

CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

DEVELOPMENT OF A HANDS-ON GARDENING CURRICULUM FOR
ELEMENTARY SCHOOL STUDENTS TO INCREASE CHILDREN'S HEALTH

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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May 2013

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DEDICATION

This graduate project is dedicated to:

My husband, whose loving support inspired me each step of the way to complete my educational goals.

My wonderful children for their love and encouragement, and who were always there when I needed them (particularly to help around the house when I had deadlines to meet or when I had to study for tests).

My professors and teachers who enlightened and motivated me to do my best and gave me the invaluable gift of knowledge and an education of the highest degree.

In memory of Dr. Allen Martin who inspired my confidence and allowed me the opportunity to give back to the school a part of what was given to me.

ACKNOWLEDGMENT

I would like to thank my committee members who supported my efforts in writing this graduate project:

Dr. Fajardo-Lira, my chair, who inspired my academic development through her love for her field of expertise and how she instills enthusiasm in her students. Words cannot express my appreciation for the opportunity she provided me to become involved with this project. It has been a great pleasure and blessing to have had Dr. Fajardo be my graduate advisor, mentor, and chair.

Professor Little, who had confidence in my ability to implement and manage this project and supported me in so many ways. As the *go-to* person for this project, she provided unfailing assistance and I will always be extremely appreciative of her support.

Dr. Gilbert, who made this project available to graduate students as a Master's Degree project and served as Project Director. Her guidance as a professor has been truly incredible and I will always treasure that I was able to be one of her students.

I would also like to thank the following:

Kelley Gold and Ava Ghobadpour, for being my project support group. I cannot imagine having anyone else better go through this process with me.

Patty Rodriguez, whose green thumb provided seedlings for the project and Crystal Aguilar, whose consistent presence at the schools was extremely supportive.

The many other volunteers who supported the implementation and teaching of the gardening lessons to the first and second grade students.

The principals and teachers at the elementary schools who gave up class time and had the courage to allow us to teach gardening lessons to their students.

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ABSTRACT

DEVELOPMENT OF A HANDS-ON GARDENING CURRICULUM FOR ELEMENTARY SCHOOL STUDENTS TO INCREASE CHILDREN'S HEALTH

by

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Master of Science
Family and Consumer Science

This project developed a hands-on gardening curriculum manual for teachers of first and second grade students that can be utilized as a guide for elementary schools to implement school gardens. The curriculum was created to support a grant from the U.S. Department of Housing and Urban Development (HUD) awarded to the Marilyn Magaram Center for Food Science, Nutrition and Dietetics at California State University, Northridge, (CSUN) to address issues of childhood obesity and eating behaviors through nutrition education and gardening, and to increase the consumption of fruits and vegetables by elementary school children.

A total of five lesson plans were created. The lesson plans were developed utilizing *Woolly Pockets*, which are space efficient hanging planters that are easy to install and move. The five lessons each include the following sections: *Objectives, Grade Level, Duration, Materials, Procedures, and References*. The lessons allow students to be involved in the gardening project and provide them with an opportunity to understand the link between gardening and the food supply, a concept which many urban and suburban

children do not often understand or have the opportunity to experience. The initial lesson plans were originally tested in four first grade classes (96 students total) at Cohasset Elementary School, Van Nuys, California, in the fall of 2011 and modified (including an additional lesson plan) before being taught again in the spring of 2012 at Cohasset Elementary and Anatola Elementary Schools to a total of 192 students.

The lesson plans developed were based upon study findings that an experience with hands-on gardening will improve student health. Through the lesson plans students will also be able to utilize their individual learning styles and abilities, learn social skills (such as cooperation and leadership through working together in a garden), and come to appreciate and care for the environment and the animals and creatures that depend on it. Moreover, students will improve their understanding of food production and of the importance of proper nutrition with a resulting positive impact on the trend of childhood obesity.

CHAPTER I

INTRODUCTION

Background and Justification

Childhood obesity is an epidemic in the United States. Over the past thirty years the prevalence of obesity has increased significantly in U.S. children. Obesity related risk factors and diseases have also increased alarmingly and are being identified even in young children. Even recently, the occurrence of obesity among children aged 6-11 years increased from 6.5% in 2007 to 19.6% in 2008 (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). The obesity issue may also be further defined by ethnicity as shown by data released from the Centers for Disease Control and Prevention (CDC) which revealed that 26.8% of Mexican-American boys are obese compared to 16.7% of non-Hispanic white boys (Ogden & Carroll, 2010).

To help reverse the trend of obesity among Hispanic elementary children, the Marilyn Magaram Center for Food Science, Nutrition and Dietetics at California State University, Northridge, (CSUN) was awarded a grant from the U.S. Department of Housing and Urban Development (HUD). This grant provides funding to address issues relating to children's physical fitness and eating behaviors, and to also encourage parent involvement in nutrition education. The grant targets three elementary schools in Van Nuys, California, where the obesity rate is 29% (Los Angeles County Department of Public Health, 2008). Part of the children's nutrition education program outlined in the grant is a hands-on gardening program. Studies show that school gardens can change attitudes towards vegetables and increase the willingness of children to taste different types of vegetables (Ratcliff et al., 2009). Creating a curriculum manual for the

“Gardening Program” activities for first and second graders will help create a standardized approach to teaching gardening to children to assist them in developing healthy eating habits and a healthy lifestyle early in their lives. The opportunities provided by this program will also improve the quality of education in the elementary schools targeted by the grant (F.Y. 2010-2015 HUD Strategic Plan, 2010-2015).

