts were asked to rate the curriculum on a scale from 1 (low) to 5 (high), based on the objective and topics of the lessons and the content of the lessons. Lastly, the experts were asked to provide any additional feedback or suggestions for the curriculum. Their feedback can be used to improve future nutrition and gardening projects.

**Interview of Participating Educators**

An interview was conducted with all the participating educators and the principal of the selected elementary school. The interviewees were asked a series of questions regarding their thoughts on the garden-enhanced nutrition education program (see Appendix F). Specifically, the experts were asked the following questions: (1) “What do you think about school gardening?” (2) “What are the perceived benefits of having a school garden?” (3) “What are the perceived benefits of garden-enhanced nutrition education?” (4) “How has garden-enhanced nutrition education affected your school environment?” (5) How has the curriculum affected the students/school?” (6) “Have you seen or noticed any changes in the children since the completion of this project?” Lastly, the interviewees were asked to provide additional comments or feedback on the project or curriculum. The educators commented on their experience and observations about the program and the effects they have seen in the students since the completion of the project.
CHAPTER IV
RESULTS

The purpose of this project was to create a garden and garden-based curriculum to provide children with hands-on nutrition and garden education. The objective of the project is to create a tool that can be used to combat childhood obesity. The project examined if garden-enhance nutrition education will increase nutrition and gardening knowledge in elementary school children. The research questions were developed to analyze the effectiveness of the program.

This project included the construction of a garden, creation of a curriculum, pre- and post-tests to evaluate the participants, expert evaluation, and an interview of the participating educators. This section will be organized according to the research questions and results.

Research Questions

1. Are there significant differences in nutrition and gardening knowledge between pre- and posttest after the completion of the intervention?

The percentage of correct responses was compared from pretest to posttest for 41 students. At pretest, first graders correctly identified 63% of the foods in each food group. At posttest, first graders correctly identified 73% of the foods in each food group (see Table 4.2). This was not statistically significant (p=0.07). Table 4.1 shows that the paired samples t-test indicated no significant difference in the students' ability to identify food groups ($t = -1.86, p = .07$).

Results from pretest to posttest were compared to analyze the students’ ability to identify parts of the plant. The results indicate that the students’ ability to identify the
different parts of the plant between pre- and posttest was statistically significant (p= 0.002) (see Table 4.1). The students’ ability to identify plant parts increased from 85% to 99% (see Table 4.2).

Pre- and posttest data were analyzed to measure the students’ knowledge of the elements required for plant growth. As Table 4.1 shows, there was no statistical significance in the students’ knowledge of the elements needed for plant growth (t= -1.22, p=0.23). At pretest, first graders correctly identified 97% of the elements required for plants' growth. At posttest first graders correctly identified 99% of the elements required for plants growth (see Table 4.2)

Table 4.1

Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>95% confidence interval (lower)</th>
<th>95% confidence interval (upper)</th>
<th>t</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable consumption</td>
<td>-.2439</td>
<td>-.7663</td>
<td>.2785</td>
<td>-.944</td>
<td>.351</td>
</tr>
<tr>
<td>Fruit consumption</td>
<td>.0732</td>
<td>-.1946</td>
<td>.3409</td>
<td>.552</td>
<td>.584</td>
</tr>
<tr>
<td>Food groups</td>
<td>-.09756</td>
<td>-.20341</td>
<td>.00829</td>
<td>-1.863</td>
<td>.070</td>
</tr>
<tr>
<td>Parts of the plant</td>
<td>-.14634</td>
<td>-.23452</td>
<td>-.05816</td>
<td>-3.354</td>
<td>.002</td>
</tr>
<tr>
<td>Plant needs</td>
<td>-.02033</td>
<td>-.05400</td>
<td>.01335</td>
<td>-1.220</td>
<td>.230</td>
</tr>
</tbody>
</table>

2. Is there a significant difference in fruit and vegetable consumption between pre- and posttest after the completion of the intervention?

The servings of fruits and vegetables consumed by 41 students were compared from pre- to posttest. As Table 4.1 shows, there was no statistical significant in fruit consumption (p=0.58). There was also no statistical significance in vegetable consumption (p=0.35). First graders reported eating 2.7 and 2.9 servings of vegetables at pre- and posttest, respectively. First graders also reported consuming 3.2 servings of fruit
at pretest and 3.1 servings at posttest. A summary of the data is shown in Figure 4.2.

