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**THE IMPACT OF A SCHOOL GARDENING PROGRAM ON NUTRITION
ATTITUDES, BEHAVIORS AND INTEREST AMONGST FOURTH GRADE
STUDENTS**

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**THE IMPACT OF A SCHOOL GARDENING PROGRAM ON STUDENTS'
NUTRITION ATTITUDES, BEHAVIORS AND INTEREST AMONGST FOURTH
GRADE STUDENTS**

ANJALI MALLIK BARNICK

ABSTRACT

This study intended to examine the impact of the gardening curriculum in an urban elementary school in Cleveland, Ohio. This yearlong gardening education program is introduced to the students in the 4th grade and incorporates a curriculum that includes gardening, nutrition, community service and experiential learning. With ample support from the community and from parents, this school provided the ideal setting to research the topic of how school gardening programs influence the students, their families and the community.

The study used a series of questionnaires administered to the students in the fall of August 2013, early winter December 2013 and February 2014. The study sought to determine how students' knowledge, behavior, attitudes and interest are influenced by this program. These administrations are to demonstrate the differences between the knowledge of nutrition before the pretest and after as well as retention of information about consuming vegetables after the curriculum.

The gardening program is offered once per week and is part of the ten month curriculum. This program is offered in a greenhouse that is located onsite of the school grounds. Once per week, students leave their classrooms and walk to the greenhouse that is near the main school building. During class time, students are provided instruction for 20 minutes and for the remainder of the class period students do hands-on exercises.

Depending on the weather, activities could entail being inside working on seedlings or outside working in the designated children's garden. The variables being assessed are nutritional knowledge, attitudes about healthy eating, eating behavior and motivation / interest in school and these variables have been taken from An Evaluation of the School Lunch Initiative (Pearson, Atkin, Biddle, Gorely, & Edwardson, 2010). This study will extend the literature on this field by examining the impact of a nutrition-based gardening education intervention in an urban setting.

After exposure to the program, students indicated a significant change in their behavior and interest in the gardening and nutrition curriculum. Students responded positively with respect to the nutrition based education, made healthier choices when given options between foods, and interest increased on the days of the nutrition program. Despite the absence of significant change in self-reported knowledge among these students, the gardeners and teachers found that the gardening environment was an essential tool because all around learning was frequently reported as being beneficial for students. These students, in this urban setting, felt that they had a better understanding about their environment and had a sense of belonging to the community after having worked with the gardening initiative.

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CHAPTER I

INTRODUCTION

Problem Statement

Rising obesity rates and health issues are driving development of programs on how to educate adults and children on healthier eating choices. As stated in Cosoveanu and Bulucea (2011), according to a study carried out in 79 countries, the World Health Organization (WHO) estimates that there are 250 million obese people in the world, among which approximately 22 million are children aged less than 5 years. Half of these obese children will become obese adults; WHO estimates about 300 million will be obese for 2025 (pg. 133).

One logical entry point for intervention to increase nutrition knowledge and awareness is the school setting because youth spend the greater part of their day in the classroom. Schools have been indicated as the ideal location to provide nutrition education and school gardening has been proposed as a cost effective way to engage students in increasing nutrition knowledge (Anzman, Rollins, & Birch, 2010; Kohlstedt 2008; Ozer 2007).

School gardening became popular in the early 1800s through the work of John Dewey (1915). As a progressive educator, Dewey felt that we should integrate this type

of curriculum as a vocational tool. Because of the importance of this vocation, schools in remote areas looked for ways to change curriculum to teach students agricultural knowledge so that they could apply this to their living space and provide a livelihood. At that time, gardening education was promoted to increase awareness about how to grow your own food and decrease the economic burden on families in the United States. Today, gardening education represents a pragmatic way to address how to frugally increase nutrition. In addition it provides an active way for individuals to address health concerns and be more involved in monitoring their daily food intake (Anzman et al., 2010). Existing gardening education programs have also been shown to increase academic achievement, and promote healthier lifestyle choices among school-aged children (Kohlstedt 2008; Ozer 2007; Yu, 2012).

To date, few studies have investigated the impact of school gardening in an urban atmosphere; specifically, this research seeks to investigate how a school gardening education program influences students' knowledge, awareness, behaviors and interest towards nutrition.

Research Objectives

An urban elementary school in Northeast Ohio started a gardening education program in 1922. Utilizing a five acre site, with 204 plots and an average of 180 gardeners per year, it happens to be one of the largest community gardens in all of Cuyahoga County. The produce is shared with the students of this program as well as with the school. The excess harvest from this school is not sold; instead they donate their harvest to local food banks.

At this school, the gardening curriculum is introduced to the students in the 4th grade. This is a yearlong program that introduces children to gardening, nutrition, community service and a different type of learning. With support from the community and support from parents, this school provides the ideal setting to research the topic of how school gardening programs influence the students, their families and the community.

Specifically this study addresses the following research questions:

1. After the nutrition based intervention program, is there a statistically significant difference in knowledge about nutrition in students over time? It is hypothesized that nutrition awareness will increase.
2. After the nutrition based intervention program, is there a statistically significant difference in attitude about nutrition in students over time? It is hypothesized that attitudes about nutrition will increase.
3. After the nutrition based intervention program, is there a statistically significant difference in students' retention of nutrition behavior over time? It is hypothesized that behavior towards nutrition will increase.
4. After the nutrition based intervention program, do the students display increased motivation / interest in school nutrition programs? It is hypothesized that motivation / interest in school will increase.

Using a quantitative, quasi-experimental pre / post design, this study measured the impact of experiential learning programs on students' knowledge about nutrition and eating behaviors.

CHAPTER II

LITERATURE REVIEW

The literature review begins with the pertinence of this topic, historical backgrounds of gardens, discussion of the relevance of community and school gardens today and how they influence the participants and will end by focusing on the areas of research: nutrition, health issues, existing gardening programs and their impact on achievement, community engagement and motivation..

Pertinence of Topic

How children make eating choices: (what to eat, when and how much) is at the forefront of discussions in health and medical communities, school environments and home environments. There is concern that choices about food intake are being influenced by media, convenience, and household budgets. This may lead to health issues in children and adults, which include overweight individuals, obesity, type II diabetes, heart disease, and hypertension, (Yu, 2011). These medical issues may be possibly leading to higher health insurance rates and impacting the community.

In order to address health issues, it is important to understand what influences children and their food intake choices. With the economic downturn, it is increasingly necessary for all able bodied individuals to work to support a household. Consequently,

when adults of a given household may be absent from the home, their children are spending more time indoors without an adult presence. When children are less active, they spend more time watching TV and using the computer and more time playing video games. While engaged in these passive pursuits, children are exposed to media advertising (TV commercials) that influences their choices on what to eat and when (Anzman et al., 2010). Additionally, working parents may be distracted because of financial obligations and life stresses, allowing their children to dictate what should be eaten or not (Graham & Zidenberg-Cherr, 2005).

Furthermore, parents are making food decisions based on convenience, and due to lack of time. When they are absent from the home, there is limited time available for cooking or planning meals. Because students are being influenced by outside factors, it is important to know what their understanding is about healthy food vs. not healthy food. And the challenge with modeling or educating students about healthy eating is that society has been conditioned to “biggie size” everything, and individuals really do not have a clear understanding about what portion control is.

Additionally, rising obesity rates and health issues are causing stakeholders to take notice and develop programs on how to educate families on healthier eating choices. Indications include involving schools and utilizing after-school programs, cooking classes, and school gardening programs which will include students, parents, teachers and the community. Other remedies could include: providing healthier school lunches, developing nutritional standards for beverages sold in schools, ensuring that all students participate in approximately 30 minutes of moderate exercise daily, including nutritional

education classes and conducting annual assessments of each students health and wellness profile.

Implementation of a variety of programs is believed to increase awareness and increase retention of information amongst all students while decreasing sedentary behavior. One main factor that needs to be addressed is how to offset what the children are learning from over exposure to electronic commercial media. According to Yu (2011) recent reports (Campaign for a Commercial-Free Childhood, 2007; Kunkel 2001; Mercola 2004) state that the average child in the United States is exposed to about 40,000 TV commercials a year: candy, toys, cereal, soda and fast food are among the major products advertised in these commercials. Children not only make food choices for themselves, but they also highly influence food choices for the entire family (McDermott, O'Sullivan, Stead, & Hastings, 2006). Involving parents, schools, media and the community will create a support network to influence the child toward a healthier way of living. Not only does this engage a support network, but it also teaches respect for all things. Since the earth's resources are limited, it is essential that our ways of life should change. For example, in Japan, they believe it is possible to conserve energy while protecting the environment, (Isomura, 1998).

Family eating preferences are largely due to the ways in which families are structured on a daily basis (Neumark-Sztainer et al., 2002). Given this, interventions that target not only changes in nutritional knowledge but also which target specific behaviors may be most effective for reducing obesity. Family meals provide the opportunity for modeling food behavior, influencing nutritional beliefs, and controlling the family food environment by offering healthy foods. Parental modeling, monitoring, and support of

child physical activity all are positively associated with children's physical activity level (Arredondo et al., 2006). In contrast, excessive screen time, defined as exposure that exceeds 2 hours per day, is associated with increased risk of childhood obesity (Lumeng et al., 2006). Intervention strategies like those listed above help parents establish rules and boundaries related to screen time have proven effective (Robinson & Zajicek, 2005).

Despite these corrective strategies, childhood health issues have increased dramatically in the latter part of the 20th century, making it a leading public issue (Ogden, Flegal, Carroll, & Johnson, 2002). From 2009-2010, 18.2% of US children aged 6 through 19 years were considered obese (Ogden 2010). There is a difference between healthy, obese and severely obese based on body mass index (BMI) numbers. Children defined to be severely obese (at the highest BMI range) face even greater health risks than obese children. Among children examined in the recent surveys, those who were above the 99th percentile of BMI had higher mean blood pressures and insulin levels, lower mean high-density lipoprotein (HDL) cholesterol levels, and higher prevalence of metabolic syndrome than those who had BMI percentiles in the 95th to 97th range, putting them at greater risk of cardiovascular disease (Skelton, 2009).

Because of these trends, efforts are in place to assess the increases in childhood health issues in the United States. An important context in which such monitoring can take place is the school, because most children aged 5 through 18 years are enrolled in school and 90% of these students attend public schools (Strizek, Pittsonberger, Riordan, Lyter, & Orlofsky, 2006). Many schools and school districts are mandating routine weight screening for students and piloting methods to address these health concerns and educate students towards making healthier eating and lifestyle choices.

In order to confront and combat these concerns, proponents are indicating improving the school health environment. Since 1999, the EAT.RIGHT.NOW, program in Philadelphia has provided nutrition education to all students and parents who are eligible for a federal supplemental nutrition assistance program. This program provides financial assistance for obtaining healthy foods, and guidance towards physical activity and nutrition education. Additionally, the school food services were provided funding to begin offering free breakfast to all students (www.foodfitphilly.com). The funding of this program was predicated upon the revelation of alarmingly high BMI scores revealing escalating obesity levels.