In order to provide a garden area in which to teach the children, grant money was used to obtain an innovative gardening system called a *Woolly Pocket* which uses recycled plastic bottles to create a hanging garden area (Woolly Pocket Garden Company, 2011). The Woolly Pockets are space effective and are easy to install and to move. This allows the schools to be flexible in moving the pockets to fulfill their needs. A series of five lesson plans will be developed. The focus of these lesson plans will be the planting of the seeds or seedlings, care of the plants, harvesting of the edible portion of the plants, and tasting of the harvest. This will teach the children the joy of gardening and provide an inspiration to grow their own vegetables and fruits at home. In addition, the children will be exposed to different vegetables which they can grow, harvest and taste. This experience will create better eating habits for the children and their families. The creation of the manual for the hands-on gardening project will allow the teachers to continue educating the children when the grant is completed.

Statement of Purpose

The purpose of this project is to create a curriculum that will provide a direct experience for children in growing their own fruits and vegetables and develop their understanding and knowledge of healthy foods.

Objectives

- 1) To create a curriculum manual for first and second graders relating to hands-on activities in a garden.
- 2) To implement the lessons included in the manual at two elementary schools in Van Nuys, California.
- 3) To help children understand the importance of taking care of a garden.
- 4) To have children be able to identify vegetables and develop their willingness to taste different types.

Assumptions

The following assumptions were made for the purpose of the project:

- 1) The children understand English.
- 2) The elementary schools that are included in the grant have a strong interest in incorporating the school garden curriculum and are supportive of the project.
- 3) A support staff is available to keep the garden alive, (i.e. by watering and feeding).
- 4) There is access to the garden when needed.
- 5) Sufficient funding is available from the grant to provide materials, including seeds, plants, fertilizer and other necessary items.
- 6) Support from the CSUN faculty and volunteers is available to successfully implement the lesson plans.
- 7) The Woolly Pockets will function as necessary.
- 8) The Woolly Pocket garden project will be interesting and beneficial to children so they will enjoy the process of gardening.

Limitations

The limitations of this project are the following:

- 1) The hands-on garden project has no direct assessment criteria to evaluate the effectiveness of achieving the objectives laid out in this project.
- 2) There is no guarantee that the hands-on gardening program will be sustainable by the schools after the grant is completed.
- 3) The grant does not provide for a follow-up survey in the years to come.
- 4) The lesson plan / manual will be geared toward the Woolly Pockets and would need to be altered when used in conventional gardens.
- 5) Without using lesson time from subjects, teachers will have time constraints in teaching the hands-on garden program during the regular school day.

CHAPTER II

REVIEW OF LITERATURE

History of School Gardens

The history of school gardens, according to the authors Callo, Hein and Plahl (2004), dates back to sixteenth century Europe at a time when society was primarily agricultural and children were taught to enjoy the beauty and value of the herbs, flowers, vegetables and trees in their gardens. The importance of school gardens since that time has left its mark on our education system even through today. The term “Kindergarten” was coined in the 1900s by Friedrich Froebel, who saw the nurturing and growing of the gardens as synonymous for parenting children. He compared the nurturing and growth of plants to the nurturing and developmental growth of a child. Froebel realized the importance of physical activities in the gardens as an important experience and key to the education of children. Their play activities resulted in expanding their knowledge of gardening and nutrition. Later, the Swiss educator Johann Pestalozzi considered the school garden as a resource to produce food for underprivileged children. The school garden in effect not only provided them with much needed food, but the children also learned how to garden and were also taught important life skills needed to be successful in society such as responsibility and cooperation (Callo, Hein, & Plahl, 2004, pp. 126-128). At the end of the nineteenth century, over one hundred thousand school gardens had been developed throughout Europe (Davis, 1905).

The garden movement in the United States began in the late nineteenth century, inspired by a teacher visiting school gardens in Europe. The movement was encouraged in every state and it grew rapidly across the United States. The garden movement served

multiple purposes. In rural communities garden education helped make the school environment more relevant to students by teaching them a variety of subjects related to their agrarian lifestyle. In the cities the gardens provided children the opportunity for physical activities and also provided them with vocational and agricultural training. Overall, school gardens helped instill in children a sense of accomplishment and teamwork as they “cultivated and maintained” their gardens (Davis, 1905). The gardens were also thought to be natural laboratories where children could experience life sciences and where children were taught about food production and health (Parson, 1910). School gardens had strong financial support from the United States government from 1914 until 1920. By 1921 monetary support in the United States stopped because of a lack of funding. Most school gardens vanished from schools by the mid-1920s (Trelstad, 1997).

