An Assessment of a 13-week Teaching Gardens Intervention on Healthy Behavior Outcomes in 4th and 5th grade students at Crestwood Elementary School in Las Vegas, Nevada

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AN ASSESSMENT OF A 13 WEEK TEACHING GARDENS INTERVENTION ON HEALTHY BEHAVIOR OUTCOMES IN 4TH AND 5TH GRADE STUDENTS AT CRESTWOOD ELEMENTARY SCHOOL IN LAS VEGAS, NEVADA

By

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Abstract

Nearly 13 million children and adolescents are considered to be obese in the United States, with children enrolled in Clark County School District showing elevated overweight and obese weight statuses compared to national averages. Carrying an excessive amount of weight can lead children to experience a multitude of complications with their physical and mental health as well as increase their risk of developing various chronic diseases. The American Heart Association’s Las Vegas Teaching Gardens program implemented a school-based garden pilot study to target environmental causes of obesity in 4th and 5th grade students at Crestwood Elementary School. The objective of this study was to assess the success of the program to increase fruit and vegetable intake, increase physical activity, decrease sugar-sweetened beverage consumption and increase healthy behavior knowledge in the children through participation in garden activities and healthy family nights. A total of 105 students were assessed on their health behavior changes through the analysis of pre- and post-surveys. Data from the pre-test were compared to the post-test data using Wilcoxon match pair tests, McNemar’s chi square tests and t-tests. The results showed a significant decrease in children’s sugar-sweetened beverage consumption after the intervention (P=0.045) and a significant increase in children’s reported participation in physical activity (P<0.000). The program was not able to provide significant results for fruit and vegetable consumption or healthy behavior knowledge. Priority recommendations for enhancements to the Teaching Gardens program and improvements to the student survey were provided for use in future schools to better influence children’s health behavior outcomes.
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Chapter 1

INTRODUCTION

Obesity Statistics

The number of American children who are overweight or obese has dramatically increased in the past three decades, with the amount of children who are at an unhealthy weight doubling and the number of adolescents at an unhealthy weight quadrupling (Centers for Disease Control and Prevention, CDC, 2013). In 2010, 33 percent of the United States’ children and adolescents between the ages of 6 to 19 were either overweight or obese (Ogden, Carroll, Kit, Flegal, 2012). Today, a total of nearly 13 million U.S. children and adolescents are considered to be obese (American Heart Association, AHA, 2014). The prevalence of boys who were obese showed an increase from 14 percent in 2000 to nearly 19 percent in 2010, while the prevalence rate of obesity in girls stayed relatively the same, rising only 1.2 points to 15 percent. (Ogden et al., 2012). The likelihood of children becoming obese increases as they age, with adolescents exhibiting a higher prevalence rate than children under the age of 12.

Nevada ranks 17th out of the 50 states in America in regards to the number of individuals who are at an unhealthy weight, according to the Behavioral Risk Factor Surveillance System, (BRFSS), a telephone based interview that assesses various health risk factors item (United Health Foundation, 2013). The 2011 data revealed that the prevalence rate for obesity in Nevada had increased from the 2000 rate of 19 percent and the 2005 rate of 23 percent to just over 26 percent of adults considered to be obese (United Health Foundation, 2013). In Clark County, Nevada’s largest county, 63 percent of adults over the age of 18 years old, more than half of the adult population, fall into the categories of overweight or obese (Network of Care, 2014). Because weight status was shown to be such
an overwhelming problem in Nevada, the Clark County School District (CCSD) in collaboration with the Southern Nevada Health District (SNHD), performed a similar data collection for various health risk factors, for children in grades 4, 7, and 10 from selected schools in the valley (SNHD, 2013). Compared to other similar data sources such as the National Health and Nutrition Examination Survey (NHANES), CCSD, as a whole, had higher overweight and obesity numbers. In 2010, the NHANES found a prevalence of roughly 33 percent of children between the ages of 6 to 19 that were estimated to be either overweight or obese. The 33 percent estimated prevalence was lower than the 41 percent of overweight or obese children found in CCSD. Also, the number of children who were considered to be obese only were higher in CCSD, 23 percent, than in the NHANES findings, 18 percent (SNHD, 2013). The overall numbers for both adults and children in Nevada and Clark County demonstrate an expressed need for action to be taken to understand the root issues surrounding what causes obesity in order to determine the best approaches to prevent obesity and the development of the many chronic diseases associated with unhealthy weight.

**Obesity Definition**

Obesity, in its simplest definition, is an excessive storage and accrual of body fat. The excess body fat can be attributed to an overall energy imbalance in which the number of calories that are consumed by a person outweigh the number of calories burned. A person’s unhealthy weight status is not the result of a daily energy imbalance, but rather a lack of balance sustained over a long period of time (National Heart, Lung, and Blood Institute, NHLBI, 2014). While obesity can be the result of a number of causes within the individual, such as genetics, health conditions, or certain medications they take, these are not the reasons that the nation is faced with such a pressing weight epidemic. For children, the
causes of an unhealthy weight status are primarily environmental, due to physical inactivity and increased consumption of high-energy, low-nutrient foods, such as sugary beverages, candy, chips, and other types of junk food (CDC, 2013).

**Related Health Outcomes**

Obesity has the potential to lead to a surplus of medical conditions over a child’s lifespan, surfacing during their childhood and continuing into their adulthood. When a child carries an excess amount of weight on their growing, changing frame, it can cause a burden on all of their developing systems and internal organs (Daniels, 2006). This excessive burden on their organs can produce acute medical conditions, with symptoms arising while they are still young and in school. Excessive weight can harm their body’s ability to tolerate glucose, thus leading to early onset type II diabetes or insulin resistance (CDC, 2013). They can experience poor immune performance and various issues with their skin (Doak, Visscher, Renders & Seidell, 2006). Children who carry excess weight experience decreased mobility further limiting their chances of being physically active. Their decrease in mobility can be further compounded by the development of joint pain and discomfort, another problem common in overweight and obese children. Childhood obesity can lead children to have disruptions in their sleep patterns related to the onset of sleep apnea or asthma, which can be exacerbated by extra weight (CDC, 2013). Also, children who are overweight or obese are often scrutinized by their peers, leading to psychosocial issues, including social alienation, low self-esteem, and sign of depression have been identified in girls (Doak, et al, 2006). As children grow into young adults, they can experience more issues from sustaining a frame that is overweight or obese for an extended period of time. They may see the appearance of gall stones or the development of fatty liver. Adults who were obese as children are more likely to have high cholesterol, high blood pressure and the development of heart disease.
Childhood weight statuses of overweight and obesity pose numerous health concerns to children and their families, especially when the status continues into their adult years, but the health problems have the potential of being prevented if the proper actions are taken to modify children’s environments.
Chapter 2

ENVIRONMENTAL FACTORS INFLUENCING CHILDHOOD OBESITY

Dietary Patterns and Nutrition Education

Research demonstrates that fruit and vegetable consumption can decrease the risk of cancer and heart disease and may even play a protective role against other chronic diseases including strokes, chronic obstructive pulmonary disease and hypertension (McAleese & Rankin, 2007; O'Brien, Story, & Heim, 2008; Somerset & Markwell, 2008). Although there is overwhelming evidence that demonstrates the importance of consuming fruits and vegetables for a well-balanced, healthy diet and the ability of healthful dietary patterns to decrease the risk of numerous chronic diseases, over 90 percent of children, between the ages of 4 to 13 years old, are not meeting the national recommendations for their nutrition (Heim, Stang, Ireland, 2009; McAleese & Rankin, 2007; O'Brien, Story, & Heim, 2008). The ease at which children can obtain high-fat, unhealthy foods contribute to their poor eating habits as does their exposure to televised food commercials (Briggs, Safaï, & Beall, 2003).

When dietary intake is influenced at a young age, the effects can be traced throughout their adolescence and adulthood, maintaining healthy eating patterns throughout their life and decreasing obesity (McAleese & Rankin, 2007). Due to this fact, many researchers believe it is most effective if interventions, in regards to eating patterns, are introduced early on in a child's life to increase the likelihood of healthy diet (McAleese & Rankin, 2007).

Physical Activity

Less than one-quarter of children get the adequate amount of daily recommended physical activity. With technological advances in televisions, computers and video games, there has been an overall shift from an active lifestyle, including playing outdoors, to a more
sedentary lifestyle, indoors, spent overindulging in various forms of media (NHLBI, 2014). The NHLBI reports that an unhealthy weight is correlated with those who watch television or use other forms of technology for more than two hours per day (NHLBI, 2014), and the average child in the U.S. spends around seven and a half hours using technology each day (CDC, 2013). Not only has the rise in technology usage contributed to the inadequate levels of physical activity in children, but many parents consider their community to be unsafe for their children to participate in outdoor activities (NHBLI, 2014).

National recommendations for physical activity are 150 minutes per week for children in elementary schools; however, only eight percent meet this recommendation (Story, Kaphingst, & French, 2006). Physical activity programs in schools have suffered greatly with the economic recession in recent years. The recession has attributed to significant cuts in Physical Education (PE) courses and any extracurricular sporting activities were cancelled to save money in many schools (Shaya, Flores, Gbarayor, & Wang, 2008). Parents were often unable to afford community league recreation teams for their children to participate in, and the recession also resulted in the inability of community facilities to stay open for children (Shaya et al., 2008). In addition, school focus on achieving higher national academic test scores have significantly reduced the amount of recess and physical education classes allowed in schools in order to allot additional time for subjects featured on the tests (Story et al., 2006). Just over 25 percent of elementary schools do not allow for a scheduled recess period for their elementary students to get outside for unstructured physical activity. For schools that do allow recess to be a scheduled event during the students' day, it is often the first activity to get taken away as a form of punishment for misbehavior.

Research shows that regular participation in physical activity can reduce obesity as well as the risk factors associated with the development of chronic disease (Briggs et al.,
With adequate instruction and guidance, children can better maintain an active, healthy lifestyle throughout their lives. An intervention that targets physical activity alongside nutrition and dietary behaviors is an essential method to ensure all aspects of a child's healthy lifestyle are influenced.