Trends from this Philadelphia study helped to further the research on this topic. One method that surfaced was school gardens. School gardening promises multiple ways of reaching a student. The child who does not do well in a classroom setting may learn differently by working actively with their hands. Science and math take on a whole different meaning when you can teach the student through visual learning. How effective a school garden program is depends on all the participants and their commitment. Teachers would need to change lesson plans from “book work” to outside of the classroom learning. Parents would need to be involved, because a school garden needs workers and attention all year long and the community would also need to be involved through donations and knowledge of gardening. The “Master Gardeners” can assist our teachers and students in learning about gardening, and cooking lessons will help students to understand how to consume these vegetables in a tasteful way.

Ozer (2007) researched how school gardening benefitted students. In the study Ozer concluded that in these “outdoor learning labs”, regardless of the size of the garden,

whether it was container or land, the students gained higher achievement (pg. 846).

Students also felt that they had a better understanding about their environment and had a sense of belonging to the community after having worked with the gardening initiative.

Gardens

Historical background. School gardens initially started in Europe. Johan Comenius, a 16th century Moravian educator, has been credited with starting this movement. It was later brought to the USA by Mary Tyler Peabody Mann (Horace Mann's wife). The movement quickly traveled from New England to the Midwest.

When gardening arrived in the Midwest, it was used as a vocational tool. Schools in remote areas looked for ways to change curriculum so that their students could benefit from this opportunity to gain a skill and be able to provide support for their families. This concept was later supported by Theodore Roosevelt, who wanted to emphasize the value of rural environments and the puritan way of living.

School gardens flourished from the 1890s-1920s. Gardening's popularity increased after the Panic of 1893, which led to economic depression (Kohlstedt, 2008, pg. 74). When immigrants could not find work to feed their families, they had to resort to other means to support their families. Seeds were sold to school- aged children for use in their own yards/neighborhoods and the produce could be eaten by the family or sold to buy other necessities. When people did not have land to plant their seeds, window boxes were created so that they could still benefit from this opportunity.

During this time, the first organized urban gardening program was started by the city of Detroit in 1893 (Huff, 1990). In the early 1900s, gardening was vital to livelihood and land was allocated to support this use. Today, gardening is vital in a different way

and small pieces of land are being utilized more frugally and hopefully effectively. The community also seems to be involved in a different, yet collaborative way. Although the early history of community gardens in the US is one of food production in response to economic depression, war and civic movements (Hynes & Howe, 2004), the benefits of gardening provided by this community effort reach far beyond food sustenance. In 1908, the Smith-Hughes Act endorsed a vocational, agricultural education. School gardens were identified to have character-building traits and promote civic values; however the momentum for gardens started to decrease because the nation continued to struggle economically. Gardening popularity sprang back when the US Garden Army was created as part of the WWI Domestic War Preparedness efforts (Kohlstedt, 2008, pg. 62) and this resurgence occurred because gardens and food were needed because of wartime emergency.

Later, the national Urban Gardening Program (UGP) was started in 1977 by the Extension Service, and the United States Department of Agriculture (ES_USDA) piloted this program in six cities, including New York, Chicago, Los Angeles, Philadelphia, Detroit and Houston. Due to the success and feedback from this program, the school gardening initiative was extended to an additional twenty three cities.

Not only was gardening popular with the community, it was further supported by the federal government. The Bureau of Education and The Department of Agriculture supported and funded school gardens (Kohlstedt, 2008, pg. 84). These organizations viewed gardening as an extension of education, in line with John Dewey's (1915) ideas to integrate school and society through gardening. The idea of school gardens spread

quickly and the popularity of school gardens existed because it was considered “new education” in theory (Kohlstedt, 2008, pg. 62).

Community gardens today. The uses and popularity of gardening has evolved through the years. Community gardens are now well-accepted as providing numerous social, economic, health, and educational benefits (Patel, 1991). Based on these benefits, community gardening has been shown to serve as an important method for educational outreach, essentially allowing people another means to improve their lives. Extension involvement with urban community gardening projects has been considerable. (Jayaratne, Bradley, & Driscoll, 2009). Additionally, gardeners who increase their amount of time in the garden by about 45 minutes also increase their daily vegetable consumption (Blaine, Grewal, Dawes, & Snider, 2010). Studies indicate an important correlation between diet and community garden participation. This supports proposals to address the issues at school and in the home environment so children can have this experience and also improve their dietary behaviors.

Because individuals are busier, larger plots of land are not sought after and probably would not get the attention that was necessary to succeed. Today, individuals are sharing the work and also sharing the produce by forming community gardens. Because people are busier, some are using this as a means to exercise or stress relieve.

School gardens today. Our youth today are dealing with health concerns that typically afflict adults. When comparing the historical importance of garden education, the economic needs remain today, however the emergent need is one of nutrition.

In addition to health benefits, because of the health issues, the need for health education is becoming widespread. An increase in weight amongst young children is on

the rise and young children are suffering because of it. Food is being produced and processed to meet the needs of the consumer, however it is not a healthy fulfillment. Gardens provide exposure to a community, fresh vegetables that a child may not have experienced and a diverse population that exposes students to other cultures and foods. School gardens can positively impact children's food choices by improving their preferences for vegetables and increasing their nutrition knowledge (Morris, 2003).

Studies conducted using school gardens and structured garden-enhanced nutrition education curricula applying Social Cognitive Theory have reported increases in students' fruit and vegetable consumption (Morris 2003, Bandura, 1986). School foodservice programs are more involved in lunch preparation and offering healthful options utilizing gardens in schools to educate students about healthful eating habits. In addition, gardening can be a beneficial tool that provides teachers with an excellent opportunity to teach nutrition, and other subject topics related to healthy eating and/or supplementing the school curriculum. It has been demonstrated that environmentally-based educational programs can have a beneficial impact on performance on standardized achievement tests, as well as increase attention and enthusiasm for learning (Lieberman & Hoody, 2004). Based on benefits such as these, provisions are being made to have a garden in every school in California. The initiative "A Garden in Every School" encouraged schools to establish and sustain school and community gardens as a learning laboratory or outdoor classroom.

Given the increased importance placed on common core assessment results in establishing the efficacy of a school program, gardening programs may be more beneficial now than ever before for elementary students. Experiential learning

opportunities may in fact be a viable vehicle through which to address curricular issues for these students, particularly in science, language arts and mathematics (Graham & Ziedenberg-Cherr, 2005). The hands-on setting afforded by school gardens are a key element of experiential education, which allows for the incorporation of core curriculum (Canaris, 1995). The multidisciplinary pedagogy has been shown to be quite effective with respect to a number of key learning outcomes (Lieberman & Hoody, 2004).

Among the skills promoted by school gardening programs include research methodology, planning and implementing, expanding horticultural knowledge base and interpersonal skills. Further, measurement, from simple mathematical skills to geometry and beyond are often implemented. Even given the rigor of participation in this endeavor, students who have been exposed to gardening programs show higher levels of motivation than those who have not (Akinyemi, 2009). Additionally, young students benefitted from nutritional education, as reflected in the increase in their knowledge and retention

School gardens tend to reach the learner who may not learn well from books. School gardens are also reaching out and including the community, including parents and also incorporating cultural diversity.

Nutrition

What is young American children's knowledge about healthy eating, physical activity and media practices? Over time and through many studies, children have demonstrated that they understood some of the benefits of healthy eating much more than understanding the benefits of physical activity. They also have demonstrated that they do not understand the importance of drinking water. The necessity to address these issues derives from "the patterns and preferences that children exhibit at age 2.9 have been

found to be highly correlated with preferences at age 8” (Skinner, Carruth, Bounds, Ziegler, & Reidy, 2002). In order to move towards addressing these issues, it is important to involve the children in meal preparation and serving themselves. This will lead them towards understanding what to consume and how much by learning to recognize internal cues on hunger vs. boredom of food and beverages. Also, success in making healthier eating choices will come faster in a supportive environment and when adults stop using “junk food” as rewards (Ogden, Carroll, & Flegal, 2008).

Media marketing has also been shown to affect how kids eat. Children viewed an average of 1.354 food advertisements per half –hour of TV (Connor 2006, page 369). Because the amount of time with media is not adequately supervised, physical activity is therefore decreased. In order to increase physical activity, it is necessary to decrease media time. Since the media seems to be an agency to provide information to our children, we need to take advantage of public service announcements, web based apps, MyPlate.gov to name a few examples, to promote healthy eating (Lanigan, 2011).

In order to increase vegetable intake, gardening combined with nutritional education and daily exercise is indicated. Students in schools that support gardening curriculum, have shown that they can identify more vegetables after growing them and their preference for vegetable intake increased because of this (Yu, 2012).

Ultimately, the most purposeful way to implement nutritional education to these students is via their school. Several schools have attempted to integrate many different approaches to this topic; however schools have reported most success via school gardens. Furthermore, the presence of a diverse population exposed Caucasian students to fruits and vegetables that they generally would not be exposed to. This exercise and the

students' positive reactions illustrate the need to increase opportunities to taste different fruits and vegetables and increase the availability and varieties of fruits and vegetables. The challenges to hosting a school garden and nutrition curriculum are: limited resources of funding, personnel, time and even with these resources, disappointingly, school gardens aren't always sustained.

Health Issues

Factors such as culture, cuisine, economics, education and ethnicity are variables that may influence parents' food preferences which may then impact food availability and their children's food behavior. Parents act as models to children and this may impact early learning food behaviors. Additionally, as people are becoming busier and busier, they are increasingly reliant on the ease of purchasing inexpensive take out/ prepared / fast foods/ ready to eat food to feed their families. However, reducing junk food consumption tends to increase a child's desire and acquired taste for the high sugar, high fat foods, and consequently consumption tends to increase.

It is also necessary to respect and understand the culture behind each person and how this determines a lifestyle. Eating to please our parents, "cleaning our plate" or having seconds in order to avoid insulting the cook are some examples. This is difficult to balance because people today are not as physically active as they were in the past. With the invention and cost availability of vehicles, people are spending more time in vehicles and are thus more sedentary than ever before. Eating as our cultural norms historically dictate cannot continue. Maintaining our culture and family traditions are important but a balance needs to be instituted and healthier versions and portion sizes of our "home foods" need to be created.

Furthermore, Anzman et al. states that (2010) observational learning also affects children's intake; observing others consuming healthy foods can promote children's acceptance of these foods. Because children usually eat in social contexts, there are many opportunities for parents, peers and siblings to model healthy (or unhealthy) eating behaviors. Mothers who drank more milk had daughters who drank more milk, and hence were more likely to meet dietary recommendations for dairy-related nutrients and have higher bone density. Adult models can be also effective at increasing children's willingness to try novel foods, especially when the models eat enthusiastically and when both the models and the children are eating the same foods (page 1120).