School gardens started to reemerge in the early 1980s when United States Secretary of Agriculture John R. Block established the *Agriculture in the Classroom* program. The Secretary found students knew little about the origin of their food (Hillison, 1998). The California Department of Education (CDE) also recognized the health and educational benefits school gardens could provide to students. The Garden in Every School initiative was implemented in 1995, with a mission to enhance student education and health. The CDE recognized that nutrition is an indispensable component for a student’s success in being motivated to learn and attend school. By establishing gardens, schools can guide students in making healthy food choices which in turn lead to healthier lifestyles in adolescence and adulthood. California’s governor and legislature have ratified several bills in support of school gardens. In 1999 the State Assembly passed a bill which established an instructional school garden program. This bill was followed by

a State Senate bill which identified school gardens as beneficial to student fruit and vegetable consumption. Another Assembly bill was approved in 2002 to support a grant program. A 2006 Assembly bill gave the CDE \$15 million to award grants for promoting, developing and sustaining instructional school gardens (CDE, 2012).

As national childhood obesity rates increased over the last several decades, national interest in school gardens reemerged. The National Health and Nutrition Examination Survey (NHANES) found that the childhood obesity rate increased from 5.5% in 1976-1980 to 10.0% in 1988-1994. The 2007-2008 survey established that 16.9% of all children are obese. The prevalence of obesity was the greatest in Mexican-American boys with 26.8% considered obese in 2007-2008 compared to 16.7% of non-Hispanic Boys (Ogden & Carroll, 2010). An article by Sheffield and Galvez (2009) states that obesity has irreversible consequences on children's health. Obese children are more likely to have diabetes, cancer, hypertension, atherosclerosis, and depression. These new pediatric morbidities are increasing due to changes in childhood diet and activity levels. The study also shows that there is an association between children spending time outdoors and their physical activity level. One intervention of obesity suggests that school gardens, while they enhance academic instruction, also provide more outdoor time and more physical activity (Sheffield & Galvez, 2009). So, while a school garden program provides children an outdoor "learning laboratory" and the opportunity to experience the garden environment from planting to harvesting to preparing and tasting vegetables and fruits, it has the additional benefit of helping in the effort against childhood obesity (Story, Nanney, & Schwartz, 2009).

Another motivation for the current interest in school gardens is that these gardens

increase exposure to fresh fruits and vegetables. A research study showed that an increase in fruits and vegetables decreases the body mass index (BMI) of elementary school age children (Sheffield & Galvez, 2009). NHANES compared the recommended fruit and vegetable consumption of children (which included fruit juices and French fry intake) to the 2005 U.S. Dietary Guidelines for Americans and found that only 26% of children ages 6-11 met the recommended fruit intake and only 16% met their vegetable intake recommendation. This survey found that many children did not know the origin of food and have inadequate exposures to healthy foods. Schools could help bridge the knowledge gap by introducing children to healthier foods through nutrition education and gardening. School gardens can promote an increased consumption of fruits and vegetables (Oxenhan & King, 2001).

Ancillary Benefits of School Gardens

According to the Center for Disease Control and Prevention (CDC) gardens not only provide fresh fruits and vegetables to eat but also encourage physical activity, build useful skills, help in teaching science based education, and allow students to learn to become better stewards of the environment (CDC, 2010). Students receive a hands-on learning experience about the lifecycle of plants, from seed to their plate. They also become better environmental stewards when they understand that they can have an impact on reducing their carbon footprint by growing food locally (Blair, 2009). As with other habits, it is important to educate children to take care of the environment early so positive attitudes towards the environment can be promoted. This allows them to grow up with the knowledge to be able to make educated decisions to benefit the environment and ecosystem (Waliczek & Zajicek, 1999).

The environmental benefits of hands-on gardening were explored in *Project GREEN*. Seven elementary schools from Kansas and Texas participated in this project and 598 students took part in the pretest and the post-test phases. All schools received materials for setting-up their garden and the students actively participated in the program. After statistically analyzing the differences in the pretest and posttest results, the findings were that students had significantly increased their positive attitudes towards the environment (Waliczek & Zajicek, 1999). The study by Aguilar, Waliczek and Zajicek (2008) confirms the results of the previous findings that students participating in gardening activities have a more positive attitude towards the environment (Aguilar, Waliczek, & Zajicek, 2008). Another research project measured the parental perception of children's awareness towards the environment after children received a garden curriculum, known as *Growing in the Garden*. The outcomes were that parents themselves observed that their children had an increased interest in the environment (Hilgers, Haynes, & Olson, 2008).

In addition to creating environmental awareness in students, gardening can be a valuable component in a child's education process. Since not all student learning styles correspond best to the traditional auditory learning environment, consideration needs to be given to a variety of alternate learning styles such as visual, tactile and kinesthetic. Visual learners learn by seeing the information and remember it through visual reinforcement. Tactile learners retain information best with hands-on activities and by touching or manipulating items. The kinesthetic learner absorbs knowledge best when their whole body is involved in the activity (Wallace 1995).

