A Sensory-Based Multi-Component School-Based Nutrition Intervention Among Fifth-Grade Students

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A SENSORY-BASED MULTI-COMPONENT SCHOOL-BASED NUTRITION INTERVENTION AMONG FIFTH-GRADE STUDENTS

by

Stacy Lyn Bevan

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE in

Nutrition and Food Sciences

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ABSTRACT

A Sensory-Based Multi-Component School-Based Nutrition Intervention among Fifth-Grade Students

by

Stacy Lyn Bevan, Master of Science
Utah State University, 2011

Major Professor: Dr. Heidi J. Wengreen
Department: Nutrition and Food Sciences

The nutritional status of children is declining as evidenced by the steady rise in childhood obesity rates over the last three decades. Consuming five servings of fruit and vegetables (FV) daily has shown to help with weight maintenance, but children are consuming far less than the recommended servings. This study was designed to test the efficacy of a sensory-focused multi-component school-based program at increasing vegetable intake among fifth-graders. Classroom, family, and community components allowed children to explore thirteen target vegetables with their senses including taste. Vegetable consumption was measured by digitalized observations of lunchtime vegetable selection and consumption. Vegetable acceptance was evaluated using a self-administered survey assessing attitude and behaviors related to vegetable consumption. Measures were assessed at multiple time points and compared between the intervention school and a comparison school matched for demographic similarities.
Parental consent was obtained for 136 fifth-graders to participate in the multi-component study and 114 were included in the plate waste study. Data were collected over six days of plate waste observations including two phases: the control phase (CP) and the target vegetable phase (TVP) where target vegetables were served in addition to the regular lunch vegetables.

Differences in mean vegetables taken and consumed during each phase of the plate waste study were analyzed using analysis of variance (ANOVA) and paired sample t-tests. When fried potatoes were included as a vegetable in the analysis, the comparison school took (P < 0.001) and consumed (P < 0.001) significantly more vegetables than the intervention school. There were no significant differences in vegetables taken (P < 0.258) and consumed (P < 0.217) when fried potatoes were excluded. Self-administered surveys were analyzed using the Fisher’s exact test and ANOVA. Significantly more children at the intervention school compared to the comparison school reported ever eating bell peppers, butternut squash, and cucumbers.

The findings of this study do not show significant differences in vegetable consumption when the intervention school is compared to the comparison school, but do show a small trend toward increased acceptance of target vegetables. Future studies should evaluate a larger sample size with increased frequency of taste testing opportunities.
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I also want to thank the Carol M. White Physical Education Grant and the Hidden Valley Ranch Grant awarded to the Cache County School District for funding this thesis project and all the teachers, school and foodservice staff at Canyon Elementary School for their enthusiasm and support for the program. I want to thank the USU Student Organic Farm for providing the fieldtrip opportunity and delicious produce to distribute to the elementary children, and the many dietetic students that assisted with the implementation of this project. I want to especially thank my husband who has been my biggest supporter throughout this journey, always giving me the encouragement that I needed, and my family for their love and support.

Stacy L. Bevan
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CHAPTER 1
INTRODUCTION AND BACKGROUND

ABSTRACT

Childhood obesity is becoming a major health threat in the United States. Many programs and initiatives have been implemented in an effort to attenuate this epidemic. School-based programs aimed specifically at increasing fruit and vegetable consumption is becoming an increasingly well-liked approach. Fruit and vegetables are nutrient-dense, low-calories foods which may displace higher calorie, nutrient poor foods. Consuming the recommended servings of fruit and vegetables may contribute to weight maintenance and risk reductions of chronic diseases and certain cancers, however many children are consuming much less than recommended. Ensuring the availability, accessibility, and development of taste preferences have been associated with children’s consumption of fruit and vegetables. This study implemented and tested the efficacy of a multi-component school-based intervention with sensory-based education to increase fifth-grade student’s acceptance and consumption of vegetables. Vegetable consumption was measured by visual plate waste data collection; vegetable acceptance behaviors and attitudes were measured using pre/post and cross-sectional surveys. Background, hypotheses, methods, and statistical procedures are included. This project was funded by the Carol M. White Physical Education Grant and the Hidden Valley Ranch Grant awarded to the Cache County School District (2007-2010).
INTRODUCTION

Childhood obesity is becoming an epidemic in the United States (U.S.).¹ The nutritional status of our nation’s children is now a major concern, with government, health organizations, and researchers all searching for a solution. One well-accepted approach to improving children’s nutrition is to implement school-based programs as a means to increase children’s consumption of fruits and vegetables. Fruits and vegetables are low-energy, nutrient-dense foods which contribute to satiety and may also help to displace high sodium and energy-dense foods.² Consuming five servings of fruits and vegetables daily have been identified as a method to prevent the development and progression of chronic diseases and certain cancers, and maintain an appropriate body weight.³-⁶ Despite the ample health benefits of consuming fruits and vegetables, national studies show that American adults and children are not consuming the recommended servings and in fact are consuming much less.⁷

Numerous studies have been conducted to increase children’s fruit and vegetable consumption. A large percentage of these studies have found statistically significant positive changes in children’s fruit and/or combined fruit and vegetable consumption, but when vegetable consumption was examined separately only a small trend toward significance or no change at all was found.⁸-¹³ These results may be attributable to children’s superior preference and acceptance for fruits in comparison to vegetables.¹⁴,¹⁵ Understanding that, it should not be surprising that the consumption of less preferred vegetables is more difficult to change.¹⁶
For these reasons, Utah State University (USU) Dietetic faculty and students developed and implemented an intervention aimed specifically at increasing vegetable consumption called *Canyon Colts Love Veggies*. This project was funded by the Carol M. White Physical Education Grant and a Hidden Valley Ranch Love Your Veggies Grant awarded to the Cache County School District (CCSD) to from April 2004 to April 2010. The objective of the grant program was to promote healthy eating and physical activity in schools as a means to decrease the incidence of childhood overweight and obesity in the U.S. Of the 12 elementary schools in the CCSD, Canyon Elementary School was chosen for the implementation of the vegetable-focused nutrition intervention. Canyon Elementary School is a Title I school meaning the school receives federal grants due to its high percentage of low-socioeconomic status children,\(^1\) with 45.5% of the children receiving free and reduced lunch, and 15.3% of the students as minorities.\(^2\)

The CCSD collaborated with USU Dietetic Program faculty and students to achieve the nutritional goals of the grant. This thesis project was completed during the last portion of the grant funding from August 2009 to May 2010. Previous interventions developed and implemented by USU dietetic faculty and students at Canyon Elementary School included monthly newsletters and tasting experiences highlighting a vegetable of the month, nutrition education in the afterschool program, and nutrition education curriculum provided to teachers to use as desired in their classrooms.

The purpose of the research discussed in this thesis project was to assess the efficacy of a multi-component school-based intervention with sensory-based education to increase fifth-grade students’ acceptance and consumption of vegetables, and develop and implement parent-child cooking classes (intended for all children attending Canyon
elementary school and their parents) to increase self-efficacy of preparing and providing vegetables to children at home. The intervention components included: (1) USU dietetic student-led vegetable-farm field-trips at the USU Student Organic Farm during the fall of 2009; (2) offering vegetable tasting opportunities in the cafeteria by means of a “Tasty Table”; (3) providing sensory-based classroom vegetable educations via dietetic students; (4) distributing free vegetables from the USU Student Organic Farm to families by way of classroom sensory-based educations, family cooking classes, and after school free vegetable distributions; and (5) providing family cooking classes to increase parents’ vegetable preparation knowledge and willingness to prepare and eat more vegetables at home.

BACKGROUND

Childhood obesity is becoming an epidemic in the U.S. with occurrence even among infants and toddlers.¹⁹ According to the National Health and Nutrition Examination Surveys (NHANES), the prevalence of obesity in U.S. children and adolescents over the last three decades has significantly increased.¹ Between 1976 and 2006, obesity rates in children ages 2 through 5 increased from 5.0% to 12.4%, in children ages 6 through 11 rates increased from 6.5% to 17.0%, and in adolescence ages 12 through 19 obesity rates increased from 5.0% to 17.6%.¹ These numbers are staggering as obesity rates have nearly tripled in each age category and even more than tripled in adolescents. Healthy People 2010 recognized overweight and obesity as one of the top ten health risk indicators and set a goal for decline in childhood and adolescent
overweight and obesity with a target prevalence of 5%.\textsuperscript{1,20} Disappointingly, the goal was far from being met and the prevalence of overweight children and adolescents is currently approximately 33%.\textsuperscript{1} One in three U.S. school-aged children is overweight or obese.\textsuperscript{21,22} Healthy People 2020 set forth the objective to “reduce the proportion of children and adolescents who are considered obese” by reducing obesity rates of children from 2 to 19 years old to 14.6%.\textsuperscript{23}

Childhood obesity is a major health concern and contributes to many chronic medical conditions and cancers.\textsuperscript{1,24,25} The Bogalusa Heart Study, a community-based study in Louisiana, identified that about 60% of overweight children between the ages of 5 to 10 years-old have at least one risk factor for cardiovascular disease and 25% have two or more risk factors.\textsuperscript{26} Childhood overweight and obesity may affect the child’s quality of life by lowering self-esteem and social functioning, while contributing to depression, discrimination, and teasing.\textsuperscript{1,24,27-29} These negative psychosocial aspects can thwart scholarly and social advancements and continue into adulthood.\textsuperscript{1,28,29} According to Whitaker et al., older childhood obesity is significantly associated with adulthood obesity.\textsuperscript{30} In agreement, Serdula et al. found in a review of literature, that approximately 30% of obese preschool children, 50% of obese school-age children, and 75% of obese teenagers grow-up to be obese as adults.\textsuperscript{31}

There are approximately twice as many overweight and obese adults as there are children,\textsuperscript{32} yet a large push has been made to focus efforts on children. Studies have concluded that children are more accepting of changes than adults and they are still in the process of developing dietary habits, so interventions aimed early in life are beneficial.\textsuperscript{12,16,33,34} Schools have been sought after as the location of implementation of fruit and
vegetable interventions, because they reach a large child population, provide continual contact during the childhood years, and offer a support system of teachers and school staff.\textsuperscript{27,35,36} In a review of school-based interventions with 7 out of 11 interventions in elementary schools, the results indicated that upper elementary and lower middle school years are the most effective.\textsuperscript{37}

**Benefits of Fruits and Vegetables (FV)**

Health professionals and researchers understanding the dire consequences of childhood obesity are promoting evidence-based practices to significantly reduce the incidence of childhood overweight and obesity. One well-accepted approach is an effort to increase children’s intake of fruits and vegetables. The American Dietetic Association evidence analysis library, an online library which provides a summary of the most validated research on various nutrition topics, determined that fruits and vegetables have a fair effect on adiposity in children.\textsuperscript{38} In addition, research has shown that the consumption of fruits and vegetables is positively related to health and has an inverse relationship to chronic diseases, numerous cancers, and excessive weight gain.\textsuperscript{39-43}

According to the World Health Organization, interventions promoting fruit and vegetable consumption may be an effective strategy to decrease the incidence of chronic diseases.\textsuperscript{44} Data collected by telephone interviews as part of the Behavior Risk Factor Surveillance Survey, a population-based study, was used to examine the connection between fruit and vegetable intake and chronic disease risk factors.\textsuperscript{45} The analysis revealed that the likelihood that an individual would consume five or more servings of fruit and vegetables a day was approximately 50\% greater for those who participated in
intense physical activity compared to those who were physically inactive, 30% greater for
nonsmokers in comparison with heavy smokers, 40% greater for those who have been
screened for blood cholesterol levels compared with those who have not, and 50% greater
for nondrinkers in relation to heavy drinkers. Serdula et al. interpreted from these
findings the importance of accounting for lifestyle factors in addition to dietary factors,
before assessing the beneficial effects of fruit and vegetable consumption on chronic
disease risk. Failing to control for non-dietary factors may lead to an over-calculation of
the protective effects fruits and vegetables.

Another population-based trial, Dietary Approaches to Stop Hypertension
(DASH), revealed the potent effect that eating a diet rich in fruits and vegetables, 8 to 10
servings a day, in combination with low-fat dairy products and lower saturated and total
fat can have on blood pressure and cholesterol levels. The DASH diet in comparison to
a control diet lowered study participant’s systolic blood pressure by 5.5 mm Hg, diastolic
blood pressure by 3.0 mm Hg, total cholesterol by 7.3%, low-density lipoprotein (LDL)
cholesterol by 9.0%, and high-density lipoprotein (HDL) by 7.5%. A step taken to
remove possible lifestyle confounding factors among participants included a physical
activity recall and report of alcohol consumption. Insignificant changes in lifestyle
patterns were found during the trial, indicating that the changes in health indicators were
due to increased fruit and vegetable consumption.

In a second trial, the DASH diet and three different levels of sodium intake were
studied to examine their effects on blood pressure. Weight was kept stable during the
study to prevent bias from lifestyle changes. The results of this study found even greater
significant decreases in blood pressure, especially at the lower levels of sodium intake in
both the DASH and the control diets. The greatest decreases in blood pressure were seen in those on the DASH diet in the lowest sodium intake group. Individuals with hypertension had decreases in systolic blood pressure of 11.5 mm Hg and those without hypertension decreased by 7.1 mm Hg.

These studies, although among adults, emphasize the important role fruits and vegetables play along with other nutrients as a dietary pattern in reducing risk factors for chronic diseases. Encouraging children to develop these heart-healthy dietary patterns may have substantial effects on their longevity and quality of life.

The World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (AICR) in their 2007 *Food, Nutrition, Physical Activity, and the Prevention of Cancer: Global Perspective* stated that non-starchy vegetables and fruit, especially those containing carotenoids and beta-carotene, have convincing evidence for reducing the risk of mouth, pharynx, larynx, esophagus, and stomach cancers. The WCRF and AICR recommend consuming 400 grams (five servings) of a variety of fruits and non-starchy vegetables a day for the best health benefits. This is further validated by a meta-analysis of case-control and prospective studies that found people who consume diets rich in fruit and vegetables are less likely to develop certain cancers.

In addition to being cancer and chronic disease preventative, fruits and vegetables assist in maintaining a healthy body weight. Fruit and vegetables are low in fat and have a high water content which makes them low in energy density. Therefore when fruit and vegetables are added to the diet, the energy density is reduced allowing more food to be consumed for a set calorie level, increasing satiety. Bell and Rolls conducted a feeding trial in which lean and obese women were given diets with varying levels of fat content
and energy density. The low-fat, low energy-dense diet contained more low-fat and fat-free dairy products, water, fruit, and vegetables in comparison to the higher-fat and energy-dense diet. Bell and Rolls found that both obese and lean women consuming the low-fat and low-energy-dense diets consumed less calories than the other groups. It can be concluded that consuming a diet rich in fruits and vegetables can help maintain body weight by increasing satiety while decreasing energy-density.

**Youth FV Intake Recommendations and Consumption Patterns**

The U.S. government has published several resources with recommendations for the general public on how to maintain health. Two of those resources are the Dietary Guidelines for Americans and the U.S. Department of Agriculture’s (USDA) MyPyramid food guide. The Dietary Guidelines for Americans (DGA) is updated every five years with the most current, science-based recommendations to promote healthy lifestyles and reduce the risk for chronic diseases through diet and physical activity. Food group guides, like the USDA MyPyramid, have been published since 1916 and categorizes food into five food groups and oils, while emphasizing that the acquisition of health comes through choosing lower calorie foods at the base of each food group and by increasing physical activity. Fruits and vegetables are the lowest calorie and most nutrient dense foods among the food groups and the 2005 DGA and the USDA MyPyramid recommend choosing and consuming them often. MyPlate introduced with the DGA released in 2010 recommends that children who are active for at least 30 minutes a day and are between the ages of 2 to 5 years should aim to consume approximately 1 to 1 ½ cups of
fruit and vegetables and children 6 to 11 years old should aim to consume approximately 1 ½ to 2 cups of fruit and 2 to 2 ½ cups of vegetables daily.⁵⁰

Although these recommendations are science-based and research has shown a link between fruit and vegetable consumption and reduction in excess weight gain and chronic diseases,³⁹, ⁴³ studies confirm that children and adolescents are not meeting these recommendations.⁷, ⁵¹ Guenther et al., using the data from the 1999-2000 NHANES and the 1994-1996 Continuing Survey of Food Intakes by Individuals, found that less than 20% of children between the ages of 9 to 13 years are consuming five or more servings of fruits and vegetables daily.⁷

School lunches provide a considerable percentage of the total fruits and vegetables consumed daily by elementary children, despite the fact that schools generally only provide one fruit and one vegetable serving for lunch.¹⁵, ⁵² The National School Lunch Program (NSLP) offers a nutritious lunch, meeting one-third of the Dietary Reference Intakes for calories, protein, calcium, iron, vitamin A and C for all children and adolescents attending school.⁴⁹, ⁵³, ⁵⁴ The NSLP is also required to follow the Dietary Guidelines for Americans by offering a variety of foods, limiting fat to 30% of total calories offered, saturated fat to less than 10% of calories offered, reducing sodium and cholesterol levels, and increasing the fiber content of meals.⁵⁴ Serving many different types of foods with a variety of fruits and vegetables is encouraged,⁴⁹ but unfortunately may be lacking in many NSLP meals.

Briefel et al., using data collected in the third School Nutrition Dietary Assessment Study, found that about half of all children participating in school lunch did not consume any fruit, 100% fruit juice, or vegetables while at school.²¹ Another study
assessing fruit and vegetable consumption in school lunch found that the average fifth-grade grade student consumed less than one serving of fruits and vegetables. Even more disturbing, a study using the 1999-2002 National Health and Nutrition Examination Survey (NHANES) data, found that French fries make up more than 28% of total vegetable consumption among U.S. children. These studies highlight the seriousness of the current problem—U.S. children’s lack of consumption of fruit and non-starchy vegetables. As children move to middle school and high school, fruit and vegetable consumption continues to decline; possibly from increased access to snack bar lines and vending machines. This dramatic decrease in fruit and vegetable consumption may be attenuated if children develop preferences for a variety of fruit and vegetables while in elementary school. For that reason, there is vital need for schools to serve fresh and appealing fruit and vegetables during school lunch to encourage preference development and intake of nutrient-dense fruits and vegetables.

**Factors Affecting Youth FV Consumption**

Youth consumption or lack of consumption of fruits and vegetables is influenced by numerous factors. According to Rasmussen et al. in a literature review of 98 articles, these factors include but are not limited to children’s age, gender, socioeconomic condition, taste preferences, parental fruit and vegetable intake, and home availability and accessibility. In a literature review of 21 studies, Blanchette et al. found that the greatest predictors of fruit and vegetable consumption for children aged 6 to 12 years old were accessibility, availability, and taste preference.
Most U.S. children spend the majority of their time at home or school. The NSLP is required to provide at least two servings of fruits and/or vegetables with lunch. However, children are recommended to consume five servings of fruits and vegetables a day, meaning the remaining servings need to come from outside of school or home. A Norwegian study among sixth and seventh graders revealed that children’s vegetable intake was significantly linked to home accessibility. Home is a comfortable and supportive environment for most children. It is a place where children develop many lifelong habits, especially daily consumption of fruits and vegetables. Exposing children to the tastes of fruits and vegetables in a supportive environment, such as the home, results in children being more willing to try and accept fruits and vegetables as part of their diets. Researchers found that children’s perception of the home environment was a greater predictor of children’s fruit and vegetable intake, than their parent’s perception of the home environment. This can be interpreted that in order for children to consume fruits and vegetables at home, they must be made aware that they are available and readily accessible.