Is income a factor to consider when analyzing fast food intake? According to Babey, Hastert, Wolstein, and Diamant (2010), cross-sectional data has shown an inverse relationship between family income and health issues among children and adolescents (page 2149). Regarding children's unhealthy eating habits, consumption of fast food has been identified as the most critical reason for the epidemic of childhood obesity (Pereira & Ludwig, 2001). Children's fast food consumption has increased more than five times since 1970, with nearly one-third of the U.S. children ages 4-19 eating fast food daily (Bowman, Gortmaker, Ebbeling, Pereira, & Ludwig, 2004).

In order for the playing field to be fair for all students, the message for health and wellness must become the responsibility of the community. In order for a consistent message to be delivered, schools are a tool that has been indicated for retention of information. Schools can become a tool to convey this message because most children attend school and it is here that guidelines can be created for school meals, beverages and physical activity. If everyone involved (i.e., school administration, teachers, community,

parents and students) would brainstorm on how to implement a program, this would reinforce parents' efforts by spreading consistent messages. According to Matthews, Wien, and Sabaté (2011), the 2005 Dietary Guidelines for Americans and MyPyramid currently emphasize the inclusion of a higher proportion of plant – based versus animal-based food for optimal health and the preliminary report of the Advisory Committee for the Dietary Guidelines for Americans 2010 calls for Americans to shift toward a more nutrient – dense, plant-based diet to reduce the prevalence of overweight (page 5).

Existing Gardening Programs and Their Impact on Achievement

Over the past two decades, schoolyard gardens have been appearing across the country with the hope to teach children better eating habits by helping them experience where food comes from. School gardens have provided experiential learning and the opportunity for Americans concerned about the spiking growth rate in obesity and juvenile diabetes, highlighted by First Lady Michelle Obama's Let's Move initiative to share with children how to make healthy choices. In a study performed by Tangen and Fielding-Barnsley (2007), the research evaluated effects of school gardening on English as a Second Language students learning about nutrition. Results indicated positive gains in student learning and feelings of belonging to the school community. The students found that learning was successful because teachers made it relevant to their lives and this setting made it possible for all students to participate.

Garden-based education is a relatively inexpensive way to develop innovative health interventions with urban youth. It offers a number of advantages over other types of nutrition programs and can be implemented at school sites and integrated into existing curriculum and support other environmental intervention strategies. This method can

address multiple, interrelated issues associated with health and education (Alexander, North, & Hendren, 1995; Bachert, 1976; Braun, Kotar, & Irick, 1989; Canaris, 1995; Lineberger & Zajicek, 2000; Morris, & Zidenberg- Cherr, 2002).

Generally, school garden programs consist of some classroom instruction and some hands on experience relating to one or more subject areas. Combined with garden-related activities, students learn to plant, tend, harvest and /or consume garden-grown produce. Educators use this experiential curriculum in subject areas including science, math, social studies, language arts, environmental studies, nutrition, physical education, and agricultural studies (Desmond, Grieshop, & Subramaniam, 2002; Graham, Lane Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005).

Since interest in school garden programs is on the rise, it is important to know if, and how, this intervention strategy might be effective at improving children's health behaviors (Graham et al., 2005). The importance of school gardening and garden based learning was highlighted by Marturano (2000), who reminds practitioners of the need to understand the philosophical roots of garden based learning in order to find contemporary gateways to gardening with children.

The value of gardening was recognized over a century ago, as records show that school gardens have been used since the 1800s. Fredrick Froebel founded and designed the first kindergarten in 1840 in order to teach children through gardening. As early as 1909, Montessori identified that children's gardens could be used beyond the standard curriculum to help to develop patience, enhance moral education, increase responsibility and improve appreciation for nature and relationship skills (Montessori, 2013). Montessori also found that school gardening provides an experiential learning setting,

especially one in which children have direct hands-on experiences and construct knowledge, skills and values.

Desmond et al. (2002) highlighted the value of experiential learning in the “living laboratory of the garden”. In this study, researchers found that school gardens can be a powerful teaching tool when integrated with nutritional and educational programs.

Canaris (1995) reports that a project involving a class of 40 children from the USA that integrated nutrition and gardening, went well beyond teaching good nutrition and the origin of fresh food to include improved learning across all subjects. Further evidence that children learn better outdoors with hands-on experiences and that this experiential learning has an impact on learning in a number of curriculum areas, comes out of research by Klemmer, Waliczek, and Zajicek (2005a). These researchers found that children who participated in school gardening activities scored significantly higher in general science achievement tests compared with children who did not experience any garden-based learning activities. Another study of children in the USA participating in a school garden program showed that students developed better interpersonal skills and attitudes towards school (Waliczek, Bradley, & Zajicek, 2001).

Eberbach (1988) offered guidelines in the design process for children’s gardens that noted some of the previously mentioned characteristics: play and exploration, activity, sensory experiences through plant variety, child’s scale, feeling of possession of their space and the freedom to manipulate objects, aesthetically pleasing, bright and bold color use, and gathering places. Other researchers indicate that there are many types of gardens, and all have different purposes because they are in different places and fostered by different people. The garden should be a place to entice students to participate, inspire

parents, teachers and the community to connect and create spaces for learning, engagement and any other benefits that can arise from this setting.

Experiential Learning and Motivation to Change Behavior

Gardens are meant to provide a sensory connection back to our origins of simplicity and sustenance. The garden brings communities together: to garden, to cook, and to learn from each other. Gardening has created a space for English as a second language (ESL) students and it allows for all students to benefit from and celebrate cultural diversity (Pearson et al., 2010). This space encourages children to talk about their culture while learning to speak the English language. Students who are less proficient in speaking English would draw or journal their experience in the garden, resulting in enhanced language skills and confidence.

The motivation towards supporting schoolyard gardens is gaining momentum. It brings together all the best features of hands on curriculum allowing students to collaborate, communicate with a large population, collect data, observe daily environmental conditions and relate to natural and environmental issues.

Continuing motivation, the tendency to return to and continue working on a task, is one of the most important goals of education. Continuing motivation for a particular academic task is largely influenced by an individual student's interest, rather than the external pressure of grading or other negative consequences (Maehr, 1976). Specifically, continuing motivation in the context of schooling is important for two main reasons. First, the transferability of learning is vital to any academic tasks. Teachers work with students with the expectation that all learning will be transferred to new situations. Secondly, the goal of any educational program is to produce lifelong learners. The

school setting should serve as the place where learning is initiated; students should be motivated to continue this journey without the threat of coercion of negative evaluation. As we have discussed throughout this essay, existing school gardening programs serve to promote continuing motivation through their unique curriculum. Hands on learning experiences encourage students to pursue their interests and transfer their understanding of sustainability and healthy eating habits to their lives outside of school (Maehr 1974).

Further, school gardening programs promote active learning and deep-level processing, the cornerstones of transfer (Bransford & Schwartz, 1999). Gardening programs have been incorporated into mathematics, science and language arts classes, enabling students to apply their understanding of gardening in new contexts, connect key ideas, activate relevant prior knowledge, and extend the efficacy of everyday experience (Doerfler, 2011). Research on the academic performance of children who participate in school gardening programs indicates greater recall performance on academic tasks, in math in particular as a result of high-level transfer of gardening curricula (Klemmer et. al., 2005b).

Additionally, there is a clear association between transfer and interest that is encouraged by participation in the school gardening program. Research indicates that when students experience increased individual interest, they are more likely to process information more deeply and retain content at a higher rate (Ainley, Hidi, & Berndorff, 2002). Because of this, educators are interested in understanding how to promote this type of learning. They have found that student interest in school gardens has been initiated in a variety of different ways. In language arts classes, instructors have used journals to encourage students to reflect upon their experiences and lifestyle choices

(Robinson & Zajicek, 2005). In physical education classes, students are taught the importance of interpersonal relationships, social skills, teamwork, leadership, and problem solving skills, which enhances their interest in the creation of a productive environment, both at home and in schools (Thorpe, 2003). Also, in science classes, students are encouraged to explore an understanding of nature (Angulo et al., 2010). This is especially important for student motivation because a student's situational interest has been shown to be a positive predictor of deep-level strategy use, recall and reading comprehension (Hidi, 2001).

As one major goal of education is to influence out-of-school learning activity, and school gardening programs are useful vehicles towards helping students develop an interest in a topic and continue to pursue that interest outside of school. School gardens provide an enjoyable experience, promote transfer to new situations and help students to sustain an interest in a number of academic topics. From a motivational perspective, gardening programs have been quite successful not only promoting nutritional knowledge and healthy lifestyle choices but also academic motivation. The contribution of this study adds to the understanding of urban youth, nutritional patterns and the ways in which school gardening curriculum supports student learning.

CHAPTER III

METHODOLOGY

This research study extended the literature on the impact of school gardening programs in an effort to understand their impact on an urban population of elementary students. Specifically, it will utilize the instrumentation of the Pennsylvania State University investigation with respect to an understanding of the impact of gardening on the knowledge, attitudes, behavior and interest of grade four students.

In the Penn State research study, a quasi-experimental design consisting of pretest-posttest comparison control group was used. Two after-school programs were categorized into treatment (TG) and control group (CG). Youth receiving nutrition education lessons through Penn State Nutrition Links-Expanded Food and Nutrition Education Program (EFNEP) were identified to participate in the treatment group. Overall, a total of 86 youth participated in the study, (treatment=43, and control=43). Nutrition knowledge and nutrition behaviors were measured at pretest (time 1), posttest (time 2), and delayed post-posttest (time 3) for follow-up after two weeks.

Additionally, a three-part evaluation tool was developed to collect data. The tools were developed to reflect the content of the five nutrition lessons based on lesson objectives/outcome described in the Up for the Challenge: Health, Fitness, and Nutrition

curriculum. Part one contained 11 questions pertaining to general nutrition knowledge. Questions were measured using multiple choices and a yes or no format. Part two contained seven questions on nutrition behaviors. Statements were measured using a four-point scale that ranged from 1 = never to 4= several times a day. Part three contained demographic questions such as gender, age, grade level, and ethnicity.

Pretest data on nutrition knowledge and nutrition behaviors for both the treatment and control groups were collected. Two-three hour hands-on nutrition education lessons were taught to youth in the treatment group every week over a four-week period, after which posttest data were collected, followed by delayed posttest data for both groups after two weeks. The control group did not receive any nutrition lessons. Each questionnaire was labeled and given an identification letter for easy data entry and analysis. Data from the treatment and control groups were examined for equivalence (see Appendix A).

Key Terms

For the purpose of this study, the terms below will be operationalized in this manner.