A pilot garden study by Morris, Neustadter and Zidenberg-Cherr (2001)

concentrated on the visual learning styles of young children since, in general, first grade students are better in visual identification of items than in verbal identification, and a school garden is an environment well suited to visual learning. The intervention group, through increased visual reinforcement, significantly increased their scores in the posttest, which tested the children's ability to identify fruits and vegetables (Morris, Neustadter, & Zidenberg-Cherr, 2001).

In a case study by Miller (2007), children had a greenhouse and a garden in which they completed their observation and experiments. Teachers carefully documented the children's skills learned during their garden times, such as how to build and manipulate material like dirt, seeds, and flowers. The skills the children developed through the hands-on gardening experience helped the teachers understand the process of tactile learning so they could assist children in advancing their knowledge to the next level. This garden experience also focused on the kinesthetic learners, who, through gardening, were also observed in improving their body awareness and movement. A role playing activity helped them move their bodies to improve learning and grasping new concepts (Miller, 2007).

With increased technology, scientific education is critical to everyday living in our society and educators look for enhancing academic curricula for the sciences. School gardens can improve the understanding of science as shown in the next studies. Researchers collected evidence from the *Growit* project. Growit used expert gardeners to develop school gardens in primary schools with the help of the students and faculty. Twenty schools participated in the program, with students ranging in the ages from 3 to 6 years old. Research was conducted over a period of three years. The primary goal was to

understand the link between gardening and the enhancement of the understanding of life sciences. The researchers collected verbal information from teachers, and verbal and written feedback from students to include in the findings. The results indicated that students learned different scientific concepts from the garden experience, such as describing the food chain of a ladybug. Growit provided a link between the abstract and the hands-on garden experience of the life sciences. In interviewing the students the researcher found that most of the students enjoyed the gardening experience. Other findings were that students developed a good understanding of planting, taking care of plants, and composting, and that the scientific knowledge of the students had significantly increased. The outcome of the science questionnaire was that the students' test scores were statistically significantly improved in the life sciences (Woolner & Tiplady, 2009).

In a different research study, which had the largest amount of student participants, a "science achievement test instrument" was created to assess the 647 students in third, fourth, and fifth grades from seven different elementary schools in Texas. As in the previous article, the overall test results were that the experimental group, which had participated in gardening activities and received additional training in horticulture, health, nutrition, environmental science, and leadership, scored significantly higher than the control group. The experimental group from fifth grade had an even higher increase of over twice as many points than the other experimental group over the control group. The authors suggest that these students were already more developed in cognitive skills related to science and therefore could fully take advantage of the learning possibilities of a hands-on gardening curriculum (Klemmer, Waliczek, & Zajicek, 2005).

The next studies looked at a holistic approach regarding the effect of school

garden programs on children. These studies not only examined academic gains but also the social development of the students. In a pilot study by Block et al. the students not only acquired gardening knowledge by being actively involved in all aspects of gardening and eating fruits and vegetables, but the program also improved many students' social skills; the students made friends and had better connection with their teachers, their schoolmates, and their communities (since volunteers were asked to help with the gardens). The students developed teamwork skills and confidence. The increase in confidence was especially noted in children with learning disabilities and children with disciplinary issues (Block et al., 2012).

In the Miller (2007) case study, teachers observed and carefully documented the skills the children developed during their garden times. The children, three to six years of age, learned through observation about the details of textures, shapes, or sizes of plants and animals. They were taught to create maps and how to read them, follow them and recognize landmarks. They also improved their visual and spatial skills. In their observations the teachers also noticed the children's improvement of language skills. The children learned how to recognize symbols, the names of fruits and vegetables, and learned how to spell and read. They conducted experiments in the gardens, learned about the causality of nature, and learned about plant and animal life, thereby improving their scientific knowledge. Another subject in which the teachers noticed an improvement was mathematics. The garden experience taught the children counting, matching, determining area and volume, and understanding the concept of perimeter. The children were also observed improving their body awareness, developing their motor skills, and expanding their sensory abilities through the garden experience. Social, interpersonal, and

intrapersonal skills were also seen to develop. The children learned cooperation and teamwork, interaction with adults, as well as being able to share their ideas and needs with their peers. The hands-on garden activity further helped them develop critical thinking, respect for their environment, ownership and responsibility (Miller, 2007).

Similar findings were reported by the authors Bradley and Skelly (1997), who found that gardening contributes to personal growth and social skill development. As in the early twentieth century, through their hard work of nurturing plants, students find it a rewarding experience which can increase their confidence and self-esteem. This article also supports the results of other studies which indicate that by taking care of a garden, children are more active and that through gardening, children understand and appreciate the origin of food. As they plant, water, fertilize, harvest, and eat the foods they grow, children learn about the components of a healthy diet (Bradley & Skelly, 1997).

Impact on Children's Health and Nutrition

CDC recommendations and reports conclude that school health education is beneficial to all students. Skills learned during nutrition education can increase student academic performance through healthier eating behavior and may lead students to a healthier future (CDC, 1996). According to the California Department of Education (CDE), this type of education in the form of school gardens provides an effective setting to improve students' health. By participating in the garden program students are further motivated to learn about nutrition, the food they eat, and to also taste the vegetables they grow (CDE, 2012).