Practices in the home environment such as availability and accessibility of fruits and vegetables, occurrence of family meals, and positive role modeling of parental consumption of fruits and vegetables have been recognized as potential contributors to children’s fruit and vegetable intake. Parents can make fruits and vegetables easy for children to access by placing fruit on the table or countertop in a bowl and/or having cut-up, ready-to-eat fruit or vegetables in the refrigerator. In a school-based study, Wind et al. found significant associations between parental involvement and children’s consumption of vegetables. Therefore, when developing a school-based program to
increase children’s consumption of fruits and vegetables, a parental/home component is vital.

Taste preference is defined as desiring one food over another. Bircher explained that humans have genetic predispositions beginning in the early years of life that affect food preferences. One of these predispositions is having an innate preference for sweet and salty tastes, while avoiding sour and bitter tastes. Consequently, children have a greater preference for the sweetness of fruits over the bitterness of vegetables and the consumption of vegetables is more challenging to increase. A study by Zeinstra et al. concluded that the taste of vegetables independently is unacceptable and too strong for children, but when eaten with other foods is more tolerable. In contrast to Zeinstra’s opinion, Havermans et al. declared that children’s reluctance to or experienced dislike of vegetables simply requires more exposure to those vegetables to shift their dislike. It has been shown that exposure to a specific vegetable for 10 consecutive days may improve children’s acceptance of that taste and diminish the reluctance of trying other vegetables, yet Wardle et al. found that some parents may not be willing or able to provide that many exposures. School lunch programs are another feasible option for additional exposure to those vegetables.

To emphasize the effects of repeated exposure on preference, Sullivan and Bircher conducted a small study with three different groups of preschool aged children. Each group was given a sample of tofu or ricotta cheese that was either plain (unflavored), sweet (added sugar), or salty (added salt). The children were exposed to one of these flavors for a total of 15 times and then assessed on preference changes and the ability to generalize that flavor preference to other foods. Sullivan and Bircher found that the
children’s preference increased for the particular flavor they were exposed to after 8 to 15 exposures, while their preference for the other flavors decreased. Interestingly, when exposed to a novel food (jicama) with the same flavor (plain, sweet, or salty) as the treatment food, the children preferred the treatment food to the novel food. This study demonstrates that preference for a particular food or taste can be learned through repeated exposures, but is not likely generalized to other foods with same flavoring. Therefore, it is pertinent to find a way to increase vegetable availability and create opportunities to taste unfamiliar vegetables as that is associated with increased vegetable preference.

Wardle et al. in a study comparing the effects of exposure and reward on acceptance of a new vegetable compared a control group, an exposure group, and exposure plus a reward group and found a significant linear trend in increased consumption of the vegetable in the exposure group that was not found in the reward group. Preference significantly increased in the exposure group compared to the control group, but the reward group only had an intermediate level of change that was not significant from the control group. Wardle’s study may indicate that to increase consumption and preference of vegetables, physical awards are not necessary and may impair the development of preference. Therefore sensory-based education, where children are able to taste and experience vegetables based on their own desires, could be beneficial to increasing vegetable acceptance and consumption.

Objectives

The purpose of this study was to assess the efficacy of a multi-component school-based intervention with sensory-based education to increase fifth-grade student’s
acceptance and consumption of vegetables. The intervention components, dates implemented, and assessments are listed in Table 1-1.

1. Increase fifth-grade children’s awareness and knowledge of vegetables and willingness to try new vegetables through a school-based multi-component intervention.
   a. USU Dietetic student-led vegetable-farm field-trip at the USU Student Organic Farm Fall 2009 school year.
   b. Offered cafeteria vegetable tasting opportunities by means of the “Tasty Table” to increase children’s willingness to try new vegetables.
   c. Provided classroom sensory-based vegetable educations to increase children’s and teachers’ knowledge of vegetables and willingness to try vegetables prepared/cooked in a new way.
   d. Distributed free vegetables from the USU Student Organic Farm by way of classroom sensory-based educations, family cooking classes, and after school give away to increase availability and consumption of vegetables at home.

2. Developed and implemented parent-child cooking classes for all children attending Canyon Elementary school and their parents to increase self-efficacy of preparing and providing vegetables to children at home.
   a. Conducted focus groups of parents whose children attend Canyon Elementary School to identify families’ nutritional needs and interests in learning.
Table 1-1. The school-based multi-component program timeline.

<table>
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<th>Interventions</th>
<th>Vegetable Farm Field Trip</th>
<th>Cafeteria Tasty Table</th>
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<td>Pre/Post Assessment Surveys (Sept 14, 2009/ Sept 28, 2009)</td>
<td>Plate Waste Study (Jan 26 to Feb 11)</td>
<td>Plate Waste Study (Jan 26 to Feb 11)</td>
<td>Plate Waste Study (Jan 26 to Feb 11)</td>
<td>Plate Waste Study (Jan 26 to Feb 11)</td>
<td>Plate Waste Study (Jan 26 to Feb 11)</td>
</tr>
</tbody>
</table>

b. Provided family cooking classes to increase family vegetable preparation knowledge and their willingness to prepare and eat more vegetables at home.

c. Developed an interactive blog specific for Canyon Elementary School students to increase family involvement, distribute recipes, and obtain feedback.

Hypothesis

1. A school-based multi-component program will positively increase fifth-grade students’ attitudes toward vegetable consumption.

Methods

The Institutional Review Board at USU reviewed and approved this school-based multi-component research study (see Appendix A for consent forms). All fifth-grade
children attending Canyon and Lincoln Elementary schools were invited to participate in the study. Canyon Elementary was chosen as the intervention school due to previous collaboration with the school and enthusiasm of the school staff and administration. Lincoln Elementary was chosen as the control school because of its similar demographics to Canyon Elementary. Parents/guardians of these fifth-grade students received an opt-out consent form to review and return if they did not wish their child to participate. There was no penalty for opting out. Data were collected from 93.8% of the 145 students. One student opted out of the study.

Each participant was given an ID number to protect personal identity. ID numbers and collected data were kept confidential, consistent with federal and state regulations. Data were collected from September 2009 to May 2010. Data collected consisted of pre- and post-assessment surveys for the fifth-grade students and their parents and 6 days of cross-sectional observations of lunch-time vegetable consumption.

Lunch-time observations of vegetable consumption took place on six different lunch periods (3 days of control vegetables and 3 days of control vegetables plus target intervention vegetables), each Tuesday and Thursday from January 26, 2010 to February 11, 2010. Data collected of lunch-time vegetable consumption was obtained by digitally photographing each fifth-grade student’s lunch tray containing their ID number before and after consumption of lunch.

Eligible participants for the parent focus groups received a consent form (see Appendix A) describing the particular study, procedures, risks and benefits, and a statement of confidentiality regarding participation in the study. Parents who desired to participate in the focus groups signed and returned consent forms.
Methods for objective 1: school-based multi-component program. Fifth-grade students at Canyon Elementary School were invited to participate in a school-based multi-component program with sensory-based education. In this program they had the opportunity to be involved in the interventions described below. The duration of the school-based program was from August 2009 to May 2010, one full school year. Fifth-grade students were assessed on vegetable preference, willingness to try vegetables, and vegetable intake. Canyon Elementary School fifth-graders (the intervention group) were compared to Lincoln Elementary School fifth-graders (the comparison group). Both schools participated in a preference survey and in a six day plate waste study (see methods for assessment objectives). These assessments were the outcome measures for each of the components of the multi-component program.

Methods for objective 1a: vegetable-farm field-trip. Fifth- and second-grade students attending Canyon Elementary School were invited to visit the USU Student Organic Farm. All grades were invited to attend the farm tour; however only the fifth- and second-grade teachers expressed desire to participate. The vegetable-farm field-trip was a means to increase the children’s awareness of the path food takes from the farm to their plates. Fifth- and second-graders toured the farm on different days to ensure the information provided was age-appropriate. Fifth-grade students completed a pre- and post-assessment field-trip survey (see Appendix E), explained in further detail in the methods of assessment objectives section.

The tour lasted approximately one and a half hours, where fifty minutes were spent at the farm and the last thirty minutes in a nearby agricultural building. At the farm the children visited five different stations including: compost piles, plant parts, how to
weed and water the farm, hoop-houses, and harvesting the vegetables with a scavenger hunt (see Appendix B). At the agricultural building, the children used their senses of taste, touch, smell, and sight to explore a variety of unfamiliar vegetables. Children had the opportunity of experiencing the complete process of seeing vegetables growing, assisting in the harvest of vegetables, and tasting the fresh vegetables. Each child was able to take fresh produce they personally harvested home to prepare and eat with their families. Researchers have shown children who participate in the growing and harvesting process of vegetables are more likely to consume those vegetables.59, 69

**Methods for objective 1b: Tasty Table.** Once a month, a “Tasty Table” was set up in the cafeteria during lunch. The “Tasty Table” provided opportunities to try samples of vegetables prepared in a delicious recipe that were harvested from the USU Student Organic Farm from August 2009 to January 2010, and then bought from a local grocery store for the remainder of the school year. Each month the “Tasty Table” highlighted a different vegetable including: August- zucchini, September- tomatoes and peppers, October- carrots, November- purple potatoes, December- potatoes, January- Onions, February- broccoli, March- asparagus, and April- salad greens (see Appendix D for recipe handouts). Vegetables were highlighted based on seasonal availability. Viva Vegetables Recipes70 were used for the majority of the vegetable recipes prepared. “Kid-friendly” recipes were found for the remaining “Tasty Tables.” Samples from the “Tasty Table” were offered to all students, teachers, and staff at Canyon Elementary School. It was important that the staff and teachers were allowed to participate in sampling from the “Tasty Table” as they were great models for the children and set a strong example of the importance and satisfaction of eating vegetables.
To assess the effectiveness of the “Tasty Table”, fifth-grade students participated in a plate waste study, and vegetable consumption was compared to a comparison school. The plate waste study is explained further in the methods of assessment objectives section.

**Methods for objective 1c: classroom sensory-based education.** Dietetic students presented a fifteen-minute sensory-based vegetable education once a month (see Appendix C). Each month highlighted a different vegetable to the fifth-grade classes at Canyon Elementary School. The children were educated briefly about the history and/or important facts concerning the highlighted vegetable. Children had the opportunity to help prepare a recipe with that vegetable and then taste the dish they helped prepare. The children were provided with the recipe and produce to take home, so they could prepare it at home with their families. The classroom sensory-based vegetable educations were assessed using the plate waste study to see if vegetable preference and consumption has increased.

**Methods for objective 1d: free produce distribution.** Zucchini from the USU Student Organic Farm was distributed free in a give-away to all students attending Canyon Elementary School who brought back a parent/guardian signed ‘Veggie Buck’ with the amount they wanted specified. Other produce was freely distributed to fifth-graders following the classroom sensory-based vegetable educations, and to families that attended the family cooking classes so they could practice the recipes they learned in the class at home. Produce was given away from August 2009 to January 2010.
**Methods for objective 2a: parent focus groups.** Two focus groups were conducted with parents whose children were attending Canyon Elementary School. One focus group was conducted in English and the other in Spanish. The focus groups were used to: 1) assess the nutritional needs of families in the Canyon Elementary region and 2) to learn what their interests are in nutrition education. Each focus group was administered by a trained facilitator in a relaxed setting. Discussions were guided by five main questions developed by the primary investigators. Daycare and snacks were provided. Each participant received $20 for coming.

The data obtained from the focus groups were used to develop family cooking classes. In the past cooking/nutrition classes have been offered, but attendance was extremely poor, so efforts were made to identify relevant topics, preferred schedule and format of classes, marketing methods, and incentives for attendance.

**Methods for objective 2b: family cooking classes.** Family cooking classes were offered twice in the fall and twice in the spring to children that attended Canyon Elementary School and their parents. Each class provided hands-on education on how to pick, prepare, and store specific vegetables. The class participants had the opportunity to sample recipes made with the highlighted vegetables. The participants were able to take home a handout with tips and recipes learned in the class, as well as fresh produce to try cooking the learned recipes at home. The effectiveness of these classes was assessed by vegetable consumption in the plate waste study.

**Methods for objective 3: interactive recipe blog.** Dietetic students developed an interactive blog for Canyon Elementary School (http://www.canyoncoltsloveveggies.blogspot.com/). The blog contained recipes from the “Tasty Table”, classroom sensory-
based vegetable educations, family cooking classes, and recipes including the vegetable of the month. The posted recipes included detailed pictures of pertinent steps in the process of preparing the recipe. This assisted those who were new at cooking or were not familiar with a particular cooking technique. The blog created a comfortable atmosphere for cooking and nutrition-related discussions, recipe sharing, and polls on what vegetables were favored.

Every other week a discussion or recipe was posted on the blog. The discussion was used to get feedback from the children about what vegetables they liked, how they liked them prepared, what new vegetable they tried that week, etc. The week opposite of the discussion posting, a recipe using the vegetable of the month was posted. Flyers were sent home with each student at the intervention school informing parents about the interactive vegetable blog. A “hit counter” was incorporated on the blog to assess the number of visits to the site. Unfortunately the blog was poorly utilized.

REFERENCES


17. US Department of Education. Improving basic programs operated by local educational agencies (Title I, Part A).

18. Utah State Office of Education. Fall enrollment by school, district, grade, gender & ethnicity.


CHAPTER 2
SCHOOL-BASED INTERVENTIONS AIMED AT INCREASING FRUIT AND VEGETABLE CONSUMPTION: A LITERATURE REVIEW

ABSTRACT

Objective: This review assesses the effectiveness of five components utilized in school-based multi-component programs, assessment tools as a measure for change in vegetable consumption, and the role of theories in multi-component programs.

Design: Ten elementary school-based multi-component programs which reported changes in vegetable and/or fruit and vegetable consumption were included in this literature review to be analyzed.

Outcome Measures: Components of programs associated with increased vegetable consumption.

Results: Components that increased vegetable exposure and tasting opportunities resulting in enhanced preference demonstrated the highest increases in vegetable consumption.

Conclusions and Implications: Implementation of individual components to increase vegetable consumption does not appear to be as effective as the synergistic effect seen when combining multiple components. Applying theory-based approaches may play a vital role in the effectiveness of multi-component programs at increasing vegetable consumption.
consumption. Mealtime observations provide the best and most reliable estimation of fruit and vegetable consumption among elementary aged-children.

**INTRODUCTION**

Institutes, organizations, and many researchers for decades have understood the threat of obesity, especially in United States (US). Consequently, they have implemented initiatives and programs in an attempt to improve eating habits and attenuate the obesity epidemic. In 2010, new research-based recommendations were released by the US Department of Agriculture (USDA) and US Department of Health and Human Services known as the Dietary Guidelines for Americans (DGA). The goal of DGA is to improve our Nation’s health through promotion of nutritious eating and physical activity. The 2010 DGA discloses four areas of concern among American’s lifestyles including balancing calories to manage weight, foods and food components to reduce, foods and nutrients to increase, and building healthy eating patterns. Increasing consumption of fruits and vegetables is the first recommendation listed under the foods and nutrients to increase group. The DGA provides three reasons as justification for this recommendation, including the majority of fruit and vegetables (FV) contain a variety of nutrients that are under consumed in the US, consumption of FV is associated with reduced risk of many chronic diseases and certain cancers, and FV are nutrient-dense low-calories foods that assist in maintenance of a healthy weight among children and adults.
Other research has also shown that the consumption of fruits and vegetables is positively related to health and has an inverse relationship to chronic diseases, numerous cancers, and excessive weight gain.\textsuperscript{2-6} In a study with eight year-old children and their parents, Vanhala et al. found that overweight children and their mothers consumed fruit and vegetables significantly less often than normal weight children and their mothers (P < 0.001),\textsuperscript{7} indicating a link between vegetable consumption and weight maintenance. FV are nutrient-dense foods, but low in calories. Adding FV to your snack or meals allows for consumption of the same volume and weight of foods and comparable satiety, while providing considerably less calories.\textsuperscript{8} Leahy et al. altered the energy density of a two day menu by decreasing fat and sugar content and increasing FV.\textsuperscript{9} Leahy et al. found preschool children consumed the same weight of the reduced energy dense food, thus decreasing the energy intake by 27%.\textsuperscript{9} Increasing FV consumption and lowering fat and sugar content, as was done in Leahy’s study, results in decreased energy intake which is associated with weight loss.\textsuperscript{10} The American Dietetic Association evidence analysis library established from available valid research, fruits and vegetables have a fair effect on adiposity in children.\textsuperscript{11}

Although FV have many health benefits and may assist with weight maintenance, children are not consuming the recommended servings.\textsuperscript{12} For this reason well publicized nutrition initiatives including the National 5-A-Day for Better Health Program\textsuperscript{13} and the Fruit and Veggies More Matters health initiative were developed to promote increased consumption of FV each day.\textsuperscript{14} These initiatives and guidelines, along with many others, have broadly focused on the US population as a whole. However, as childhood obesity rates continue to rise with approximately 50% of obese school-age children growing up
to be obese adults, importance has been placed on developing successful programs to implement among youth aimed at halting the progression of this challenging epidemic.

In February 2010, first lady Michelle Obama announced her nationwide campaign, entitled Let’s Move! Let’s Move! is an effort to combat childhood obesity in one generation. The campaign focuses on four main objectives including giving parents support to make healthier choices, offering more nutritious foods in schools, increasing children’s physical activity levels, and making healthy foods more accessible and affordable in all parts of the country. In 2004, the Institute of Medicine (IOM) acknowledged that schools should be fundamentally involved in childhood obesity prevention, as is emphasized in Obama’s campaign, Let’s Move!

Schools have become a well-accepted setting for childhood overweight and obesity prevention interventions because they provide an established learning environment where information can easily be shared, nutritious food provided, healthful behaviors reinforced, and data gathered. The average time spent in school by children and adolescents is approximately six hours a day. During those six hours, the majority of all youth consume on average 35% of their daily food intake and one-tenth of youth consumes about 67% of their daily food intake. Consequently, schools are prone to have some influence on children’s eating behaviors, especially consuming FVs.

This potentially substantial impact schools may have on influencing healthy eating patterns in children has led to the implementation of numerous school-based nutrition programs. The American Dietetic Association (ADA), the Society of Nutrition Education (SNE), and the American School Food Service Association (ASFSA) stated that effective school-based nutrition programs include education about foods and
nutrition, school environments that support healthful eating and physical activity, involvement of parents and the community, and involvement of the school health services. As a result, a great deal of research is being conducted on programs that incorporate two or more of these components, referred to as multi-component programs.