Gardening Programs – The school gardening program at this school consists of a single one-hour session, once a week from August through May with the fourth grade class. The one-hour session consists of a 20 minute lesson, 20 minute hands-on activity, and a 20 minute nutrition piece that might include cooking, taste testing etc. Weather permitting; topics covered include photosynthesis, germination, soil sampling, and transplantation techniques.

Nutritional Knowledge - using a pre / post survey, this study will measure the change in students' knowledge. Specifically, the instrument will measure the change in fiber awareness, the understanding of quantity, of necessary servings of daily fruits and vegetables, and the criteria by which individuals may make healthy food options.

Attitudes about healthy eating - using a pre / post survey, we will measure the change in students' attitudes. This instrument will assess attitude changes in students and willingness to partake in fruits and vegetables.

Eating Behavior - using a pre / post survey, we will measure the change in students' eating behavior. Specifically, the instrument will assess the frequency of fruit and vegetable intake and determine if there was an increase over the course of the year-long exposure to the program.

Obesity and BMI – As stated by the Centers for Disease Control, Body mass index (BMI) is a measure used to determine childhood overweight and obesity. It is calculated using a child's weight and height. BMI does not measure body fat directly, but it is a reasonable indicator of body fatness for most children and teens. A child's weight status is determined using an age- and sex-specific percentile for BMI rather than the BMI categories used for adults because children's body composition varies as they age and varies between boys and girls.

The variables being assessed (nutritional knowledge, attitudes about healthy eating, eating behavior and interest) have been taken from An Evaluation of the School Lunch Initiative (Pearson et al., 2010).

Research Design

The study included the following elements in order to seek an understanding of students' retention of nutrition education through school gardening programming.

Research conducted in this study used surveys to focus on the experiences of students participating in the school gardening programs. This research is a quasi-experimental study that will rely on the results of three different iterations of questionnaires administered through the course of one academic year.

Hypotheses

The following outcomes are hypothesized:

1. Gardening program participation will increase students' nutrition awareness.

(Existing gardening programs have been shown to promote healthier lifestyle choices among school aged children (Ozer, 2007).

2. Gardening program participation will increase students' ability to retain information about nutrition.

(Students who are involved in hands on learning are more engaged and retain more information (Connor, 2006).

3. Gardening program participation will increase students' motivation and interest in school nutrition programs.

(Students who are exposed to experiential learning prefer this methodology to learning and have more interest in school academics (Skinner et al, 2002).

The goal of the intervention that will be evaluated with this study is to expose the students to knowledge about nutrition, food and the environment as well as to improve attitudes toward healthy eating, and to improve eating behaviors. Additional goals

include exposing children to the experience and techniques of growing and preparing food, with the objective of increasing children's willingness to try new foods, especially peak-season produce grown in gardens at school. Ultimately, the purpose of this study is to see if this program is effective in increasing student nutrition knowledge, as well as preference for and consumption of healthy foods, particularly fruits and vegetables among elementary school students.

Participants and Gardening Intervention Program

The process of choosing participants started with a request to this Urban School in Cleveland, Ohio. This school was chosen because of the existing gardening program at the school. Parents will be asked to sign a permission letter authorizing their student to participate in this study. This school and location is ideal because it includes a diverse population (see Table 1). This program has been part of the 4th grade curriculum and runs for the entire academic year.

This School started a gardening program in 1922. Utilizing a five-acre site, this happens to be one of the largest community gardens in all of Cuyahoga County. With 204 plots and on average 180 gardeners per year, this school does not sell their excess produce. Instead they donate their efforts to local food banks. With so much support from the community and so much support from parents, this school provides the ideal setting to research this topic.

This setting will be ideal because of its urban location. Urban locations tend to have fewer options for produce purchases, making it difficult to follow a healthier lifestyle. This program also hopes to influence how people purchase their groceries. The gardening program at this Urban School is a collaborative partnership with the school

administrative team, the 4th grade teachers and the Master Gardener volunteers to commit to this weekly curriculum.

This comprehensive program features gardening classes and integration of science and math curricula while including hands-on learning with weekly, regular classroom lessons. This program includes a curriculum that is standards-based and therefore manageable for any teacher to include in classroom lesson plans. Each lesson contains: hands-on activities, planting activities, and nutrition references to MyPyramid. For example, one lesson includes seed collecting. This exercise is meant to show how healthy bodies and healthy gardens are connected. It demonstrates that as we care for the garden, it produces healthy plants that provide healthy food for our bodies. The goal of this lesson is to help draw a connection for the students to see that we can live long lives by staying healthy. Another lesson includes facilitating the importance of sun, air, water and soil and how these four basic necessities impact plant growth and how this growth influences so many aspects of daily human functioning.

Additional goals of this program are to teach every child to grow, prepare, and eat nourishing, delicious, and sustainably grown food; to empower students to make healthy food choices; and to educate students about the connection between these choices and the health of their families, communities, and planet. This garden also brings community members to the school site. Because there is a large presence of Master Gardener volunteers, there is constant collaboration and contact between the teachers, community and the students.

This program has been sustained because of the group of volunteers that have donated their time for several decades. The importance of this commitment shows how

exposure to experiential learning may influence childhood nutrition and increased academic performance. Through a series of food categories, students are informed and instructed on the importance of choosing healthier options. Topics that are covered include: vegetables, fruits, dairy, grains, fast food options, and how to navigate and make the better choice. Specifically, since students lean towards convenience foods, they are directed on how choosing differently may provide them with more energy and better focus.

While health benefits of a diet rich in a variety of fruits and vegetables are widely known, children in the U.S. consume less than half the recommended number of fruit and vegetable servings (Fusco, 2001, DeMarco, Relf, & McDaniel, 1998). Of those they do consume, fruit juice accounts for approximately 40% of fruit servings, and fried potato products account for approximately 20% of vegetable servings (Desmond 2002). Diets that rely on fruit juices and fried potatoes to meet the recommendations are likely low in fiber, high in fat, and lack the variety of phytochemicals, vitamins and minerals needed for optimum health (Gardner, 1999).

Today, gardens have become a popular addition to school campuses, and there are indications that garden programs may positively influence children's eating patterns. Studies that have looked at garden-based programs indicate that they may increase children's food knowledge and their preference for or consumption of fruits and vegetables (Lawson, 1995, Alexander et al., 1995). This study researched these students for the entire academic year. This included weekly observations, participation in hands-on classroom assignments, hands-on gardening time outside in the garden and tasting

sessions where the students sampled their harvest. Listed in Table 1, is the demographics and enrollment for the research site.

Table 1

Enrollment for this school and program.

| | Total | Caucasians (% of Total) | Blacks (% of Total) | Hispanics (% of Total) | Other (% of Total) | Females | Males |
|--------------------------------------------|-------|----------------------------|------------------------|---------------------------|-----------------------|---------|-------|
| Total Enrollment for School | 738 | 524 (70.9 %) | 83 (11.2%) | 106 (14.3%) | 20 (2.7%) | 377 | 361 |
| 4 th grade class (gifted class) | 20 | 8 | 6 | 4 | 2 | 12 | 8 |
| Ms. U's 4 th grade class | 30 | 8 | 10 | 11 | 1 | 16 | 14 |
| Ms. B's 4 th grade class | 31 | 13 | 5 | 9 | 4 | 14 | 17 |

Table 1 provides a summary of the school population. Of this population, there are approximately 474 students who are eligible for free lunches and approximately 56 eligible for reduced price lunches.

Instruments

The survey was given at three different times during the academic year. All the administrations of the survey were administered by Master Gardener Volunteers. The first administration of the survey was in August, the second in December

and the third in February. This survey was used by the Master Gardener Volunteer to evaluate the effectiveness of the garden education program. The survey (EFNEP) that was administered for this topic was used before in the Penn State study and evaluated the nutrition education program for low-income youth in Philadelphia.

The survey evaluated whether selected nutrition education lessons change knowledge and behaviors about nutrition in youth who are in after-school programs. The lessons were taught to youth to change knowledge, enhance skills, and make healthy food choices via experiential learning activities that included food tasting, food art, food puzzles, games that identify fruits and vegetables, and preparation of healthy snacks.

When administering the Penn State Survey for this study, the first survey was given in August, the second in December and the third was administered in February. The entire survey was utilized to maintain reliability and credibility. For the Penn State Survey, a panel of experts (two nutrition education specialists and three faculty members at The Pennsylvania State University) reviewed the questionnaire for content and face validity. A pilot test was conducted using youth not included in the study to estimate instrument reliability. All the parts of the questionnaire had acceptable reliability. Cronbach's alpha for the final study ranges from .68 (Nutrition knowledge) to .60 (Nutrition behaviors).

For the site in Cleveland, OH, data was compiled and compared to determine changes in student's attitudes, knowledge, behaviors and interest towards this nutrition program and healthier eating. These surveys were administered in August, December and February. The intent of this study is to determine if there is an increase in nutrition knowledge, attitudes, behavior and interest from the first administration of the survey

(August) to the second (December) and how much this changes with reference to the third administration (February). The students' scores were measured and analyzed to see what changes occurred from the three administrations of the surveys. The value of approaching data analysis from this angle was to determine whether a once per week/60 minute pull-out program was sufficient to promote change.

Additionally, schools in the Cleveland Municipal School District (CMSD) are supporting a new mission of healthy eating. A new department was created (Food and Child Nutrition Services) that is committed to providing healthy food choices for breakfast and lunch. Their intent is to educate students with lifelong healthy eating habits while providing nutritious meals. A staff of 325 provides approximately 17,000 breakfasts and 30,000 lunches per day. For the 2012-2013 school year, USDA's Community Eligibility Option, states that all students will receive breakfast and lunch at no cost regardless of family size or income. This program, the "National School Breakfast and Lunch Program" is governed by USDA regulations and must meet the breakfast and lunch meal patterns and recommendations of the 2010 Dietary Guidelines for Americans and be in accordance with the Healthy, Hunger-Free Kids Act of 2010. Their nutrition strategies are intended to expand healthy food choices and curb childhood obesity. The program supports these goals by providing food items that are trans-fat free have increased whole grain content, make fresh fruits and vegetables available daily, and serve more fresh salads. Key food changes include a food-based, caloric menu which allows portion sizes and recipes to meet a specific age group. Students will be allowed to select two 1/2 cup servings of vegetables, and older students may take two 1/2 cup servings of fruit. Students must also select at least 1/2 cup of fruit or vegetable

component for their trays. Food services will also limit the quantity of meats, cheeses and grains offered weekly to maintain the min / max caloric levels.

To further support this vision of healthy lifestyles, it is pertinent to see what other options help students retain nutrition knowledge. The pertinence of studying the gardening curriculum in the Northeast Ohio area, in an urban district with limited resources and funding will help educators, administrators and the community to know and understand what students are taking away from this type of exposure.