A study by Somerset and Markwell (2008) supports the CDE findings. In the study, the school garden curriculum was taught by a garden-based teacher who was

responsible for establishing and maintaining the garden and coordinating and teaching garden activities for the students. The teacher was not privileged to the evaluation tool, which added credibility to the research. The first set of data was collected from the students in the fall before the project started and the second set of data was collected a year after. After a year of garden experience the students' ability to identify specific vegetables and fruits improved significantly. More children also increased their preferences for vegetable and fruits. To answer the question of whether they subsequently ate more fruits and vegetables daily, the data was reviewed and showed there was an increase from the baseline test in grades four, five and six (Somerset & Markwell, 2008).

The *Garden Reaching Our World (GROW)* project in Wisconsin's elementary schools from kindergarten through fifth grade took a different approach towards assessing the effect of school garden programs on student vegetable consumption. The GROW project installed a salad bar in the school lunch room. The school's salad bar was used as a measure to record any variances in vegetable consumption during school lunches. The salad bar was situated so that all students needed to pass the salad bar as they were waiting in line for hot foods. The selected vegetables were weighed and recorded by the school food service staff for each student throughout the GROW project. A plate waste study was done twice during the duration of the project to estimate the percentage of vegetables actually being eaten. The garden program was introduced to the students about 10 weeks after the beginning of the use of the salad bar. The students were using microfarming to grow their vegetables due to the winter season and at the end of three weeks the microgreens could be harvested by using scissors. The students sampled each type of microgreens and then combined them to make a salad. Prior to the garden

program, salad bar consumption was between 6.55 grams and 40.55 grams per student, with a negative trend of vegetable consumption being recorded. After the garden activities the amount of vegetables selected from the salad bar increased and an upward trend of vegetable consumption was noted (Wright & Rowell, 2010).

In the study by Radcliffe et al. (2009), a total of 320 sixth grade students from the San Francisco Unified School District were enrolled in the study. The students received gardening instructions and 40 minutes of hands-on gardening each week for 13 weeks. The students participated in a garden vegetables frequency intake pretest and posttest and also participated in a taste test. The students in the garden program significantly increased their preferences toward vegetables when compared to a control group and students in the garden group also increased the variety of vegetables they ate each month at school (Radcliffe et al., 2009).

Another study showed similar results. Parmer et al. (2009) investigated six second grade classes with a total of 115 students which were divided into three groups. Two classes received both nutrition and gardening education (NE+G), two classes only received nutrition education (NE) and the last two classes received no education and served as the control group (CG). The study was conducted over 28 weeks and included a pretest and posttest. The 37 students in the nutrition education and gardening group received an hour of nutrition lessons every other week and a hands-on gardening experience every alternating week. The 39 students in the nutrition education class received nutrition education classes every other week. The 39 student in the control group received no garden or nutrition related lessons. The pretests and posttests measured the students' knowledge, preference and consumption of fruits and vegetables. The students'

fruit and vegetable preferences were also observed in the lunch room and the results recorded. The findings were that the students in both the NE+G and NE groups significantly increased their knowledge related to the food groups and could significantly more often correctly identify fruits and vegetables over the control group. Both groups also showed a significantly increased rate of tasting fruits and vegetables over the control group, but the NE+G group showed the greatest improvement from the pretest to the posttest especially in tasting spinach. These findings would suggest that gardening has a positive influence on vegetable consumption in children (Parmer et al., 2009).

Another research project used a different assessment approach. It used a two-day 24-hour food recall method in assessing students but had similar findings as the previous study, that is, gardening and nutrition education had a greater influence on the willingness to taste different types of vegetables (Morgan et al., 2010). Yet another research project, the *Delicious and Nutritious Garden*, was included in a 12-week YMCA summer camp. As well as working in the garden and receiving nutrition education the students were also encouraged each week to taste local fruits and vegetables from the farmers market. The researcher found in the posttest that the participants significantly increased their vegetable preference, as well as increased the number of fruits and vegetables they had ever eaten (Heim, Stang, & Ireland, 2009).

To determine whether a garden program could advance the goal of creating healthy eating habits, a study in which 111 third and fifth graders from five elementary schools in Texas participated established that students significantly improved their vegetable preferences after the gardening program. After the garden program the students were more likely to choose a fruit or a vegetable for a snack (Lineberger & Zajicek,

2000). Studies have also shown that increasing fruit and vegetable consumption in children will result in them having healthier adult diets. Once food behaviors are established they are difficult to change and therefore good eating habits need to be developed in childhood so they can continue through adolescence and adulthood (Heimendinger & Van Duyn, 1995).