Table 4.2

*Paired Samples Statistics*

<table>
<thead>
<tr>
<th></th>
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<th>Posttest</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
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<tr>
<td>Vegetable</td>
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<tr>
<td>consumption</td>
<td></td>
<td></td>
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<tr>
<td>Fruit</td>
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<td>3.146</td>
</tr>
<tr>
<td>Consumption</td>
<td></td>
<td></td>
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<tr>
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<td>.6341</td>
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<tr>
<td>Parts of the</td>
<td>41</td>
<td>.8476</td>
</tr>
<tr>
<td>plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant needs</td>
<td>41</td>
<td>.9715</td>
</tr>
</tbody>
</table>

3. What feedback and/or suggestions do the experts have to improve upon the curriculum?

After the development of the curriculum, two experts were asked to evaluate the lessons and provide feedback and suggestions for improvement. The experts were asked to rate the lessons on a scale from 1 (low) to 5 (high) for appropriateness of topics, objectives, and content. The experts were then asked to provide feedback for improvement of the curriculum (see Appendix F).

The experts were asked to rate the program's ability to cover and address its stated objectives and topics. The first objective of the curriculum was to increase student exposure to vegetable and fruit by tending a garden. Both experts rated this objective a 5 out of 5. The second objective of the curriculum was to increase students' knowledge of nutrition. Expert #1 and Expert #2 rated this objective 4 and 5, respectively. The next objective of the curriculum was to increase student knowledge of gardening. Expert #1 and Expert #2 rated this 4 and 5, respectively. The ratings given by both experts indicated that the curriculum meets the stated objectives.
Next, the experts were asked to rate the content of the materials within the curriculum based upon appropriateness for the intended audience and consistency with the stated objectives. For appropriateness, Expert #1 and Expert #2 rated this 4 and 5, respectively. For consistency with stated objectives, both experts rated this 5 out of 5. The ratings indicated that the content of the curriculum is both appropriate for its intended audience and consistent with the stated objectives.

Lastly, the experts were asked to provide any feedback they had to improve upon the curriculum. Expert #1 stated that the lessons were easy to follow and well-written. The expert noted that he especially liked the “things to do at home” component of each lesson. He stated, “It is important for the students to bring home what they have learned to educate the parents.” The expert commented on the hands-on aspect of the curriculum and stated, “The curriculum is effective in engaging the students both inside and outside of the classroom.” The expert explained that the lessons were appropriate for the intended audience and could easily be adjusted to meet the needs of students depending on knowledge and skill level.

Expert #1 was also asked to provide additional comments or suggestions. The expert suggested that the curriculum should be made available in Spanish due to the high population of Hispanics in the local community. The expert also suggested that future curriculum should further incorporate the students’ parents. The expert stated, “You can educate the parents through the students, but it would be more effective if you had a parent workday or activity.” Overall, the feedback given by Expert #1 was positive, and the suggestions can be used to improve upon future projects.

Additionally, Expert #2 was asked to provide feedback and suggestions for
improvement. The expert stated, “The lessons are simple, clear, and easy to understand and the activities sound engaging.” Expert #2 also commented that she liked the “things to do at home” portion of each lesson. Lastly, the expert stated, “The lessons are age appropriate and could be easily adapted for any K-5th grade students.” In summary, Expert #2 noted that the curriculum was well done, but provided some suggestions that can add to the lessons.

Expert #2 suggested that the lessons could be improved by adding extra examples to each lesson so that the curriculum could be adapted to a variety of classroom settings. The expert noted that adding additional examples or options would help the student further understand the concept or topic being discussed. Another recommendation was to include a section for the adult or educator on how to model tasting new foods. Expert #2 stated, “It is important to teach the kids not to ‘yuck someone else’s yum,’ and to appreciate those who were involved with growing the food.” Expert #2 commented that it is critical that students respect the food and those involved in the cultivation of the food. Expert #2 stressed the importance of this because students are heavily influenced by their peers and one negative comment can change another student’s opinion.

In conclusion, both experts gave positive feedback to improve the current curriculum. The experts rated the objectives and content of each lesson above average. Both experts noted that the “things to do at home” portion of each lesson was important in impacting the students and parents. The experts also noted that the curriculum was engaging and hands-on. The suggestions and feedback given by the experts can be used to improve future garden-enhanced nutrition education projects.