Multi-component programs have been implemented and evaluated for effectiveness in reducing childhood obesity, improving health indicators (i.e. body mass index and blood pressure) and key behaviors associated with childhood overweight and obesity such as television and computer screen time, physical activity, and nutrition and eating behaviors such as increasing FV consumption.

The focus of this review is to assess the effect of school-based multi-component programs on children’s vegetable consumption. Most school-based programs published in the literature target increasing both FV consumption, thus literature was determined relevant and included in this review if it was school-based, focused on elementary-aged children (kindergarten to sixth-grade), and vegetable consumption and/or combined FV consumption was reported. An analysis of the effectiveness of each component in these programs, the learning and behavior-based theories applied, and assessment tools used for evaluation of the success of each program, will be reviewed and discussed as a means to evaluate which components are most successful at increasing children’s vegetable consumption.
BACKGROUND

Several studies have confirmed what many parents, foodservice staff, and nutritional professionals have known for years, that children prefer and accept fruits more easily than vegetables\textsuperscript{28,29} and that consequently the consumption of vegetables is more difficult to change.\textsuperscript{30} Research has found that the greatest predictors of FV consumption for children aged 6 to 12 years old were accessibility, availability, and taste preference.\textsuperscript{31} Among the numerous studies conducted to increase children’s FV consumption, the majority show significant positive changes in children’s fruit and/or combined FV consumption.\textsuperscript{27,32-36} However, vegetable consumption examined separately shows no change or simply a small trend toward significance.\textsuperscript{27,32-36} These studies confirm that positive changes in fruit intake is accomplished more easily than with vegetables. The explanation for this division may be that sweet-tasting fruit merely needs to be made more accessible and available to increase consumption. In contrast, vegetables need to be made more accessible, available, and preferences need to be developed. Accordingly, it should be considered essential to school-based multi-component programs to include a component focused specifically on increasing vegetable preference in order to increase consumption.

Components of Multi-Component Programs

In school-based FV programs, the type of components chosen to be implemented may be a limiting factor of its success depending on the overall objectives of the program. Objectives may vary, but often include increasing attitudes towards, knowledge
of, preference for, and consumption of FV. It appears that developing preference for vegetables is one of the strongest predictors of vegetable consumption. Children may learn an abundant amount of information on the nutritional aspects of FV, but if they never develop a preference it is unlikely there will be a significant increase in the consumption of FV. Therefore, program components which focus on instructing children on taste and health benefits of vegetables, without children actually tasting or being exposed to the vegetable, are not likely to be effective in increasing consumption.

Components that have been incorporated into FV programs in an attempt to accomplish health objectives include sensory or experiential learning activities, modifications in the cafeteria, classroom activities, home/community involvement, and rewards for consumption of FV. A few of these components overlap, for example modifications in the cafeteria may also include rewards, or classroom activities may include a sensory component. Table 2.1 lists each study design, components included, and outcomes in regards to vegetable and or combined FV consumption. Table 2.2 describes the components incorporated in each study that was included in this review.

**Sensory and/or experiential learning component.** Sensory-based and experiential learning involves practical, hands-on learning where students are actively involved in the learning process. These methods of learning have similar concepts, but are defined differently. Sensory-based learning involves using the senses to gain knowledge, whereas experiential learning is a process where the learner interacts with the world and incorporates new knowledge into previous ideas. Thus, experiential learning involves using our senses in application of a task, which leads to a more in-depth understanding of the content than is achievable through classroom instruction.
<table>
<thead>
<tr>
<th>Program</th>
<th>Grade</th>
<th>Sample Size (# children)</th>
<th>Objectives</th>
<th>Program Components</th>
<th>Theory-Based</th>
<th>Length</th>
<th>Groups Analyzed</th>
<th>Evaluation Measures</th>
<th>FV Consumption Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gimme 5⃣2</td>
<td>4⃣th</td>
<td>16 schools (1172)</td>
<td>Dietary changes at home and F&amp;V intake and related psychosocial variables.</td>
<td>Sensory, experiential, home, community, classroom, rewards</td>
<td>SCT</td>
<td>24 sessions over 2 years</td>
<td>Treatment and control groups</td>
<td>7-day food record, parent telephone interviews, and student survey assessing psychosocial measures</td>
<td>Significant group by time effects in tx group for F&amp;V combined (p = .038) and vegetables (p = .004). Tx group vegetable intake increased .07 servings yr 1, and decreased .05 serving yr 2. Overall difference between tx and control was 0.2 servings of vegetables in yr 1.</td>
</tr>
<tr>
<td>5-a-Day Power Plus⃣3</td>
<td>4⃣th</td>
<td>20 schools (1612)</td>
<td>Increasing F&amp;V consumption.</td>
<td>Sensory, experiential, cafeteria, home, community, classroom, rewards</td>
<td>SCT</td>
<td>~3 months each year for 2 years</td>
<td>Treatment and control groups</td>
<td>Random sample lunchtime observations, 24-hr recalls, parent telephone surveys, and health behavior questionnaire</td>
<td>Lunchtime observations significant for differences in fruit consumption (p &lt; .001), but not for vegetables (.63 servings to .79 servings or +.16 servings, p = .17)</td>
</tr>
<tr>
<td>High 5⃣</td>
<td>4⃣th</td>
<td>28 schools (1698)</td>
<td>Children and parents consume more F&amp;V, less Fat &amp; kilos, higher psychosocial variables related to F&amp;V intake.</td>
<td>Sensory, cafeteria, home, classroom, and rewards</td>
<td>SCT</td>
<td>1 year with 2 booster session the next year</td>
<td>Treatment and control groups</td>
<td>24 hr recall interviews, cafeteria observation on sample of students, psychosocial questionnaire, and parent questionnaire</td>
<td>Fruit and vegetable consumption both significant at yr 1-2 follow-ups using 24 hr recall. Neither significant with bulk plate waste. Vegetable intake went up by .03 servings (to 12 servings) in tx group, but was always less than control by ~.03 servings.</td>
</tr>
<tr>
<td>5-a-Day Power Play⃣4</td>
<td>4⃣th</td>
<td>49 schools (2684)</td>
<td>Self-reported changes in F&amp;V consumption</td>
<td>Sensory, home, classroom, community</td>
<td>SCT</td>
<td>8 weeks</td>
<td>Control, school intervention (T1), and school and community intervention (T2)</td>
<td>Prepost California Children's Food Survey (24 hr food diary, and attitudinal questions)</td>
<td>Fruit and vegetable overall day's intake increased by 2 servings for T1, and 4 servings for T2. Only lists combined FV.</td>
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### Table 2.1. (continued)

<table>
<thead>
<tr>
<th>Program</th>
<th>Grade</th>
<th>Sample Size (# children)</th>
<th>Objectives</th>
<th>Program Components</th>
<th>Theory-Based</th>
<th>Length</th>
<th>Groups Analyzed</th>
<th>Evaluation Measures</th>
<th>FV Consumption Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Nutrition Project</td>
<td>Year 3: 3rd–5th</td>
<td>Year 3: 3 tx (768) and 1 comparison school (181)</td>
<td>Dietary behavior change (whole grains and FV) with blending of theories.</td>
<td>Sensory, experimental, cafeteria, home, classroom, community</td>
<td>SCT, CDT, and educational theories of Dewey</td>
<td>Years 3 and 4 of a 4 year project</td>
<td>Treatment and comparison groups</td>
<td>Plate waste pre-post year 4, food recall/record, survey on knowledge and attitudes, focus group with parents and teachers, and teacher interviews</td>
<td>Tx group at lunch ate significantly more fruit (3 servings, p &lt; .001) and vegetables (25 servings, p &lt; .01) than comparison group. Change in tx group pre to post was not significant for vegetable intake (increased 0.09 servings).</td>
</tr>
<tr>
<td>School-based FV Promotion Program</td>
<td>K – 1st</td>
<td>4 schools (297)</td>
<td>Impact of program on FV consumption during lunch and sustained increases of FV consumption over time.</td>
<td>Cafeteria, home, classroom, rewards</td>
<td>SCT</td>
<td>~ 1 year</td>
<td>Experimental and control group</td>
<td>Weighed plate waste (23% of students), child and acceptability questionnaires, FV preference surveys, and parent interviews</td>
<td>Experimental group ate significantly more FV at lunch than did the control at year 1, but only fruit in year 2. Vegetable intake increased by 10 g in year 1 and decreased 3 g in year 2. Change in servings to year 1 was 0.7 servings more for tx group.</td>
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<tr>
<td>Free FV Distribution Program</td>
<td>K – 6th</td>
<td>6 schools (~1168)</td>
<td>Effects of a free FV distribution and a multi-component curriculum compared with a control on FV intake</td>
<td>Sensory, cafeteria, home, classroom, community</td>
<td>Free FV distribution group (DI), multi-component group (MC), control group</td>
<td>~ 1 year</td>
<td></td>
<td>Baseline and follow-up intake survey questionnaires completed by parents (food recalls and FFQ)</td>
<td>Both DI and the MC were successful at improving average fruit intake. DI was more effective at improving vegetable intake at dinner (P &lt; .001) and for non-native children (P &lt; .01) and vegetable snack time for 4th–6th graders (P &lt; .05) and boys (P &lt; .05). Vegetable intake for DI increased 13 g, MC decreased by 2 g.</td>
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<tr>
<td>Program</td>
<td>Grade</td>
<td>Sample Size (# children)</td>
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<tr>
<td>Garden-Based Nutrition Education</td>
<td>6th</td>
<td>99 students</td>
<td>Measure effects of garden-based education on FV consumption</td>
<td>Sensory, experiential, cafeteria, classroom</td>
<td>---</td>
<td>12 weeks</td>
<td>Control, nutrition education (ES2), and nutrition education and gardening (ES2) groups</td>
<td>3 consecutive days worth 24 hr food record booklets (pre/post)</td>
<td>FV servings significantly increased for ES2 compared to control school and ES1. Fruit increased 1.13 servings (p&lt;0.001), overall day's vegetables intake increased by 1.4 servings from 1.2 to 2.6 servings (p&lt;0.001)</td>
</tr>
<tr>
<td>School-Gardens</td>
<td>2nd</td>
<td>6 classes (115)</td>
<td>Effects of a school garden on children's FV knowledge, preference, and consumption</td>
<td>Sensory, experiential, classroom</td>
<td>---</td>
<td>28 weeks</td>
<td>Control, nutrition education (NE), and nutrition education and gardening (NE+G) groups</td>
<td>Lunchroom observations, pre-post FV survey, FV preference questionnaire with taste test</td>
<td>NE+G ate significantly more vegetables (p&lt;0.01) at lunchtime - increased 0.3 portions from 0.7 portions to 1.0. That is .5 portions more than the control group and .4 portions more than the NE group.</td>
</tr>
<tr>
<td>Food Dudes</td>
<td>4 yrs - 11 yrs</td>
<td>3 schools (402)</td>
<td>Impact on FV consumption</td>
<td>Cafeteria, home, classroom, rewards</td>
<td>---</td>
<td>8-12 day baseline followed by 16-day intervention</td>
<td>3 treatment groups, no controls</td>
<td>Lunch and snack plate waste observations, FV preference survey using photos, 24 hour recalls via parent phone calls in 1 of the 3 schools</td>
<td>Significant increases in lunchtime fruit and vegetable intake (p &lt; .001). Fruit intake increase .69 portions and vegetables .48 portions for 7-11 yr-olds.</td>
</tr>
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</table>

FVJ = fruit, juice, vegetables; SCT = social cognitive theory; FV = fruit and vegetables; CDT = cognitive development theory; FFQ = food frequency questionnaire
<table>
<thead>
<tr>
<th>Description</th>
<th>Sensory/Experiential</th>
<th>Cafeteria</th>
<th>Home/Parent Component</th>
<th>Classroom Component</th>
<th>Community</th>
<th>Rewards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gimme 5[13]</td>
<td>Increasing FV availability/accessibility at home and fast food restaurants through role plays and other activities; enhancing preference via taste tests with foods prepped in class; training students in snack and meal prep skills</td>
<td></td>
<td>Newsletters for parents, students set goals to make recipes at home; videotapes featuring Atlanta Hawks sent to parents at 2-week intervals; family night at grocery store.</td>
<td>12 (43 to 55 min.) sessions yearly training students in goal setting and problem-solving skills when goals not attained</td>
<td>Family night at grocery store by produce manager with suggestions for selecting, storing, and preparing inexpensive fresh FJV, conducted taste tests, and distributed recipes; raffle drawing was held</td>
<td>Earned points toward a small prize for attaining three dietary change goals in each grade; points for a team prize were awarded in class for students completing six home assignments</td>
</tr>
<tr>
<td>5-A-Day Power Plus[13]</td>
<td>Classroom snack preparations and taste testing</td>
<td>Team competitions for eating FV during lunch, point-of-purchase promotion of FV using characters and messages; increasing FV appeal/attractiveness, variety served; offering additional fruit choice on days when baked or frozen desserts were served</td>
<td>5 activity and information packets brought home by students: info on curriculum content; tips for encouraging FV intake, recipes prepared in class, and activities to do together</td>
<td>16 lessons (40-45 min., 2/wk for 8 wks), skill building, problem solving activities, and stories</td>
<td>Local producer did 30 min. presentation on FVs, provided some FV for classroom taste testing, home snack packs, and expanded choice in school lunch</td>
<td>Incentives were awarded to students who attained the intervention goal of eating 2 or more FV daily at school lunch</td>
</tr>
<tr>
<td>High 5 Project[13]</td>
<td>Taste testing in classroom</td>
<td></td>
<td>Foodservice staff received training to make their service four stars, offer more variety of FVs, and complete 10 intervention tasks.</td>
<td>Kick-off night for parents to learn about program; asked to encourage and support behavior change in children; complete Freggie book and one interactive Freggie lesson with their children each week for 7 weeks.</td>
<td>14 (30-45 min.) lessons 3 consecutive days/week reviewing high 5 cheer, Freggie Fact, learning &amp; homework activity to build skills, self efficacy, alter food preferences, and challenges 1/week to eat 5 FV and record consumption on food record</td>
<td>Prize drawings were done for children who brought signed vouchers from parents that they did lessons at home</td>
</tr>
<tr>
<td>5-A-Day Power Play! Campaign&lt;sup&gt;24&lt;/sup&gt;</td>
<td>Sensory/Experiential</td>
<td>Cafeteria</td>
<td>Home/Parent Component</td>
<td>Classroom Component</td>
<td>Community</td>
<td>Rewards</td>
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<td>Taste tests at family event with the coalition</td>
<td>Activities in supermarkets (adds and point-of-sale); farmers' markets (providing FVs and in class activities); media; two community youth organizations</td>
<td>Teachers were encouraged to do at least 10 or 14 core activities</td>
<td>Salinas Valley 3 a Day Coalition expanded its membership of growers to include local voluntary and service organization and put on a special event for families. Local TV stations aired 4 animated announcements</td>
<td>Teachers given a $100 stipend for participating</td>
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| Integrated Nutrition Project<sup>25</sup> | 24 weekly SRT-taught classroom activities all including food prep and eating. | Six mini-lessons focused on increasing intake of whole wheat and FV taught by trained parent volunteers; goal to eat 2 FV found at lunch out of the 5 they needed a day | Focus groups; 12 bimonthly newsletters; nutrition classes taught by existing community nutrition education programs; and 2 family fun nights per school | 24 weekly lessons (45-60 minutes) integrated into class curriculum including topics such as grains, fruits, vegetables; year 4 school vegetable FV-a-day, | Community nutrition/food resource development |

<p>| School-based FV Promotion Program&lt;sup&gt;26&lt;/sup&gt; | Posters reflecting the FV of the day (changed daily based on FV served at lunch); lunch aids giving praise for eating FV | Series of interactive children's books assigned as homework; the 5-A-Day cookbook and school cookbook developed by the children, parents, and teachers used for a fundraiser | Influential role models (cartoon characters, videos with same age peers, school principal, and coaches); loud speaker announcements providing facts about FV of the day; 5-A-Day Adventures CD-ROM during computer classes | Lunch sides give sticker for taking one bite of FV |</p>
<table>
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<tr>
<th>Program</th>
<th>Sensory/Experiential</th>
<th>Cafeteria</th>
<th>Home/Parent Component</th>
<th>Classroom Component</th>
<th>Community</th>
<th>Rewards</th>
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<tr>
<td>Free FV Distribution Program</td>
<td>Free FV distribution: daily FV snack given at school (fruit 2/wk, juice 1/wk, and raw vegetables 2/wk) to incorporate recurring moments children ate the FV together (taste, exposure, and peer modeling)</td>
<td>Cafeteria</td>
<td>Children received lunchbox to bring FV undamaged to school</td>
<td>Multi-component program: classroom curriculum distributed to teachers to present with a variety of FV activities</td>
<td>Posters with mascots were displayed at local supermarkets to remind parents to buy FV for kids</td>
<td>Posters with mascots were displayed at local supermarkets to remind parents to buy FV for kids</td>
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<td>Garden-based Nutrition Education</td>
<td>Hands-on, garden-based activities (planting, weeding, watering, harvesting), salsa making workshop: food experiences with FV harvested</td>
<td>Add a veggie to lunch day</td>
<td>Nutrition in the Garden curriculum; class cookbook</td>
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<td>School Gardens</td>
<td>Hands-on gardening experiences (planted seeds and plants, watered, weeded, pest management), prepared recipe from produce they grew</td>
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<tr>
<td>Food Dudes</td>
<td>Daily fruit or vegetables served as snack in class</td>
<td></td>
<td>Reward for eating portion of their FV (sticker) or a better reward if they ate all of the fruit and/or vegetable (pen, pencil, pencil case with food dude logo)</td>
<td>In one of the 3 schools, home packs were delivered to parents, which included tips to get children to consume more FV and reach goal of 5-a-day; included sticker card which parents could give to children when they ate enough FV at home</td>
<td>Rewards (stickers, pens, pencils, etc.) for consuming FV at lunchtime.</td>
<td>Rewards (stickers, pens, pencils, etc.) for consuming FV at lunchtime.</td>
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According to Erikson, all knowledge starts due to sensory experiences and this self-gained knowledge persists throughout life. Eyler, a professor of the practice of education at Vanderbilt University, stated that in order for someone to recall or transfer knowledge, it has to be linked to an experience or situation. If it is not, it is unlikely that the learned concepts will be remembered or used in the future. For these reasons, sensory-based and experiential learning that are linked to situations are vital to helping children gain knowledge of and acceptance and preference for vegetables.