Further research has also shown an increase in better eating habits due to garden education. In the study by McAleese and Rankin (2007) three similar elementary schools participated and random assignments were made for the treatment. One school was designated for its students to receive only nutrition education. One school was designated for its students to receive both gardening and nutrition education. The remaining school was used as the control group. Students filled out three consecutive 24 hour food recall workbooks before and after the intervention which lasted 12 weeks. In a review of the students' before to after recall workbooks it was found that the combined number of servings of vegetables and fruits more than doubled from 1.93 to 4.5 servings per day for students at the school where the students received the gardening and nutrition education. The students in this school also significantly increased their vitamin A, vitamin C, and fiber intake. For the students in the control group and in the school that received just the nutrition information, no significant changes were observed (McAleese & Rankin, 2007).

Garden programs also tend to impact the family of the garden participant beyond just the gardening experience. This was shown in the YMCA summer camp project, the *Delicious and Nutritious Garden*. Young campers participated in hands-on gardening and were exposed to growing their own fruits and vegetables. The participating campers then provided snacks from their garden to younger campers, promoting healthy eating habits

through positive peer influence. In addition, the parents and caregivers of the campers were influenced by weekly newsletters and a cookbook with the recipes of meals the children ate while in summer camp. The children also took home vegetables grown in their *Delicious and Nutritious Garden*. This intervention resulted in the children themselves being the motivators to influence the availability of fruits and vegetables as they got home. By doing so, this helped improve the whole family's eating habits and improved their nutritional intake (Heim, Stang, & Ireland, 2009).

With the positive impact of garden programs on eating habits well established, dietitians suggest that garden and nutrition education can lead to a prevention or reduction in childhood obesity through developing healthier eating habits in children and that a main goal of a garden program should be to positively impact childhood obesity (Gorman et al., 2007). To illustrate this goal, Ozer (2007) created a “conceptual model of potential effects of school garden programs” from her studies of school gardens. The concept is that the school garden exposes the student to fresh produce. Eating produce in a garden program becomes a peer group activity which uses peer influence to promote the consumption of fresh fruits and vegetables. Formal education and hands-on education of nutrition and other academic subjects increases students' knowledge of nutrition and the environment. With increased parental involvement in the school garden program, they increasingly become more knowledgeable in nutrition and in environmental conservation. This knowledge improves the nutritional intake of the whole family. These components together lead to improved and higher intake in fresh produce and potentially reduce or prevent obesity and chronic diseases (Ozer, 2007).

The *LA Sprouts* study by Gatto et al. (2007) came close to a conceptual model of

the school garden by successfully increasing fruit and vegetable consumption and reducing weight in participating students. This study involved 104 mostly Latino students in fourth and fifth grades from the Los Angeles Unified School District. Participating students had their weight measured and their body mass index calculated based on that information. More than half of the students were overweight or obese. These students received weekly 90 minute intervention sessions for 12 weeks. The session included a 45 minute cooking and nutrition education lesson and a 45 minute hands-on gardening experience for the students. In the gardening lesson the students performed the tasks of planning, maintaining and harvesting their produce. In the obese/overweight subgroups the preferences for vegetable increased by 16%. The study also showed that students who took part in the gardening program were 54% more likely to respond that “vegetables from the garden taste better than vegetables from the store.” The analysis of the data also revealed that students lost weight while participating in LA Sprouts. Other health benefits found from the study were that students in the overweight/obese group also decreased their weight gain and reduced their blood pressure (Gatto et al., 2012).

School gardens however also provide a further element to reducing obesity. In the article “Designer Schools” the authors researched the influence of the spatial features in a school environment on the childhood obesity epidemic. After their examination of existing school designs they found that, besides changing the traditional recreational space of schools, school gardens also provided a broader range of physical activities to students. The school garden program encourages physical activity in a non-competitive setting (Gorman et al., 2007).

Conclusion

It is very important to invest in children's health and academic future. School gardens have been found through this literature review to have a positive influence on students. Even in the nineteenth century school gardens were considered "natural laboratories" and beneficial to a child's education, particularly in respect to science and their knowledge about food production and health (Parson, 1910). In the twenty-first century, as many students became far removed from food production centers and as the childhood obesity rate climbed, the United States government and the states themselves, including California, once again became very interested in school garden programs. Research has found that children, through hands-on gardening activities, also develop a more positive attitude towards the environment, becoming better environmental advocates (Blair, 2009; Waliczek & Zajicek, 1999). Gardening also improves many children's academic processes. Since not all students are traditional auditory learners, the visual, tactile and kinesthetic learners improve their understanding through the hands-on activities provided by a school garden and through the total body movements incorporated in gardening activities (Wallace, 1995). School gardens can be especially favorable for children with learning disabilities and discipline problems (Block et al., 2012).

The value of gardening can further be seen in the improvement of a student's scientific knowledge, language skills and in the social development of children. The impact of school gardens on child health and nutrition knowledge is significant. Studies have shown that through gardening students are able to learn and identify a wider variety of fruits and vegetables. And while the methods of retrieving the results varied, the

studies reviewed showed an increase in vegetable consumption with hands-on gardening experiences. This increase of fruit and vegetable consumption in childhood leads to new habits being formed at a young age, which will be continued through adolescence into adulthood. This improved consumption pattern can lead to reduction of weight and obesity in children, which in return reduces the onset of chronic adult diseases.