4. What feedback and/or suggestions do the elementary school teachers and
principal have regarding the program?

Upon completion of the garden and nutrition program, the teachers and principal of the selected school were interviewed about the program and curriculum (see Appendix F). When asked, “What do you think about school gardening?,” the teachers and principal had positive reactions. All the teachers and the principal stated that school gardens are great additions to the learning environment. The principal stated, “School gardens are a wonderful opportunity for children and it can help support nutrition education in schools.” One teacher mentioned, “Many students do not have the opportunity to access or work in a garden.” All the interviewees stated that they felt a school garden is a great opportunity for the children and a great tool for education.

Next, the interviewees were asked about their thoughts on the perceived benefits of having a school garden. Several stated that one benefit is the ability to utilize the garden to facilitate health lessons. One teacher commented, “The kids can get their hands dirty and have a hands-on experience versus learning from a textbook.” The interviewees explained that they supported a school garden and felt that access to one is beneficial for the students' learning environment.

Then the teachers and principals were asked about the perceived benefits of garden-enhanced nutrition education. One teacher mentioned that garden-enhanced nutrition education can help students make a connection with the foods they consume. Another teacher stated, “The kids are more likely to try different foods because they take pride in the process of growing their own food.” All the teachers felt that nutrition education in the garden could produce positive results and help students relate to food and its origins.
The next question inquired about how garden-enhanced nutrition has affected the school environment. Many of the teachers stated that the program empowered the students to make better choices. One teacher mentioned, “The program opens a dialogue for the children about health and the food they put into their bodies.” The teachers and principal noted that students had an increased awareness of “healthy” versus “unhealthy” foods. Some of the teachers praised how the program was able to bring the students’ learning to life. A common theme among the educators was that garden-enhanced nutrition education has increased health awareness among the students and given them pride in making the “healthier” choice in foods.

Next, the teachers and principal were asked, “How has the curriculum affected the school and students?” All the interviewees noted positive effects on the school and students involved with the program. One teacher stated that the garden exposed the students to a wider variety of fruits and vegetables that they would not normally encounter. The educators also mentioned that the students are more health-wise and are proud to eat healthier foods. One teacher stated, “Some of my students have started planting and gardening at home.” Other teachers noted some dietary changes in the children, such as an increase in fruits or vegetables as snacks.

Lastly, the interviewees were asked, “Have you seen any changes in the children since the completion of this project?” The teachers mentioned that the program had increased the students’ awareness of different foods and understanding of the lifecycle of plants. The teachers also stated that the children were taking ownership of their food choices and were proud to show other students their healthy choices. The principal also noted that the students were policing and monitoring their peers in regard to healthy
choices.

Lastly, the educators were asked to provide feedback about the program. One educator mentioned that it would be beneficial for the students to be able to work in the garden from the planting process until harvest. The teacher stated, “I think the students would make a better connection with the food if they were able to see the fruits of their labor.” No other improvements or changes were suggested.

Several common themes emerged in the educators' interviews. Table 4.3 summarizes the themes.

Table 4.3

*Common Themes among Educators*

<table>
<thead>
<tr>
<th>Common Themes among Educators</th>
<th>Educators</th>
<th>% Mentioned Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENE supports nutrition education</td>
<td>3/4</td>
<td>75%</td>
</tr>
<tr>
<td>Provides hands-on education</td>
<td>4/4</td>
<td>100%</td>
</tr>
<tr>
<td>Increased exposure to fruits and vegetables</td>
<td>4/4</td>
<td>100%</td>
</tr>
<tr>
<td>Increased students’ pride and ownership of healthy diet</td>
<td>3/4</td>
<td>75%</td>
</tr>
<tr>
<td>Increase students' awareness of healthful practices</td>
<td>3/4</td>
<td>75%</td>
</tr>
</tbody>
</table>

Overall, the teachers and principal were pleased with the program and saw positive results among the children. All the educators stated that the program benefited the students and the garden space was a great hands-on learning experience for the children. The garden helped the students establish a connection to the foods they eat and increased their awareness of healthy choices. The educators noted that the program was well received and they looked forward to working in the garden in the future.
CHAPTER V

DISCUSSION

The purpose of this project was to develop a garden and curriculum that could be implemented in an elementary school setting. The goal was to create a gardening space and curriculum that educators could easily access and utilize in their day-to-day activities. The curriculum was developed with elementary-level students and educators in mind. The focus of the current curriculum was the elementary grade population. The lessons were designed to be interactive both inside and outside the classroom. The students engaged in nutrition education through discussions in the classroom and hands-on experiences growing food in the garden.