Research Questions

1. After the nutrition-based intervention program, is there a statistically significant difference in knowledge about nutrition in students over time?
 - a. Use a repeated measures ANOVA. (Aug, Dec & Feb) (see Appendix A)
2. After the nutrition-based intervention program, is there a statistically significant difference in attitude about nutrition in students over time?
 - a. Use a repeated measures ANOVA. (Aug, Dec & Feb) (see Appendix A)
3. After the nutrition-based intervention program, is there a statistically significant difference in students' retention of nutrition behavior over time?
 - a. Use a repeated measures ANOVA. (Aug, Dec & Feb) (see Appendix A)
4. After the nutrition-based intervention program, do the students display increased motivation / interest in school nutrition programs?
 - a. Use a repeated measures ANOVA. (Aug, Dec & Feb) (see Appendix B)

Hypotheses

The following categories will be surveyed during the academic year:

- *Nutritional Knowledge* – Using a pre / post approach, these questions test what students know about healthy eating and how better choices can have benefits. It is expected that, over time with exposure to the gardening program, students will show an increase in nutritional knowledge.
- *Attitudes about healthy eating*- using a pre / post survey, these questions address the student’s attitude towards food and student’s attitude towards their environment and food. Participants who complete this section will indicate what their attitude is towards healthy eating and living a healthy lifestyle. It is expected that, over time with exposure to the gardening program the student’s attitude towards nutrition will reflect greater awareness of healthy choices.
- *Eating Behavior* - using a pre / post survey, these questions address the student’s eating behaviors. Participants who complete this section will indicate what their behaviors are towards healthy eating. It is expected that, over time, with exposure to the gardening program students will report a greater awareness of healthy eating behaviors.
- *Motivation / interest* – using a pre / post survey, these questions address the student’s interest in attending school. Participants who complete this section will indicate what their interest is towards attending school. It is expected that, over time, with exposure to the gardening program, students will express a greater interest in attending school on gardening days.

Data Collection

Independent Variables (2): time

Dependent Variables (4): knowledge, attitude, behavior, interest

The survey being administered is that which was formerly used with the EFNEP program. Student's names will be recoded to ID numbers to maintain confidentiality. One spreadsheet will contain data by ID numbers and will contain all three attempts to the surveys.

A quantitative survey instrument will be used to explore the effects of participating in a hands-on gardening experience on students' knowledge, attitudes, behaviors and interest associated with vegetable consumption; paper and pencil survey questionnaires will be utilized. The scores obtained from pre- to post- tests are going to be used to compare the results from iteration 1 to iteration 2 to iteration 3. The independent variable (IV) for this study is time and the dependent variables (DV) are knowledge, attitude, behavior and interest.

Using a repeated measures ANOVA, we can test the hypothesis that the independent variable has an effect on the dependent variable over time. The value of using an ANOVA is that it may indicate that the IV may produce a significant effect on the DV or a combination of when taken together, rather than separately. ANOVAs also take into account the intercorrelations among the DVs. Research questions 1, 2 and 3 will utilize this method to obtain results. For the last question, research question 4, the study is seeking to determine if one day of the week is more interesting to the students than another. Utilizing an ANOVA test of significance, this part of the survey seeks to discern a change between different administrations of the survey.

The survey obtains demographic data, assesses nutritional knowledge, attitude and behaviors towards healthy eating. The survey asks questions regarding how much students know about healthy options, how often they choose healthier options and what

they believe about healthy options. Each of these questions provides multiple choice answers for students to select. The survey takes approximately 10 minutes to complete and can be simultaneously administered to all study subjects, thus decreasing study resource needs and minimizing disruption to class time.

Sampling for this particular study was restricted to incoming 4th grade students in a Cleveland School. Selection bias was accounted for in this sampling frame because school attendance is mandatory and this gardening curriculum is part of the 4th grade program. Students in the 4th grade class are required to participate in garden activities. To be considered a garden-school site, a school garden program had to include activities where students plant, tend, harvest and consume vegetables they grew as part of the curriculum for an average of at least forty minutes a week over the entire school year.

Nutrition knowledge. Items to assess nutrition knowledge are shown in Appendix A. These items assess what students retain with respect to the nutrition program. This section contains 11 questions which are coded as follows:

- The first 7 dichotomous questions require the students select yes or no. This section was analyzed using dummy coding, with yes =1, and no=0.
- The final 4 closed-choice questions require the students to select one choice as the best possible answer. For analysis, student responses will be compared to a pre-determined best choice. The student's answers were tabulated and compared across administrations of the survey. These results gave one point for a correct answer and no points for an incorrect answer.

Behavior checklist. Items to assess behavior are shown in Appendix A. These items assess how frequently students choose to eat healthier options. This section contains 7 questions which are coded as follows:

- There are 4 closed-choice items that require students to choose one option from among four choices. These options were coded from 0-3 for each question, resulting in a total score between 0 -21. The student's answers were tabulated and compared across administrations of the survey.

Attitude checklist. Items to assess attitudes are shown in Appendix A. These items assess what students beliefs are about healthy lifestyle choices with respect to the nutrition program. This section contains 15 questions which are coded as follows:

- There are 15 close-ended items that required students to choose from among 5 possible options. These options were coded from 0-4 for each question, resulting in a total score between 0-75. The student's answers were tabulated and compared across administrations of the survey.

Interest questions. Items to assess motivation / interest are shown in Appendix B. These items assess what students' motivation / interests are about the nutrition program and the day that the program is offered. This section contains 5 questions which are coded as follows:

- For the first two questions, students were asked to select one answer for each question. Using a scale of 1-5, students were asked to rate their excitement and attendance importance for school. This rating was compared across administrations to determine changed over time.

- For the third question, this study sought to determine if interest in attending school on Thursday (the day of the gardening program) is significantly higher than other days.
- The fourth question sought to determine if students have a favorite day in school and whether this changed during the academic year.
- The final question sought to determine students overall interest in the gardening program

CHAPTER IV

RESULTS

The purpose of this study was to examine the impact of a school gardening program on the nutrition knowledge, attitudes, behavior, and interest level of urban fourth grade students. This study tested for nutrition knowledge, changes in behavior after the gardening program, changes in attitude towards nutrition and an increase in interest in school on the days students participated in the gardening program.

Sixty-seven fourth-grade students completed at least one of the three administrations in this study. Of this sample, 41 students were male and 26 were female. Only students who completed the study's three instruments at all three data points were included in this analysis. Data were collected during the morning period in August (prior to the beginning of the school gardening initiative), in December and in February.

Research Question #1

After the nutrition based intervention program, is there a statistically significant difference in knowledge in students over time?

A repeated-measures analysis of variance was used to determine changes over time among student scores on the knowledge subsection of the study's instrument. This test is traditionally used to evaluate changes in mean scores over time. Assumptions for

this test include the following: a) that the dependent variable is measured on a continuous level; b) that the same subjects complete all dependent measures; c) a normal distribution of the dependent variable; and c) sphericity.

Of the sixty-seven students in the total pool, sixty-four completed the nutrition survey in August, December and February. Scores on this eleven-item survey ranged from a low of zero (indicating a complete lack of knowledge of nutrition) to a high of eleven. Mean scores and standard deviations for the three administrations of the knowledge subscale are displayed in table 2. The assumption of sphericity is tested using the Mauchly test; the results indicate that this data set has met this assumption ($F = 1.29$; $p > .05$) which enables the use of this method of analysis (see Table 3). The results of the within-subject tests, however, fail to show a significant linear trend with respect to students' scores on the knowledge subscale over time (see Table 4; $F = 2.26$; $p > .05$). This would indicate that there is no statistically significant change in score on the knowledge subscale across the three administrations of the survey.

Table 2.

Mean Scores for the Knowledge Subscale

| | Mean (SD) |
|-----------------------------------|-------------|
| Nutrition Scale Score in August | 3.33 (1.46) |
| Nutrition Scale score in December | 3.42 (1.38) |
| Nutrition Scale score in February | 3.09 (1.38) |

Table 3.

Test of Sphericity for Knowledge subscale

| | F | Sig. |
|-----------------|------|------|
| Nutrition score | 1.29 | .279 |

Table 4.

Test of Significance for Knowledge Subscale

| | F | Partial Eta Squared. | Power |
|-----------------|------|----------------------|-------|
| Nutrition score | 2.26 | .279 | .316 |

*p<.05

Research Question #2

After the nutrition based intervention program, is there a statistically significant difference in attitude about nutrition in students over time?

Again, a repeated-measures analysis of variance was used to determine changes over time among student scores on the attitude subsection of the study's instrument. Sixty-three students completed the survey for all three administrations in August, December and February. Scores on the attitude subscale ranged from a low of 0 (indicating an absolute opposition to nutrition-supportive attitudes) to a high of 75. Mean scores and standard deviations for the three administrations of the attitude subscale are displayed in table 5. The assumption of sphericity is tested using Mauchly test; the results indicate that this data set has met this assumption ($F = 1.063$; $p > .05$) which enables the use of this method of analysis (see Table 6). The results of the within-subject tests, however, fail to show a significant linear trend with respect to students' scores on

the attitude subscale over time (see Table 7; $F= 1.81$; $p >.05$). This would indicate that there is no statistically significant change in score on the attitude subscale across the three administrations of the survey.

Table 5.

Mean scores for Attitude subscale.

| | Mean (SD) |
|----------------------------------|---------------|
| Attitude Scale Score in August | 61.21 (11.38) |
| Attitude Scale score in December | 60.72 (6.90) |
| Attitude Scale score in February | 62.90 (6.99) |

Table 6.

Test of sphericity for Attitude subscale

| | F | Sig. |
|----------------|------|------|
| Attitude score | 1.04 | .479 |

Table 7.

Test of Significance for Attitude subscale.

| | F | Partial Eta Squared. | Power |
|----------------|------|----------------------|-------|
| Attitude score | 1.81 | .029 | .263 |

* $p <.05$

Research Question #3

After the nutrition based intervention program, is there a statistically significant difference in students' expression of positive nutrition-based behavior choices over time?

Next, a repeated-measures analysis of variance was used to determine changes over time between student scores on the behavior subsection of the study's instrument. Sixty-three students completed the survey for all three administrations in August, December and February. Scores on the behavior choices subscale range from a low of 0 (indicating the complete absence of nutrition-supportive behaviors) to a high of 21. Mean scores and standard deviations for the three administrations of the behavior subscale are displayed in table 8. The assumption of sphericity is tested using Mauchly test; the results indicate that this data set has met this assumption ($F = .89$; $p > .05$) which enables the use of this method of analysis (see Table 9). The results of the within-subject tests indicate a significant linear trend with respect to students' scores on the behavior subscale over time (see Table 10; $F = 7.91$; $p < .05$). Post-hoc testing reveals significant differences between students' subscale scores in February and that of both December and August. This indicates that there is a statistically significant change in score on the behavior subscale across the three administrations of the survey.