It should be noted that most research reviewed concentrated on an increase of fruit and vegetable consumption through gardening and that only one study took anthropometric measurements of the participants and successfully proved that participating in garden activity and nutrition education can achieve weight loss and reduce blood pressure. So while more studies are needed to assess the benefit of school gardens on the reduction of obesity, there is no doubt that school gardens are a great teaching tool for improving eating habits, the health of children, and a positive influence on student awareness of food choices and nutrition.

CHAPTER III

METHODOLOGY

The main purpose of this project was to develop a hands-on gardening curriculum manual for first and second grade students that can be utilized as a guide for elementary schools that wish to implement school gardens. The hands-on garden curriculum was designed to expose students to gardening and allow them to experience the enjoyment of maintaining a garden. Since students learn with hands-on experience, the lesson plans were developed to promote student involvement and were aimed at increasing the student's knowledge of how plants grow, to learn more about the life sciences, and to improve nutritional knowledge by allowing them to grow food and then taste the different vegetables they grew. The lesson plans were developed for *Woolly Pockets*. Woolly Pockets use recycled plastic bottles to create a hanging garden area (Woolly Pocket Garden Company, 2011). They are space effective and are easy to install and to move. This allows the schools to be flexible in moving the pockets to fulfill their needs.

The following sections were included in each of the lesson plans:

Objectives: Determines what the students will have learned at the end of the lesson.

Grade level: States the grade level for which this lesson plan is indented.

Duration: Time needed for the lesson.

Materials: Supplies and preparation needed to be able to implement the lesson plan.

Procedures: Detailed instructions on how to implement the lesson plan.

References: List of resources used to create this lesson plan.

This format was used to simplify the implementation of the lessons. The objectives are clearly stated so the garden instructor will know at a glance if the lesson can be implemented or if additional resources are required.

Articles by garden experts and information from academic literature and reference books were consulted when compiling the lesson plans. Most of the material for the lesson plans was obtained from internet searches of “school garden lesson plans” and “garden activities for children”. The lesson plans were designed to focus students on gardening, food origin and nutrition.

The four initial lesson plans were tested at Cohasset Elementary School (Van Nuys, California) during the fall 2011 semester. A total of four second grade classes, with twenty-four students in each class, participated in the program. The gardening lessons chosen for that semester were as follows:

1. Planting Our Garden in Woolly Pockets
2. Composting and Insect Control
3. Taking Care of Our Garden
4. Tasting the Delicious and Nutritious Fruits and Vegetables

Anatola Elementary School (Van Nuys, California), with an additional four classes, was added in the spring 2012 semester. For this semester, a total of eight second grade classes, with a total of 192 students, participated in the hands-on gardening classes. An additional lesson plan was added this semester. These five lesson plans, which had been revised and refined, were as follows:

1. Planting Our Garden in Woolly Pockets
2. Composting and Insect Control

3. Container Gardening
4. Taking Care of Our Garden
5. Tasting Delicious and Nutritious Fruits and Vegetables

For each lesson plan individualized preparation was required for the twenty minute presentation. A schedule was created by the coordinator of the grant with all the elementary school teachers at the beginning of each semester. For the implementation of each lesson plan volunteers were needed to assist the students. The students in each class were divided into three smaller groups of eight students for each hands-on gardening activity, and each group was assisted by the volunteers. In order to enhance student involvement and retention, the lessons were designed and implemented in a manner so as to provide students a fun filled and educational garden experience. Each lesson ended with a short review of the topic discussed and the students received a topic related hand-out when appropriate.

CHAPTER IV

RESULTS

The result of the project was the development of a first and second grade curriculum manual for hands-on gardening (see Appendix). Students were engaged in the gardening education process through tactile and kinesthetic learning, as well as through audio and visual techniques. This approach allowed all students to be involved and provided the students an opportunity to understand the link between gardening and the food supply, a concept which many urban and suburban children do not often understand or have the opportunity to experience. The initial lesson plans were presented to four first grade classes (96 students total) at Cohasset Elementary School in the fall of 2011 and modified before being taught again in the spring of 2012.

The first lesson taught was “Planting Our Garden in Woolly Pockets”. The lesson started with a short presentation on the origin of food and the identification of healthy and unhealthy foods. This dialogue led into the introduction of the *Woolly Pockets* gardens and the beginning of the instruction on how to plant the seeds and seedlings. A pair of students either planted a seed or a seedling. After their planting, they were instructed on how to water the plants. Another segment was a “seed bank” activity planned for each student. The students were to place a seed on a moistened paper towel into a Ziploc-bag, close it, and take it home, watch the seed germinate, and write down the observation. Since there was no time for the students to do this activity a volunteer placed the seeds into the bags so the students could take them home for observation.