**Sugar Sweetened Beverage Consumption**

Children consume up to 20 percent of their daily caloric intake from excess sugar (Briggs et al., 2003) and well over half of children drink at least one soda every day. The consumption of sugar-sweetened beverages has been correlated with the increased weight gain and obesity epidemic in children (van de Gaar, Jansen, Grieken, Borsboom, Kremers & Raat, 2014). Sugar-sweetened beverages are defined as beverages that contain any added sugar or sweetener, such as soda, energy drinks, fruit drinks that are not 100 percent fruit juice, and sweetened dairy products such as chocolate or strawberry milk (van de Gaar, 2014). Healthier beverages such as water and low-fat dairy products have been replaced with soda and fruit juice in many young children's daily life (Briggs et al., 2003). Studies have shown that replacing just one sugar-sweetened beverage a day with a beverage that does not contain calories can significantly decrease the amount of weight a student may gain each year (van de Gaar et al., 2014). When interventions promote water as a replacement beverage for sugar-sweetened beverages, children have been shown to demonstrate healthy behavior changes and overall decreases in weight gain.
Chapter 3

REVIEW OF RELATED LITERATURE

Obesity Prevention Strategies

With more than one-third of American children considered to be either overweight or obese, there is a need for intervention and prevention programs to stop the problems associated with caloric imbalance (CDC, 2013). Health professionals, professors, politicians, and many other leaders have expressed the imminent need for a call to action against the obesity epidemic among Americans (Doak, et al, 2006). Targeting children as the subjects of obesity prevention and intervention strategies has been shown to be somewhat more effective than treatment of obesity at later stages in life. Prevention of childhood obesity can help diminish the risk of obesity in adulthood as well as an overall reduced risk to a number of chronic diseases.

There are dozens of obesity prevention strategies available to target weight problems in children. These strategies range from home-based, programs that take place primarily in the child’s house, to school-based programs, which take place primarily on school campuses with occasional homework or parental involvement, to community-based interventions which involve policies and legislation or interactions with a group of individuals who share a common set of characteristics (i.e. church groups) (Wang, Wu, Wilson, Bleich, Cheskin, Weston, Showell, Fawole, Lau, & Segal, 2013). The CDC recommends parents reduce the overall amount of media time children are allowed to indulge in at home, limiting children to less than two hours each day (CDC, 2013). They are also advised to limit the purchases of sugar-sweetened beverages for the home so that children do not have access to the calorie rich beverage. For school-based strategies, parents are urged to demand the availability of fresh fruits and vegetables at lunch for students from the school board. They can also
request the removal of vending machines or allowance of outside food on campus to help reduce the obesity problem. The CDC also urges people to target the community through the request of healthier food options at local convenience and grocery stores (CDC, 2013). Often times, the most effective obesity prevention strategies are those that incorporate home, school, and the community (Wang et al., 2013). Participation in local farmer’s markets and their involvement in the surrounding schools are a great way to incorporate all three of the strategies for optimal influence on obesity in children.

Numerous interventions have been nutrition and physical activity based programs targeting children as young as pre-school all the way up to adolescents in high school, which have produced positive outcomes associated with healthy lifestyle changes (Somerset & Markwell, 2008). Within these research programs, there has been a push towards school-based garden interventions to bring awareness to children about a variety of fruits and vegetables with the goal of increasing the amount of produce in their daily food intake. Studies have shown that an increase in fruit and vegetable consumption has been correlated as a prevention of both cancer and heart disease (McAleese & Rankin, 2007). Since eating patterns are best learned during the early years of a person’s life, during their childhood, it is necessary to target their eating habits and their general nutritional knowledge while they are still developing their likes and dislikes. To create a prevention strategy that is effective for childhood obesity, the target should be on the child’s overall environment (Doak, et al, 2006). These programs have the ability to be applied on a wide scale in a population while allowing for the program to become sustainable and long lasting.

**School-based Obesity Interventions**

In the United States, a large part of the schools across the nation lack a nutrition education program to teach their children about the necessity of living a healthy lifestyle
through nutritious dietary habits and physical activity (Briggs et al., 2003). Over 35 million American children attend school every day, making schools one of the most wide-reaching areas of influence in a child’s life (Prelip, Kinsler, Thai & Erausquin, 2012; AHA, 2011) Not only are schools one of the most effective settings to reach a large number of children at once, they also allow for interventions to reach a diverse group of children from various socio-economic statuses as well as from different ethnicities (van de Gaar, 2014). Children spend roughly seven to eight hours on campus, consuming an average of two meals with the possibility of snacks (Briggs, Safaii, & Beall, 2003). With such a large amount of time spent on campus each day, and with a substantial number of children receiving up to one-half of their daily nutritional requirements at school, it is essential to use the school setting to reiterate the importance of a nutritious diet and a healthy lifestyle. As recommended by the American Dietetic Association (ADA), a school environment which focuses on healthy behaviors assists children in adapting nutritious dietary patterns. Children have even reported that they believe they absorb more information about fruits and vegetables as well as basic nutrition knowledge at school rather than at home (Foerster, 1998). Obesity prevention studies that have been performed on school grounds, have demonstrated that the school setting is an important location for children to be introduced to prevention programs with an emphasis on changing nutrition patterns (Prelip et al., 2012).

The most effective school-based intervention programs are those that also include a parent component and a community outreach program (van de Gaar, 2014). Wang (2013) and his colleagues performed a literature review on the numerous strategies targeted towards children to reduce obesity. Over 120 total intervention studies were included in the literature review, and 84 percent of the studies were school-based interventions. Overall there was a moderate level of evidence that showed that school-based interventions were useful as a
prevention strategy for childhood obesity. The school-based interventions, ranging in their length of implementation periods, that targeted a healthy diet as well as physical activity, demonstrated a high level of evidence that when used in conjunction with a home component or a community component, prevent obesity in children (Wang et al., 2013). School-based programs with a community outreach component have been shown to be more sustainable over time and allow for healthy behaviors to be targeted in a multitude of settings (van de Gaar, 2014).
CHAPTER 4

SCHOOL GARDENS

History of Garden-based Learning

In the United States, a contemporary trend for promoting healthier eating habits while teaching children where their food comes from, is the introduction of a school-based garden (Subramaniam, 2002). The very first school-based gardens date back to the early 1800's when both European and Australia countries began implementing outdoor classrooms to promote natural sciences, agricultural sciences, and ideas related to hard work, and moral improvements. At the end of the 1800s, the United States developed interest in the use of school-based gardens, but their main focus was to provide better aesthetics on school grounds (Subramaniam, 2002). By the year of 1918, at least one school in each state possesses a school-based garden. The United States shifted their focus from aesthetically pleasing only gardens, to those that grew and harvested food. School-based gardens played a very important role in the growth and shipment of food for hungry families during the First World War.

Following World War I, there were numerous ups and downs for school-based gardening programs, until the 1980s (Subramniam, 2002). It was not until the American Horticultural Society held a symposium in the 1993 about youth gardening that school gardens began to spread throughout the United States. The symposium focused on ways in which school-based gardens could influence and enhance children’s overall learning experience. School-based gardens can be incorporated into the school setting for variety of purposes including academic focus, behavioral reasons, political ties, or even social reason (Blair, 2010). Curricula have been manifested for all of the different purposes listed as well as for the overall benefit of children’s health. Delaine Eastin, the superintendent of the

12
California state school system, attempted to create a mandate that every school in the state grow a garden in the year 1995 (Subramanium, 2002). While her ideas were not immediately reciprocated by others in the school system, school gardens continued to grow in their popularity both throughout California as well as across the United States.

**School Gardens Today**

On both a local as well as a national level, various efforts have been made to implement school-based garden programs to improve the overall health of children. Programs such as the National Farm-to-School Program, The Kids Gardening Initiative, and the Youth Farm and Market have been implemented with efforts to benefit children's understanding of and connection to the food they consume and how it involves the environment around them as well as their community (Robinson-O'Brien, Story, & Heim, 2008). Some gardens have been created using potted plants, gardens on top of asphalt through the use of raised beds, and even some greenhouse spaces (Blair, 2010). Schools have found use in introducing other accompaniments to school-based gardens such as butterfly habitats and composting areas.

California and Texas are two of the most involved states in regards to incorporating school-based gardens and outdoor learning environments for their students, with over half of school principals in the state of California reporting that they have implemented a school-based garden or planting program (Blair, 2010). Both Texas and California have been involved in the creation of curricula to enhance the outdoor learning experience as well as performing research to evaluate the benefits that gardening can provide their students. With garden popularity spreading throughout the United States, research has just begun to show how essential these outdoor learning environments are to influencing children’s behaviors both in the classroom and in regards to their health.
Heim, Stang, and Ireland (2009) performed a pilot garden intervention after which over 90 percent of the students rated the overall experience of planting, harvesting, and overall gardening experience as enjoyable. Somerset and Markwell's (2008) year-long garden intervention study showed that a school-based garden can in fact be beneficial to children's health behaviors. The introduction of gardens into the school setting allows for the topic of healthy eating and overall healthy lifestyles to be introduced in an interesting manner (Graham, Feenstra, Evans, Zindenberg-Cherr, 2004). Even the CDC supports the idea of planting school gardens as one of ten potential strategies to influence the consumption of healthier foods while increasing engagement in physical activity both in the garden and out (CDC, 2013).

School-based Garden Intervention Health Outcomes

According to researchers O'Brien, Story and Heim (2008), garden-based dietary interventions may be the ideal context for a school-based obesity prevention program targeting healthy changes in children's fruit and vegetable intake. After participation in a school-based garden education program, children who participated in two or more garden related activities demonstrated significant changes in their fruit and vegetable consumption as well as their overall preference for fruits and vegetables. They reported a decreased desire to eat foods that are considered to be unhealthy, and established higher motivation to eat fruits and vegetables. Children also scored high in survey questions related to their self-efficacy to consume fruits and vegetables, and exhibited a higher level of knowledge on questions related to fruit and vegetable information (Evans et al., 2012). Similarly, the pilot study performed by Heim, Stang and Ireland (2009), produced significant increases in children’s vegetable preferences, and their overall number of fruits and vegetables ever eaten.
There have been positive correlations between school-based gardens interventions and an increased self-efficacy to eat fruits and vegetables while increasing the amount of physical activity a child receives each day. A study by Evans et. al., demonstrated how a garden-based intervention in middle school-aged children produced positive increases of fruit and vegetable consumption (Evans, Ranjit, Rutledge, Medina, Jennings, et. al, 2008). Children from five different schools were exposed to a program known as Sprouting Healthy Kids, which exposed them to multiple garden activities, such as vegetable tasting with local farmers, field trips to the farm, planting and harvesting in their own school garden, as well as in class lesson plans. The children that participated in more than two of the garden components showed significant increases in their fruit and vegetable preferences, their knowledge about fruits and vegetables, as well as their self-efficacy to choose fruits and vegetables over unhealthy foods (Evans et. al., 2008). The 12-week school garden-based intervention led by McAleese and Rankin (2007) demonstrated significant increases in 6th grade children's fruit and vegetable intakes based on their responses in a 3-day food recall questionnaire, distributed both before and after the intervention. The children were exposed to one of three experimental conditions: nutrition education, nutrition education with the inclusion of garden activities, or a control group which experienced no intervention. Children who were exposed to the nutrition education-only intervention, received a curriculum which focused nutrition and horticulture elements alongside their usual school lesson plans. The nutrition education with garden activities allowed for children to participate in hands-on garden work along with the inclusion of the nutrition and horticulture curriculum and their regular school lesson plan. Those children assigned to the control group were given no curriculum additions. Data analysis on the food recall questionnaires resulted in an increased intake of fruit and vegetable servings for those
children who were exposed to the nutrition curriculum as well as the garden activities, more so than those children who were in the other two intervention groups (McAleese and Rankin, 2007).