In this review of ten school-based multi-component FV programs, nine of the studies included a sensory or experiential learning component. This learning component was delivered in the form of taste testing opportunities and food preparations, school gardening, and/or role playing asking behaviors for FV (see table 2.2). Tasting of FV was integrated in the classroom, at a family event outside of school, or along with a school garden. It has been suggested that repeated tasting experiences are essential to developing food preferences. Wardle et al. found that children who tasted a novel vegetable or a disliked vegetable for 10 to 14 consecutive days, had an increased preference for that vegetable. Later research by Williams et al. proposed that as there is an increase in novel foods presented to the diet, the number of needed repeated exposures may decrease for improved preference to develop. Although William’s study was a small sample size (n=6), and each participant had a severe selectivity and/or a food refusal condition, his research lends hope to school programs repeatedly offering a variety of novel or dislike vegetables for increased acceptance and preference, that is if the children consume them.
A study by Lakkakula et al. demonstrates this reduced number of exposures needed when children were exposed repeatedly to four different vegetables. The tasting exposure took place in cafeterias of four low-income schools among fourth- and fifth-grade students. Taste preference for four different vegetables including bell peppers, carrots, tomatoes, and cooked peas were evaluated after each exposure for a total of ten exposures. Lakkakula et al. found the greatest percentage of students reported an increase in taste preference for bell peppers and tomatoes on the eighth tasting exposure and for carrots and peas on the ninth tasting exposure, thus taking less than 10 to 14 exposures.

Developing food preparation skills has also been linked to increased vegetable consumption. Five of the ten reviewed studies had a food preparation component. Recipes containing fruit and/or vegetables such as salsa were prepared in the classroom and in some situations students helped prepare those recipes. Another delivered method of the sensory-based or experiential learning component was by children actively participating in gardening. School gardens are beginning to emerge in many areas throughout the U.S. In 1995, California’s Department of Education announced their initiative to have “A Garden in Every School” which urged schools to develop and maintain school and community gardens to create a learning environment for students.

School gardens present an opportunity for experiential learning through planting, weeding, harvesting, and food preparation which consequently builds a personal connection with food. Children involved in these activities are more likely to enjoy the taste of vegetables and be accepting of them. Schools are a prime location for gardening
and may provide the only opportunity for many children to receive this kind of education.51 Those lacking in resources to initiate a school garden can provide alternative sensory opportunities such as tours to local farms. Children attending farm tours are still able make the connection where their food comes from, how it grows and eventually ends up on their plate. The USDA’s initiative “Know Your Farmer, Know Your Food” is another means to connect children to their food and develop ways in which local farmers can provide produce to schools in their communities.52

A review by Robinson-O'Brien on the impact of garden-based youth nutrition intervention programs, found that garden-based education may be beneficial in improving children’s fruit and vegetable knowledge, preference, and consumption.53 Despite this positive evaluation of garden-based educations, there are still many limitations for having school gardens. A study surveying California teachers’ perception of school gardens found that the greatest barriers in the use of school gardens included time, lack of teachers’ interest in gardening, lack of teachers’ experience with gardening, not enough linking of curricular materials to academic standards, and lack of teacher training.49

In this literature review, the studies containing a sensory and/or experiential learning component had an increase in vegetable consumption,25, 30, 32-35, 38, 40, 41 however not all these were significant33, 35 (see table 2.1). Increases in vegetable consumption may have been from the actual repeated tasting of the vegetables and experiencing them in a tactile manner, allowing the students to develop “self-knowledge” and preference of them. The effectiveness of these studies at increasing FV consumption cannot be fully attributed to the sensory/experiential components, because they were not evaluated separately from the other components included in each study. The one study that did
assess a sensory component (repeated taste testing) separately found a free FV
distribution program, where children received a fruit or vegetable snack each day, to be
more effective at increasing FV intake than a multi-component program. Sensory and
experiential learning experiences appear to be an effective means to increasing children’s
preference for and consumption of vegetables.

**Cafeteria component.** School-based cafeteria components were in six of the studies reviewed and included training foodservice staff, additional FV choices offered in the National School Lunch Program (NSLP) and/or improving appearance of choices offered, mini nutrition lessons offered in the cafeteria, marketing to increase consumption of FV via posters and messages, praise/awards given by lunch aides and school staff for consumption of FV, and/or FV eating competitions (see table 2.2). The cafeteria component in each of these studies was combined with a classroom and/or a home component, making it difficult to assess the effectiveness of the cafeteria component on its own.

It is helpful to review studies including only the component of interest, to assess whether it is effective on their own. One example, the “Kid’s Choice” lunch program was developed to increase children’s FV consumption and preference by offering additional FV choices, opportunities for peer participation and modeling, and for half of the participants to receive small and delayed reinforcements for consuming FV. The program resulted in a significant increase in fruit, vegetable, and FV combined consumption (P<0.001), but only in the children who were rewarded for their consumption. There was not a significant increase in consumption for children who were merely exposed to increased FV choices during lunch.
Another example, Cafeteria Power Plus project was designed to determine if a cafeteria-only intervention would increase FV consumption of elementary-age children. This cafeteria intervention was well-planned with several meaningful components including increased appeal and variety of FV offered during school lunch, monthly samplings of FV during lunchtime, providing positive role models, promotional posters and signage, and increasing social support with food service staff, parents, and others. The results demonstrated that the intervention was effective at increasing FV consumption at lunch when potatoes were excluded, however the increase in consumption was only by a small amount. Examining the vegetable consumption at lunchtime separately from fruit consumption revealed no significant difference between the intervention group and the control group. The authors of this study concluded that multi-component programs that include a cafeteria, classroom, and home component are more effective at increasing fruit and vegetable consumption in children.

Although a cafeteria component on its own does not look promising at improving FV consumption, including a cafeteria component is essential to a multi-component program. For many elementary children, school lunches provide a considerable percentage of the total fruits and vegetables consumed each day. Students’ learning should not stop in the cafeteria, because the cafeteria is an ideal environment for students to learn what a balanced, healthy meal consists of modeled by dishes rich in whole grains and FV. Serving many different types of foods with a variety of fruits and vegetables is encouraged, but unfortunately may be lacking in many NSLP meals.

**Classroom component.** All of the school-based programs reviewed in this study incorporated a classroom component. The delivered classroom
component varied between studies, but included activities such as weekly nutrition lessons integrated into class curriculum, loud speaker announcements with facts about FV, influential role models (cartoon characters, peers, school faculty) promoting consumption of FV, videos, 5-a-day Adventures CD-ROM, goal-setting and problem solving skills, stories/letters, class cookbook, classroom taste tests, and/or FV distributions (see table 2.2).

Assessing the degree to which the classroom component is effective at increasing vegetable consumption, is also difficult when many of the studies do not evaluate this separately. Fortunately, three of the multi-component programs reviewed in this study analyzed this component separately, making this task more feasible.

California’s 5-A-Day Power Play! Campaign was implemented in 49 elementary schools among fourth and fifth-grade students. Participants were divided into three different groups including: the control group, school intervention group, and school- and community-wide intervention group. Teachers were provided 14 core activities to teach within their course work curriculum and were encouraged to do at least 10 of them during the course of the 8-week intervention for the school intervention group. In addition to that, the school and community wide group joined forces with youth organizations, grocery stores, farmer’s markets, and mass media. Both intervention groups reported significant increase in fruit and vegetable consumption (p<0.001). FV intake went up 7% (0.2 servings) in the school intervention group and 14% (0.4 servings) in the school and community intervention group, and declined in the control schools. This study does not report fruit and vegetable consumption separately, making it impossible to determine the actual increase in consumption of vegetables. These results, however do illustrate that
when another component was added to the nutrition curriculum (classroom component), such as the community component, FV consumption increased. It should be noted that this study used self-reported FV consumption which could give biased results.

McAleese et al. examined whether FV consumption among sixth-grade students would increase more in a 12-week garden-based nutrition intervention (garden group) or from nutrition in the garden classroom curriculum (classroom group) without the gardening component. The garden group developed a school garden and the children were able to be involved in the entire process of planting, growing, harvesting, and eating from the garden. The differences in vegetable consumption following the intervention phase between the garden group and the classroom group were astonishing. Daily fruit consumption increased by 1.13 servings (p<0.001) and vegetable consumption increased by 1.44 servings (p<0.001) in the garden group, whereas there were no significant increases in consumption in the classroom group. McAleese et al. concluded that it is essential to have hands-on activities when seeking to change nutrition-related behaviors, especially FV consumption.

Parmer et al., much like McAleese et al., examined the effects of a school garden on children’s FV consumption as well as FV knowledge and preference. Second-grade students were divided into three treatment groups: a nutrition education and gardening group (NE+G), a nutrition education only group (NE), and a control group (CG). FV knowledge and preference significantly increased for both of the treatment groups compared to the control group (p<0.001), but preference increased significantly more in the NE+G group. Children in the NE+G group were also more likely to choose vegetables in the school lunch compared to the other groups. Lunchtime vegetable
consumption increased by 0.3 servings in the NE+G group compared to no increase in the NE group and a decrease in the control group.\textsuperscript{25}

Other research has shown that programs which only provide nutrition information or only teach skills fail to result in behavior change.\textsuperscript{58} In agreement with that research, a British study aimed at examining whether school initiatives to promote FV actually influence children’s consumption also found that lessons teaching about fruit and vegetables were not associated with children’s FV intake.\textsuperscript{59} These studies show that nutrition education (classroom component) can be effective at increasing FV knowledge, preference, and possibly consumption, yet has a more potent outcome when combined with other components such as sensory-based/experiential learning activities.

**Home/community component.** Regardless of how assiduously the school may encourage healthy eating behaviors such as consumption of vegetables, if children’s home environments are promoting negative eating behaviors, poor dietary habits are likely to persist.\textsuperscript{19} For this reason the American Dietetic Association (ADA) took the position that overweight interventions require a combination of both family-based and school-based multi-component programs.\textsuperscript{60}

Eight\textsuperscript{30, 32-35, 38, 39, 41} of the ten multi-component programs reviewed in this study had a home component and some also had a community component.\textsuperscript{30, 32, 34, 35, 38} These consisted of focus groups, newsletters, nutrition classes, family fun nights at grocery stores and the school, parent-taught lunchroom activities, FV homework packs sent home for children to complete with parents, school cookbooks developed by children and parents, recipes sent home for children to make with parents, videotapes, program information packets sent home, farmer’s market initiatives, and/or marketing of programs
via posters and/or commercials on television (see table 2.2). Each of these activities was a means to ensure the parents were informed and involved in the program’s initiative to increase children’s FV consumption.

The NSLP provides two servings of fruit and/or vegetables each day, but the daily FV recommendation for children is five servings. Theoretically, children should be getting the other three servings from home or outside of school. Research shows that children are not meeting these recommendations with less than 20% between the ages of 9 to 13 years consuming five or more servings of fruits and vegetables daily.12

Significant associations have been acknowledged between parental involvement and children’s consumption of FV.24 Practices in the home environment such as availability and accessibility of FV, occurrence of family meals, and positive role modeling of parental consumption of FV have been recognized as potential contributors to children’s FV intake.31, 61, 62 Parents have the ability to create a foundation for children to develop preferences toward many FV. Unlike school food service staffs that are often limited by availability of different kinds of FV to be served and the manner in which they are prepared, parents have the capability of exposing their children to a variety of FV prepared in various ways throughout the child’s life. Bere et al. found that children’s vegetable intake was significantly linked to home accessibility,63 so as parents make an effort to ensure FV are available and accessible to children at home, their consumption is likely to increase.

Food neophobia is natural disinclination to consume novel foods.64 This reluctance to consume foods may be from a dislike of the mouth-feel of certain food, fear of harm from eating the food, or the idea that the novel food is less palatable than other
foods. Children prefer fruits over vegetables and perhaps food neophobia plays a role in this tendency. One method for overcoming food neophobia and increasing food preferences, as discussed earlier, is providing repeated tasting exposures for 10 to 14 consecutive days. The task for parents to expose their children to vegetables for 10 consecutive days may not be desirable or even feasible. School-based programs promoting FV assist parents in this role and may act as a way to continue to motivate them in that valuable task. The multi-component programs reviewed in this study found a variety of ways to support parents in these roles.

**Rewards component.** Six of the ten multi-component programs reviewed had a rewards component, five of them for the children and one for the teachers. These rewards or incentives included stickers or other simple prizes for consuming FV at lunchtime, points toward prizes or prize drawings for accomplishing dietary goals and/or homework assignments, and monetary stipends awarded to teachers for participating (see table 2.2).

Differences of intended outcomes, types of rewards used, and level of initial liking of the FV have been identified as to why inconsistencies exist between effects of reward-based programs on children’s FV preference and consumption. Birch et al. tested four different kinds of instrumental food intake contingencies and two control conditions among preschool children to assess the affect they had on preference. Children were presented a fruity kefir drink as a “special snack” and given a verbal praise, verbal praise and extra drink, movie tickets, movie tickets plus extra drink, or as the control movie tickets before or after drink without any contingencies. Birch found significant decrements in preference in all four instrumental conditions and no significant
effects in the control condition. Other studies have found similar decrements to intrinsic motivation. Cooke et al., in contrast to these studies, found that rewards were not detrimental to long term liking of the targeted vegetable. She examined changes in preference and intake of a moderately disliked vegetable under four conditions consisting of exposure plus a nonfood reward (stickers), exposure plus a social reward (praise), exposure alone, and no-treatment. Post-intervention results revealed all three intervention groups had significant (P<0.001) increases from the control in preference and intake, but the increases were more substantial in the exposure plus nonfood reward group. Preference in each intervention group remained high through the 3 month follow-up period, whereas the intake only remained high in the exposure plus nonfood reward group and the exposure plus social reward group.

Among the ten multi-component programs this study reviewed and the six that offered rewards, the “Food Dudes” program by Lowe et al. was found to be one of the most effective at increasing vegetable consumption (see table 2.1). Fruit and vegetable preference and consumption increased significantly. Vegetable consumption increased in children between the ages of 4-7 years by 0.9 servings a day and for children 7-11 years by 1.39 servings a day. Increase in vegetable consumption in the other rewards-based programs only ranged from 0.07 to 0.52 servings a day, though assessment methods were different which could affect comparisons.

Contrasting the Food Dude’s rewards-based component to similar rewards-based programs may illuminate why it was so much more effective at increasing vegetable consumption. In the Food Dudes study, during lunch if students ate a portion of their FV they received a sticker and if they ate all of it they received a slightly better reward a pen,
pencil or pencil case with the Food Dude’s logo on it. Children received the award immediately following the good behavior, making certain the children were aware that they received the reward for consuming the fruit or vegetable. As stated earlier in this study, repeated exposure is related to increased preference and consequently consumption. Not only were the children in the Food Dudes study receiving constant reinforcement for consuming FV, they had continual taste exposure to those FV. In addition to rewards and taste exposure, peer modeling was taking place. Six videos were presented in children’s classrooms of heroic, slightly older children known as the “Food Dudes” that combat the “Junk Punks” by consuming powerful fruit and vegetables. Children in the Food Dudes study observed the “Food Dudes” heroes and classmates eating, enjoying, and then being rewarded for consuming FV; a behavior with positive consequences.

A study with a similar approach by Hoffman et al. also used stickers to reward students for consuming FV. However, the results were dramatically different, with fruit consumption increasing by 0.21 servings per lunch and vegetable consumption by only 0.07 servings. Taste preference did not increase for either fruit or vegetables. One reason for the discrepancy in FV intake between this study and the Food Dudes study maybe the incorporation of other components or factors. The Food Dudes study also had a component where students received a fruit or vegetable snack daily in the classroom in addition to the lunchroom reward system. This contributed to further exposure to the FV without other foods also being available and may have been accompanied by social rewards such as the teacher or school staff praising the students for consuming the FV. The study by Hoffman et al. had a classroom education component delivered by 5-A-Day
Adventures CD-ROM and a home component of interactive books and a cookbook, but
did not have an additional tasting component outside the cafeteria during lunch. Timing
of the reward may also play a role in the effectiveness. In the High 5 Project, Gimme 5,
and the 5-A-Day Power Plus program, rewards were given as prize drawings and/or when
dietary goals were met, but were not given immediately following FV consumption. This
may have limited the effects of the rewards, as children may not have associated
the rewards with consuming FV as was seen with lower increases in consumption.

Although previous research has implicated caution in using rewards, these
studies are dated and more recent studies show benefits of using rewards offered in an
appropriate manner to increase fruit and vegetable consumption. Rewards appear
to contribute to the consumption of fruit and vegetables and may be warranted if funding
for prizes is available.

**Applied Theories**

Theories are commonly used as a foundation for nutrition interventions. They act
as a guide to why individuals behave the way they do and offer perspective on how to
approach behavior change. Three different theories were used in the studies analyzed in
this paper. These include social cognitive theory, cognitive development theory, and the
educational theories of Dewey.

**Social Cognitive Theory.** Albert Bandura’s Social Cognitive Theory (SCT) is a
theoretical framework for examining motivation, thought and action. It is a well-
accepted theory applied in numerous nutrition programs. This is evidenced by the sixty
percent of multi-component school-based programs reviewed in this study which
followed the SCT model.\textsuperscript{32-35, 38, 39} Components of SCT such as peer modeling and development of self-efficacy however, were also often integrated in the studies that did not indicate the use of SCT in their programs.\textsuperscript{25, 30, 40, 41}

SCT evaluates both the nature of the learning process and the outcomes of learning.\textsuperscript{71} Bandura believed the learning process is a reciprocal relationship between behavior, cognitive and other personal factors, and environmental events.\textsuperscript{70} Thus, each factor can directly affect the other factors in a three-way interrelating system called reciprocal determinism.\textsuperscript{70, 71} This learning process assumes the learner can gather a wide range of information from observing the behaviors of others and then decides which of those behaviors he/she wants to portray based on the perceived benefit.\textsuperscript{71} The outcomes of this learning process are not always portrayed immediately in the behavior of the observers.\textsuperscript{71} Rather, simply stored and remembered internal codes of behavior, both visual and verbal, are obtained and may or may not be performed at a later time.\textsuperscript{71, 72}

Bandura emphasized that modeled behavior acts as a trigger to stimulate similar behavior in others.\textsuperscript{71} Models can be living (family, friends, etc.) or symbolic (cartoon characters, media, etc.).\textsuperscript{71} Models who are credible, relevant, trustworthy, appear prestigious, and admired by the child tend to be the most influential among observers.\textsuperscript{71, 72} Hence, school-based nutrition programs have used influential role models including but not limited to peers,\textsuperscript{30} cartoon characters,\textsuperscript{39, 41, 69} videos featuring the Atlanta Hawks basketball team from the National Basketball Association\textsuperscript{32} and same-aged peers,\textsuperscript{39} school principals, coaches, and teachers.\textsuperscript{39} Fehrenbach et al. explained that multiple models, instead of a single model, are more strongly associated with children mimicking the modeled behavior.\textsuperscript{73, 74} Reinaerts et al. in their free FV distribution program used peer
modeling by adopting a school-wide intervention which they believed portrayed eating FV at school as a social norm. Gredler described how certain types of modeling could result in negative outcomes. Examples of negative modeling may be exhibited by the poor dietary habits of parents or unhealthy foods served during school lunch. These may have life-long impacts on children’s health.