Table 8

Mean scores for Behavior subscale.

| | Mean (SD) |
|----------------------------------|--------------|
| Behavior Scale Score in August | 12.21 (2.55) |
| Behavior Scale score in December | 12.34 (2.42) |
| Behavior Scale score in February | 13.45 (2.91) |

Table 9.

Test of sphericity for Behavior subscale

| | F | Sig. |
|----------------|------|------|
| Behavior score | .897 | .638 |

Table 10.

Test of Significance for Behavior subscale.

| | F | Partial Eta Squared. | Power |
|----------------|-------|----------------------|-------|
| Behavior score | 7.91* | .981 | 1.0 |

*p<.05

Research Question #4

After the nutrition based intervention program, do the students display increased motivation / interest in school nutrition programs?

Two means of analysis were used to address research question #4. First, a repeated-measures analysis of variance was used to determine changes over time between

student scores on the motivation/interest subsection of the study's instrument. Sixty-four students completed the survey for all three administrations in August, December and February. Scores ranged from a low of 0 (indicating a total lack of interest in the gardening program) to a high of 70. Mean scores and standard deviations for the three administrations of the motivation/interest subscale are displayed in Table 11. The assumption of sphericity is tested using Mauchly test; the results indicate that this data set has met this assumption ($F = .597$; $p > .05$) which enables the use of this method of analysis (see Table 12). The results of the within-subject tests indicate a significant linear trend with respect to students' scores on the motivation/interest subscale over time (see Table 13; $F = 149.89$; $p < .05$). Post-hoc testing reveals a significant difference between the February score on the motivation/interest subscale and that of both August and December. This indicates that there is a statistically significant change in score on the motivation/interest subscale across the three administrations of the survey.

Finally, for the final administration of the survey, an item was included on which students' indicated their favorite day to attend school during the week. A nonparametric test was used to determine if students disproportionately selected the gardening day as their most preferred school day of the week. Distribution of students' choices is displayed in Figure 1. Chi-square analysis indicated a disproportional preference for Thursday, the day that students participated in the gardening program ($\chi^2 = 19.07$, $p < .05$).

Table 11.

Mean scores for motivation/interest subscale.

| | Mean (SD) |
|----------------------------------|--------------|
| Interest Scale Score in August | 34.26 (5.37) |
| Interest Scale score in December | 36.26 (4.60) |
| Interest Scale score in February | 63.85 (5.26) |

Table 12.

Test of sphericity for motivation/interest subscale

| | F | Sig. |
|----------------|------|------|
| Interest score | .597 | .738 |

Table 13.

Test of Significance for motivation/interest subscale.

| | F | Partial Eta Squared. | Power |
|----------------|---------|----------------------|-------|
| Interest score | 149.89* | .711 | 1.0 |

*p<.05

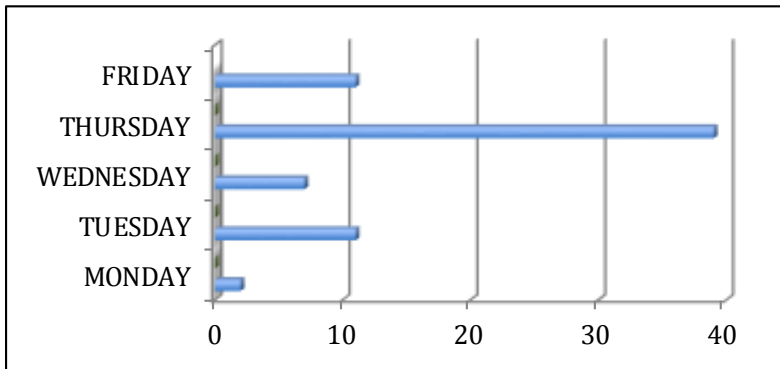


Figure 1. Distribution of students' favorite day to attend school.

With regard to research question 1, this study failed to find a statistically significant change in self-reported knowledge. The second research question attempted to determine whether students had a change in attitude towards nutrition after being exposed to the nutrition-based program. This too failed to produce a statistically significant change in attitude over the three iterations of the survey. The third research question sought to determine whether students had a change in self-reported nutrition-based behaviors after being exposed to the nutrition-based program. Students were asked to rank frequency of eating habits that corresponded to a healthy lifestyle along a continuous scale from never to several times a day/more. Students' self-reported responses showed an increase in the frequency of nutrition-supportive behaviors between August and February. These results demonstrate the positive effects of school gardening experiences on the dietary behavior of students. The fourth research question sought to determine whether students had an increased interest in school and whether their "favorite day" coincided with the gardening day after being exposed to the nutrition based program. Based upon the results of this survey, interest in attending school on days in which the gardening program was held increased significantly.

CHAPTER V

SUMMARY, DISCUSSION, IMPLICATIONS & RECOMMENDATIONS

This chapter includes a restatement of the purpose of this study as well as a summary of the research, a discussion section, implications and avenues for future research.

Purpose of the Study

The purpose of this study was to investigate the gardening curriculum in an urban elementary school in Cleveland, Ohio. Specifically, the study examined the impact of a school gardening program on the nutrition knowledge, attitudes, behavior, and interest level of urban fourth grade students. This study tested for nutrition knowledge, changes in behavior after the nutrition program, changes in attitude towards nutrition and an increase in interest in school on the days students participated in the gardening program. After collecting and analyzing the data, results indicated significant changes in both behaviors and interest level over the course of the academic year. Overall, students in this study responded positively with respect to nutrition-based education, made healthier choices when given options between foods, and expressed a higher degree of interest in attending school on the days that the nutrition program was offered. These data indicate a positive impact of the nutrition-based program on these students.

Discussion of Findings

The first research question sought to determine whether students gained nutritional knowledge after being exposed to the nutrition based program. Study results found no statistically significant change in score on the knowledge subscale. This may be due in part to students providing socially desirable feedback because their hope is to promote sustainability of this program.

In previous research, learning in a natural setting was reported as improving cognitive skills, socialization skills, health and nutrition, environmental attitudes, community involvement, and a host of other knowledge, skills, attitudes, and behaviors (Alexander et al., 1995; Bauer, 2002; Bell, 2001; Billmore, Brooke, Booth, Funnell, & Bubb, 1999; Boleman & Cummings, 2004; California Dept. of Education, 2003). Despite the absence of significant change in self-reported knowledge among these students, the gardeners and teachers found that the gardening environment was an essential tool because all-around learning was frequently reported in the literature as being beneficial for students.

The second research question attempted to determine whether students had a change in attitude towards nutrition after being exposed to the nutrition-based program. Study results found no statistically significant change on the attitude subscale. This, as was the case with the study's failure to produce statistically significant changes in nutritional knowledge, may be due in part to students providing socially desirable feedback because their hope is to promote sustainability of this program.

Since the number of garden-based educational programs in schools is increasing (Klemmer et al., 2005b), it is possible to reach more and more students with nutritional

programming and increase this awareness. A limited number of studies have evaluated the effects of school garden experiences on middle school aged students' environmental knowledge, attitudes and behaviors. Murphy and Schweers (2003) reported the findings of an evaluation of the Edible School Yard in Berkeley, California. The Edible School Yard is a garden based learning program that is integrated into all aspects of the school. As measured by analysis of students' grade-point-averages, a survey questionnaire, and experiential assessment activities, they found that students who participated in the Edible Schoolyard showed significantly greater gains in test scores for science generally, and a better understanding of garden cycles and nutrition awareness, when compared to a control school (Murphy & Schweers, 2003). This was replicated in the findings for this study, which reaffirms the efficacy of school-based gardening programs with respect to awareness of and receptiveness to healthy eating patterns.

The third research question sought to determine whether students reported a change in self-reported nutrition-based behaviors after being exposed to the nutrition-based program. Students' self-reported responses showed a statistically significant increase in the frequency of nutrition-supportive behaviors between August and February. These results demonstrate the positive effects of school gardening experiences on the dietary behavior of students and that nutrition education and the gardening component appear to strengthen the likelihood that children will increase vegetable intake. Similarly, a study performed by Parmer, Silisbury-Glennon, Shannon, and Struempfer (2009), found that participants who were part of a nutrition and garden program experienced a significant increase in their food group knowledge from pretest to posttest, a significant increase in nutrient food association, and an increase in participants

willingness to try fruits and vegetables. Other programs such as the EAT.RIGHT NOW. and Pennsylvania Nutrition Education TRACKS program have provided nutrition education to all students and parents who are eligible for SNAP (the federal Supplemental Nutrition Assistance Program) and is now in more than 270 district schools (T.E. Wolford, written communication, March 2012) and have found positive responses and benefits to participation in their programs. This study contributes to the literature by demonstrating the impact of a similar program on urban students, a group that has not been extensively studied with respect to the impact of gardening programs to date.

In 2004, the district beverage policy mandated the removal of all sodas and sugar-sweetened drinks from vending machines, and in 2006 snack standards were developed for á la carte and vending items. In 2006, the Philadelphia School Reform Commission passed a comprehensive School Wellness Policy with provisions for competitive foods, physical activity, and nutrition education. Finally, from 2009–2010, School Food Services began offering “universal” or free breakfast to all students, discontinued the use of fryers, and switched from 2% to 1% low-fat milk. In 2010, the Philadelphia Department of Public Health (PDPH) launched the Get Healthy Philly (www.foodfitphilly.org) initiative to improve nutrition and physical activity through citywide policy and systems changes. PDPH has partnered with public and private sector organizations, including the School District of Philadelphia, to decrease the population-level burden of obesity and related diseases, particularly among children (Rappaport & Robbins, 2005). Such efforts may help accelerate the behaviors towards making healthy choices and people may feel more comfortable making these lifelong choices. Again, the

results of this study reaffirm the strength of school gardening program with respect to changing the behaviors of students.

The final research question sought to determine whether students had an increased interest in school and whether we could determine if their “favorite day” coincided with the gardening day after being exposed to the nutrition based program. Using a 5-question survey, students were asked to rank whether they were excited about school, felt that it was important to do well and determine which was their favorite day to attend. Based upon the results of this survey, interest in attending school on days in which the gardening program was held increased significantly. Since students became familiar with the process and the gardening program, the students became more engaged and excited in learning.

Consistency with Previous Literature

The findings of this investigation are generally consistent with the available literature for school gardening programs. Since parents are making food decisions due to lack of time, but more importantly for the sake of convenience, it is essential that a program during the school day provide all students with information and choices that reflect the ideals of a healthy lifestyle.

Additionally, rising obesity rates and health issues are causing stakeholders to take notice and develop programs on how to educate families on healthier eating choices. Implementation of experiential programs is believed to increase awareness and increase retention of information among all students while decreasing the promotion of sedentary behavior among students. Involving parents, schools, media and the community will create a support network to influence the child toward a healthier way of living. Research

indicates that family and their structure are determinants of childhood and their eating preferences. (Neumark-Sztainer et al, 2002). By adjusting factors such as unhealthy eating, lack of activity or too much media exposure in a child's daily routine, the likelihood of that a child will become overweight may be reduced.