Morris and Zindenberg-Cherr (2002) recruited three schools to a quasi-experimental design study, in which the schools as opposed to the children were non-randomly assigned to one of three treatment groups. At each school, 4th grade classrooms participated in one level of a school-based garden nutrition intervention, with one school receiving nine nutrition lessons, one school receiving garden lessons in addition to the nutrition lessons, and one school having no intervention but receiving the same evaluation (Morris & Zindenberg-Cherr, 2002). Students were evaluated with multiple choice questionnaires about general nutrition knowledge and with vegetable preference surveys highlighting lesser known and less desirable vegetables (i.e. broccoli, radishes, swiss chard, etc.). The evaluation materials were given both pre-intervention, 17 weeks later post-intervention, and again five months after the intervention for a follow-up data set to see if there was a change in children’s knowledge and behavior. Children from the Morris and Zidennber-Cherr (2002) study showed significant differences between the nutrition-only group and the nutrition group complemented by garden activities over the control group. These differences were upheld at the follow-up study, showing that not only are school-based garden interventions effective in producing behavior changes in vegetable preference and nutrition knowledge after the intervention, but also months later.

Somerset and Markwell (2008) performed school-based garden interventions on children, producing results that showed a rise in fruit and vegetable intake and an improved level of knowledge on dietary recommendations for a healthful diet. The garden intervention allowed children to increase their awareness of fruits and vegetables available to
include in their diet. The study also demonstrated that the children increase in their amount of physical activity from working in the garden. Similarly, Hermann et al. (2006) incorporated an after-school garden intervention on children to influence their dietary intake as well as their physical activity. Responses on pre- and post-intervention surveys exhibited significant increases in children’s reported fruit and vegetable intake and physical activity performed.

While a couple of research studies related to school-based gardens noted an increase in physical activity in addition to their dietary intake (Somerset & Markwell, 2008; Hermann et al., 2006), Wells et al. (2014) identified a gap in research that would help identify their potential to influence physical activity in children. The study included 4th and 5th grade students from 12 different schools in New York, six schools were involved in the intervention and six schools were used as a control. The students participated in garden-based activities including planting, weeding and harvesting as well as curricula focused on nutrition and plant science lessons. The study measured changes in children’s physical activity before and after a garden intervention using self-report surveys, accelerometers, and direct observation. The students in the intervention schools showed a decrease in their usual sedentary behavior while the control group did not (Wells et al., 2014). The students in the intervention schools also demonstrated significant increases in their moderate physical activity as well as their moderate to vigorous physical activity on their pedometers at the end of the intervention while the students at the control schools did not. Wells et al. (2014) study exhibited findings that school-based gardens can have a positive influence on increasing children’s physical activity while decreasing their likelihood to be sedentary.
Chapter 5

PROJECT PROPOSAL

Objective

The American Heart Association, AHA, has set impact goals to meet for the year 2020 regarding “Life’s Simple 7,” to decrease the number of those afflicted by cardiovascular disease in the United States. “Life’s Simple 7” are the seven most important indicators for whether someone will develop cardiovascular health issues. Among the seven indicators are healthy diet score, physical activity levels, and amount of sugar-sweetened beverage intake. The AHA collaborated with the Teaching Gardens program to work toward the prevention of cardiovascular health issues in children by targeting these three indicators.

Teaching Gardens is an organization that was founded by Kelly Meyer, a well-known activist for children’s health (AHA, 2014). Teaching Gardens was established with the premise that by planting gardens at elementary schools around the United States and providing an introduction to an outdoor learning laboratory, children would be more equipped to make healthy food choices and perform healthy behaviors. The Las Vegas Teaching Gardens program unlike other Teaching Gardens across the United States, chose to further the programs involvement with the school and the community, to foster health behavior changes. Unique to the Las Vegas program, a student evaluation component was incorporated to help assess whether healthy behaviors are actually changed as a result of the Teaching Gardens program. The Las Vegas Teaching Gardens program also created their own objectives, based on the 2020 impact goals of the AHA, to decrease the risk of cardiovascular disease. The impact objectives are to increase the number of children who consume the daily recommendation of fruits and vegetables, 4.5 cups, to 26 percent of participants; and to reduce the percentage of those who consume more than 36 ounces of
sugar-sweetened beverages per week to 15 percent. The program also aims to increase the overall number of children who participate in a minimum of 60 minutes of physical activity per day. These objectives are to be met by the end of the 2015-2016 school year. To ensure that the Teaching Gardens program is effective in its ability to reach their impact goals, they added an enhanced parental involvement component into the Las Vegas program. The objective of this study is to provide an assessment of the Teaching Gardens pilot study’s ability to demonstrate any change in healthy behavior outcomes of 4th and 5th grade children at Crestwood Elementary School.

**Research Questions**

1. Is there a difference in daily fruit and vegetable consumption after participation in the Teaching Gardens intervention?
2. Is there a difference in physical activity after participation in the Teaching Gardens intervention?
3. Is there a difference in the sugar-sweetened beverage consumption after the Teaching Gardens intervention?
4. Is there a difference in children’s health behavior knowledge after the Teaching Gardens intervention?

**Hypotheses**

The overall goal of this study is to determine if a change is observed in 4th and 5th grades students’ healthy behaviors or health-related knowledge following a 13-week long school-based garden intervention.

$H_0$: Children will exhibit no significant differences in their fruit and vegetable intake after taking part in the Teaching Gardens program.
H\textsuperscript{2}_0. Children will exhibit no significant differences in their physical activity level after taking part in the Teaching Gardens program.

H\textsuperscript{3}_0. Children will exhibit no significant differences in their sugar, sweetened-beverage consumption after taking part in the Teaching Gardens program.

H\textsuperscript{4}_0. Children will exhibit no significant differences in their health behavior knowledge after taking part in the Teaching Gardens program.
Chapter 6

PROJECT APPROACH

Methods

A literature search was performed to gather a variety of existing publications available on school-based garden interventions, as well as interventions focused on children’s fruit and vegetable intake, dietary patterns, physical activity for children and sugar-sweetened beverage consumption. Crestwood Elementary School served as the pilot study location for the Teaching Gardens program, to assess the changes in children’s health behavior outcomes. IRB approval was applied for and obtained by both the CCSD (Appendix A) and the University of Nevada, Las Vegas, Office of Research and Sponsored Programs (Appendix B). The intervention was a pre-post intervention because all fourth and fifth grade students at Crestwood Elementary had the opportunity to participate in the Teaching Gardens program in which they were given both pre- and post-intervention surveys to assess their behaviors and knowledge (Harris, McGregor, Perencevich, Furuno, Zhu, Peterson, & Finkelstein J, 2006).

The Teaching Gardens pilot study was a 13-week long intervention that included both 4th and 5th grade students at Crestwood Elementary School in Las Vegas, and their parents, if they chose to participate. A total of three on-campus, family-friendly events were hosted at Crestwood to encourage participation in healthier behaviors among children and their families. The three events included Plant Day, to kick off the intervention in February 2014, Healthy Family Night, hosted in April at the mid-point of the Teaching Gardens intervention, and Harvest Day, to celebrate the end of the intervention in June 2014. All events included garden-based activities, taste testing of various fruits and vegetables,
including those grown in the school garden at Harvest Day, physical activity stations, alternatives to sugar-sweetened beverages and heart health information tables.

All students were administered the pre-surveys during the week of Plant Day, to obtain a baseline of students self-reported health behaviors and healthy behavior knowledge. Following the Plant Day held on February 28, 2014, the celebratory day to officially introduce the school garden to the children, school, parents and the community, the 4th and 5th grade children began the Teaching Gardens intervention. Throughout the Teaching Gardens program, students were allowed to view the garden before and after school, and during their school day if time permitted. The 4th and 5th grade students participated in a weekly garden visit during which the Teaching Garden Coordinator introduced them to lessons (Appendix C) targeting one of the four main objectives of the program: healthy eating, physical activity, sugar-sweetened beverage alternatives, and overall healthy lifestyle knowledge. A Healthy Family Night was incorporated at the mid-point of the intervention, and it featured a number of stations for families to visit and participate in healthy behaviors such as physical activities, fruit and vegetable tastings, and to learn about healthy behavior knowledge at an information table with materials from the American Heart Association, AHA. While students participated in the intervention, their parents had the opportunity to participate in a 4-week long Healthy Parents, Healthy Kids workshop series. Classes were divided up into one English speaking class and three Spanish speaking classes, taught in one-hour increments by health promoters other than the Teaching Gardens coordinator. Parents were instructed on ways they could create a healthier lifestyle for their families at home, through managing energy in versus energy out and how to maintain a healthy weight by limiting the energy in and increasing the energy out. Harvest Day was hosted at the end of the 13th week of the intervention on June 2nd, 2014. During the event, parents and students
could purchase vegetables from the Teaching Gardens farmers market, enjoy a healthy salad featuring items from the garden, prepared by an onsite chef, and try fresh fruit-infused water as a replacement for sugar-sweetened beverages. Post-surveys were administered to children and collected 13 weeks after the pre-surveys, upon completion of the Teaching Gardens intervention. The post-surveys were used as a comparison to the pre-surveys, to assess changes in fruit and vegetable consumption, daily physical activity, sugar-sweetened beverage consumption, and healthy behavior knowledge.

The pre- and post-intervention surveys utilized the same questions for students to answer (Appendix D). The survey was not validated prior to administration to students; it was developed by the Teaching Gardens staff, with the help of Johns Hopkins University, for use in the pilot study at Crestwood. The surveys were composed of 23 questions in total, four that were related to demographic information, five that targeted fruits and vegetables, two that were related to healthy drinks, two about healthy snacks, three that were related to physical activity, and three about television screen time.

Data Analysis

After the final collection of the post-test surveys, the Teaching Gardens staff matched the pre- and post-test surveys based on their student survey IDs. Although there were 196 pre-surveys collected from students and 175 post-surveys collected, only a total of 105 4th and 5th grade surveys were analyzed. Due to errors in the distribution of the survey IDs by the Crestwood Elementary School teachers during the administration of the post-test surveys, many of the post-surveys were not able to be matched to the pre-surveys for analysis. Of those surveys that were matched, results from the pre- and post-intervention surveys were entered into excel and additional variables were created for assessing healthy behavior changes and knowledge. Additional variables were created to properly assess
change for fruit and vegetable intake, physical activity, sugar-sweetened beverage consumption and overall nutritional knowledge.