According to SCT, consequences of modeled behavior can be vicarious or self-imposed. Vicarious consequences occur when an individual observes someone receiving a reward for a particular behavior, thus processing a perceived benefit for that behavior. The Fruit and Vegetable Promotion Program, Gimme 5, 5-A-Day Power Plus, and the High 5 Project all included this concept in hopes of motivating students to take a more active role in their programs. On the other hand, self-imposed or self-reinforcing behavior disregards praise received from society, but rather focuses on the individual’s own conscience or desires.

Behavior change would not take place without internal processing of actions and subsequent possible outcomes. In order for a model to attract the attention of observers, the information provided needs to be simple, age- and skill-level appropriate, and visually presented with abundant verbal repetition. The observer has more complete retention of the information when he/she mentally and physically rehearses the behavior. Therefore providing hands-on activities with reflection of the consequences of that action or behavior will aid in retention.

Bandura’s component of perceived self-efficacy in SCT is one of the most applicable components to nutrition programs. Self-efficacy is defined as belief in one’s own abilities to act or behave successfully in a particular way. Bandura emphasizes that
self-efficacy does not regard one’s skills, but one’s judgment of what can be accomplished with those skills.\textsuperscript{70} Self-efficacy is fundamental to personal change, because without belief that the desired effects can be accomplished through their actions, there is little reason to attempt the action especially when obstacles arrive.\textsuperscript{75} Self-efficacy is influenced by mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states.\textsuperscript{71} Bandura states that self-efficacy beliefs must be tried against challenges to achieve a successful performance.\textsuperscript{75} A vicarious experience, where a model is observed successfully achieving a behavior or action, increases self-efficacy for the observer.\textsuperscript{71} Studies have shown that children’s preference for and consumption of vegetables, which could be referred to as self-efficacy, increases from participation in hands-on activities such as gardening, food preparation, and taste-testing.\textsuperscript{25, 40, 50} Increased self-efficacy for vegetables may facilitate children acting on observed and learned behaviors in regards to vegetables more easily on their own.

**Cognitive Development Theory.** Cognitive Development Theory (CDT), formulated by Jean Piaget, a Swiss scholar, focuses on four cognitive developmental stages that children go through in a consecutive manner, unable to move to the next stage without completing the former.\textsuperscript{76} These stages include sensorimotor (birth to 2 years), preoperational (2 to 7 years), concrete operations (7 to 11 years), and formal operations (11 years and older).\textsuperscript{76} As children progress to each developmental stage, their capabilities advance from simple sensorimotor activities such as grasping or moving an object, to being able to use their imagination in play to imitate an object when it is not present, to thinking logically and assess the consequences of behaviors of others, and to finally thinking abstractly and being able to critically evaluate problems to come up with
Piaget’s CDT is a tool to develop learning curriculum that is age- and skill-level appropriate.\textsuperscript{76} Piaget believed as children encounter new experiences they interpret them through an existing thought process, but as contradictions to those existing thought processes arise the children must alter their thought processes to integrate those new experiences.\textsuperscript{76} This course of action is referred to as the assimilation and accommodation process.\textsuperscript{76} Piaget’s CDT is often adapted to classrooms in the form of hands-on learning experiences that allow children to use their existing thought processes and make critical findings for themselves.\textsuperscript{76}

The Integrated Nutrition Project (INP), the only study in this review to incorporate the CDT, was implemented among children from kindergarten to fifth-grade, Piaget’s preoperational and concrete operational stages which are unable to grasp abstract concepts.\textsuperscript{38, 76} The INP used CDT model to ensure their program was suitable for the age and developmental levels of these children.\textsuperscript{38} Hands-on activities such as food preparation and eating were incorporated to gather information by use of the senses.\textsuperscript{38} Also, simple concrete messages were used, for instance “eat more of” whole grains, fruits, and vegetables so children would not have to decipher which foods were better or worse choices for them to consume.\textsuperscript{38}

**Educational theories of Dewey.** John Dewey was a philosopher of education who theorized that there is a connection between experience, thinking, and eventually the development of knowledge. Experience involves a combination of an active and passive constituent.\textsuperscript{78} The active portion involves the experiment or a person doing something, and the passive portion involves consequences whether good or bad as a product to the
Merely participating in an activity will not result in learning or generate knowledge. However, linking the consequences of an activity to the individual participating by reflection of changes occurred will produce the outcome of knowledge gained.

Dewey acknowledged the senses as an integral part to the development of knowledge. The senses are a “gateway” for moving information from the “external world” to the mind. Unlike the customary ways of scholastic learning, where students are expected to resist tendencies to incorporate their naturally energetic bodies in soaking up immense amounts of information into their minds, Dewey theorizes directing the use of those energetic senses with a set purpose for applied meaning of what is being taught. This enables children to use both their minds and their bodies in learning. The INP used SCT, CDT, and the educational theories of Dewey as a theoretical guide, which allowed for use of the senses in hands-on, age-appropriate activities as a means to increase fruit and vegetable consumption.

Tools of Assessment

Reliable dietary assessment tools are crucial in evaluating the effectiveness of nutrition-based programs. In this review of literature, changes in FV consumption were evaluated by a variety of methods including 24-hour dietary recalls (self- or parental-reported), food records, lunch and/or snack-time observations (visual or weighed), and food frequency questionnaires (FFQ). Surveys and questionnaires to assess children’s FV preferences, knowledge, attitudes, self-efficacy, and other health-related characteristics were also conducted. In addition, questionnaires
have been given to children, lunch and school staff to assess the acceptability of the intervention.

Researchers may face many problems when attempting to evaluate children’s dietary intakes, including poor knowledge of foods and portion sizes, literacy limitations, inability to describe mixed food dishes, and a brief attention span. Certain assessment tools may be more appropriate than others depending on the sample population; however, none of them are flawless. Since the focal point of this literature review is multi-component programs aimed at increasing FV intake among children, this section will address the validity of assessment tools aimed specifically at evaluating changes in FV consumption.

24-hour recalls/food records. Quick and simple to conduct, 24-hour recalls generally ask children to report detailed information about everything they consumed for the past 24 hours, as well as estimate the portion sizes. Multiple 24-hour recalls can help to provide an estimate of food intakes without altering the usual consumption patterns of the child. Of the ten studies analyzed in this review, six incorporated some form of a 24-hour recall (see table 2.1).

A significant disadvantage of 24-hour recalls is the reliance on memory. Baxter et al. referred to 24-hour recalls as a “memory test”, indicating the difficulty in remembering detailed information from a previous time period. Validation studies of 24-hour recalls have found that some children report intrusions (inclusion of foods not eaten) and/or omissions (failure to report foods eaten) in their recalls. Fourth graders who completed three separate food recalls validated against mealtime observations were found to have matched only 35% of foods observed eaten, 24% of foods reported were
intrusions, and 41% of foods eaten were not reported. A study with third graders found they were able to recall 77.9% of the food they consumed in a 24-hour period with the help of unquantified food records, but of those foods reported 64.7% of the portion sizes estimated were inaccurate. Seventy-six percent of children incorrectly estimated the portion size of vegetables, with 60% overestimating. This finding is in contrast with Lytle et al., who suggested that fourth graders overestimate consumption of fruit, but correctly estimate vegetable intake. These studies point out that researchers should use caution in how they interpret data collected among children from 24 hour recalls, as there is a great deal of inconsistency.

Parental input on children’s 24-hour recalls has been speculated as whether or not that would improve the validity of the recall. One study presented moderate Pearson correlations (0.41 to 0.79) when comparing observed versus third graders’ self-reported intakes. Similar correlations have been seen in mother’s recall of children’s consumption. Basch et al. tested the validity of Latino mothers’ 24-hour recall for children between the ages of four to seven years-old. Correlations between mother’s recalls and trained observers ranged from -0.10 to 0.82 for major nutrients with an average of 0.51. Only 41.3% of mother’s reported vegetable consumption were the same as observed, with 28.3% over-reporting. Fisher et al. found that mother’s 24-hour recalls, for infants and toddlers less than two years-old, overestimated nutrients. Garceau et al. found parental input on dietary recalls necessitated substantially more time and resources than children’s self-reports and only resulted in a small effect of difference in mean nutrient intake. Restraints on time and resources should be evaluated in the decision of whether to use parent-assisted recalls.
Food records are an alternative to 24-hour recalls. Food intake and portion sizes are recorded simultaneously with the consumption of meals, snacks, and beverages. Food records are usually recorded for three to seven days, including at least one weekend day. This method avoids reliance on memory and offers a more complete picture of usual eating patterns, but is time intensive and may result in diet modifications. For these reasons, along with the necessity to be literate, it appears that food records are not as commonly used in elementary school-based nutrition programs as an assessment tool. Only one of the ten studies in this review utilized food records to track changes in FV consumption. Unquantified food records, however, have been used as memory aids for 24 hour recalls.

Lytle et al. conducted a validation study of the reliability of 24-hour recall interviews in addition to unquantified food records among third grade students. A significant difference was found between observed versus recalled energy intake (p<0.05), but there were no significant differences in actual sodium intake, or in the percentage of energy from total fat, saturated fat, monounsaturated fat, polyunsaturated fat, carbohydrate, and protein. In this study it was concluded that 24-hour recalls with the assistance of food records may be a beneficial assessment tool when comparing group means. Interestingly, in a later study by Lytle et al., food records to assist 24-hour recalls failed to show a positive cost and benefit outcome. 

**Mealtime observations.** Mealtime observations are frequently used in validation studies for 24-hour recalls and food records. They are an effective way to evaluate the success of FV interventions, because observations allow for the most precise assessment of food intake among children. Observations, though require a
significant amount of time and are expensive. In this review of literature, 5-A-Day Power Plus and the High 5 Project conducted mealtime observations in addition to 24-hour recalls. The Integrated Nutrition Project, the Fruit and Vegetable Promotion Program, the School Garden’s Experiential Learning Approach Program, and the Food Dudes all utilized mealtime observations to assess consumption of FV.

Most mealtime observations for school-based programs generally occur during the National School Breakfast and/or Lunch Programs. Trained research staff examine children’s food trays prior to and after eating each meal. The proportions of each variety of food consumed are determined by either weighing the food, digital photography, or visual estimation based on a specified protocol. Weighing the food before and after consumption will provide the most exact measurement of food eaten, but has the disadvantage of expense and requires an abundance of time. Direct visual observation and digital photography are less expensive and time-intensive, so provide more efficient assessment tools. These methods are similar to one another but instead of researchers directly observing meals, digital photographs of the meal are taken before and after consumption.

Benefits of digital photography include being quick, more convenient, and allows for adequate assessment of consumption of the foods photographed. Swanson, in a plate waste study using digital photography, identified some of the issues involved when using digital photography. He indicated that items presented in the before photo, such as apples or bananas, were missing in the after photo. A little investigation revealed that students were encouraged to take the fruit with them to eat on the bus ride home or later that day. This made it more difficult to assess fruit intake. Swanson also found that it
was extremely difficult to assess the amount of small condiments consumed.\textsuperscript{94}
Williamson et al. also documented difficulty in assessing consumption of condiments with digital photography compared to weighed measurements, with correlations of 0.52 for condiments and 0.89 for overall food estimations.\textsuperscript{93}

In a validation study, visual estimation and digital photography were compared against weighed food measurements.\textsuperscript{93} Both methods were highly correlated (0.89 digital, 0.95 visual) for estimations of plate waste compared to the weighed amount.\textsuperscript{93} Ball et al. compared visual observers’ accuracy to weighed food portions and also found high correlations for each observer, ranging between 0.952 to 0.977.\textsuperscript{95} In agreement, Gittelsohn et al. found that trained staff can provide accurate visual estimations of food weight with a correlation of 0.96 for actual food weight compared to estimated.\textsuperscript{92} These high correlations are considerably greater than the correlations calculated between children’s self-reported 24-hour recalls and direct observations as described earlier. Mealtime observations appear to be a more accurate means of evaluating foods consumed by children.

\textbf{Food frequency questionnaires.} Food frequency questionnaires (FFQ) consist of a list of foods with corresponding questions regarding how often the respondent has eaten the particular food in a set time period, as well as what portion size they consumed. They offer a perspective of how frequently an individual consumes particular foods or nutrients. FFQs work well for large-scale studies because they can be self-administered and easily analyzed with machine readable forms\textsuperscript{82, 96} and provide an assessment of usual intake from a single administration. Limitations of FFQs include a limited list of foods and portion sizes presented to respondents to choose from, difficulty in determining
actual intake over large time periods (seasonal differences), and lengthy FFQs can be burdensome and tedious to finish.82

Among the ten studies in this literature review, only the free fruit and vegetable distribution multi-component program by Reinaerts et al. used a FFQ as an assessment tool to determine FV consumption.30 The FFQ used by Reinaerts et al. was based on the FFQ used in the Pro Children study, a project aimed to increase FV consumption among 10-13 year-old children in three European countries.24, 97 Haraldsdóttir et al., in a validation study for the Pro Children’s FFQ found high correlations for reproducibility tested among six different countries, with Spearman correlations ranging from 0.59 to 0.74 for total vegetable consumption.97 However when assessing validity of the FFQ to 7-day food records, Spearman correlations were low to moderate (r = 0.38 to 0.53).98 Rockettet al. in an updated FFQ, the youth/adolescent questionnaire (YAQ), only found a moderate Pearson correlation for overall consumption (r = 0.41) and vegetables consumed (r = 0.48) for reproducibility, between the two FFQs for energy and nutrient intake.99

In accordance with the low correlations for validity, Crawfordet al. compared 24-hour recalls, 3-day food records, and FFQ against lunch-time observations in a validation study with 9-10 year-olds and found Spearman correlations for the FFQ that were substantially lower than both the 24-hour recall and the 3-day food record (r = 0.11 – 0.50, r = 0.46 – 0.79, r = 0.78 – 0.94, respectively).80 The FFQ also had more omission foods and 50% of the foods’ portion sizes were estimated incorrectly.80 In an adult-based study Kristalet al. in addition found that FFQ are appreciably less precise at measuring
vegetable intake than fruit intake compared to 24-hour recalls and food records, which may be due to underestimation of vegetable consumption.96

These studies indicate that FFQ are convenient for large population-based studies, but are not as accurate as other means of evaluation for FV consumption among children. Twenty-hour food recalls like FFQ are easy to administer, but lack in accuracy with young children. Children often forget foods eaten or include foods not eat in recalls.84 Food records do not rely on memory, but estimating portion sizes is challenging for children.85 Mealtime observations are the most accurate estimations of children’s consumption92 and should be used when possible.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Increasing children’s vegetable consumption is a challenging endeavor. This review of literature has illustrated the need to incorporate a variety of components in school-based multi-component programs to increase vegetable consumption. Implementation of individual components to increase vegetable consumption does not appear to be as effective as the synergistic effect seen when combining multiple components. Components which increased vegetable exposure and tasting opportunities resulting in enhanced preference whether in the cafeteria, classroom, at home or in the community, in conjunction with a garden, or with rewards demonstrated the highest increases in vegetable consumption. Applying theory-based approaches such as using the senses, peer-modeling, and increasing self-efficacy may play a vital role in the effectiveness of multi-component programs at increasing vegetable consumption.
Mealtime observations provide the best and most reliable estimation of fruit and vegetable consumption among elementary aged-children.\textsuperscript{92}

REFERENCES


52. Agriculture Deputy Secretary Merrigan Announces Initiative to Connect Children to Where Their Food Comes From and Provide More Local Foods In School Lunches; Washington; US Department of Agriculture; September 15, 2009; release number 0441.09.


CHAPTER 3
A SENSORY-BASED MULTI-COMPONENT SCHOOL-BASED NUTRITION INTERVENTION AMONG FIFTH-GRADE STUDENTS

ABSTRACT

Objective: To assess the efficacy of a multi-component school-based intervention with sensory-based education to increase fifth-grade student’s acceptance and consumption of vegetables.

Design: A quasi-experimental study using plate waste observations with digital observations of lunch-time consumption, and pre-/post-intervention and cross-sectional surveys among fifth-graders and their parents.

Setting: Two low income elementary schools.

Participants: Fifth-grade students (n = 136).

Main Outcome Measure(s): Changes in vegetable preference, acceptance, and consumption.

Analysis: Data were analyzed using paired sampled t-tests, chi-square, Fisher’s exact test, and analysis of variance. Statistical significance was set at $P \leq 0.05$.

Results: The comparison school took and consumed more vegetables than the intervention school in both phases (control phase – CP, target vegetable phase – TVP) of the plate waste observations when fried potatoes were included in the analysis (took: $P < 0.001$, $P < 0.05$; consumed: $P < 0.001$, $P < 0.05$; respectively), but when fried potatoes were excluded no differences were seen. Significantly more fifth-graders at the
intervention school compared to the comparison school stated they had ever eaten bell peppers, butternut squash, and cucumbers. No significant differences were seen among parent cross-sectional surveys.

Conclusions and Implications: The school-based multi-component program was not effective at significantly increasing vegetable consumption. Multi-component programs with increased frequency of taste testing opportunities, gardening activities, and rewards may be more successful at increasing vegetable consumption.

INTRODUCTION

Obesity has become a major health threat among American children with rates more than quadrupling in the last three decades to 19.6% in children ages 6 to 11 years-old.\(^1\) Consequently, the government, health organizations, and researchers have implemented initiatives and programs aimed at halting the progression of this challenging epidemic. Schools have been targeted for these interventions as children spend a large portion of their day at school, with the majority of children consuming an average of 35% of their daily food intake and one-tenth consuming approximately 67% of their daily food intake from school meals.\(^2\)\(^4\) Schools provide an established learning environment where information can easily be shared, nutritious food provided, healthful behaviors reinforced, and data acquired.\(^5\) The Institute of Medicine (IOM) acknowledged that schools should be fundamentally involved in childhood obesity prevention.\(^6\)

According to the American Dietetic Association, the Society of Nutrition Education, and the American School Food Service Association school-based nutrition
programs are more likely to be effective when they include multiple components, such as sensory-based experiences, nutrition education, cafeteria modifications, home and community involvement, and/or other components. A recent widespread approach to improving children’s nutritional status is to implement school-based multi-component programs designed to increase consumption of fruit and vegetables. Fruit and vegetables are low-energy, nutrient-dense foods which contribute to satiety and may also help to displace high sodium and energy-dense foods. The Center for Disease Control recommends consuming five servings of fruit and vegetables a day and the United States Department of Agriculture (USDA) in their MyPlate recommends that children eight to eleven years-old who are active for at least 30 minutes a day consume approximately four cups of fruit and vegetables daily. Consuming the recommended amounts fruit and vegetables have been identified as a method to prevent the development and progression of chronic diseases and certain cancers, and maintain an appropriate body weight. Despite the health benefits of eating fruits and vegetables (FV), less than 20% of children between the ages of 9 to 13 years are consuming the recommended five or more servings daily.