Research shows that childhood obesity in the United States has reached epidemic proportions since the 1960s (Hedley et al., 2004; Leob, 2009). Ogden et al. (2014) stated that childhood and adolescent obesity can be caused by a number of factors. One factor that plays a critical role in overall health and weight status is fruit and vegetable intake (Hung et al., 2004). This GENE program aimed to impact the dietary habits of the participating students by providing a hands-on approach to nutrition education.

Nutrition education can be used as a tool to increase fruit and vegetable intake (Perez-Rodrigo & Aranceta, 2001). Nutrition education can influence dietary habits that not only impact the individual’s current condition, but can also play a large role in the overall health and dietary habits of the individual in adulthood (Larson et al., 2008; Neumark-Sztainer, Wall, Perry, & Story, 2003; Perez-Rodrigo & Aranceta, 2003). The concepts and topics addressed in this program aim to impact dietary habits by increasing nutrition and gardening knowledge.
Schools are a novel place to implement early nutrition education (Briggs, Fleischhacker, & Mueller, 2010). The school setting is critical to the social environment of the child and can have a large role in shaping their overall dietary habits (Bradley, 2007; Hoffman, Franko, Thompson, & Stallings, 2010). Knowing this, the GENE program utilized the school setting and classroom to implement a nutrition education program. While nutrition education in the classroom can be effective, school gardens have also been utilized to facilitate nutrition education (Wijesinha-Bettoni, Orito, Lowik, Mclean, & Muehlhoff, 2013). One objective of the program was to create a garden space that could be utilized by the educators to facilitate nutrition and garden education.

Researchers have found that garden-enhanced nutrition education is associated with higher fruit and vegetable intake among participating students and can also increase their willingness to try new fruits and vegetables (Barnidge et al., 2013; McAleese & Rankin, 2007; Robinson-O’Brien, Story, & Heim 2009). Based on this evidence, this program was developed to provide a hands-on learning approach to nutrition education for students in a garden environment. This environment has the potential to impact the students by helping them connect and relate to their food.

This project targeted a low income Title 1 school in which many students do not have the opportunity to work and learn in a garden space. The goal of the program is to empower students to make healthy choices by providing them hands-on education that they would not otherwise receive.

This project adds to the literature by providing a guide for future programs who wish to create and implement a school gardening program. While many studies report the positive effects of GENE, few discuss or provide guidance on the developmental process.
and implementation of such interventions. This project can be used as a model to create and improve upon future projects and GENE programs.

**Discussion of the Findings and Modifications**

**Discussion of the Participant Evaluation**

The participant evaluation was used to assess students’ knowledge of nutrition and gardening before and after implementation of the project. After completion of the program, the data collected from pre- and posttests were analyzed and the following was found.

Upon examining the students’ knowledge of food groups, we found that the students were able to correctly identify 73% of the items at posttest compared to 63% at pretest. Our findings were similar to Ratcliff, Merrigan, Rogers, and Goldberg (2011) who found that gardening increased children’s ability to identify fruits and vegetables. Due to our small sample size, the paired samples t-test indicated no statistical significance.

Next, the data showed that the students’ ability to identify the different parts of the plant between pre- and posttest was statistically significant. The students were able to correctly identify 99% of the parts of the plant compared to 85% at pretest. This shows that the gardening program was able to increase the students gardening knowledge.

When analyzing the data regarding the students’ knowledge of the elements needed for plant growth there was no significant difference. However, it should be noted that the students correctly answered most of the questions at pretest; therefore, there was no room for change.

When analyzing students’ fruit and vegetable consumption, paired samples t-test
indicated no significant difference between the number of servings of fruits and vegetables first graders reported eating at pre-test versus posttest. However, one must note that first grade students do not have full control of their food selections.

While some of the data showed significance, we cannot generalize these findings to other populations. Also, the project was intended for students in K-5th grade, but it is difficult to accurately assess young students due to education level. The participants in this study were selected by the school principal, and there was no choice in the selection of the group. These results do not represent the general population or other grade levels. Measuring fruit and vegetable intake with this particular population is difficult due to lack of autonomy. Students are generally provided with food items by the school or their parents.

Overall, the results from the participant evaluation may not be significant or generalized to other populations, but the project provides the students with an opportunity to connect with the foods they consume through hands-on education. The project enables the students to take ownership of the fruits and vegetables that they are able to plant and cultivate. The curriculum may open up a dialogue that will in turn empower students to make better, healthier choices. A GENE program exposes students to a variety of new foods that they may not have the opportunity to experience otherwise.