For survey questions related to the dietary intake, several new variables were required for further analysis. For fruit, a new variable, FCup, was created based upon children’s self-reported consumption of fruit. FCup was equivalent to 1 cup of fruit for each whole fruit reported as eaten (USDA, 2014). A new variable, VCup was created based upon children’s self-reported consumption of vegetable. VCup was equivalent to one-half cup for each whole vegetable reported by the children. The sum of FCup and VCup, was then taken for overall fruits and vegetables consumed per day and represented as another new variable, FVCup. To analyze the snacks, both healthy and unhealthy, eaten by the children, two new variables were created. TotalHealthySnacks, the sum of all fruit, vegetable and yogurt snacks consumed by a child, were added as the total healthy snacks consumed by a child. TotalUnhealthySnacks, the sum of all chips, donuts, and candy consumed by a child, were added as the total of unhealthy snacks consumed by a child.

To analyze the survey questions related to physical activity performed, one additional variable was created. For every minute of physical activity reported by children in biking, playing outside, running, walking, participating in karate, dancing, playing sports, swimming or exercising in the gym, the sum was totaled and represented as a new variable, PATotal. PATotal is a representation, in minutes, of the daily amount of physical activity performed by the child.

Additional variables were also created for the data analysis related to sugar-sweetened beverages consumption, as well as general knowledge about healthy drinks. For each reported soda consumed by a child, 12 ounces were added to a new variable, SodaOz. For each glass of kool-aid, low-fat chocolate milk, water, fruit juice, and skim milk reported, 8
ounces were added to the new variables, KoolAidOz, LowFatChocolateOz, WaterOz, FruitJuiceOz, and SkimMilkOz. All ounces of kool-aid, low-fat chocolate milk and soda were totaled to obtain the new variable, TotalSSB, which showed the total number of sugar-sweetened beverage ounces consumed daily by the children. All ounces of water, fruit juice, and skim milk were summed together to obtain the new variable, TotalHealthyDrinks, as a total of all healthy drinks consumed daily by the child.

Data were analyzed using the SSPS version 22.0 software (SPSS Inc., Chicago, IL). Data from the pre-test were compared to the post-test data using a combination of statistical tests. McNemar’s chi square test was used for dichotomous variables. Student t-tests were used for mean comparisons of beverage consumption, fruit and vegetable intake, snack consumption, and the total amount of physical activity performed. The Wilcoxon match pair test was used to analyze ordinal scaled questions. \( P<0.05 \) was used as the \( \alpha \) level to indicate statistical significance in the data.
Chapter 7

RESULTS

Between February 2014 and June 2014, 4th and 5th grade students participated in the Teaching Gardens intervention which focused on improving their fruit and vegetable consumption, physical activity, and their overall healthy behavior knowledge while decreasing their consumption of sugar-sweetened beverages. Each of these areas for improvement were assessed using a 23-question pre- and post-intervention student survey to determine whether there were changes. The data from the computer-based post-survey were exported from the online database into an Excel file (Appendix E) and combined with the pre-survey data. Histogram data distributions pre- and post-survey were created for fruit and vegetable consumption (Figure 1A and 1B), healthy snack (Figure 2A and 2B) and unhealthy snack consumption (Figure 3A and 3B), healthy drink (Figure 4A and 4B) and unhealthy drink intake (Figure 5A and 5B), and physical activity (Figure 6A and 6B), to determine if the data were normally distributed and to identify potential outliers. The data were determined to not be normally distributed, and all statistical analyses performed were nonparametric tests. After review, the data were then uploaded into SPSS for further statistical analysis.
Figure 1-A Normal Distribution of Pre-Survey Fruit and Vegetable Consumption

Figure 1-B Normal Distribution of Post-Survey Fruit and Vegetable Consumption
Figure 2-A Distribution of Pre-Survey Healthy Snack Consumption

Figure 2-B Distribution of Post-Survey Healthy Snack Consumption
Figure 3-A Distribution of Pre-Survey Unhealthy Snack Consumption

Figure 3-B Distribution of Post-Survey Unhealthy Snack Consumption
Figure 4-A Distribution of Pre-Survey Sugar-Sweetened Beverage Intake

Figure 4-B Distribution of Post-Survey Sugar-Sweetened Beverage Intake
Figure 5-A Distribution of Pre-Survey Healthy Beverage Intake

Figure 5-B Distribution of Post-Survey Healthy Beverage Intake
Figure 6-A Distribution of Pre-Survey Daily Physical Activity

Figure 6-B Distribution of Post-Survey Daily Physical Activity
**Fruit and Vegetable Consumption and Dietary Habits**

The variable, FVCup, was used to show the total number of fruits and vegetables that each student recorded they consumed. The FVCup pre- and post-survey means were analyzed with a paired-samples t-test to determine whether there was a statistically significant difference in consumption before and after the Teaching Gardens program. Students’ FVCup means did not show a significant difference before ($Mean=2.21$, $SD=0.133$) or after the Teaching Gardens program ($Mean=2.20$, $SD=0.137$), $P=0.896$. Since there was no significant difference in children’s fruit and vegetable intake pre- and post-intervention, we fail to reject the null hypothesis, $H_{10}$.

Students were asked to report the number of snacks, both healthy and unhealthy, that they ate the previous day. Based on their answers, children’s consumption of healthy snacks, yogurt, fruits, or vegetables, was higher before the intervention, ($Mean=6.43$, $SD=7.958$) than after the Teaching Gardens program ($Mean=3.73$, $SD=3.479$), $P=0.001$. There was no significant difference in the amount of unhealthy snacks consumed before the intervention, ($Mean=2.75$, $SD=5.543$) versus after ($Mean=4.28$, $SD=10.277$, $P=0.178$).

**Physical Activity**

To assess whether there was a change in children’s physical activity levels after participating in the Teaching Gardens program, students were asked to respond to two survey questions. The first question required a yes or no response on whether they participated in any physical activity the previous day. McNemar’s chi square was used to analyze whether there was a difference in pre- and post-survey answers. Children’s self-report of whether they exercised the day before was significantly higher after the 13-week Teaching Gardens program ($P<0.001$). If students reported that they participated in exercise
the previous day, they were asked to then specify which exercises they participated in, and how many minutes they performed of each exercise.

Prior to analysis of the variable PAtotal, the participants who reported more than 240 minutes of physical activity were removed as outliers. The data, based on the Histogram distribution graphs shown above (Figures 6A-B), were determined to contain outliers. Those participants who recorded 240 minutes or 4 consecutive hours of physical activity, were not included in the data analysis as 240 minutes was considered to be an excessive amount of exercise for children in 4th and 5th grade. After removal of the outliers, 100 of the 105 student surveys were used for data analysis of the PAtotal variable, which were analyzed using a paired sample t-test. There was no significant difference between the minutes of physical activity students performed before the intervention (Mean=65.39, SD=48.951) versus after the Teaching Gardens program (Mean=56.62, SD=67.142), P=0.190. Since there was no significant difference between the pre- and post-survey means of daily physical activity minutes, we fail to reject the null hypothesis, $H_0$.

**Sugar-Sweetened Beverage Consumption**

Students were asked to record the drinks, both healthy and unhealthy, they consumed the previous day, and the number of each. The totals of both the healthy drinks and the unhealthy drinks, sugar-sweetened beverages were calculated and new variables were created to be analyzed. The means of the pre- and post-survey variable, TotalHealthyDrinks were analyzed using a paired t-test. The t-test showed students’ consumption of healthy beverages was significantly higher before the intervention (Mean=51.66, SD=50.28) versus after the Teaching Gardens program (Mean=37.10, SD=35.347), P=0.014. The TotalSSB variable was determined to contain outliers, after review of the Histogram distribution graphs shown above (Figure 5A-B). Those participants who reported they drank 168 ounces
of sugar-sweetened beverage the previous day were determined to be outliers, as 168 ounces, the equivalent of fourteen, 12-ounces beverages, was considered an excessive amount for children. After removal of the outliers, 99 student surveys were analyzed out of the 105 surveys in the dataset. The TotalSSB variable was also analyzed using a paired t-test, and showed that students’ consumption of sugar-sweetened beverages was significantly lower after the Teaching Gardens program \((\text{Mean}=20.60, \text{SD}=27.024)\) than before \((\text{Mean}=14.26, \text{SD}=18.763)\), \(P=0.045\). There was a significant difference between pre- and post-survey, sugar-sweetened beverage consumption means, resulting in the rejection of the null hypothesis, \(H_0\).

**Health Behavior Knowledge**

There were six questions from the pre- and post-surveys that were used to assess each students’ health behavior knowledge. The questions asked the children about daily fruit and vegetable serving recommendations, how much of a plate should include fruits and vegetables, whether the student felt certain they consumed fruits and vegetables as a snack each weekend, identification of healthy and unhealthy snacks, identification of healthy and unhealthy drinks, and finally, how many minutes of physical activity are recommended per day.

To analyze if there was a difference in students’ knowledge about fruit and vegetable serving recommendations, McNemar’s chi square test was performed. The test showed there was no significant difference between pre-survey responses in February and post-survey responses in June \((P=1.000)\). McNemar’s chi square test was also used to analyze children’s responses about how much of their plate should be filled with fruits and vegetables. Their responses were not significantly different before the intervention versus after the intervention \((P=0.694)\). Children were asked if they felt certain they consumed
fruits and vegetables as a snack on the weekends, responses were analyzed using a Wilcoxon matched pair test. The test showed children’s certainty that they eat fruits and vegetables as snacks on the weekend was significantly higher before versus after the Teaching Gardens intervention ($z=-7.184, P<0.001$).

Children were asked to distinguish between healthy and unhealthy snack items, and to circle those that they believed to be healthy. Their classifications of the six snack items were dichotomized and McNemar’s chi square tests were performed to determine any differences before and after the Teaching Gardens intervention. The results from the McNemar chi square tests demonstrated no significant differences between pre- and post-survey responses, for any of the snack items (Table 1).