Multi-component school-based studies intended to increase fruit and vegetable consumption have been successful at increasing fruit consumption, but changes in vegetable consumption remain minimal. The disparity between changes in fruit and vegetable consumption in these studies may be associated with the well-known fact that children prefer and accept fruits more easily than vegetables. The 5-a-Day Power Plus and the Fruit and Vegetable Promotion programs implicated the need for future studies to research how to enhance desirability and availability of vegetables and
overcome the barriers to vegetable consumption. Multi-component, school-based studies have yet to focus solely on increasing vegetable acceptance and consumption.

Vegetable consumption has been shown to be more difficult to change than fruit consumption. Multi-component programs with a gardening component appear to be effective at increasing vegetable consumption. Parmer et al. provided nutrition education and implemented a school garden among second-graders and observed an increase of 0.3 portions of vegetables consumed during lunchtime over a 28 week period. In a similar study, McAleese et al. found that vegetable consumption among sixth-graders increased by 1.4 servings a day. The significant increases in vegetable consumption illustrated in the prior studies is likely due to experiential learning associated with school gardens such as planting, weeding, harvesting, and food preparation which consequently builds a personal connection with food. Children involved in these activities are more likely to enjoy the taste of vegetables and be accepting of them.

Vegetable acceptance and consumption may be enhanced through repeated tasting exposures. Wardle et al. found that children who tasted a novel vegetable or a disliked vegetable for 10 to 14 consecutive days, had an increased preference for that vegetable. Williams et al., demonstrated as more novel foods are presented to the diet, the number of needed repeated exposures may decrease for improved preference to develop. In a school-based study, fourth and fifth-grade students in low-income elementary schools were repeatedly exposed to four different target vegetables. Children who disliked the target vegetables had an increase in preference for them in eight to nine tasting exposures and children who liked the vegetables at baseline maintained a high preference.


throughout the study. In a study by Lowe et al., children were provided a daily fruit or vegetable snack in their classrooms, offered rewards for tasting and consuming fruit and vegetables at lunch, and shown videos with peer-models eating and encouraging fruit and vegetable consumption. Children’s lunchtime vegetable consumption was evaluated using plate waste observations and increased by 0.48 portions, indicating the effectiveness of repeated vegetable tasting exposures.

Furthermore, a literature review of twelve school-based studies reported, interventions that are behavior-based or focus on a particular behavior tend to be the most successful. Many school-based nutrition programs integrate Social Cognitive Theory (SCT) as a theoretical guide for behavior change in children’s fruit and vegetable intake. SCT is based on a reciprocal relationship between behavior, cognitive and other personal factors, and environmental factors. This theory emphasizes that children who observe a modeled behavior may at a later time demonstrate that behavior. Fehrenbach et al. explained that multiple models, instead of a single model, are more strongly associated with children mimicking the modeled behavior. Self-efficacy, another element of SCT, is defined as the belief in one’s own abilities to act or behave successfully in a particular way. One’s self-efficacy can be strengthened by vicariously observing models or physically participating in a behavior. Thompson et al., in study testing the reliability and validity of a questionnaire measuring self-efficacy and social norms, found that among fifth-graders, self-efficacy and social norms were associated with fruit and vegetable consumption at school lunch, vegetable self-efficacy was correlated positively with low-fat vegetable intake and negatively with intake of high-fat fried vegetables such as French fries and tator tots.
that self-efficacy is a modest predictor of fruit and vegetable consumption ($\beta = 0.284, P < 0.001$) among middle school students and that it acted as a mediator between the positive effect of perceived parent support and fruit and vegetable consumption ($\beta = 0.390, P < 0.001$).39

Current research indicates that multi-component programs aimed at increasing vegetable acceptance and consumption should include experiential learning components to increase children’s awareness of vegetables and where they come from, provide repeated tasting exposures, and develop self-efficacy. The purpose of this study was to assess the efficacy of a multi-component school-based intervention with sensory-based education incorporating SCT to increase fifth-grade student’s acceptance and consumption of vegetables.

**METHODS**

The principal objectives of this multi-component intervention were to 1) increase fifth-grade children’s lunchtime consumption of vegetables; 2) awareness and knowledge of vegetables; 3) willingness to try new vegetables; and 4) develop and implement parent-child cooking classes for families at the intervention school to increase self-efficacy of preparing and providing vegetables to children at home. Objectives were evaluated by digital observations of lunchtime consumption and student and parent surveys.
Study Participants

This study was conducted September 2009 through May 2010, in two Title I elementary schools in a rural community in northern Utah. Title I schools have a high percentage of economically challenged students. The school chosen for implementation of the intervention was by reason of previous collaboration efforts at that school and enthusiasm of the school staff and administration for a vegetable program. The school chosen as the comparison had similar demographics and class sizes (see table 3.1). The intervention school had 84.7% white, non-Hispanic students with 44.5% receiving free or reduced priced lunch. The comparison school had 77.3% white, non-Hispanic students with 51.5% receiving free or reduced price lunch.

All fifth-grade teachers and their students attending these schools were invited to participate in the study with permission of the principals. Parents/guardians of these fifth-grade students received an opt-out consent form to review, sign, and return if they did not wish their child to participate (see Appendix A). There was no penalty for opting out. The

<table>
<thead>
<tr>
<th>Table 3-1. Demographics of the intervention and comparison schools.</th>
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<tbody>
<tr>
<td>Intervention School</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Total number of students in school</td>
</tr>
<tr>
<td>White, non-Hispanic</td>
</tr>
<tr>
<td>Free and reduced lunch</td>
</tr>
<tr>
<td>Total number of fifth-grade students</td>
</tr>
<tr>
<td>Average fifth-grade class size</td>
</tr>
<tr>
<td>Fifth-grade females</td>
</tr>
</tbody>
</table>

a Race data unknown for two (2.6%) participants.
http://www.schools.utah.gov/data/Educational-Data.aspx
Institutional Review Board at Utah State University reviewed and approved this school-based multi-component research study. Data were collected from 93.8% (n = 136) of the fifth-graders attending both schools.

**Description of the Intervention**

The intervention for this multi-component program consisted of many elements in an effort to increase children’s exposure to, acceptance and consumption of vegetables. In order to meet these requirements, the children in the intervention group (n = 71; 45.6% female) received components including 1) a vegetable-farm field-trip, 2) monthly classroom sensory-based vegetable demonstrations, 3) cafeteria vegetable tasting opportunities at the “Tasty Table” with recipes sent home, 4) locally grown free vegetable distributions to fifth-graders and families, 5) semi-annual newsletters, 6) three family vegetable-based evening cooking classes, and 7) an interactive vegetable recipe blog.

Components of SCT were used as a theoretical framework for this program. Teachers, peers, and research staff modeled the enjoyment and social norm of eating and sampling new kinds of vegetables. Tactile experiences where the children were able to use their senses including preparation and tasting of vegetable recipes were incorporated into this program to enhance self-efficacy in vegetable preference, preparation, and consumption.

**Vegetable farm field trip.** Fifth- and second-grade students attending the intervention school were invited to visit the Utah State University Student Organic Farm. The vegetable-farm field trip was an opportunity to increase the children’s awareness of
the path food takes from the farm to their plates. Fifth- and second-graders toured the farm on separate days to help with crowd management and ensure the content delivered was age-appropriate. The tour lasted approximately one and a half hours, which during that time children visited seven different stations (see Appendix B). The stations included the topics of compost piles, plant parts, how to weed and water the farm, hoop-houses, harvesting the vegetables with a scavenger hunt, and two stations focusing specifically on using the senses of taste, touch, smell, and sight to explore a variety of unfamiliar vegetables. Children experienced the complete process of growing, harvesting, and eating fresh vegetables. Each child took home fresh produce they personally harvested to prepare and eat with their families.

Classroom component. Fifteen-minute sensory-based vegetable demonstrations were presented in each fifth-grade classroom in the intervention school once a month during the academic school year; excluding August and December (see Appendix C). One additional demonstration was presented at the vegetable-farm field trip. Each month classroom demonstrations highlighted a seasonal vegetable including tomatoes and peppers, potatoes, squash, onions, cucumbers, broccoli, and salads. Each demonstration consisted of a brief overview of the vegetable (history and/or important facts), children participating in the preparation a recipe with the highlighted vegetable, and a taste testing experience. “Kid-friendly” vegetable recipes with only a few ingredients and recipes from the Viva Vegetables Recipes cookbook were used for the classroom demonstrations. These demonstrations provided students with opportunities to develop self-efficacy skills with vegetable preparation and consumption.
Sampling the vegetable recipes in class offered tasting exposure to a variety of vegetables and direct peer modeling. Repeated tasting exposures are associated with increased preference for those vegetables.\textsuperscript{27} Students observed other students (peers) and their teachers taste and react optimistically to the vegetables’ flavors. Modeled behavior acts as a trigger to stimulate similar behavior in others,\textsuperscript{36} and observation of multiple models compared to one is more strongly associated with children mimicking the modeled behavior.\textsuperscript{37, 38} Recipes were sent home with each child and fresh produce from the USU Student Organic Farm for the potato, squash, and onion demonstrations in hopes they would prepare the recipe again at home with their families.

Children were also invited to participate in a poster contest of their favorite vegetable recipe. Posters were hung in a school hallway for everyone to view. A small prize was awarded to those who participated.

\textbf{Cafeteria component.} Seven vegetable tasting opportunities, approximately one each month, were offered as a “Tasty Table” in the cafeteria. “Tasty Tables” were set up near the salad bars at the end of the lunch line. Samples from the “Tasty Table” were offered to all students, teachers, and staff at the intervention school. This allowed many students to observe positive modeling of eating vegetables prepared in a variety of ways by peers, teachers and staff.

The “Tasty Table” provided opportunities to taste samples of delicious recipes made with fresh vegetables that were harvested from the USU Student Organic Farm when available (August to January) or from a local grocery store (February to May). Different seasonal vegetable(s) were highlighted in recipe(s) each month (see Appendix
D). “Kid-friendly” vegetable recipes with only a few ingredients and Viva Vegetables Recipes\textsuperscript{41} were used for the “Tasty Table” samples.

The food samples were prepared by research staff and senior dietetic students in a practicum class. Collaboration with the foodservice staff at the intervention school allowed for much of the recipe preparations to be done in the school kitchen. Recipe handouts were available on the “Tasty Table” as well as sent home with each child in the school. A section on most of the recipe handouts informed parents that their child had the opportunity to sample a recipe and prompted the parent to ask their child if they tasted the recipe and whether they like it. This helped to create a home connection to the vegetable program. Parents had the ability to identify new vegetables to prepare that they may have not known their child had a preference.

**Family component.** As a means to get parents involved, two parent focus groups were conducted to assess nutritional needs of their families and develop related nutrition classes, free fresh vegetable distributions from the USU Student Organic Farm took place, semi-annual newsletters (see Appendix D) with recipes based on vegetable topics were sent home, three family cooking classes were developed based on information presented in the focus groups offered during the intervention school year, and an interactive vegetable recipe blog was developed.

Two focus groups were conducted with parents whose children attended the intervention school. One focus group was conducted in English and the other in Spanish. The focus groups were used to: 1) assess the nutritional needs of families in the school’s region and 2) to learn what their interests were in nutrition education. Cooking/nutrition classes were offered in the past at the school, but attendance was extremely poor so
efforts were made to identify relevant topics, preferred schedule and format of classes, marketing methods, and incentives for attendance. Each focus group was administered by a trained facilitator and in a relaxed setting. Daycare and snacks were provided. Each participant received $20 for their contribution. The data collected was used to develop vegetable-based family evening cooking classes.

The family cooking classes were offered twice in the fall (potatoes and onions/squash) and once in the spring (salad greens) to all children that attended the intervention school and their parents. Each class provided hands-on education on how to pick, prepare, and store specific vegetables. Taste tests of recipes made with the highlighted vegetables were provided. Participants received a handout with recipes and tips learned in the class, as well as fresh produce to take home and prepare the recipes sampled in class.

Free vegetables were also distributed in a variety of ways. As mentioned previously, potatoes, onions, and squash were sent home with fifth-graders as part of the classroom component, and a variety of vegetables in relation to the vegetable-farm field trip. A zucchini give-away took place following school once in the fall. With parental/guardian permission children were able to take home as many zucchini as they desired.

An interactive blog (http://www.canyoncoltsloveveggies.blogspot.com/) was also launch as a way to promote the program and get parents more involved. The blog contained recipes from the “Tasty Table,” classroom sensory-based vegetable demonstrations, family cooking classes, and recipes including the vegetable of the month. The posted recipes included detailed pictures of pertinent steps in the process of
preparing the recipe. The blog created a comfortable atmosphere for cooking and nutrition-related discussions, recipe sharing, and polls on what vegetables were favored. Flyers were sent home with each student at the intervention school informing parents about the interactive vegetable blog. A “hit counter” was incorporated on the blog to assess the number of visits to the site. Unfortunately the blog was poorly utilized.

**Evaluation Tools**

**Lunchtime observations using digital photography.** Cross-sectional lunchtime observations of vegetable plate waste using digital photography at the comparison and intervention schools were used to assess the effectiveness of the multi-component program on vegetable consumption. Digital photography is quick, convenient, and has been found to be highly correlated \((r = 0.89)\) with weighed plate waste measurements. USU dietetic student researchers visited each fifth-grade class the week prior to the plate waste observations to provide parental opt-out consent forms and explain in detail the protocol for the plate waste study to the fifth-graders and their teachers. Students \((n = 12)\) who returned a signed consent form from their parents were excluded from the plate waste study. There was no penalty for opting out.

Fifth-grade students were observed on six different lunch periods, every Tuesday and Thursday for three weeks. Multiple days of observation provide a measure of usual intake; therefore six days of observation were chosen to obtain an estimate of usual intake. Both the intervention and the comparison schools were observed on the same days. The first three days of the plate waste observations will be referred to as the control phase (CP), and consisted of vegetables served that were on the regular lunch menu. The
second three days of the plate waste observations will be referred to as the target vegetable phase (TVP) and vegetables the intervention school had been exposed to during the intervention period were added to the fruit and vegetable bar in addition to the regular school lunch vegetables served for those days. Preparations of the target vegetables were done by the USU dietetic student researchers to avoid adding burden to the foodservice staff.

The type and form of vegetables served to the comparison and intervention school were matched on the days of assessment. The comparison and intervention schools were in the same school district, which provides monthly lunch menus to be followed by each school, thus the foods served at each school were consistently similar. However, depending on what each school has in stock, they may slightly alter their menus. So even though every effort was made to match all food served on assessment days, in a few instances food service staff were forced to make minor alterations. This resulted in entirely matched vegetables at each school for three of the six days and partially matched vegetables on the other three days (see table 3.2). Fried potatoes were served on three days at the comparison school and only one day at the intervention school during the plate waste observation days. Target vegetables added during the TVP of the plate waste observations were completely matched.

USU dietetic student researchers assisted with the plate waste observations. They each attended a training session a week prior to the start date of the plate waste study. They were educated on the protocol of the study, how to properly take digital photographs of the students’ trays, crowd management techniques to use in the busy
Table 3-2. Vegetables served at each school during plate waste study observation days.

<table>
<thead>
<tr>
<th>Plate Waste Day</th>
<th>Intervention School</th>
<th>Comparison School</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fresh green salad with spinach, <strong>broccoli</strong></td>
<td>Fresh green salad with spinach, <strong>pickles, corn, French fries</strong></td>
</tr>
<tr>
<td>2 *</td>
<td>Baked potato wedges, corn, carrot sticks</td>
<td>Fresh fries, corn, carrot sticks</td>
</tr>
<tr>
<td>3</td>
<td>Green beans, <strong>cauliflower</strong></td>
<td>Green beans</td>
</tr>
<tr>
<td>4 *</td>
<td>Cooked peas and carrots, celery sticks, bell pepper sticks *</td>
<td>Cooked peas and carrots, celery sticks, bell pepper sticks *</td>
</tr>
<tr>
<td>5</td>
<td>Roasted cauliflower, zesty black bean salad *</td>
<td>**French fries, green beans, cauliflower, zesty black bean salad *</td>
</tr>
<tr>
<td>6 *</td>
<td>Fresh green salad with spinach, corn, carrot sticks, jicama *</td>
<td>Fresh green salad with spinach, corn, carrot sticks, jicama *</td>
</tr>
</tbody>
</table>

\* Day that all vegetables served at both the comparison and intervention schools were the same.
\* Target vegetable added during intervention days.

cafeeteria to avoid missing photos of some students’ trays, and instructions to only photograph trays with labels (students with parental consent).

Each participant in the plate waste was given a random identification (ID) number to protect their identity. USU dietetic student researchers delivered sticker labels with student ID numbers to each fifth-grade classroom 10 minutes before the start of each plate waste observation lunch period. The fifth-grade teachers were instructed to place the sticker ID labels on the shirt of each student prior to going to lunch. Teachers were then to instruct the children, as they got their lunch tray in the cafeteria, to remove their ID labels from their shirt and place it on their lunch tray. This enabled pictures to be taken of the tray and ID numbers only. No photos were taken of the students to protect confidentiality.
Children participating in the NSLP at these two schools are required to take at least one entrée in addition to another food item, whether it is vegetables, milk, etc. They also have access to a self-serve fruit and vegetable bar at the end of the lunch line. After obtaining their food and before sitting down, the children were directed to the photo-taking table designated with a sign labeled “Picture 1” to get a photograph of their full lunch tray. Three USU dietetic student researchers were present with cameras ready to take photos. This ensured not slowing down the lunch line, as students have a limited time to get through the lunch line and finish eating. The children were then instructed to sit at their regular lunch table and eat their food as normal. If they got seconds on any food, they were instructed to get another photo at the table designated “Picture 1.” Before disposing of their tray’s contents, the children were directed to another photo-taking table designated with a sign labeled “Picture 2” for a photo of their plate waste. Children that participated in the study for at least three days were awarded with a prize following the completion of the study.

After the data were collected, the digital photographs were uploaded onto private research computers in a locked room. Two USU undergraduate dietetic student researchers assisted with the analysis of the digital photographs. The students were trained by the principal investigator on the analysis procedures in the estimation of portion sizes of vegetables taken and consumed in ounces or pieces, depending on the vegetable. Amounts taken and consumed were later converted to cup equivalent servings in the final analyses. The USDA My Pyramid cup equivalent servings were used as the standard, for example one cup lettuce equals one half cup equivalent, six baby carrots one
half cup equivalent, and one half cup cooked vegetables equals one half cup equivalent serving, etc.

To validate accuracy of data, the student researchers separately analyzed the digital photographs for each day of the plate waste observations at both schools. Comparison of their estimations was then conducted to find any disparities on portion sizes taken or consumed by the fifth-graders. Interobserver agreement of amounts of vegetables taken and consumed was 0.95. A trained USU graduate student analyzed the discrepancies between the two undergraduate student researchers and made a final estimation of portion sizes taken and consumed.