The second lesson plan, “Composting and Insect Control”, was developed to teach the students what plants need to grow. During the lesson a comparison was created

between the students' needs and the plants' needs. With the help of picture cards the importance of air, water, sun, insects, soil, and plant food was presented. Environmental benefits of composting were also introduced. The children made their own compost container. Pieces of lettuce, apples and banana peels were placed into separate clear plastic containers and were filled with dirt so that the food items were still visible. The items were then covered and labeled indicating what was in each container. The containers were placed in the classroom so the students could observe the decomposition process. The contents of the container were used in the next gardening class as fertilizer. Another topic was the importance of insects to the plants. The life-cycle of ladybugs was discussed and the children received ladybugs which they placed on the plants. The ladybug distribution needed to be controlled because the children become overly excited about handling them.

The third lesson plan was the "Taking Care of Our Garden". The compost containers were taken out of the classroom into the garden area and the content was distributed by the students to the plants in the Woolly Pockets and the plants were then watered. The students took part in a discussion of how the items changed in the compost container. The effects of water on the plants and how it helps distribute nutrients throughout the plant were also presented to the first graders. After watering the plants the students could hold and touch night crawler worms and a discussion of the benefits of earthworms for the soil and plant life cycle took place. The lesson was closed with a brief review of the lesson and each child received a handout describing the earthworm's life cycle.

The fourth and last lesson plan for the fall 2011 semester was "Tasting the

Nutritious and Delicious Fruits and Vegetables”. Ideally the students would have harvested some of the vegetables from their Woolly Pockets and tasted them. However, the growing period was too short so no vegetables had grown to a size large enough for tasting. Instead, the same vegetables were purchased as were growing in the garden for the students to taste. Emphasis was placed on the importance of eating fruits and vegetables and their health benefits. Students were shown vegetable picture cut-outs of the parts of the vegetables they were eating. The students were encouraged to taste a variety of fruits and vegetables. Most students were very willing to taste the different fruits and vegetables. The first graders were eager to share if they liked the food, also how it tasted and were happy to comment on the texture. The lesson was closed with a brief review of the lesson

In spring 2012 the lessons were reevaluated and revised. They were then presented to four second grade classes at Cohasset Elementary School and four more classes at Anatola Elementary school (a total of 192 students). In the first lesson, “Planting Our Garden in Woolly Pockets”, two revisions to the lesson plan were made. Due to the short growing time of the season and the constraints of the school year, students planted seedlings instead of seeds. This however was only conducted at Cohasset Elementary School. The planting had to be canceled at Anatola Elementary School because of rain and the lesson could not be rescheduled. Volunteers therefore planted the seedlings at Anatola Elementary School. The second change was the omission of the “seed bank” activity due to lack of time.

The next session, “Composting and Insect Control”, was taught with success at both schools and all eight second grade classes participated. The only change in this

lesson was that orange peels were substituted for the banana peels because the smell of banana peel decomposition was very strong.

The “Container Gardening” lesson plan was added in the spring of 2012 to inspire students to encourage their parents to start their own container garden to increase better nutrition at home. This lesson was taught at Anatola but had to be canceled due to rain at Cohasset and could not be rescheduled. The lesson started with a container holding different types of seeds. The students were asked to describe their shapes, color and size. The seeds were compared to a seed picture card so they could see the plant that would develop from a particular seed. Each student received a cup, filled it with soil and planted the seeds and watered them after they had received instructions. Students could take the cup with the seeds home to watch them grow and share with their families. The second graders were encouraged to show and talk to their parents about how to plant additional seeds in containers since plants can be grown in small spaces. The final activity for this lesson was having the children act out growing like a plant from a seed to becoming a full plant. They were then asked if they could show where their root, stem, and petals were. The lesson closed with a brief review of the lesson and a reminder that a container garden only requires a small space.

The final two lesson plans were taught basically without significant change. The lesson on “Taking Care of Our Garden” followed the previously outlined procedures except that red worms were used due to an availability and better longevity in the garden environment. The only change to the last lesson “Tasting Delicious and Nutritious Fruits and Vegetables” was that a few vegetables were substituted since the ones previously used were not grown in the Woolly Pockets that semester. The finalized lesson plans

tested in spring 2012 were assembled into a gardening manual to aid teachers in implementing and supporting school gardens.

CHAPTER V

SUMMARY AND CONCLUSION

The benefits for students who are involved in a hands-on gardening project have been well documented. The purpose of this project was to support a HUD grant funded nutrition education program by creating a hands-on gardening lesson plan manual to supplement the current curriculum of first and second grades at two schools in Van Nuys, California. Lesson plans were developed with the following sections: Objectives, Grade Level, Duration, Materials, Procedure, and References. The initial four lesson plans were tested in the fall of 2011 on 96 first grade students. The lesson plans were then edited and revised, with an additional lesson added for testing in the spring of 2012. The five revised lesson plans were then presented to 196 second grade students and compiled into the lesson plan manual.

The lesson plans developed through this project may be used to promote school gardening in the early grade levels when children are most open to new experiences and approach this type of activity with heightened curiosity. An experience with hands-on gardening will improve student understanding of the life sciences. They will also be able to utilize their individual learning styles and abilities, learn social skills such as cooperation and leadership through working together in a garden, and come to appreciate and care for the environment and the animals and creatures that depend on it. Moreover, they will improve their understanding of food production and of the importance of proper nutrition with a resultant positive impact on the trend of childhood obesity.

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