**Table 1: Identification of Healthy Snacks**

<table>
<thead>
<tr>
<th>Healthy</th>
<th>Unhealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yogurt</td>
<td>Chips</td>
</tr>
<tr>
<td>Fruit</td>
<td>Donuts</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Candy</td>
</tr>
</tbody>
</table>

| P-Value | 0.188 | 1.000 | 0.754 | 1 | 0.687 | 0.687 |

Children were also asked to distinguish between healthy and unhealthy drinks, and to circle those that they believed to be healthy. Their answers were dichotomized and McNemar’s chi square tests were performed on each of the six drink options, to determine if there was a difference in children’s classification of the drink before and after the Teaching Gardens intervention. The results showed, children were more likely to correctly identify low-fat chocolate milk as an unhealthy drink after the intervention ($P=0.025$) than before the intervention. There were no significant differences, according to the McNemar’s chi square tests, in the children’s ability to accurately differentiate the other five drinks as healthy or unhealthy (Table 2).
Table 2: Identification of Healthy Drinks

<table>
<thead>
<tr>
<th></th>
<th>Healthy</th>
<th>Unhealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skim Milk</td>
<td>0.054</td>
<td>0.025</td>
</tr>
<tr>
<td>Water</td>
<td>1.000</td>
<td>0.648</td>
</tr>
<tr>
<td>100% Fruit Juice</td>
<td>0.648</td>
<td>0.453</td>
</tr>
<tr>
<td>Soda</td>
<td>0.453</td>
<td>0.146</td>
</tr>
<tr>
<td>Kool-Aid</td>
<td>0.146</td>
<td></td>
</tr>
<tr>
<td>Low-Fat Chocolate Milk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*bold values show statistical significance

Finally, children were asked how many minutes are recommended for physical activity per day. The Wilcoxon matched pair test was used to analyze their responses and to determine if there was a difference between their responses before and after the interventions. Children's responses were not significantly different before versus after the Teaching Gardens intervention ($z=-0.804, P=0.421$). Of the six questions related to healthy behavior knowledge, only one question was able to demonstrate a significant difference between children’s pre- and post-intervention responses. Since the majority of the healthy behavior knowledge questions failed to demonstrate a significant difference between pre- and post-surveys, we fail to reject the null hypothesis, $H_0$. 

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Chapter 8

DISCUSSION

The purpose of this study was to assess whether the Teaching Gardens obesity intervention program was able to produce changes in healthy behavior outcomes in children, to prevent obesity and cardiovascular disease. Children's survey responses were used to evaluate whether the Teaching Gardens program was successful in creating changes for those children who participated in the program. The results of this study indicate that garden visits and three on-campus family health nights were not enough to produce the changes desired, for all of the health behavior outcomes targeted.

Fruit and Vegetable Consumption and Dietary Habits

Based on children's responses on their pre- and post-surveys, there was no significant difference in 4th and 5th grade students’ fruit and vegetable consumption after participation in the Teaching Gardens intervention. The findings from this study are inconsistent with previous research which showcase school-based gardens’ ability to increase fruit and vegetable consumption in children. Several research studies demonstrated increased fruit and vegetable intake after implementation of a school garden as well as nutrition education components (McAleese & Rankin, 2007; Parmer et al, 2009; Somerset & Markwell, 2008). These studies showed that when students were involved in garden-based activities, such as planting, harvesting, and maintaining the garden, they were more likely to demonstrate an increase in their fruit and vegetable consumption as well as their self-efficacy to eat those healthy foods. The Teaching Gardens coordinator visits that included students’ participation in garden-based lessons were limited to activities which were to strengthen their
knowledge and participation in healthy behaviors. The only times the children participated in actual gardening activities were at Plant Day and Harvest Day, limiting their experience in the gardens growth and maintenance. In addition to their limited involvement in the garden with the coordinator, the Crestwood Elementary teachers did not implement their Teaching Gardens curriculum highlighting healthy behaviors in addition to math, science and literacy. The limited exposure to health behavior education as well as garden instruction time may have restricted the change in children’s fruit and vegetable consumption as seen in other studies.

Children demonstrated a significantly higher consumption of healthy snacks prior to the intervention than after the intervention, while the amount of unhealthy snacks eaten showed no significant difference. Healthy and unhealthy snack consumption was not a main area of focus in the Teaching Gardens intervention; however, the program believed that if students were able to increase their fruit and vegetable consumption, they would incidentally decrease their unhealthy snack consumption as well. In contrast to the Teaching Gardens findings on students healthy and unhealthy snack intake, one school-garden intervention demonstrated that students who participated in garden activities and nutrition education programs reported a decreased desire to consume unhealthy snack foods (O’Brien, Story & Heim, 2008). Another garden research study involving children, not introduced in a school but rather a community, exhibited increased healthy snack consumption among children in grades 2 through 5 (Koch, Waliczek & Zajicek, 2006). Limited nutrition education as well as lack of focus on decreasing unhealthy snack consumption may have contributed to these results in the Teaching Gardens intervention.
Physical Activity

The number of students that indicated they participated in physical activity the day prior to the survey showed a significant increase on post-surveys when compared to pre-survey responses. The increase in children who reported that they participated in physical activity after the intervention indicates that the Teaching Garden program may have influenced students’ healthy behavior. Other school-based garden interventions produced statistically significant results that support the Teaching Gardens program’s findings. Somerset and Markwell (2008) showed that children who participated in a community garden showed increases in their physical activity levels, similar to these results. Wells et al. (2014) school garden intervention produced study results which demonstrated significant increases in students’ levels of physical activity. Children who participated in the garden intervention were more likely to decrease their sedentary behavior and more likely to partake in moderate to vigorous physical activity. The significant findings from other garden interventions supports the Teaching Gardens findings that the increase in reported participation in physical activity may have been influenced by the various physical activity related components of the Teaching Gardens intervention such as the coordinator lessons and the family health events on-campus. However, responses to the number of overall minutes of physical activity children completed did not show a significant increase between the pre- and post-survey responses. This finding could be a result of the survey design used for this question (Appendix D) rather than actual lack of behavior change. Some children mentioned that they did not understand how they were supposed to respond to the question, or exactly what each graphic on the survey was demonstrating. The boxes intended for children to add their minutes of physical activity performed, caused confusion in many of the students, resulting in them leaving the spaces blank rather than filling in their time.
Sugar-Sweetened Beverage Consumption

The total number of ounces of sugar-sweetened beverages consumed by the 4th and 5th grade children showed a significant decrease from the pre-survey to post-survey. The Teaching Gardens program appears to be the first of its kind to target sugar-sweetened beverage consumption using a school-based garden intervention. However, studies that targeted sugar-sweetened beverage consumption by offering water as an alternative, showed that children demonstrated healthy behavior changes (van de Gaar et al., 2014). Van de Gaar and colleagues offered various activities that exhibited how “fun” water was to drink and distributed reusable water bottles for children to decorate and use daily. The children demonstrated decreases in their average sugar-sweetened beverage consumption and average servings of unhealthy drinks (van de Gaar et al., 2014). Because the Teaching Garden coordinator performed garden lessons that targeted sugar-sweetened beverage intake and the children were exposed to sugar-sweetened beverage alternatives at the on-campus events, it may be that the intervention influenced the students’ behaviors. The total number of ounces of healthy beverages consumed were significantly lower post-survey compared with pre-survey, the opposite of the expected result. Confusion about the correct healthy beverage identification, with options such as skim milk, low-fat chocolate and 100 percent fruit juice, may have contributed to this decrease. Children’s ability to distinguish between what percentages their fruit juice is, or what fat content their milk contains may have led them to skip the answer.

Health Behavior Knowledge

Children were unable to distinguish between which snacks were healthy and unhealthy on their pre- and post-surveys. Children also failed to show a significant increase in their ability to correctly identify which beverages are healthy and unhealthy on the student
The only beverage that children were able to demonstrate a significantly higher ability to correctly identify as unhealthy, was low-fat chocolate milk. Nearly all of the children, on both the pre- and the post-surveys, correctly identified water as healthy and soda as unhealthy, so it may have resulted in a ceiling effect, causing there to be no significant difference between pre and post-intervention. As the previous section mentioned, students were not sure what the terms “skim milk” and “100% Fruit Juice” were. While children were instructed to avoid sugar-sweetened beverages and to choose healthier alternatives for their consumption, the only alternative offered at the on-campus events and during the coordinator garden visits were water. The children may have been unsure of other healthy drink options, resulting in their incorrect identification of them on the survey.

There was no significant change in children’s ability to identify the recommended amount of fruits and vegetables they should eat each day or how much of their plate should be made up of fruits and vegetables at each meal. Previous research on garden interventions for children demonstrated significant increases in their nutritional knowledge (Morris and Zidenberg-Cherr, 2002; Evans et al, 2006). The study performed by Evans et al (2006) demonstrated that the more garden activities students participated in, the more significant their results were to increase their nutrition knowledge. The limited garden activities the students at Crestwood Elementary participated in may have led to their inability to produce similar results.

Also, there was a significant difference in children’s responses to whether they felt certain that they eat fruit and vegetables as snacks on the weekend, reflecting their self-efficacy to perform this behavior. However, the pre-survey responses were significantly higher than their post-survey responses. The garden intervention study by Evans et al (2009), found that students experienced increases in self-efficacy to consume fruits and vegetables.
after partaking in a garden intervention, contradicting these findings. O’Brien and Shoemaker (2006) produced similar results to Evans et al., showing that a garden intervention influenced children’s self-efficacy to consume fruits and vegetables. The change in survey mode may have contributed to this finding or the garden activities and family nights may have not been enough to influence their self-efficacy on eating fruits and vegetables.
Chapter 9

LIMITATIONS

The Teaching Gardens program was strong in its ability to obtain survey responses from the students. Over ninety percent of students returned their surveys, with 196 pre-survey responses and 175 post-survey responses collected from the 4th and 5th grade children. However, only half of the participants from the pre-survey were able to be compared to the post-surveys, due to an error in the distribution of the survey ID numbers to be used on the post-survey for identification. The inability to match all of the post-surveys to the pre-surveys led to only 105 participants used in data analysis. The overall interpretation of the results is limited due to the lack of a control group for comparison of findings. The short time frame for the study is not indicative of a long term behavior change for the children.

There were limitations with the implementation of the Teaching Gardens program at Crestwood Elementary School. The instrument used to collect baseline data and post intervention data was not a validated survey. The survey was created through the collaboration of the AHA and Johns Hopkins, specifically for the Teaching Gardens program and was needed for immediate use in the Teaching Gardens pilot study, so the ability to have the survey undergo a validation process was not possible. Validation processes usually involve tests and calculations which assess the instruments reliability, face validity, content validity, construct validity and criterion validity (Burton & Mazerolle, 2011). Reliability demonstrates the survey instruments ability to produce consistent results across multiple uses. Face validity as well as content validity are often determined by a panel of experts, in the field of the survey subject matter, who assess the appearance of the questions to ensure that they are clear and easy to understand as well as whether they are relevant and representative of the variables being measured. Construct validity is established if the
survey questions are determined to measure the variables that they are supposed to measure (Burton & Mazerolle, 2011). Criterion validity is assessed through comparison of survey questions to those of similar instruments, to determine its use over a similar instrument and to establish its ability to be used in the future. A survey that demonstrates reliability as well as face, content, construct, and criterion validity allows the researcher to exhibit greater confidence in their results and gives additional strength to the data collected. Also, the pre-surveys were given in paper format for the students to fill out, but they were administered in digital format for the post-survey, per teachers’ request. The change in format is a potential threat to the internal validity of the study, through instrumentation bias, which means results from the surveys may exhibit changes associated with the variation in survey modes rather than the intervention (Slack & Draugalis, 2001). Finally, the Teaching Gardens study may have experienced history bias as the surveys were given out at the end of the school day prior to their release for the day, possibly resulting in their inability to focus on the subject at hand while pre-occupied with their free time.