**Discussion of the Expert Evaluation**

The experts found that the curriculum was satisfactory in meeting the stated objectives and the content of the lessons were appropriate for the intended audience. The experts found that the lessons were clear and easy to follow. This is important because the educators need to feel comfortable with the subject matter to complete the
activities (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005). Both experts commented on the hands-on aspect of the curriculum. To have a successful garden-enhanced nutrition education program, the students need to be able to interact and learn in the garden (Blair, 2009). The experts also found that the “things to do at home” portion of each lesson valuable. One of the goals of the program is for the students to take the lessons learned during this program and apply them outside this setting.

Both experts provided valuable feedback that can be used in future projects or other garden curriculums. One suggestion for future programs is that the curriculum should be available in Spanish due to the high population of Hispanics in the local community. By providing such a curriculum, the educators can reach a larger population. Another suggestion was to add extra examples to each lesson so that the curriculum could be adapted to a variety of classroom settings. Additional examples or options would help the student further understand the concept or topics being discussed.

In conclusion, both experts rated the curriculum above average on its content and its ability to meet objectives. While the experts provided positive reviews of the curriculum, the suggestions given can help create a more effective curriculum.

**Discussion of the Educator Interview**

The teachers and principal thought that school gardening is a great opportunity for the students. The teachers and principal also noted that a benefit of having a school garden is the ability to utilize it to facilitate health lessons. The interviewees explained that they supported a school garden and felt that access to one is beneficial for the students’ learning environment. All the teachers felt that nutrition education in the garden could produce positive results and help the students relate to the food and its origins.
Many of the teachers stated that the program empowered the students to make better choices. The teachers and principal noted that students had an increased awareness of “healthy” versus “unhealthy” foods. Some of the teachers praised how the program was able to bring the students’ learning to life. A common theme among the educators was that garden-enhanced nutrition education has increased health awareness among the students and given them pride in making “healthier” choices in foods.

All the interviewees noted positive effects on the school and students involved with the program. The educators also mentioned that the students are more health conscious and are proud to eat healthier foods. Other teachers noted some dietary changes in the children, such as an increase in fruits or vegetables as snacks.

The teachers mentioned that they noticed an increase in the students’ awareness of different foods and understanding of the lifecycle of plants. The teachers also stated that the children were taking ownership of their food choices and were proud to show other students their healthy choices. Overall, the teachers and principal were pleased with the program and saw positive results among the students.

The results from the participant evaluation were not impressive, but the educators observed significant changes among the students. While the changes cannot be wholly attributed to the GENE program, some of the lessons may have played a role in the observed changes. This project adds to the literature by provided a framework for future projects. The comments and feedback provided by the experts and educators can be used to improve future programs.

**Recommendations for Further Research**

Further research is recommended to implement the intervention over a longer
time period and conduct an evaluation one year after completion to assess long-term changes. Researchers may want to extend the curriculum and cover a wider variety of nutrition and gardening topics. Future development of the curriculum may include lessons from planting to cultivation of crops. This will provided the students with understanding of the full cycle of the plant. Further studies are recommended to enlist other age groups. For example, first grade students may not have been the best to assess due to their current age and education level. Older children may produce more accurate results due to their increased level of education and understanding of topics. Future GENE programs may consider a parent component to further educate parent and child. Parent education may foster the continuation of the topics discussed during the program. Also, further studies should include a follow-up to evaluate the long-term effects of the intervention.

**Limitations**

The main limitation of this project was the selected population. First grade students may not be the best population to assess due to their education level and age. Also, the selected population attends a Title 1 school in a highly Hispanic area. The results from this population cannot be generalized to other populations. Future interventions should address this by selecting an older, more diverse population. Some other limitations included the small sample size, nonrandomized selection of participants, and duration of the intervention.

**Implications for Practice and Policy**

Despite the limitations of this project, the development and implementation of a GENE program has the potential to provide students with basic nutrition and gardening
knowledge. This can serve as a building block for future nutrition education. The developed curriculum and garden space can serve as a tool for educators to facilitate nutrition education. The GENE program can serve as another tool to combat childhood obesity. This project can serve as a guide to improve upon future GENE programs. This project can also serve as a tool to develop policies that increase nutrition education. Policies can be created to promote GENE programs in schools and thus provide students with exposure to nutrition education.