**Pre-/post-assessment and cross-sectional surveys.** Fifth-grade children attending the intervention school were administered a vegetable-farm field trip pre-assessment survey by their teachers approximately one week before their farm field trip. The pre-assessment survey consisted of questions concerning vegetable preferences, consumption patterns, and vegetable growing/farming knowledge. The field trip post-assessment survey was conducted by dietetic students immediately following the field trip, while the students were still at the farm. The pre- and post-assessment surveys were used to assess the students’ increase in vegetable knowledge from the vegetable-farm field trip (see Appendix E).

At the end of the multi-component program intervention, fifth-graders were given a post-assessment survey with the same questions as the pre-assessment survey with the addition of acceptability and effectiveness of the program questions (see Appendix E). The post-assessment survey, minus the acceptability questions, was given to the comparison school fifth-graders for a cross-sectional evaluation of vegetable preferences
at each school and by gender. Students at each school received a small prize for completing the surveys.

**Parent pre-/post-assessment and cross-sectional surveys.** At the beginning of the intervention, children at the intervention school were sent home with a pre-assessment survey for their parents to complete and return to school. The pre-assessment survey consisted of two parts including questions on parents’ vegetable consumption patterns, preferences, and attitudes toward vegetables, and secondly a vegetable home inventory (see Appendix E). The home inventory consisted of a list of vegetables and asked if they had them currently at home fresh, frozen, and/or canned.

We adapted surveys used by Heim et al.\(^ {25} \) to assess vegetable preferences, attitudes, self-efficacy, asking behavior, and home availability and accessibility among the fifth-graders and their parents. The same survey, with additional questions regarding the acceptability and effectiveness of the multi-component program, was sent home as a post-assessment at the end of the intervention. Fifth-graders at comparison school also were sent home with the parental post-assessment survey, lacking the acceptability/effectiveness of the program questions, to use as a cross-sectional comparison. Children that brought the survey backed signed by a parent/guardian received a small prize.

**School faculty, staff and foodservice acceptability survey.** A survey adapted from Hoffman et al.\(^ {18} \) and Blom-Hoffman\(^ {45} \) was distributed post-intervention to school faculty/staff and foodservice staff to access the acceptability of the program and desirability of continuing the program another year (see Appendix E). All of the fifth-grade teachers (n = 4) and the foodservice manager and head cook responded.
Statistical Analysis

The analyses of data were performed using PASW (version 18.0, SPSS, Inc. Chicago, IL, 2007). Quantitative data collected from the plate waste observations were inputted into Microsoft Excel (2007) and then imported into PASW for further analyses. For validation of the data, all plate waste records were reviewed by a second researcher and any discrepancies were reviewed by a third researcher. Cross-tabulations were conducted to determine the level of student participation in NSLP. Students participating in two or more days of the NSLP in both the CP and TVP were included in the analyses. Data were excluded if children brought lunch from home, vegetables were covered by another item in the before or after photo, and vegetable consumption was apparent in the before photo but not the after photo or visa verse.

Frequencies were computed to determine days the children took vegetables during school lunch in both the CP and TVP of the plate waste observations. Descriptive analyses, including means and standard deviations were used to evaluate the fifth-graders’ vegetable consumption at lunchtime. The average vegetable consumption from multiple days of observation was used to compute average consumption. Means of vegetables taken and consumed were calculated for all vegetables, all vegetables excluding fried potatoes, and the target vegetables only. Average consumption across time and across school was compared using paired sample t-tests and analysis of variance (ANOVA).

Children’s and parents’ cross-sectional and pre- and post-assessment surveys were analyzed using paired sample t-tests, ANOVA, and two-sided Fisher’s exact significance test. Fisher’s exact tests were used instead of chi-square analyses due to the
small sample size. Pre/post data analyzed for the intervention school excluded students who did not have both baseline and intervention surveys. Home vegetable availability questions on the pre/post surveys were recoded from “Hardly Ever,” “Sometimes,” “Often,” “Almost Always” to “Hardly Ever/Sometimes” and “Almost Always/Often.” Vegetable preference and program acceptability questions used a Likert Scale with six responses from strongly agree to strongly disagree. These were recoded to “strongly agree/agree,” “neither agree nor disagree,” and “strongly disagree/disagree.” Each recoded Likert Scale response was scored in a ranking order from one to three. Means of the ranked responses were compared using ANOVA. The school faculty, staff and foodservice acceptability surveys were analyzed with frequencies of responses on the six point Likert Scale from strongly disagree to strongly agree. Significance was considered P ≤ 0.05.

RESULTS

Participation

In August 2009, 148 fifth-graders were enrolled at the two participating schools and of those 136 (94%) fifth-graders participated in the study. One (0.7%) student was opted out by a parent from the pre- and post-surveys and that student in addition to eleven (8%) others were opted out by parents from the plate waste study.

Vegetable Plate Waste

The CP and TVP of the plate waste observations took place over three days each, for a total of six days of lunchtime observations. Cross-tabulations revealed that 84% (n =
of the fifth-graders participated in two or more days during the CP of the plate waste observations and 82% (n = 111) during the TVP. Only these students who participated in two or more days during each phase were included in the analyses for the plate waste study. The comparison school had significantly (P = 0.022) more girls in the TVP of the plate waste study and approached significance (P = 0.090) in the CP. However, gender differences did not have a significant effect on the amount of vegetables taken and consumed.

On average 13% percent of students at the intervention school compared to 19% of students at the comparison school took vegetables, excluding fried potatoes, everyday. However, on average a higher percentage of students (58%) at the intervention school took vegetables at least one day compared to the comparison school (51%) when fried potatoes were excluded. The intervention school also had a higher percentage of students that took the target vegetables (see table 3.3)

In the analysis that included fried potatoes the comparison school took and consumed more vegetables during the CP and TVP than did the intervention school (CP took: 0.68 cups, 0.36 cup, P < 0.001; CP consumed: 0.45 cups, 0.27 cups, P < 0.001; TVP took: 0.35 cups, 0.24 cups, P < 0.05; TVP consumed: 0.25 cups, 0.16 cups, P < 0.05), respectively (see table 3.4). Potatoes contributed 30% of average vegetable consumption at the intervention school and 63% of average vegetable consumption at the comparison school. When fried potatoes were excluded from the analysis, there were no significant differences between schools in vegetables taken or consumed during both the CP and TVP.
Table 3-3. Plate waste demographics and participation rates based on plate waste phase.

<table>
<thead>
<tr>
<th></th>
<th>Comparison School a</th>
<th>Intervention School a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP b (n = 58)</td>
<td>TVP c (n = 54)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>63%</td>
<td>65%</td>
</tr>
<tr>
<td>Days vegetables taken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No days</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>At least 1 day</td>
<td>79%</td>
<td>72%</td>
</tr>
<tr>
<td>Every day</td>
<td>21%</td>
<td>26%</td>
</tr>
<tr>
<td>Days vegetables taken, excluding fried potatoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No days</td>
<td>28%</td>
<td>33%</td>
</tr>
<tr>
<td>At least 1 day</td>
<td>53%</td>
<td>48%</td>
</tr>
<tr>
<td>Every day</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>Days target vegetables taken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pepper sticks</td>
<td>-----</td>
<td>9%</td>
</tr>
<tr>
<td>Zesty Black Bean Salad</td>
<td>-----</td>
<td>15%</td>
</tr>
<tr>
<td>Jicama</td>
<td>-----</td>
<td>22%</td>
</tr>
</tbody>
</table>

a Numbers based on those who participated in each plate waste study phase two or more days.
b Control phase of the plate waste observations.
c Target vegetable phase of the plate waste observations.

Differences across time within each school were examined separately. In the analysis that included fried potatoes, less vegetables during the TVP compared to the CP were taken and consumed by both the intervention (P < 0.001, P = 0.001) and comparison schools (P < 0.001, P < 0.001), respectively (see table 3.5). In the analysis that excluded fried potatoes, more vegetables were taken by intervention school students during the TVP compared to the CP (P = 0.002), though consumption did not significantly change (P = 0.134). Excluding fried potatoes resulted in no significant differences in vegetables taken and consumed during the CP and TVP of the plate waste observations for the comparison school students (see table 3.5).
### Table 3-4. Cross-sectional three-day mean intake for both phases of plate waste study.

<table>
<thead>
<tr>
<th></th>
<th>Comparison School</th>
<th>Intervention School</th>
<th>ANOVA P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control phase in cup servings ± SD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.68 ± 0.2</td>
<td>0.36 ± 0.2</td>
<td>0.000***</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.45 ± 0.3</td>
<td>0.27 ± 0.2</td>
<td>0.000***</td>
</tr>
<tr>
<td>All vegetables, excluding fried potatoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.21 ± 0.2</td>
<td>0.18 ± 0.2</td>
<td>0.347</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.14 ± 0.2</td>
<td>0.14 ± 0.2</td>
<td>0.953</td>
</tr>
<tr>
<td><strong>Intervention Phase in cup servings (SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.35 ± 0.2</td>
<td>0.24 ± 0.2</td>
<td>0.012*</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.25 ± 0.2</td>
<td>0.16 ± 0.2</td>
<td>0.015*</td>
</tr>
<tr>
<td>All vegetables, excluding fried potatoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.19 ± 0.2</td>
<td>0.24 ± 0.2</td>
<td>0.258</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.12 ± 0.2</td>
<td>0.16 ± 0.2</td>
<td>0.217</td>
</tr>
<tr>
<td>Target vegetables, only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.07 ± 0.1</td>
<td>0.09 ± 0.1</td>
<td>0.342</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.04 ± 0.09</td>
<td>0.06 ± 0.09</td>
<td>0.379</td>
</tr>
</tbody>
</table>

*** P < 0.001, ** P < 0.01, * P < 0.05.

* Standard deviation

### Table 3-5. Comparison of vegetable consumption in the control and target vegetable phases.

<table>
<thead>
<tr>
<th></th>
<th>Comparison School (n = 52)</th>
<th>Intervention School (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three day average for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>all vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.65 ± 0.22</td>
<td>0.35 ± 0.24</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.46 ± 0.26</td>
<td>0.25 ± 0.18</td>
</tr>
<tr>
<td>Three day average for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vegetables, excluding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fried potatoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken</td>
<td>0.20 ± 0.19</td>
<td>0.18 ± 0.24</td>
</tr>
<tr>
<td>Consumed</td>
<td>0.14 ± 0.16</td>
<td>0.12 ± 0.18</td>
</tr>
</tbody>
</table>

* Control phase of the plate waste observations.

b Target vegetable phase of the plate waste observations.

c P-value for paired sample t-tests. Significance: *** P < 0.001, ** P < 0.01, * P < 0.05.

d Standard deviation
Fruit and Vegetable Acceptance and Preference

Food availability was found to be similar in both the intervention and comparison schools with greater than 80% of fifth-graders indicating they almost always/often have vegetables in their homes. Seventy-eight percent of the fifth-graders at the intervention school compared to 68% at the comparison school almost always/often have vegetables served at meals; though this was not significant (see table 3.6). All (100%) of the intervention school participants indicated that they had eaten a fruit or vegetable picked from a plant compared to 92% at the comparison school (P = 0.023). Significantly more fifth-graders at the comparison school indicated that they had eaten vegetables with their lunch that day (P = 0.037), however there were no significant differences between schools when asked if they usually eat vegetables with their lunch (P = 0.850) or dinner (P = 0.817) (see table 3.7). More than 75% of students at both schools agreed that they liked to eat vegetables and greater than 70% agreed that vegetables taste good. Sixty-five percent of fifth-graders at the intervention school agreed that they like to try new vegetables they have never eaten before compared to only 55% at the comparison school, though not significant (see table 3.8). There were no significant differences in the intervention school, pre to post assessment, on attitudes about vegetables such as liking to eat vegetables, taste of vegetables, and liking to try new vegetables (see table 3.9).

Exposure to and preference for the target vegetables was examined cross-sectionally (see table 3.10). Fifth-graders from the intervention school indicated they liked on average 12 different vegetables compared to 10.5 that the comparison school liked (P = 0.077). Significantly more fifth-graders at the intervention school
### Table 3-6. Cross-sectional vegetable availability/accessibility information for fifth-graders

<table>
<thead>
<tr>
<th></th>
<th>Intervention School (n = 71)a</th>
<th>Comparison School (n = 65)b</th>
<th>P-valueb</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Almost Always/Often</strong>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We have vegetables in my home.</td>
<td>82.9%</td>
<td>82.8%</td>
<td>1.000</td>
</tr>
<tr>
<td>In my home, vegetables are served at meals.</td>
<td>78.3%</td>
<td>67.7%</td>
<td>0.235</td>
</tr>
<tr>
<td>In my home, vegetables are available as a snack.</td>
<td>62.7%</td>
<td>68.3%</td>
<td>0.581</td>
</tr>
<tr>
<td>In my home, there are cut-up vegetables in the fridge for me to eat.</td>
<td>50.7%</td>
<td>55.6%</td>
<td>0.604</td>
</tr>
<tr>
<td><strong>% Yes</strong>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does your family grow any fruits or vegetables to eat at your home?</td>
<td>70.4%</td>
<td>67.7%</td>
<td>0.853</td>
</tr>
<tr>
<td>Have you ever eaten a fruit or vegetable picked from a plant?</td>
<td>100.0%</td>
<td>92.3%</td>
<td>0.023*</td>
</tr>
<tr>
<td>Did you eat any vegetables at lunch today?</td>
<td>33.8%</td>
<td>52.3%</td>
<td>0.037*</td>
</tr>
<tr>
<td>Do you USUALLY eat any vegetables with your lunch?</td>
<td>69.6%</td>
<td>71.9%</td>
<td>0.850</td>
</tr>
<tr>
<td>Did you eat any vegetables with your dinner last night?</td>
<td>56.3%</td>
<td>58.7%</td>
<td>0.861</td>
</tr>
<tr>
<td>Do you USUALLY eat any vegetables with your dinner?</td>
<td>83.8%</td>
<td>81.7%</td>
<td>0.817</td>
</tr>
</tbody>
</table>

* n will vary between different variables due to missing data.

b P-value based on Fisher’s exact two-sided significance test.

* P < 0.05.

compared to the comparison school stated they had ever eaten the target vegetables bell peppers (P = 0.022), butternut squash (P = 0.003), and cucumbers (P = 0.017).

### Parental Survey Outcomes

Thirty-seven (52%) parents at the intervention school and 45 (69.2%) parents at the control school provided survey data on vegetable attitudes, barriers to vegetable preparation, vegetable eating habits, and vegetable home availability. There were no
<table>
<thead>
<tr>
<th>% Yes…</th>
<th>Pre-survey (n = 63)(^a)</th>
<th>Post-survey (n = 63)(^a)</th>
<th>P-value(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your family grow any fruits or vegetables to eat at your home?</td>
<td>77.8%</td>
<td>68.3%</td>
<td>0.000***</td>
</tr>
<tr>
<td>Have you ever eaten a fruit or vegetable picked from a plant?</td>
<td>96.8%</td>
<td>100%</td>
<td>-----</td>
</tr>
<tr>
<td>Did you eat any vegetables at lunch today?</td>
<td>22.6%</td>
<td>32.3%</td>
<td>0.120</td>
</tr>
<tr>
<td>Do you USUALLY eat any vegetables with your lunch?</td>
<td>75.8%</td>
<td>71.0%</td>
<td>0.007**</td>
</tr>
<tr>
<td>Did you eat any vegetables with your dinner last night?</td>
<td>50.8%</td>
<td>57.1%</td>
<td>1.000</td>
</tr>
<tr>
<td>Do you USUALLY eat any vegetables with your dinner?</td>
<td>93.3%</td>
<td>85.0%</td>
<td>0.488</td>
</tr>
</tbody>
</table>

\(^a\) n will vary between different variables due to missing data.
\(^b\) P-value based on Fisher’s exact two-sided significance test.

*** P < 0.001, ** P < 0.01.

<table>
<thead>
<tr>
<th>Strongly Agree/Agree(^a) (%)</th>
<th>Neither Agree/Disagree(^a) (%)</th>
<th>Strongly Disagree/Disagree(^a) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to eat vegetables.</td>
<td>IS(^b)</td>
<td>78.9</td>
</tr>
<tr>
<td></td>
<td>CS(^b)</td>
<td>76.9</td>
</tr>
<tr>
<td>I think vegetables taste good.</td>
<td>IS</td>
<td>73.2</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>70.8</td>
</tr>
<tr>
<td>There are lots of vegetables</td>
<td>IS</td>
<td>78.9</td>
</tr>
<tr>
<td>to eat at my home.</td>
<td>CS</td>
<td>76.9</td>
</tr>
<tr>
<td>I like to try new foods I have</td>
<td>IS</td>
<td>66.2</td>
</tr>
<tr>
<td>never eaten before.</td>
<td>CS</td>
<td>70.8</td>
</tr>
<tr>
<td>I like to try new vegetables</td>
<td>IS</td>
<td>65.2</td>
</tr>
<tr>
<td>I have never eaten before.</td>
<td>CS</td>
<td>55.4</td>
</tr>
</tbody>
</table>

\(^a\) Five point likert scale recoded to three point scale.
\(^b\) IS = intervention school; CS = comparison school
<table>
<thead>
<tr>
<th>I strongly agree / agree…</th>
<th>Pre-survey (n = 63)</th>
<th>Post-survey (n = 63)</th>
<th>Change in mean</th>
<th>ANOVA P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to eat vegetables.</td>
<td>80.6%</td>
<td>80.6%</td>
<td>+0.09</td>
<td>0.470</td>
</tr>
<tr>
<td>I think vegetables taste good.</td>
<td>80.6%</td>
<td>75.8%</td>
<td>-0.23</td>
<td>0.132</td>
</tr>
<tr>
<td>There are lots of vegetables to eat at my home.</td>
<td>83.6%</td>
<td>82.0%</td>
<td>+0.12</td>
<td>0.404</td>
</tr>
<tr>
<td>I like to try new foods I have never eaten before.</td>
<td>64.5%</td>
<td>67.7%</td>
<td>+0.13</td>
<td>0.458</td>
</tr>
<tr>
<td>I like to try new vegetables I have never eaten before.</td>
<td>61.7%</td>
<td>63.3%</td>
<td>+0.14</td>
<td>0.428</td>
</tr>
<tr>
<td>I liked having the classroom vegetable demonstrations in my class.</td>
<td>-----</td>
<td>81.7%</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>I liked taste testing the different vegetables.</td>
<td>-----</td>
<td>80.0%</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>I liked learning about vegetables.</td>
<td>-----</td>
<td>71.4%</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>I liked the vegetables I tried at the Tasty Table in the cafeteria.</td>
<td>-----</td>
<td>69.0%</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Trying different vegetables this year in school helped me to like vegetables.</td>
<td>-----</td>
<td>63.4%</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Trying different vegetables this year in school helped me to eat more vegetables.</td>
<td>-----</td>
<td>62.0%</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Almost Always / often…</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I tried vegetables from the Tasty Table in the cafeteria.</td>
<td>-----</td>
<td>56.5%</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>

*a* n will vary between different variables due to missing data.