Crestwood Elementary School was the first to have the Teaching Garden program implemented by the American Heart Association, and the best way to involve both the community and the parents of the students was not determined. The parents of the 4th and 5th grade students were to be involved in Healthy Parents, Healthy Kids workshops which would teach parents the effective ways to incorporate healthy behaviors into their families’ lives. The workshops were intended to enhance the curriculum the children received in the garden as well as in classroom, leading to an overall increase in positive health behavior changes. However, there was limited participation from English speaking parents in the Healthy Parents, Healthy Kids workshops and the teachers at Crestwood Elementary did not
fully implement the Teaching Gardens classroom curriculum. There was also limited participation from the community at Plant Day as well as Harvest Day.
Chapter 10

SIGNIFICANCE & CONCLUSION

This study was unable to statistically show that a school-based obesity intervention program with the implementation of a school garden, aimed at 4th and 5th grade students, effectively influenced students’ healthy behaviors. Although the results of this study were not significant, this study led to recommendations that will help reduce the presence of unhealthy behaviors in children while increasing their healthy behaviors in future implementations of this program. With the rise of chronic diseases and ailments caused or enhanced by the ever increasing number of overweight and obese adults in the United States, healthy school-based intervention programs that target children at an early age are of great importance. With a better understanding of what intervention methods work to decrease the unhealthy behaviors associated with children becoming overweight or obese, programs can be implemented across the nation to help combat the rise of chronic disease and other issues.

For the past few decades, the weight status of children in the United States has fallen into the unhealthy categories of overweight or obese in a substantial number of children. American children have been consistently unable to meet the nation’s nutrition recommendations, falling short of the fruit and vegetable allotment they are supposed to consume daily. They have increased their intake of sugar-sweetened beverages along with low-nutrient, calorie dense foods that are readily available for their consumption. Not only are American children not able to adhere to healthy dietary patterns, but they have been failing to participate in the right amount of physical activity recommended for them each day. For these reasons, children today are threatened with a vast number of health
conditions, both acute and chronic, if they do not take the proper actions to change their behaviors and focus on a healthier lifestyle.

The unanimous belief among health professionals, teachers, politicians, parents, and many other concerned adults, is that interventions targeting healthy behaviors and prevention programs targeting obesity, need to be used to help get children on a healthier path. With over 90 percent of American children in attendance at school each day, the school setting provides one of the most wide-reaching avenues for the prevention of childhood obesity. Some children consume up to half of their daily calories at school, and have the opportunity to partake in physical activity during their recess and physical education classes. Recent decades have also showed that if these school settings offer the introduction of a school-based garden that allows children to have a hands-on role in the planting, growing, maintaining, and harvesting of their food, they are more likely to develop numerous healthy behaviors. If an obesity prevention program can be created that would influence the child’s environment through the introduction of nutrition education, physical fitness guidance, and successful ways to maintain lifelong healthy lifestyles, with the opportunity of an outdoor learning laboratory, America would have a better chance of combating the obesity problem in the United States.
Chapter 11

RECOMMENDATIONS

The Teaching Gardens program in Las Vegas was the first of the AHA Teaching Gardens programs to specify their own set of program objectives to complete by the end of the 2015-2016 school year as well as the first to incorporate a student evaluation component to assess healthy behavior outcomes. The program was able to collect a substantial amount of student survey responses, however three of the four null hypotheses failed to be rejected based on their answers. Since the program was not effective in its ability to create healthy behavior changes in 4th and 5th grade students at Crestwood, new strategies to target these behaviors and to evaluate them should be considered for future implementation in Teaching Gardens schools. This study has resulted in a number of recommendations in areas such as intervention development, implementation, data collection, and data evaluation (Appendix F), but for the purposes of this paper, only the most important areas will be discussed in detail.

Teaching Gardens Coordinator Lessons

While the Teaching Gardens coordinator was able to involve the children in a garden visit nearly every week over the course of the 13-week intervention, the development of the lessons, the organization of the lessons and the lesson duration can be improved for a more influential impact on children’s health behavior outcomes.

The coordinator lessons should be revised to include gardening activities as well as lessons influencing fruit and vegetable consumption, physical activity, sugar-sweetened beverage intake and healthy behavior knowledge. Previous garden interventions have demonstrated that when children participate in garden activities such as planting, weeding, watering, and harvesting, they develop a more vested relationship with fruits and vegetables.
In turn, this relationship can help increase their fruit and vegetable consumption as well as increase their physical activity (McAleese & Rankin, 2007; Morris & Zidenberg-Cherr, 2002; Wells et al, 2014). In addition to gardening activities, the lessons should be increased in length to forty minutes, or more, to increase their impact on the students. Previous garden lessons have been fifteen to twenty minutes in length, not allowing enough time for the children to fully participate in the activities. Also, if the children are only meeting in the garden once a week, they should spend as much time as possible out there to get maximum exposure to the garden and encourage more physical activity. To reduce the amount of time away from their instructional time, one of the biggest concerns for teachers and administrators, children should participate in their garden lessons during one of their prep periods, if possible. It would also be beneficial if the Teaching Gardens coordinator maintained an attendance sheet for those students who attend garden lessons to use in evaluation at the end of the intervention.

Finally, Teaching Gardens garden lessons should be revised to better target those healthy behavior outcomes that are to be influenced. Previously used garden lessons, by the Teaching Gardens program, employed activities which targeted at one health behavior outcome at a time (Appendix C). They should be revised to target multiple health behaviors at a time, especially if they are not increased in time. If the children are given an activity, every week, that targets not only fruit and vegetable consumption but also physical activity, they will be more likely to exhibit those behaviors at the end of the intervention. Physical activities, such as those included on the student survey, should be incorporated into the garden lessons to expose children to different modes of physical activity, which may result in their finding of one they feel more comfortable with for repeated enjoyment and participation. Using that same principle, additional fruit and vegetable tastings should be
incorporated into the lessons, to expose children to those lesser known fruits and vegetables they may have never before seen or tasted. Morris and Zindenberg-Cheer (2002) reported significant increases in their students’ preference for vegetables such as broccoli and snow peas after their participation in a garden intervention.

**Teaching Gardens Classroom Curriculum**

One of the biggest issues with the Teaching Gardens pilot study, was the failure to implement the in-class curriculum by the Crestwood teaching staff. Prior to the intervention, Crestwood Elementary school was given an “activation binder” which contained all of the information regarding the Teaching Gardens program including the in-class curriculum lessons. There was no formal introduction by the Teaching Gardens staff to the teachers about implementing the curriculum or reassurances to their concerns about whether the curriculum targeted Common Core areas that are required in their normal school lessons. For future Teaching Gardens interventions, there should be an orientation between the Teaching Gardens staff, the teachers and the principals to review the curriculum. The Teaching Gardens will be able to address any of the school’s concerns about the curriculum and provide recommendations for implementation. The Teaching Gardens in-class curriculum contains lessons that target math and literacy, two main areas of focus for the Common Core Standards. Also, additional lessons can be created to ensure that there are enough lessons that the teachers feel comfortable with using for their students.

Prior to implementation, each teacher should have access to the lessons for their classes, and get familiar with the material. The teachers should strive to implement at least one lesson from the Teaching Gardens curriculum, per week, to influence the children’s health behavior outcomes. Ideally, the teachers should perform as many lessons as possible in the garden, not only the Teaching Gardens lessons, but also their own. Any extra
exposure to the garden will increase their student’s likelihood of changing their behaviors. Teachers should implement a tracking system to log the number of times that they employ the use of the Teaching Gardens lessons with their students, and also the number of times they visit the garden. The Teaching Gardens staff can offer incentives to the teachers for implementing the Teaching Gardens lessons, such as an entry into a prize raffle for each lesson they give. The teachers could also be challenged against one another to see who uses the garden the most for instructional time or who implements the most Teaching Gardens lessons.

Also, Teachers should be encouraged to be as creative as possible at influencing children’s health behavior outcomes through the use of their instructional time. Writing assignments can be focused on a specific fruit or vegetable, encouraging children to research one and write an essay about it. They can encourage children to “cook” in the classroom, using their mathematics skills to read and measure fractions in class. Children can get physically active in the classroom by performing math equations with the representation of their classmates, demonstrating their ability to add, subtract and divide up their classmates. Teachers can also use children’s prep periods, to incorporate assignments such as drawing or painting fruits and vegetables in art class or researching fun facts about nutrition during their library visits.

**Student Survey Revisions**

The evaluation instrument used for the Teaching Gardens program was created in collaboration with Johns Hopkins University, prior to the implementation of the pilot study. The instrument was not validated or tested for reliability prior to its use in the intervention, resulting in a lack of strength associated with the results from the survey. The survey was child friendly in many ways with the wording choices and use of pictures for interpretation.
of the questions, but the overall clarity, and structure of the survey can be revised to ensure more accurate results in the future.

Many previously used children’s surveys use multiple choice questions or likert scale questions to assess children’s health behaviors, rather than a fill-in method. The Teaching Gardens survey received negative feedback about children’s inability to understand the questions that required them to fill in minutes of physical activity for each exercise listed, and to report the number of drinks or snacks they consumed. Regardless of the instructions, children were still unsure of what constituted one soda serving or one chip serving as a snack. For future Teaching Gardens surveys, the use of a table can be implemented to improve children’s understanding of the questions (Figure 7).

3. In the past month, how often did you drink?

<table>
<thead>
<tr>
<th></th>
<th>Never/less than once a week</th>
<th>Several times a week</th>
<th>Once a day</th>
<th>Twice or more a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Juice at home? (like apple or orange)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>B. Other drinks at home? (like ice tea, lemonade, fruit punch, Kool-Aid, Capri Sun, Sunny Delight, Snapple, Gatorade, Vitamin Water)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C. Soda?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Milk or other milk products?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Water?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7. Example of a previously used beverage consumption survey for children (Wright, Groisman-Perelstein, Wylie-Rosett, Vernon, Diamantis & Isasi, 2011)
The example (Figure 7) also provides additional sugar-sweetened beverage options that the Teaching Gardens survey does not include, such as Gatorade and Capri suns, popular beverages among children. The question is clear and concise, offering children the ability to also include the number of times per week they consume the beverages, giving a better picture of their actual behavior. The question design can be employed for physical activity questions as well as snack consumption.

**Parent Workshops**

Another area that should be focused on for future Teaching Gardens interventions, are the parent workshops used to influence the overall healthy lifestyles of the family. The pilot study showed limited participation by parents of children in the 4th and 5th grades. A large number of Spanish speaking parent participants attended the Spanish speaking workshops, however, a small number of them were actually parents of children in 4th and 5th grade. The Teaching Gardens program may see more significant changes in children’s health behavior outcomes if their parents participate in the Healthy Parents, Healthy Kids workshops, increasing their knowledge about nutrition and physical activity.