**Conclusion**

Childhood obesity in the United States is a growing problem and has reached epidemic proportions (Hedley et al., 2004; Loeb, 2009). The purpose of the project is to develop a garden and a garden-based curriculum that can be applied to the elementary school setting. The objective is to create a garden space that can be utilized to implement curriculum, which may increase students' knowledge of nutrition and provide students with basic gardening skills. Based on the results of the participant evaluation, there was no significant difference between pre- and posttest for fruit and vegetable consumption, ability to identify food groups, and ability to identify plant needs. However, there was a significant difference in the students' ability to identify plant parts. Based on the educators' interviews and expert evaluation, the GENE program received positive feedback, and the educators observed positive changes in the students. This project may help improve nutrition and garden knowledge, which may ultimately improve dietary habits and reduce childhood obesity in the future. The project can be used as a framework for the development of future GENE programs. And, the feedback and suggestions provided by the educators and experts can be utilized to improve upon future projects.
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Whole Kids Foundation School Garden Grant Application
In Partnership with FoodCorps-USA

*All information is collected online, this is a copy of the questions asked.

Looking for the Canadian School Garden Grant information? Go to our School Garden Grant page and click on the Canadian link.

Tips for completing the application:

1. Review the application below.
2. Answer all questions in a separate document first, then copy into the online application. This will create a copy of your answers and a backup in case your internet connection is lost while saving.
3. Consult our School Garden Grant writing tips by our FoodCorps reviewers on our website: https://www.wholekidsfoundation.org/schools/programs/school-garden-grant-program
4. Consult our School Garden resource center for resources on planning for your school garden: https://www.wholekidsfoundation.org/resources/school-family-resources/
5. For all technical issues related to the online application: Consult the visual troubleshooting tips on our website.
6. Email gardens@wholekidsfoundation.org with any other questions.

TIMELINE:

Application opens: September 1, 2015

Application deadline: October 31, 2015 at 5pm CT (3pm PT, 4pm MT, 6pm ET)


Notification of all applicants: February 15, 2016
## School Vegetable Garden Budget

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<th>Unit</th>
<th>Est. #</th>
<th>Total Cost</th>
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Lesson 1: Be Safe, Responsible, and Respectful

**Learning Objectives:** To teach the students the rules of the garden. To teach the students to be safe, responsible, and respectful.

**Grade Level:** K-5th

**Sources:**

Lesson Preview—Expectations

- Outline the focus by telling the students “Today we are going to learn about being safe, respectful, and responsible in the garden.”
- Check for understand by asking, “What are we going to learn about?
- Define
  - **Being safe** is using tools safely, walking on paths, and keeping your hands to yourself. Example of what not to do: throw shovel, walking on rocks, etc.
  - **Being respectful** as respect all living things. Only water plants, not people. Listen and follow adult directions all the time. Examples of what not to do: run when teacher is talking, pulling plants out, etc.
  - **Being responsible** as cleaning up after yourself and stay in garden area. Examples of what not to do: playing on swings, leaving a mess, etc.

Background—State the Importance for the Expectations

- Explain why it expectations are important. Ask the students for their thoughts.
  - We are safe in the garden because... we love our garden, we love our school, and we take pride in being able to have a garden.
- Explain what can happen when you do not follow the expectations. Ask a student for one example of each of each expectation.
  - If you don’t follow the instructions the students may have to sit out of garden time or they will be given a task that they may not enjoy.

Activity—Demonstrate the Expectations
• Model at least two positive and negative examples of each of the expectations (emphasize the positive)
  o Use another adult or students to demonstrate these examples
  o Give students who are not participating observation tasks.
    ▪ List all the things that were done right.
    ▪ List all the things there were done wrong.

• Choose one of the following activities to reinforce the expectation that has been taught:
  o Conduct a role-play: choose one to three students to participate.
  o Require one student to demonstrate the skill in response to an example.

Discussion—Provide Monitoring and Feedback

• Discuss the role-play, focusing on the targeted skill for the lesson.
  o Use key words when discussing the role-play (safe, respectful, responsible)
    For example: “That’s right, she walked facing forward; this action was safe.”

Closure

Ask the students what the three rules were? Tell them these rules can be applied not only at school but in everyday life.

Things To Do At Home

Tell the students to try and find opportunities to tell friends/family way they can be safe, responsible and respectful.
Lesson 2: Parts of the Plant

Learning Objectives: To teach students about parts of the plant such as roots, stem, leaves, and petals.