Another key aspect of this program is the way in which it encourages more family meals. Family meals provide the opportunity for modeling food behavior, influencing nutrition beliefs, and controlling the family food environment by offering healthy foods. Parental modeling, monitoring, and support of child physical activity all are positively associated with children's physical activity level (Arredondo et al., 2006). The benefits of this nutrition and gardening curricula was researched by Ozer (2007), who found that school gardening benefitted students and concluded that in these "outdoor learning labs", regardless of the size of the garden, whether it was container or land, the students gained higher achievement (pg. 846). Students also felt that they had a better understanding about their environment and had a sense of belonging to the community after having worked with the gardening initiative. Morris (2003) also found that school gardens can positively impact children's food choices by improving their preferences for vegetables and increasing their nutrition knowledge.

Not only is school gardening beneficial to the students, it also benefits the community. The community may include Master Gardeners, volunteers, and plot owners. These community gardens are now well-accepted as providing numerous social, economic, health, and educational benefits (Patel, 1991). Based on these benefits, community gardening has been shown to serve as an important method for educational outreach, essentially allowing people another means to improve their lives. School

gardening programs contribute to the sustainability of community gardens by training future gardeners in schools. These results indicate that school gardening programs are equally effective for urban students as both rural and suburban students.

Parental Involvement

Parenting practices that focus on the quality of the family food environment result in improved child-feeding practices and reduced obesity, whereas practices that focus on control of child consumption may have negative effects (Birch & Davidson, 2001). An authoritative food parenting approach where parents provide appropriate structure and boundaries that promote healthy eating and reinforce healthy practices increases the likelihood children will eat healthfully (Arredondo et al., 2006), whereas an authoritarian food parenting style is associated with reduced healthy food consumption, increased consumption of restricted foods, and greater overall food consumption by children (Arredondo et al., 2006; Birch & Fisher, 1998).

In recent years, the role of home and school environments in influencing children's dietary behavior has been extensively studied (Cullen et al., 2004; French, Story, Fulkerson, & Gerlach, 2003), resulting in the finding that parents should be involved in nutrition education programs through active participation and information exchange in relation to their child's nutrition needs and healthy habits. In addition, nutrition education materials should be shared with parents so that they can reinforce the information at home for good nutrition practice and healthy habits. Parents influence the food environment through food-related parenting practices, the physical and emotional setting in which eating occurs, and their own food behaviors (Golan & Crow, 2004).

Furthermore, Anzman et al. (2010) states that observational learning also affects children's intake; observing others consuming healthy foods can promote children's acceptance of these foods. Because children usually eat in social contexts, there are many opportunities for parents, peers and siblings to model healthy (or unhealthy) eating behaviors. Mothers who drank more milk had daughters who drank more milk, were more likely to meet dietary recommendations for dairy-related nutrients and had higher bone density. Adult models can be also effective at increasing children's willingness to try novel foods, especially when the models eat enthusiastically and when both the models and the children are eating the same foods (page 1120). School gardening programs not only offer education in the viability of nutrition-friendly behaviors, they also provide adult models that actively promote a healthy lifestyle.

Parents influence the food environment through food-related parenting practices, the physical and emotional setting in which eating occurs, and their own food behaviors (Golan & Crow, 2004). Parents also influence the indoor and outdoor environments by promoting child activity, encouraging active leisure choices, reducing sedentary activities, and modeling physically active lifestyles (Arredondo et al., 2006). The success of gardening programs such as the one examined in this study is based heavily on parental involvement. Although we have recognized the value of parent education, reaching parents is an on-going challenge. The demanding and complicated circumstances in which many parents are raising their children not only increase the importance of providing them with information and strategies, but also increase the difficulty of doing so. Traditional classes are valuable tools, but not a practical method to reach many parents. However, current initiatives like school gardening programs tend to

ignore obesity and target a narrow range of contributing factors. One reason for this tendency is discipline-specific specializations related to nutrition, parenting, or physical activity. A multi-disciplinary, integrated approach that addresses both sides of the obesity equation with parenting education that supports family's efforts to change and adopt healthier practices offers tremendous potential to alter the unhealthy environment in which children develop.

School-Prompted Interest

It has been argued that if students do not like learning and do not use their school knowledge outside of school, the educational enterprise has failed (Maehr, 1976; Pugh & Bergin, 2005). We use the term school-prompted interest to refer to situations in which students become so interested in a school topic that they learn more about it outside of school, on their own. Students' school-prompted interest is a generally-underexplored area of educational research. The current study serves as a preliminary test of students' takeaway from a gardening program and its influences on retention of information and school-prompted interest. That student attitude, behavior, knowledge and interest would be positively increased due to this specific nutrition based program.

These findings highlight important observations that may serve as powerful influences on students' propensity to retain learning about classroom topics outside of the classroom. Parmer et al. (2009) found that students when they participated in nutrition education improved vegetable preference, participants like the vegetables even more when the gardening component was included. First, when students are confident in their capabilities to learn course content, they are more prone to experience school-prompted interest. Second, students who have a goal to learn and develop competence in the

classroom are also more likely to continue their learning interests beyond the classroom walls. When students have the ability to gain knowledge through experiential learning, their preferences and confidence increases. These interests ultimately translate to changes in behavior.

Experiential Learning

These results fit with research that shows that gardening and nutrition programs support key features of learning environments that support quality student learning (Reeve, 1998, 2002, 2006; Reeve, Bolt, & Cai, 1999; Reeve & Jang, 2006; Reeve, Jang, Carrell, Jeon, & Barch, 2004). Students were more likely to report pursuing healthier choices when they had the experiential learning component. Reeve and his colleagues have examined how teachers can support student learning. They indicate providing a rationale for why certain learning would be useful (Reeve, 2009). This requires taking the students' perspective, allowing students to work through the situation in their own way as appropriate, and avoid just giving answers (Reeve & Jang, 2006).

Measuring self-reported behavior change in children is a challenge, given the paucity of validated instruments. It is possible that the instrument used in this study was not sensitive enough to capture small behavior changes. Overall, the findings show that there was program effect and these findings also demonstrate that implementing curriculum-based nutrition education lessons using a hands-on, experiential learning approach for youth in afterschool program can have immediate effect on youths' nutrition behaviors and interest.

In addition, gardening can be a beneficial tool that provides teachers with an excellent opportunity to teach nutrition and other subject topics related to healthy eating

and/or supplementing school curricula. Other studies have demonstrated that environmentally-based educational programs can have a beneficial impact on performance on standardized achievement tests, as well as attention and enthusiasm for learning (Lieberman & Hoody, 2004).

In recent studies, gardens were most commonly found in elementary schools and K-8 schools. This finding is supported by the fact that most students are in the same classroom throughout the day and state core curriculum standards at these grade levels may be perceived as easier to meet with the use of the garden compared with standards in middle and high schools (Graham & Zidenberg-Cherr, 2005).

Typically, school gardens are used by most schools to enhance academic instruction. This indicates that the garden is being used to teach some of the core academic subjects, possibly with the incorporation of core curriculum standards (Graham & Zidenberg-Cherr, 2005). This is consistent with research in which gardens are being used to incorporate core curriculum in a hands-on setting (Canaris, 1995). Engaging hands-on learning activities incorporated into daily curriculum are essential components of experiential education. Education programs are emphasizing the development of lifelong learning skills, such as problem-solving and critical thinking through experiential programs. These programs use a multidisciplinary approach to educating students and have been shown to increase test performance, attention, and enthusiasm for learning and to decrease discipline issues in the classroom (Lieberman & Hoody, 2004).

Experiential learning in a gardening curriculum incorporates layout design, researching gardening elements, preparing the area and planting native plants. This approach includes a cross curriculum engaging numerous educators, the community and

subject overlap. Designing and constructing the layout includes measurements and geometry. Working with adults, collaborating with classmates to create drawings, develop a budget, create a volunteering schedule allowed students to experience community engagement on a whole new level. Experiential learning not only reduces energy consumption, it improves community engagement, urban diversity, mental health, and social networks. Studies show that students who experience this type of learning are more engaged and more likely to attend school and are more motivated to learn (Akinyemi, 2009). In a study performed by Parmer, 2009 and associates, they discovered that 2nd graders that were exposed to nutrition education and gardening experienced significant greater improvement gains in nutrition knowledge than the control group. Experiential learning in this study demonstrates that students learn and absorb more by doing, rather than just by learning.

A significant limitation to the current study is that all data reported are based on a sample that was limited to 4th grade students. It is important to interpret the findings of the current study within the context of the curriculum, as limiting our sample to the domain of only 4th graders may have affected the results. For example, it is possible that students would want to continue this hobby or lifestyle, and show parents the fruits of their efforts by cooking; however, given the age of students in this sample, this would need to be supported at home in order for this lifestyle to continue.

Researchers may wish to utilize an experience sampling procedure that requires students to provide a real-time report of activities throughout the day, including after school. Another method is to survey someone other than the student, such as parents, about their child's out-of-school learning activities. Finally, some scholars indicate that

when trying to understand a student's retention of information and experience, it may be useful to learn from other fields of study: Pugh and Bergin (2005), indicate finding ways to observe students in the field of education that allow us a glimpse of their every move and what they are understanding.

It is encouraging that some schools are using the garden for the production of edible produce but also unfortunate that most schools perceived the garden as being a costly and time consuming endeavor. The link between the garden and the school meal program is an area that clearly requires attention because the school meal program possesses the ability to provide students with an opportunity to integrate experiences from the garden into their lunch meal choices. This could affect dietary habits, including preferences and intake for fruits and vegetables based on evidence indicating that increased exposure to foods can increase preferences for those foods. Improving communication among foodservice staff, teachers, administrators, and others involved in the school garden may assist in identifying ways in which the garden can effectively enhance the students experience and knowledge about healthier choices. This may be initiated through the development of a school nutrition policy that is a coordinated effort among foodservice staff, teachers, and others involved in the school garden. It is not surprising that time is considered a major barrier when the greatest percentage of responses shows that teachers are responsible for the garden. This can be a tremendous burden on an individual who already has significant responsibilities associated with duties as a teacher. There is a need for strategies so that volunteers and community members are used more effectively to relieve teachers from time spent focusing on garden responsibilities. This is consistent with school administrators' responses to the

question of resources that would assist in sustaining the garden, in which 54% to 57% strongly agreed that having a parent volunteer and/or having a garden coordinator were resources that would assist in sustaining the garden. Other resource options include accessing AmeriCore volunteers, as well as master gardeners and Cooperative Extension staff. Another barrier to having a garden in schools was a lack of funding.