Teaching Gardens staff should focus on ways to increase parental involvement in the workshops and develop additional family health nights. Children’s informed consent forms should include an information request slip for parents to fill out in regards to the parent workshops. Through coordination with the school and teachers, invitations to the workshops should be sent home with the students as well as posted on the school’s website for parents to view. Children could be encouraged to ask their parents to attend the workshops, to increase their entries into a raffle for Springs Preserves passes or movie tickets. Parents can be offered grocery store gift cards, free membership to a local gym for one month, or entries into a raffle for a Nutribullet blender in return for their participation.
in the workshops. For parents that may be hesitant to attend the workshops due to their young children, a kid’s area or babysitting component can be added.
Appendix A
IRB Approval Form from CCSD

June 9, 2014

Victor E. Arredondo, MPH
Heart and Stroke Initiatives, Director
Western States Affiliate Office
American Heart Association
American Stroke Association
4445 S. Jones Blvd., Suite B1
Las Vegas, NV 89103

Dear Victor:

The Research Review Committee office of the Clark County School District has received your request entitled: American Heart Association Teaching Gardens. We are pleased to inform you that your sponsored proposal has been approved with the following provisions:

1. Participation is strictly and solely on a voluntary basis;
2. Provide letter of acceptance from any additional principals who agree to be involved with the study.

This research protocol is approved for a period of one year from the approval date. The expiration of this protocol is June 8, 2015. If the use of human subjects described in the referenced protocol will continue beyond the expiration date, you must provide a letter requesting an extension one month prior to the date of expiration. The letter must indicate whether there will be any modifications to the original protocol. If there is any change to the protocol it will be necessary to request additional approval for such change(s) in writing to the Research Review Committee.

Please provide a copy of your research findings to this office upon completion. We look forward to the results. If you have any questions or require assistance please do not hesitate to contact this office at 702-799-5195 or e-mail at laptich@internet.ccsd.net.

Sincerely,

Lisa A. Pitch
Coordinator III
Department of Accountability & Research Chair, Research Review Committee
c

Mary E. Pike - SPONSOR
Research Review Committee RRC-35-2014
Appendix B

IRB Approval Form from University of Nevada, Las Vegas

UNLV

Biomedical IRB – Exempt Review
Deemed Exempt

DATE: October 29, 2014
TO: Dr. Mark Buttner, Environmental and Occupational Health
FROM: Office of Research Integrity – Human Subjects
RE: Notification of IRB Action
Protocol Title: An Assessment of a 13 week Teaching Gardens Intervention on Healthy Behavior Outcomes in 4th and 5th Grade Students at Crestwood Elementary School in Las Vegas, Nevada
Protocol #: 1410-4975M

This memorandum is notification that the project referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46 and deemed exempt under 45 CFR 46.101(b)(4).

PLEASE NOTE:
Upon Approval, the research team is responsible for conducting the research as stated in the exempt application reviewed by the ORI – HS and/or the IRB which shall include using the most recently submitted Informed Consent/Assent Forms (Information Sheet) and recruitment materials. The official versions of these forms are indicated by footer which contains the date exempted.

Any changes to the application may cause this project to require a different level of IRB review. Should any changes need to be made, please submit a Modification Form. When the above-referenced project has been completed, please submit a Continuing Review/Progress Completion report to notify ORI – HS of its closure.

If you have questions or require any assistance, please contact the Office of Research Integrity - Human Subjects at IRE@unlv.edu or call 702-895-2794.
## Appendix C

### Teaching Gardens Coordinator Lesson Plans

#### Physical Activity Lesson Plan

<table>
<thead>
<tr>
<th>Title</th>
<th>Rainbow Hunt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Physical Activity</td>
</tr>
<tr>
<td>Author</td>
<td>Alexandra Kosmides</td>
</tr>
<tr>
<td>Grade level</td>
<td>All</td>
</tr>
<tr>
<td>Time duration</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Overview</td>
<td>Children will be able to imagine all of the colors that are in their garden while getting some physical activity in.</td>
</tr>
<tr>
<td>Objective</td>
<td>By the end of this lesson, students will be able to:</td>
</tr>
<tr>
<td></td>
<td>- Identify which colors are in their garden in what season (spring/fall)</td>
</tr>
<tr>
<td></td>
<td>- Get in some physical activity.</td>
</tr>
<tr>
<td>Materials</td>
<td>Paint chips</td>
</tr>
<tr>
<td></td>
<td>Two buckets</td>
</tr>
<tr>
<td>Activities and procedures</td>
<td>Gather the kids around and ask them if they're excited to exercise today. Tell them that they should get in at least an hour of exercise every day. Then tell them that they'll be getting in about 15 minutes right now. Have the kids reach into the bucket with the paint chips in it. Have them pick one out, but not look at it. When every child has one, tell them to run to the garden and look for that color. When they have found that color, they have to come back and tell you which color it was and where, then put it in the other bucket. They then get another color and repeat this until the lesson is over.</td>
</tr>
<tr>
<td>Conclusions</td>
<td>The students will be able to imagine all of the colors that are possible in their garden while getting in a lot of physical activity in the process. The kids should walk away with a better understanding of all the colors in nature, and a way to devise a plan to do this activity outside of this lesson.</td>
</tr>
</tbody>
</table>
# Physical Activity Lesson Plan

<table>
<thead>
<tr>
<th>Title</th>
<th>Bird Buffet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Physical Activity</td>
</tr>
<tr>
<td>Author</td>
<td>Alexandra Kosmides</td>
</tr>
<tr>
<td>Grade level</td>
<td>All</td>
</tr>
<tr>
<td>Time duration</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Overview</td>
<td>Children will be able to get up and move while choosing the best items for the jobs birds do.</td>
</tr>
<tr>
<td>Objective</td>
<td>By the end of this lesson, students will be able to:</td>
</tr>
<tr>
<td></td>
<td>• Evaluate the two best tools (bird beaks) that work the best for pollination and seed eating.</td>
</tr>
<tr>
<td></td>
<td>• Get in some physical activity.</td>
</tr>
<tr>
<td></td>
<td>• 5 pairs of chopsticks (labeled Heron beak with bird print out)</td>
</tr>
<tr>
<td></td>
<td>• 5 eyedroppers (labeled Hummingbird beak with bird print out)</td>
</tr>
<tr>
<td></td>
<td>• 5 serving spoons (labeled Pelican beak with bird print out)</td>
</tr>
<tr>
<td></td>
<td>• 5 pairs of tweezers (labeled Sparrow beak with bird print out)</td>
</tr>
<tr>
<td>Materials</td>
<td>Gather the kids around and ask them if they’re excited to exercise today. Tell them that they should get in at least an hour of exercise every day. Then tell them that they’ll be getting in about 15 minutes right now. Have the kids pick which “bird” they’d like to be. Once the kids have chosen which birds they’d like to be, tell them to move quickly around the garden and see which birds are best for what job (or if there’s even a job for the birds they picked!) Once they have figured out which birds work best, have them trade off and try to figure out what those birds might be eating instead.</td>
</tr>
<tr>
<td>Activities and procedures</td>
<td>The students will be able to interpret which birds do the best work in their garden. They will also get up and be moving around the garden. The students should walk away with a better understanding of some of the animals that visit their garden.</td>
</tr>
</tbody>
</table>
**Physical Activity Lesson Plan**

<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>Move Like the Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
<td>Physical Activity</td>
</tr>
<tr>
<td><strong>Author</strong></td>
<td>Alexandra Kosmides</td>
</tr>
<tr>
<td><strong>Grade level</strong></td>
<td>All</td>
</tr>
<tr>
<td><strong>Time duration</strong></td>
<td>20 minutes</td>
</tr>
<tr>
<td><strong>Overview</strong></td>
<td>Children will be able to imagine how far animals can move in one movement.</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>By the end of this lesson, students will be able to:</td>
</tr>
<tr>
<td></td>
<td>• Rate which animals move the farthest.</td>
</tr>
<tr>
<td></td>
<td>• Get them up and moving</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>• Removable tape</td>
</tr>
<tr>
<td></td>
<td>• Pictures of desert animals (Big horned sheep, kangaroo rat, tortoise, bobcat)</td>
</tr>
<tr>
<td><strong>Activities and procedures</strong></td>
<td>Gather the kids around and ask them if they’re excited to exercise today. Tell them that they should get in at least an hour of exercise every day. Then tell them that they’ll be getting in about 15 minutes right now. Ask the kids what kind of animals live in the desert. Show them the area where the pictures of the animals have been taped down and the measurements for how far those animals can jump. Have the students try to jump as far as the animals that are pictured. Once all the kids have had a turn, have them try again until time is up.</td>
</tr>
<tr>
<td><strong>Conclusions</strong></td>
<td>The students will be able to evaluate which animals live in the desert and how they move. They will also get in some physical activity and generate ideas of why the animals might move this way.</td>
</tr>
</tbody>
</table>
**Sugar Sweetened Beverages Lesson Plan**

<table>
<thead>
<tr>
<th>Title</th>
<th>How Much Sugar Is That?!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Sugar Sweetened Beverages</td>
</tr>
<tr>
<td>Author</td>
<td>Alexandra Kosmides</td>
</tr>
<tr>
<td>Grade level</td>
<td>All</td>
</tr>
<tr>
<td>Time duration</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Overview</td>
<td>Children will be able to assess the nutrition within their drinks.</td>
</tr>
<tr>
<td>Objective</td>
<td>By the end of this lesson, students will be able to:</td>
</tr>
<tr>
<td></td>
<td>• Rate which beverages are the healthiest between sodas, kool aid, herbal tea, and water.</td>
</tr>
<tr>
<td></td>
<td>• They will be able to decide between two healthy drinks out of five.</td>
</tr>
<tr>
<td></td>
<td>• Taste an alternative to soda as a healthy drink.</td>
</tr>
<tr>
<td>Materials</td>
<td>Soda bottles, Sugar, Seasonal fruit water, Cups</td>
</tr>
<tr>
<td>Activities and procedures</td>
<td>Ask the students if they like soda or juice. Wait for their response and then pass around the bottles filled with sugar. Let them think about how much sugar that is in one week. Then, ask them what they think healthy alternatives to juice, kool aid, and soda are.</td>
</tr>
<tr>
<td>Conclusions</td>
<td>The students will be able to critique which beverages are best for them, and conclude that water, herbal tea, and low fat/skim milk are the best options for them.</td>
</tr>
</tbody>
</table>
# Healthy Eating Lesson Plan

<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>Let’s Try Something New!</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
<td>Healthy Eating</td>
</tr>
<tr>
<td><strong>Author</strong></td>
<td>Alexandra Kosmides</td>
</tr>
<tr>
<td><strong>Grade level</strong></td>
<td>All</td>
</tr>
<tr>
<td><strong>Time duration</strong></td>
<td>20 minutes</td>
</tr>
<tr>
<td><strong>Overview</strong></td>
<td>Children will be able to assess the nutrition within their drinks.</td>
</tr>
<tr>
<td><strong>Objective</strong></td>
<td>By the end of this lesson, students will be able to:</td>
</tr>
<tr>
<td></td>
<td>• Try a new fruit or vegetable and rate how they feel about it.</td>
</tr>
<tr>
<td></td>
<td>• Seasonal fruits/vegetables</td>
</tr>
<tr>
<td></td>
<td>• Plates</td>
</tr>
<tr>
<td></td>
<td>• Silverware</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Ask the students if they like have tried whatever fruit/vegetable. Explain to them what is good about this fruit/vegetable and what nutrients they will get from it. Reiterate that they should be eating 4.5 cups of fruit a day.</td>
</tr>
<tr>
<td><strong>Activities and procedures</strong></td>
<td>The students will be able to critique the food that they have just eaten and tell you if they’d like to have it in their garden or if they’d eat it again.</td>
</tr>
<tr>
<td><strong>Conclusions</strong></td>
<td></td>
</tr>
</tbody>
</table>
Appendix D
American Heart Association (AHA) Teaching Gardens Children’s Survey
The following questions ask about foods and meals you eat, screen time, and physical activity. This is part of your school garden!