Grade Level: K-5th

Sources:
http://www.tooter4kids.com/Plants/parts_of_plants.htm

Lesson Preview

- For students to understand the basic parts of the plant.
- Check for understanding by asking, “What are we going to learn about?”
- Use worksheet and demonstration to show the parts of the plant.
- Define
  - Roots: They anchor the plant to the soil. They help the plant get nutrients and water from the soil.
  - Stem: It helps support the plant, just like your bones!
  - Leaves: These are the parts of the plant where they make their food. They don’t eat like us. They make their own food! The leaves help the plant to take energy from the sunlight.
  - Petals/flower: Pretty part of the plant. They attract insects like bees, which can get plants to spread their seeds. Some flowers turn into fruit.

Activity—Demonstrate the Expectations

- In the classroom: Give students worksheets and go through it with them as you explain each part of the plant.
  - Allow students to ask questions.
- In the garden: Explain parts of the plant again. Have each student hold a plant and let him or her explore it.
  - Use another adult or student to demonstrate with a real plant.
  - Give some examples of edible parts of the plant
    - Eat the spinach leaves
    - Eat the stem of a celery
    - Carrots are roots
- Broccoli is a flower

- Demonstrate proper planting technique both for seedling
  - Dig a hole
  - Insert plant
  - Put dirt at the base of the plant

Discussion

- Discuss the parts of the plant, focusing on the targeted skill for the lesson.
  - Ask questions as you point to certain parts of the plant. “What is this?”

Closure

Ask the students what the four basic parts of the plant are?

Things To Do At Home

Tell the students to try looking at plants around or at home and identifying the parts of the plant.
Garden Enhanced Nutrition Education

Name:_________________  
Date:_________
Garden Enhanced Nutrition Education
Gault Street Elementary School

Lesson 3: Garden Maintenance and Serving Portion Size

**Learning Objectives:** To teach students how to take care of the garden and drip irrigation. To teach students about fruit and vegetable serving sizes.

**Grade Level:** K-5th


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**Lesson Preview**

- For students be responsible for the garden maintenance.
- For students to understand how drip irrigation works.
- For students to learn what a serving portion size looks like.
  - For children 2-6 years old: 3 servings of vegetables, 2 servings of fruits
- Check for understanding by asking, “What are we going to learn about?”

**Activity**

- In the classroom: Start by asking:
  “Did you eat some fruit for breakfast?” Please raise your hand.
  “Do you know what a serving size looks like?” — Use your hands.
  Show them the food plastic models.
  1 medium apple, 1 tangerine, 1 kiwi, half a banana.
  “Do you know how many servings of fruit you should eat a day?” 2 servings.
  “Can you give me an example of two servings?”
  “How about vegetables, how many servings should you eat a day?” 3 servings.
  - Review
  - Allow students to ask questions.

- In the garden: Explain how drip irrigation works. Use the baby bottle example.
  - Use another adult or student to demonstrate with a baby.
    Ask “Do you give milk to a baby with a cup?” “Why not?”
    Well, it’s the same for our plants.
  - Give some examples of good watering techniques
    - Dump water on the plant
  - Allow the student to clean up the garden
- Explain that it is important to take care of the garden.

**Discussion/Closure**

- Discuss the serving size portions, drip irrigation, focusing on the targeted skill for the lesson.

**Things To Do At Home**

Tell the students to remember to eat 3 servings of vegetables and 2 servings of fruit every day.
Lesson 4: How Plants Grow

**Learning Objectives:** To teach students how plants grow.

**Grade Level:** K-5th

**Sources:** [http://growing-minds.org/garden-lesson-plans/](http://growing-minds.org/garden-lesson-plans/)

**Lesson Preview**

- For students to understand how plants grow
- For students to understand what plants need to grow
- Check for understanding by asking, “What are we going to learn about?

**Activity—Skit: How plants grow**

- In the classroom: We will quickly review the parts of the plant.
  - Talk about the seeds, which are like baby plants
  - Assign roles for the skit
    - Adults: Farmers and some kids can be the helpers
    - One Sun
    - Seeds
    - Clouds (water)
  - First Act: We have the seeds sitting down on the floor. Then, we ask the sun to come and “shine” on them. The farmer asks, “Would the seeds grow with just sunlight?” Everybody should say NO!
  - Second Act: We have the seeds sitting down on the floor. Then, we ask the clouds to come and “rain” on them. The farmer asks, “Would the seeds grow with just water?” Everybody should say NO!
  - Third Act: We have the seeds sitting down on the floor. Then, we ask the clouds to come and “rain” on them. After the rain, the sun comes and “shines” on them. The farmer asks, “Would the seeds grow with water and sunlight?”Everybody should say YES!
  - Final Act: The seeds stand up and grow tall and beautiful!
  - Review the parts of the plant with the children.