The results from this study indicate that experiential learning and nutrition curriculum combined with school gardening promote learning and change however, schools resources do not allow this curriculum to continue past the 4th grade. Schools need to promote the incorporation of garden curricula, such as The Guide for Linking School Gardens to California Educational Standards, which describes available instructional materials that link gardens and nutrition to educational standards. Perhaps additional marketing of information to schools will assist in exposing educators to the materials and training available to meet the specific needs of this curriculum. Training was noted as a needed resource as well and is crucial if teachers are to teach students effectively about concepts surrounding gardens and nutrition. Students taught by trained teachers have been shown to have higher nutrition knowledge and attitude scores compared with students taught by untrained teachers.

This wealth of information can be used to better meet school needs and to promote gardens in schools. It is anticipated that this will move us closer to meeting the goal of improving nutrition and health knowledge, as well as the eating habits of children.

Limitations of Study

The following factors may potentially limit the internal and external validity of this study.

- Consistency of school attendance – students may or may not have consistent attendance to school thereby influencing the success of retention of information.
- Self-report – students may not be completely forthright in their survey responses.
- Key terms and limited definitions – defining obesity, “fast food”, or “good food vs. bad food” has its limitations.
 - Students identified as obese may not be eating fast food, because this condition may be due to hereditary factors.
 - Also, many updates have been implemented from “Choosemyplate.gov”, which replaced MyPyramid in 2011; however this update is not complete and may not be referenced as consistently as necessary.
- No control group used –a control group was not available for this study, therefore results may not accurately reflect that the students are retaining information because of the program as they may have extracted information from other sources i.e. media, peers or environmental factors.

Avenues for Future Research

More research is needed that directly examines the relationship between school gardens, students’ retention of information, and core curriculum understanding. The learning and transfer processes involved in school learning may differ in some regards from the process, however, this curriculum may be supported if more quantitative data indicated an increased period of retention in information. There is a need for a cost benefit analysis as well as time commitment expected within classroom goal structures

(Linnenbrink, 2005). In addition, more experimental and quasi-experimental studies are needed that address the influence of specific goals at the time of learning versus at the time of opportunity for transfer. Furthermore, it would be helpful to revisit the class in the 5th grade to determine how much was retained from the previous year's program.

Another aspect to consider is that Ohio Senate Bill 210 mandates foodservice employees to serve healthier options which is required by policy guidelines. Based on this, future research could look at the progress of food intake vs. food throwaway to determine whether the exposure to healthy food is being accepted by the students.

Conclusion

A good deal has been written and discussed about tendencies and benefits of school gardens. The study reported here documents many of the claims that have been made about these gardens and, it is hoped, will serve to contribute to an understanding of experiential learning and gardening participation.

School gardens appear to be predominantly used by most schools to enhance academic instruction through teaching subjects such as science, environmental studies, nutrition, language arts, and math. This indicates that the garden is being used to teach some of the core academic subjects, possibly with the incorporation of core curriculum standards. This is consistent with research in which gardens are being used to incorporate core curriculum in a hands-on setting. Engaging, hands-on learning activities incorporated into subject matter are key components of experiential education in which environment-based education programs have been employed, emphasizing the development of lifelong learning skills, such as problem solving and critical thinking. These programs use a multidisciplinary approach to educating students and have been

shown to increase test performance, attention, and enthusiasm for learning and to decrease discipline issues in the classroom. Subjects taught with the use of the garden are similar among grade levels, with a few notable differences. Science was consistently reported as being taught using the garden throughout elementary grade schools to continuation high schools. The frequency of subjects being incorporated into the garden setting appeared to drop off with the middle schools, high schools, and continuation high schools, where the garden was used to teach only 1 or 2 subjects, compared with elementary and K-8 schools, which reported using the garden to teach 4 to 5 subjects with high frequency.

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APPENDICES

APPENDIX A
QUESTIONNAIRES 1, 2, & 3

Names: _____ Today's Date: _____

What is your grade: _____ Are you a (circle): Girl Boy

NUTRITION KNOWLEDGE

For question 1-11, please CIRCLE the ONE CORRECT ANSWER for each question.

1. Fruits and Vegetables are part of a healthy diet.
(a) Yes (b) No
2. It is important to eat different kinds of vegetables every day.
(a) Yes (b) No
3. It is important to eat different kinds of fruit every day.
(a) Yes (b) No
4. Eating breakfast is an important part of a healthy lifestyle.
(a) Yes (b) No
5. Reading nutrition labels is important for making health food choice.
(a) Yes (b) No
6. Eating high-fiber cereal is very important for my health.
(a) Yes (b) No
7. Eating whole grain bread is good for my health.
(a) Yes (b) No
8. From which MyPyramid food group **SHOULD YOU** eat most of your foods?
 - a. Milk
 - b. Meat & Beans
 - c. Fruits
 - d. Vegetables
 - e. Grains
 - f. All groups

9. Which of the following is good source of calcium with the lowest amount fat?
 - a. Whole milk
 - b. 2% milk
 - c. Skim milk

10. Which of the following is the healthiest snack choice that is lower in fat and added sugar?
 - a. Soda pop and chips
 - b. Milkshake and fries
 - c. Fruit juice and pretzels

11. Which of the following are some ways of eating more fruits and vegetables?
 - a. Eat an apple for dessert
 - b. Making a Banana smoothie
 - c. Using carrot and celery sticks for dipping in your bean dip
 - d. All of the above

BEHAVIOR CHECKLIST

For questions 1-7, please CIRCLE the ONE ANSWER that best describes what you have done over the past week.

1. How often do you eat vegetables?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

2. How often do you eat fruits?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

3. How often do you skip meals?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

4. How often do you eat a variety of foods?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

5. How often do you ask a parent or adult to buy fruit or vegetables that you like?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

6. How often do you change what you eat because of how much fat or sugar it has?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

7. How often do you drink milk or eat milk products like cheese or yogurt?

| | | | |
|---------------------|------------|----------------|-------|
| Several times a day | Once a day | 2-3 times/week | Never |
|---------------------|------------|----------------|-------|

ATTITUDE CHECKLIST

| Healthy Food Choice/Eating | | | | | |
|-----------------------------------------------------------------------|---------------------------------------|--------------------------------------|--------------------------------|-----------------------------------|------------------------------------|
| Please place an X in the box that best answers the question. | 1 I Disagree very much | 2 I Disagree a little | 3 I am not sure | 4 I Agree a little | 5 I Agree very much |
| 1. I think healthy food taste good | | | | | |
| 2. I think eating healthy is very important | | | | | |
| 3. I believe my health in future may be affected by what I eat today | | | | | |
| 4. I believe I eat a balanced healthy diet at home | | | | | |
| 5. I believe I eat a balanced healthy diet at school | | | | | |
| 6. I think eating breakfast every day is good for my healthy | | | | | |
| 7. Drinking a glass of fat-free milk every day is good for my health | | | | | |
| 8. I think drinking a glass of water every day is good for my healthy | | | | | |
| Fruits and vegetables | | | | | |
| I feel that if I eat fruits and vegetables every day..... | | | | | |
| 10. It will help me have a healthy weight | | | | | |
| 11. I will be healthier. | | | | | |
| 12. I will have more energy. | | | | | |
| 13. I will be stronger. | | | | | |
| 14. I will think better in class. | | | | | |
| 15. My family will be proud of me. | | | | | |

APPENDIX B
QUESTIONNAIRE 4

INTEREST CHECKLIST

Please circle one answer for each question.

How excited are you to come to school?

| | | | |
|--------------------|---|---------|--------------|
| Not at all excited | | Neutral | Very Excited |
| 1 | 2 | 3 | 4 |

How important do you think it is to do well in school?

| | | | |
|----------------------|---|---------|------|
| Not at all important | | Neutral | Very |
| 1 | 2 | 3 | 4 |

Please circle one choice for each day of the week

Rate how excited you are to go to school on specific days

| | Not at all excited | | Neutral | | Very Excited |
|-----------|--------------------|---|---------|---|--------------|
| Monday | 1 | 2 | 3 | 4 | 5 |
| Tuesday | 1 | 2 | 3 | 4 | 5 |
| Wednesday | 1 | 2 | 3 | 4 | 5 |
| Thursday | 1 | 2 | 3 | 4 | 5 |
| Friday | 1 | 2 | 3 | 4 | 5 |

Please circle one answer for each question:

What is your favorite day in school?

Mon Tues Wed Thu Fri

Why?

I wish the garden program was for all the grades.

No Don't Care Maybe Yes

APPENDIX C

CONSENT FORMS



RESEARCH CONSENT FORM

Dear Participant:

We are Dr. Brian Harper and Ms. Anjali Barnick, researchers from Cleveland State University. We are interested in examining the impact of the school gardening program on learning and motivation.

We invite your child to participate in our study and hope they are willing to share their point of view with us. We are asking them to complete 3 surveys at three different points during the 2013-2014 academic year. The survey will take about 15-20 minutes to complete. Their responses will remain completely confidential. If for any reason you do not wish for them to participate in this study, or choose to stop participating, you have the right to do so and will incur no negative consequences. By completing this survey, your child will not risk harm to him or herself in any way, nor will they benefit personally from their participation in this research. Please remember that their answers are completely confidential and they can choose not to answer any question or questions that make them feel uncomfortable. Also there are no direct benefits to be obtained by students participating in this study.

If you have any questions about this research, you can contact Brian Harper (bharper1@csuohio.edu; (216) 875-9770).

If you have any questions concerning your rights as a participant in this study, you can call the Institutional Review Board at Cleveland State University, 216-687-3630.

If you understand this letter and you wish to have your student participate in this study, please sign below.

Signature: _____

Printed Name of Parent: _____

Printed Name of Student: _____

APPENDIX D

RESEARCH ASSENT FORM

THE IMPACT OF A SCHOOL GARDENING PROGRAM ON NUTRITION ATTITUDES AND BEHAVIORS AMONGST FOURTH GRADE STUDENTS

Principal Investigator: **Anjali Mallik Barnick**

Sponsor: **Dr. Brian Harper**

We want to tell you about a research study we are doing. A research study is a way to learn information about something. We would like to find out more about *what you learn from the gardening program*. You are being asked to join the study because only *the 4th graders students are offered the gardening program*.

If you agree to join this study, you will be asked to

Fill out questionnaires, and answer some simple questions. These questionnaires will only take 10 minutes, are will be done 3 times and the question part will only take 15 minutes and will only happen 1 time. Both of these will not take you away from your classes and will be done during school time.

We do not know if you will be helped by being in this study. We may learn something that will help other children with *how a school gardening program teaches students*.

You do not have to join this study. It is up to you. You can say okay now, and you can change your mind later. All you have to do is tell us. No one will be mad at you if you change your mind.

Anything we learn about you from this study will be kept as secret as possible.

Before you say yes to be in this study, we will answer any questions you have.

If you have any questions about your rights or child's right as a research participant you may contact the Cleveland State University Institutional Review Board at (216)687-3630.

If you want to be in this study, please sign your name. You will get a copy of this form to keep for yourself.

(Sign your name here)

(Date)