**This is NOT a test.**

There are no right or wrong answers; the best answer is the one that is right for you. If you don’t understand a word or a question, you can raise your hand and ask your teacher to explain it.

The answers you give will be kept private. No one will ever know what you say unless you tell them. Your name will never be used. Please be as honest as you can.
THANK YOU!

You’re done! You can raise your hand and turn in your booklet to the person that gave it to you.

ABOUT YOU

1. What is your date of birth?
   Please write down your answer inside the boxes

   __________ / _____ / __________
   Month     Day     Year

2. How old are you?
   Please write down your answer inside the boxes

   ____________
   Years Old

3. Are you a boy or a girl?
   Please fill in ONE answer.
   [ ] Boy
   [ ] Girl

4. How do you describe yourself?
   Please check ALL that apply.
   [ ] White
   [ ] Black or African American
   [ ] Hispanic or Latino
   [ ] Asian/Native Hawaiian/Pacific Islander
   [ ] Other: ____________________
FRUITS AND VEGETABLES

5. Yesterday, did you eat ANY fruit?
   - DO NOT count fruit juice
   - Please fill in ONE answer.
   - A No, I did not eat any fruit yesterday
   - B Yes, I ate one fruit yesterday
   - C Yes, I ate two fruits yesterday
   - D Yes, I ate three or more fruits yesterday

6. Yesterday, did you eat ANY vegetables?
   - Vegetables are salads, potatoes (boiled and baked), and all cooked and un-cooked vegetables.
   - DO NOT count French fries or chips
   - Please fill in ONE answer.
   - A No, I did not eat any vegetables yesterday
   - B Yes, I ate one vegetable yesterday
   - C Yes, I ate two vegetables yesterday
   - D Yes, I ate three or more vegetables yesterday

19. Yesterday, how many hours did you spend sitting in front of a TV, computer, or while using a cell phone or electronic handheld device like a tablet?
   - Please fill in ONE answer.
   - A I did NOT sit in front of a TV, computer, or while using a cell phone or handheld device
   - B Less than 1 hour
   - C 1-2 hours
   - D 3 or more hours

19. What is the most number of hours you should be in front of a screen (such as TV, computer, cell phone, handheld device) each day?
   - Please fill in ONE answer.
   - A 0 hours
   - B 1 hour
   - C 2 hours
   - D 3 or more hours
16. How many minutes in a day should you exercise or be active?
   Please fill in ONE answer.
   A 0 minutes
   B 0-20 minutes
   C 30-50 minutes
   D 60 or more minutes

SCREEN TIME

17. Yesterday, did you sit in front of a TV, computer, or while using a cell phone or handheld electronic device like a tablet?
   Please fill in ONE answer.
   A No, I did not sit in front of a TV, computer, or while using a cell phone or handheld device yesterday
   B Yes, I did sit in front of a TV, computer, or while using a handheld device yesterday

7. How many servings of fruit and vegetables should you eat today?
   Please fill in ONE answer.
   A 0 servings
   B 1-2 servings
   C 3-4 servings
   D 5 servings or more

8. At least how much of your plate should be fruits and vegetables?
   Please circle ONE answer.
   No vegetables
   One-fourth of a plate
   One-half of a plate
   Three-fourths of a plate
   The entire plate
9. Below is a sentence about fruit and vegetables. Shade in the circle that best describes how you feel about the sentences.

Please shade in ONE circle.

I feel certain that I eat fruits and/or vegetables as snacks during the weekend.

<table>
<thead>
<tr>
<th>I don't feel certain!</th>
<th>I feel a little certain</th>
<th>I feel sort of certain</th>
<th>I feel certain</th>
<th>I feel very certain!</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

15. Circle ANY of the activities that you did yesterday at home or after school and write the number of minutes below the picture.

For example, if you walked 10 minutes yesterday, write “10” under walking, or if you played basketball for 60 minutes yesterday, write “60” under sports.

Bike Riding

____ Minutes

Playing outside

____ Minutes

Running or dancing

____ Minutes

Marital Arts

____ Minutes

Walking

____ Minutes

Dancing

____ Minutes

Playing Sports

____ Minutes

Swimming

____ Minutes

Gymnastics

____ Minutes
13. Please circle ALL the healthy snacks you see below.

Chips, fries, pizza
Doughnuts, cookies, cakes
Fruit
Yogurt, cheese
Vegetables

Candy, chocolate, ice-cream

14. Yesterday, after school, did you exercise or do any activities outside or inside your home?

Activities can be playing outside, bike riding, running, karate, walking, dancing, sports, swimming, gymnastics, etc.

Please fill in ONE answer.
A. No, I did not exercise and/or do activities yesterday
B. Yes, I did exercise and/or do activities yesterday

DRINKS

10. Please circle ALL the drinks you had yesterday and write down the total number of servings below the picture.

For example if you drank two cans of soda, write the number 2 inside a box.

Soda
Water
100% Fruit Juice

Skim Milk
Kool Aid
Low Fat Chocolate Milk

___ Glass
___ Glass
___ Glass
___ Glass
11. Please circle ALL the healthy drinks you see below.

<table>
<thead>
<tr>
<th>Drink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soda</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Skim Milk</td>
</tr>
<tr>
<td>Kool Aid</td>
</tr>
<tr>
<td>Low Fat Chocolate Milk</td>
</tr>
</tbody>
</table>

100% Fruit Juice

12. Please circle ALL the snacks you had yesterday and write down the number you ate below the picture.

For example if you ate one apple, write the number “1” next to “any fruit” or if you had two cookies, write “2” next to the line that says “cookies”.

<table>
<thead>
<tr>
<th>Snacks</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chips, fries, pizza</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doughnuts, cookies, cakes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Chips</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fries</td>
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<td></td>
<td></td>
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<td>Pizza</td>
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<td></td>
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<tr>
<td>Cookie</td>
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<tr>
<td>Chocolate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice Cream</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yogurt, cheese</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yogurt</td>
<td></td>
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<td></td>
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<tr>
<td>Cheese</td>
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<td></td>
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<tr>
<td>Vegetable</td>
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<td>74</td>
<td>74</td>
<td>74</td>
</tr>
</tbody>
</table>
Appendix F

Recommendations for the Las Vegas Teaching Gardens Program

Intervention Development

- Obtain permission to collect BMI scores from children
- Revise Coordinator lessons to ensure that they target Common Core standards, as desired by CCSD, as well as healthy behavior outcomes
- Ensure that all 4th and 5th grade teachers have the Teaching Gardens curriculum, and are on board with using at least 1 lesson plan per week from the curriculum
- Develop methods to obtain parents for involvement in the Healthy Parents, Healthy Kids Workshops
- Develop workshops or classes to target seasonal health information and pitfalls
- Plan for additional family health nights at the schools, including community participation from gyms, grocery stores, health experts, etc.
- Work with the school’s health and wellness policy to help identify strengths and weaknesses to see how the Teaching Gardens program can collaborate and influence behavior

Implementation

- **Teaching Gardens Activities**
  - Involve children in at least one gardening activity each week (planting, watering, weeding, harvesting, etc.)
  - Involve children in at least one Coordinator visit each week, targeting one healthy behavior outcome per week, if not multiple
  - Implement the use of an attendance sheet for children’s Coordinator visits to the garden
- **Teaching Gardens Curriculum for Teachers**
  - Track the use of the in-class curriculum, and provide bi-weekly check-ins to ensure teachers are implementing the lesson plans
  - Provide incentives or hold competitions for teachers that stick to their goals of teaching at least 1 lesson per week
  - Provide support for teachers with the curriculum and encourage suggestions and critiques of the lesson plans
  - Implement the usage of an attendance sheet for teachers who take their children out to the gardens, link with the attendance for that day
- **Healthy Parents, Healthy Kids Workshop**
  - Encourage parents to include their 4th and 5th grade student’s name on their attendance sheet when they attend one of the HPHK workshops
• Provide multiple workshop series over the course of the school year with rotating curriculum for the parents
• Include healthy cooking demonstrations with meal-prepping to combat the time constraints parents face with children and work
• Offer a “Shop for your Health” lesson where parents meet at the grocery store and receive instruction on how to shop for healthy items
• Provide babysitting or child-friendly area for parents to bring their children during the workshops to ensure their participation
  o Other
    • Include a farm-to-school component, invite local farmers to bring samples of their produce for students to try during their lunch period
    • Hang fruit and vegetable propaganda around the cafeteria, include physical activity posters in the halls, and include sugar-sweetened beverage information in the classroom.
    • Send home fruit and vegetable newsletters regarding what is in season, include a recipe
    • Coordinate with the school district about field trips to local farms to see produce growing on a larger scale

Data Collection

  o Revise the student survey to improve design and clarity to help children better understand and answer the questions
  o Use only one mode of survey distribution to avoid validity concerns
  o Create a log so that each student has an ID for their pre- and post-survey to avoid the inability to match the two during evaluation
  o Incorporate an observation day(s) to have teacher or Teaching Gardens staff tally the number of students who consumed fruit and vegetables, unhealthy snacks, sugar-sweetened beverage or healthy beverages in the cafeteria
  o Obtain accelerometers for children to wear to record their physical activity, especially when they are in the school garden

Data Evaluation

  o Perform analysis on fruit and vegetable servings individually as well as together
  o Evaluate the influence of number of garden visits from the children against their health behavior outcomes
  o Include observation data into evaluation for behavior outcomes
  o If accelerometers are employed, evaluate the physical activity amount in regular classroom lessons versus those lessons held in the school garden
References


The Official Journal of the British Dietetic Association, 24(1), 96-100. doi:10.1111/j.1365-277X.2010.01126.x
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