- In the garden: basic maintenance.
Discussion/ Closure

- Discuss how plants grow and the parts of the plant.

Things To Do At Home

Next time it rains, ask them to remember what plants need to grow.
Lesson 5: Fruit, Vegetable, and Grain Identification and Serving Sizes

Learning Objectives: To teach students how to identify fruits, vegetables, and grains and how many servings needed per day.

Grade Level: K-5th

Sources: http://www.albertahealthservices.ca/assets/info/nutrition/if-nfs-community-garden-lesson-plans.pdf

Lesson Preview

- For students to understand the importance of fruits and vegetables
- For students to understand how many servings of fruits and vegetables they should consume each day
- For students to be able to distinguish between different fruits, vegetables, and grains
- Check for understanding by asking, “How many servings of fruits and vegetables should you eat every day?”

Activity—Identify fruits and vegetables

- In the classroom: We will use fruit, vegetable, and grain models to determine their knowledge of different food groups.
  - Talk about the importance of eating 5 fruits and vegetables per day. Your hand with 5 fingers is a good visual aid for the kids to remember.
  - Ask, “Why is it important to eat fruits and vegetables?”
    - Vitamins and minerals
    - Keeps your heart healthy
    - They are delicious!
  - Have the kids sort the fruit, vegetable, and grain models into their own categories.
o Talk about how different vegetables grow and what part of the vegetable we eat (roots, stems, flowers).

o Discuss how fruits grow from the flowers of the plant (apples, oranges, lemons).

o The models are also in appropriate serving size, so let the students know this is how much one serving is.

o Bring in samples of grains to show the class (rice, pasta, oats, bread).

o Review how many fruits and vegetables we eat per day.

  • In the garden: Watering and maintenance.

Discussion/ Closure

  • Discuss how many fruits and vegetables we eat every day.

  • Restate what grains look like compared to fruits and vegetables

Things To Do At Home

Tell your parents how many fruits and vegetables you should eat every day!

Distinguish different fruits, vegetables and grains when grocery shopping.
Garden Enhanced Nutrition Education Pre-Evaluation

Name: __________________________ Classroom: ___________ Date: ___________

List the first letter of each food under the correct food group:
Fruits: ___,___, and ___.
Vegetables: ___,___, and ___.
Grains: ___,___, and ___.

1. Yesterday, did you eat any vegetables?
   a) No, I did not eat any vegetables.
   b) Yes, I ate vegetables 1 time!
   c) Yes, I ate vegetables 2 times!
   d) Yes, I ate vegetables 3 or more times!

2. Yesterday, did you eat any fruits?
   a) No, I did not eat any fruits.
   b) Yes, I ate fruit 1 time!
   c) Yes, I ate fruit 2 times!
   d) Yes, I ate fruit 3 or more times!

3. How many servings of fruits and vegetables should you eat a day?
   a) 1-3 servings
   b) 4-6 servings
   c) 5-9 servings
   d) 10-15 servings
   e) none
Garden Enhanced Nutrition Education Pre-Evaluation
Fill in the blanks with the correct plant parts!

Parts of a Flower

stem

leaf

petals

roots

Garden Enhanced Nutrition Education Pre-Evaluation
What do plants need to grow? Circle your answers.

Water

Sunlight

Burgers

Milk

Soap

Soil
APPENDIX E

Garden-Enhanced Nutrition Education

EXPERT EVALUATION TOOL

We appreciate your help in evaluating this program. Please indicate your rating of the curriculum in the categories below by circling the appropriate number, using a scale of 1 (low) through 5 (high).

OBJECTIVES/TOPICS
This program curriculum addresses the objectives of:

1. Increasing student exposure to vegetables and fruits by tending a garden. 1 2 3 4 5
2. Increasing student knowledge of nutrition. 1 2 3 4 5
3. Increasing student knowledge of gardening. 1 2 3 4 5

CONTENT
1. Appropriate for intended audience. 1 2 3 4 5
2. Consistent with stated objectives

SUGGESTIONS & FEEDBACK (additional comments):
Elementary School Educator Interview

1. What do you think about school gardening?
2. What are the perceived benefits of having a school garden?
3. What are the perceived benefits of garden-enhanced nutrition education?
4. How has the garden affected the school?
5. How has garden-enhanced nutrition education affected your school environment?
6. How has the curriculum affected the students/school?
7. Have you seen/noticed any changes in the children since the completion of this project?