Table 3-9. Pre-/post-intervention vegetable attitude/preference questions for intervention fifth graders.

Statistically significant differences between these measures among of parents of children attending the intervention and comparison school (see table 3.11-3.14).

Differences across time were examined for these measures excluding barriers to vegetable preparation. Program acceptability was also examined among parents from the intervention school and was found to have a high level of acceptance. There were no significant differences in measures of vegetable preference or habits among parents of students attending either the comparison or intervention school. Parents of children
<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Eaten (%)</th>
<th>P-value(^a)</th>
<th>Like(^b) (%)</th>
<th>It’s okay(^b) (%)</th>
<th>Don’t like(^b) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>IS(^c)</td>
<td>71.0</td>
<td>50.0</td>
<td>6.9</td>
<td>43.1</td>
</tr>
<tr>
<td></td>
<td>CS(^c)</td>
<td>60.7</td>
<td>43.2</td>
<td>25.0</td>
<td>31.8</td>
</tr>
<tr>
<td>Bell Peppers</td>
<td>IS</td>
<td>64.2</td>
<td>36.7</td>
<td>24.5</td>
<td>38.8</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>43.5</td>
<td>27.0</td>
<td>27.0</td>
<td>45.9</td>
</tr>
<tr>
<td>Broccoli</td>
<td>IS</td>
<td>95.8</td>
<td>67.7</td>
<td>18.5</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>95.2</td>
<td>54.4</td>
<td>28.1</td>
<td>17.5</td>
</tr>
<tr>
<td>Butternut Squash</td>
<td>IS</td>
<td>61.4</td>
<td>39.6</td>
<td>16.7</td>
<td>43.8</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>33.9</td>
<td>39.3</td>
<td>17.9</td>
<td>42.9</td>
</tr>
<tr>
<td>Carrots</td>
<td>IS</td>
<td>100.0</td>
<td>83.3</td>
<td>10.6</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>98.4</td>
<td>80.7</td>
<td>15.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>IS</td>
<td>94.4</td>
<td>74.2</td>
<td>15.2</td>
<td>10.6</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>80.3</td>
<td>63.3</td>
<td>22.4</td>
<td>14.3</td>
</tr>
<tr>
<td>Jicama</td>
<td>IS</td>
<td>36.9</td>
<td>48.6*</td>
<td>13.5</td>
<td>37.8</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>32.2</td>
<td>23.3</td>
<td>20.0</td>
<td>56.7</td>
</tr>
<tr>
<td>Onions</td>
<td>IS</td>
<td>86.8</td>
<td>35.0</td>
<td>26.7</td>
<td>38.3</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>83.6</td>
<td>42.3</td>
<td>23.1</td>
<td>34.6</td>
</tr>
<tr>
<td>Potatoes</td>
<td>IS</td>
<td>98.6</td>
<td>89.4</td>
<td>6.1</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>98.4</td>
<td>83.9</td>
<td>10.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Salad Greens</td>
<td>IS</td>
<td>90.1</td>
<td>65.6</td>
<td>21.3</td>
<td>13.1</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>85.2</td>
<td>70.8</td>
<td>14.6</td>
<td>14.6</td>
</tr>
<tr>
<td>Snow Peas</td>
<td>IS</td>
<td>42.6</td>
<td>51.5</td>
<td>21.2</td>
<td>27.3</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>41.9</td>
<td>38.2</td>
<td>26.5</td>
<td>35.3</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>IS</td>
<td>91.4</td>
<td>55.6</td>
<td>12.7</td>
<td>31.7</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>90.8</td>
<td>52.9</td>
<td>11.8</td>
<td>35.3</td>
</tr>
<tr>
<td>Zucchini</td>
<td>IS</td>
<td>73.9</td>
<td>56.6</td>
<td>15.1</td>
<td>28.3</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>66.1</td>
<td>51.3</td>
<td>23.1</td>
<td>25.6</td>
</tr>
</tbody>
</table>

\(^a\) P-value based on Fisher’s exact two-sided significance test.  
\(^b\) I really like it a lot! / I like it a little, It is OK, I really do not like it! / I do not like it.  
\(^c\) IS = intervention school; CS = comparison school  
* P < 0.05, ** P < 0.01
attending the intervention school reported eating more lettuce salad after the intervention (P = 0.044). In addition, these parents reported having more fresh and/or raw vegetables in their home after the intervention (P = 0.052). See tables 3.15 to 3.18.

**School Staff Program Acceptability**

Four (100%) fifth-grade teachers at the intervention school were surveyed to evaluate the acceptability of the multi-component vegetable program. All teachers agreed that the frequency of once a month for classroom vegetable demonstration was appropriate. They agreed that the “Tasty Table” in the cafeteria and the classroom

<table>
<thead>
<tr>
<th>Table 3-11. Parent cross-sectional vegetable attitudes and barriers to preparation.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Almost Always/Often…</strong></td>
</tr>
<tr>
<td>How often do you prepare veggies for lunch?</td>
</tr>
<tr>
<td>Intervention School (n = 37)a</td>
</tr>
<tr>
<td>Comparison School (n = 45)a</td>
</tr>
<tr>
<td>P-valueb</td>
</tr>
<tr>
<td>62.2%</td>
</tr>
<tr>
<td>64.4%</td>
</tr>
<tr>
<td>1.000</td>
</tr>
<tr>
<td>94.6%</td>
</tr>
<tr>
<td>97.8%</td>
</tr>
<tr>
<td>0.586</td>
</tr>
<tr>
<td>78.4%</td>
</tr>
<tr>
<td>66.7%</td>
</tr>
<tr>
<td>0.324</td>
</tr>
</tbody>
</table>

| **% Yes…**                                                    |
| Are you usually responsible for preparing the food for your family? |
| 91.9%                                                        |
| 100%                                                        |
| 0.088                                                        |
| A barrier to eating vegetables is my family’s and/or my own preferences? |
| 16.2%                                                        |
| 28.9%                                                        |
| 0.199                                                        |
| A barrier to eating vegetables is their cost?                  |
| 43.2%                                                        |
| 35.6%                                                        |
| 0.503                                                        |
| A barrier to eating vegetables is I don’t know how to prepare them? |
| 18.9%                                                        |
| 13.3%                                                        |
| 0.553                                                        |
| A barrier to eating vegetables is they take too long to prepare? |
| 10.8%                                                        |
| 2.2%                                                         |
| 0.170                                                        |
| A barrier to eating vegetables is I don’t have the proper kitchen equipment? |
| 2.7%                                                         |
| 6.7%                                                         |
| 0.623                                                        |

*a n will vary between different variables due to missing data.

bP-value based on Fisher’s exact two-sided significance test.

* P < 0.05.
Table 3-12. Parent cross-sectional vegetable attitudes post-intervention.

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Agree (%)</th>
<th>Neither Agree / Disagree (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to eat vegetables.</td>
<td>IS 91.9</td>
<td>5.4</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>CS 91.1</td>
<td>6.7</td>
<td>2.2</td>
</tr>
<tr>
<td>I think vegetables taste good.</td>
<td>IS 89.2</td>
<td>2.7</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>CS 91.1</td>
<td>8.9</td>
<td>0.0</td>
</tr>
<tr>
<td>I like to try new foods I have never eaten before.</td>
<td>IS 62.2</td>
<td>21.6</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>CS 61.4</td>
<td>34.1</td>
<td>4.5</td>
</tr>
<tr>
<td>I like to try new vegetables.</td>
<td>IS 73.0</td>
<td>13.5</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>CS 52.3</td>
<td>38.6</td>
<td>9.1</td>
</tr>
<tr>
<td>My children like to eat vegetables.</td>
<td>IS 75.0</td>
<td>16.7</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td>CS 60.0</td>
<td>28.9</td>
<td>11.1</td>
</tr>
<tr>
<td>My children like to try new vegetables.</td>
<td>IS 55.6</td>
<td>11.1</td>
<td>33.3</td>
</tr>
<tr>
<td></td>
<td>CS 31.1</td>
<td>31.1</td>
<td>37.8</td>
</tr>
</tbody>
</table>

* Five point likert scale recoded to three points: strongly agree / agree, neither agree or disagree, strongly disagree / disagree
* IS = intervention school; CS = comparison school

Table 3-13. Parent cross-sectional information on vegetable eating habits post-intervention.

<table>
<thead>
<tr>
<th>Over the last month (times per day)…</th>
<th>Intervention School (n = 37)</th>
<th>Comparison School (n = 45)</th>
<th>ANOVA P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often ate lettuce salad?</td>
<td>0.63</td>
<td>0.44</td>
<td>0.233</td>
</tr>
<tr>
<td>How often ate French-fries or fried potatoes?</td>
<td>0.11</td>
<td>0.15</td>
<td>0.335</td>
</tr>
<tr>
<td>How often ate other potatoes?</td>
<td>0.25</td>
<td>0.39</td>
<td>0.247</td>
</tr>
<tr>
<td>How often ate dishes that included vegetables?</td>
<td>0.99</td>
<td>0.93</td>
<td>0.738</td>
</tr>
<tr>
<td>How often ate other vegetables?</td>
<td>0.90</td>
<td>0.68</td>
<td>0.157</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Servings per day…</th>
<th>Intervention School (n = 37)</th>
<th>Comparison School (n = 45)</th>
<th>ANOVA P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many servings of vegetables do you eat on a typical day?</td>
<td>2.22</td>
<td>1.96</td>
<td>0.306</td>
</tr>
<tr>
<td>How many servings of vegetables do your children eat on a typical day?</td>
<td>1.76</td>
<td>1.89</td>
<td>0.561</td>
</tr>
</tbody>
</table>
Table 3-14. Cross-sectional home inventory: mean amount of vegetable by type post-intervention.

<table>
<thead>
<tr>
<th></th>
<th>Canyon (n = 37)</th>
<th>Lincoln (n = 45)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh/Raw Vegetables</td>
<td>8.3 ± 3.1 ( ^a )</td>
<td>7.7 ± 3.2 ( ^a )</td>
<td>0.393</td>
</tr>
<tr>
<td>Frozen Vegetables</td>
<td>2.9 ± 2.2</td>
<td>3.5 ± 2.5</td>
<td>0.279</td>
</tr>
<tr>
<td>Canned Vegetables</td>
<td>2.1 ± 1.7</td>
<td>2.8 ± 1.7</td>
<td>0.072</td>
</tr>
</tbody>
</table>

\( ^a \) Mean amount of vegetables at home ± standard deviation.

Table 3-15. Pre-/post-intervention parent vegetable attitudes.

<table>
<thead>
<tr>
<th>I strongly agree / agree(^b)...</th>
<th>Pre-survey ( n = 29 )(^a)</th>
<th>Post-survey ( n = 29 )(^a)</th>
<th>Change in mean(^c)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like to eat vegetables.</td>
<td>97%</td>
<td>90%</td>
<td>-0.11</td>
<td>0.083</td>
</tr>
<tr>
<td>I think vegetables taste good.</td>
<td>93%</td>
<td>90%</td>
<td>-0.07</td>
<td>0.424</td>
</tr>
<tr>
<td>I like to try new foods I have never eaten before.</td>
<td>59%</td>
<td>66%</td>
<td>+0.21</td>
<td>0.206</td>
</tr>
<tr>
<td>I like to try new vegetables.</td>
<td>59%</td>
<td>76%</td>
<td>+0.25</td>
<td>0.700</td>
</tr>
<tr>
<td>My children like to eat vegetables.</td>
<td>76%</td>
<td>79%</td>
<td>+0.10</td>
<td>0.415</td>
</tr>
<tr>
<td>My children like to try new vegetables.</td>
<td>45%</td>
<td>59%</td>
<td>+0.10</td>
<td>0.558</td>
</tr>
</tbody>
</table>

\( ^a \) \( n \) will vary between different variables due to missing data.
\( ^b \) Five point likert scale recoded to three points: strongly agree / agree (1), neither agree or disagree (2), strongly disagree / disagree (3)
\( ^c \) Mean calculated by ANOVA, based on recoded likert three scale. Smaller mean is better.

Table 3-16. Pre-/post-intervention parent vegetable eating habits.

<table>
<thead>
<tr>
<th>Over the last month (times per day)...</th>
<th>Pre-Survey ( n = 29 )</th>
<th>Post-Survey ( n = 29 )</th>
<th>Paired t-test P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often ate lettuce salad?</td>
<td>0.29</td>
<td>0.47</td>
<td>0.044*</td>
</tr>
<tr>
<td>How often ate French-fries or fired potatoes?</td>
<td>0.10</td>
<td>0.12</td>
<td>0.756</td>
</tr>
<tr>
<td>How often ate other potatoes?</td>
<td>0.24</td>
<td>0.26</td>
<td>0.524</td>
</tr>
<tr>
<td>How often ate dishes that included vegetables?</td>
<td>0.84</td>
<td>1.0</td>
<td>0.162</td>
</tr>
<tr>
<td>How often ate other vegetables?</td>
<td>0.90</td>
<td>0.97</td>
<td>0.459</td>
</tr>
</tbody>
</table>

\* \( P < 0.05 \).
Table 3-17. Pre-/post-intervention home inventory: mean amount of vegetables by type

<table>
<thead>
<tr>
<th></th>
<th>Pre (n = 24)</th>
<th>Post (n = 24)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh/Raw Vegetables</td>
<td>7.7 ± 3.2(^a)</td>
<td>8.8 ± 3.2(^a)</td>
<td>0.052</td>
</tr>
<tr>
<td>Frozen Vegetables</td>
<td>2.5 ± 2.4</td>
<td>3.3 ± 2.0</td>
<td>0.108</td>
</tr>
<tr>
<td>Canned Vegetables</td>
<td>2.3 ± 2.4</td>
<td>2.3 ± 1.7</td>
<td>0.086</td>
</tr>
</tbody>
</table>

\(^a\) Mean amount of vegetables at home ± standard deviation.

Table 3-18. Post-intervention parent acceptability of multi-component program.

<table>
<thead>
<tr>
<th>% Yes...</th>
<th>Pre-survey (n = 30)(^a)</th>
<th>Post-survey (n = 30)(^a)</th>
<th>P-value(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you usually responsible for preparing the food for your family?</td>
<td>96.7%</td>
<td>96.7%</td>
<td>1.000</td>
</tr>
<tr>
<td>Did you know about the veggie program this year?</td>
<td>-----</td>
<td>92%</td>
<td>-----</td>
</tr>
<tr>
<td>The veggies program increased my child’s interest of vegetables.</td>
<td>-----</td>
<td>65%</td>
<td>-----</td>
</tr>
<tr>
<td>The veggies program increased my child’s liking of vegetables.</td>
<td>-----</td>
<td>51%</td>
<td>-----</td>
</tr>
<tr>
<td>My child eats more vegetables now than before participating in the program.</td>
<td>-----</td>
<td>54%</td>
<td>-----</td>
</tr>
</tbody>
</table>

\(^a\) n will vary between different variables due to missing data.

\(^b\) P-value based on Fisher’s exact two-sided significance test.

*** P < 0.001, ** P < 0.01, * P < 0.05.

demonstrations were effective at encouraging the fifth-graders to consume more vegetables. The fifth-grade teachers sampled an average of five of the nine recipes offered at the “Tasty Table.” All teachers agreed that they would want to participate in the vegetable-based multi-component program again and would recommend it to other teachers (see table 3.19).

The foodservice manager and head cook (n = 2) responded to the foodservice acceptability survey. Each strongly agreed that they liked having the “Tasty Table”
| % Yes… | Fifth-grade teachers 
| (n = 4) |
|---|---|
| Classroom vegetable demonstrations once a month was an appropriate frequency? | 100% |
| Strongly Agree / Agree … | 100% |
| The ‘Tasty Table’ in the cafeteria is an effective way to encourage students to eat more vegetables. | 100% |
| I liked the vegetables I sampled from the ‘Tasty Table’. | 100% |
| The classroom vegetable demonstrations are an effective way to encourage students to eat more vegetables. | 100% |
| The classroom vegetable demonstrations should prove effective in improving students’ vegetable knowledge. | 100% |
| The classroom vegetable demonstrations should prove effective in improving students’ vegetable preparation skills. | 75% |
| I would recommend the classroom vegetable demonstration component to other teachers. | 100% |
| School teachers, administrators, and food service personnel should encourage students to eat healthier in school. | 100% |
| I am willing to have the classroom vegetable demonstrations in my classroom again in the future. | 100% |
| The classroom vegetable educations and ‘Tasty Table’ in the cafeteria made me more aware of my own vegetable consumption. | 25% |
| The classroom vegetable educations and ‘Tasty Table’ in the cafeteria helped me to eat more vegetables. (100% slightly agree) | 0% |
| The vegetable-farm field-trips were an effective way for children to learn where their food comes from. | 100% |
| I would want to take my class on the vegetable-farm field trip again next year. | 100% |
| Strongly Disagree / Disagree… | 100% |
| The classroom vegetable educations took away too much time from other important educational priorities in my classroom. | 100% |
during lunchtime and that it was a good approach to helping the children consume more and eat a greater variety of vegetables. They strongly agreed that they would want to do the “Tasty Table” again the next year and that other schools would benefit from having a “Tasty Table.” The head cook commented that “the ‘Tasty Table’ should be more often like twice a month” instead of once a month. The foodservice manager stated that the “Tasty Table” “got the kids excited about trying new vegetables.”

**DISCUSSION**

The multi-component school-based vegetable program was not effective at producing significant differences in vegetable consumption between an intervention school and a comparison school. Cross-sectional surveys among fifth-graders showed more students at the intervention school had ever tried bell peppers, butternut squash, and cucumbers. No differences were observed for vegetable attitudes and behaviors pre-to post-surveys among the intervention school students. Parents at the intervention school consumed more lettuce salads post-intervention, but no differences in vegetable attitudes and behaviors were found cross-sectionally among parents.

The comparison school compared to the intervention school took and consumed significantly more vegetables during the CP and TVP of the plate waste observations when fried potatoes were included in the analyses, but when fried potatoes were excluded no significant difference was apparent. This could indicate that although it appears the comparison school was taking and consuming more vegetables, fried potatoes high in fat and sodium are making up a large percentage of their vegetable
consumption. On average, fried potatoes made up approximately 62.9% of the comparison school’s vegetable consumption and 30.2% of the intervention school’s vegetable consumption. A study using data from the 1999-2002 National Health and Nutrition Examination Survey reported that French fries made up more than 28% of children’s total vegetable consumption, with the percentage increasing with age.46 The intervention school only offered fried potatoes on one of the six plate waste observations days compared to the comparison school offering fried potatoes on three of the six days despite the fact that each school follows the same lunch menu. This difference could be due to past collaboration with the intervention school foodservice staff to improve healthy fruit and vegetable offerings during school lunch. Another reason for the difference could be because the intervention school had pizza day from “Pizza Hut” on two of the plate waste study observation days (Tuesdays), whereas the comparison school had their pizza day on a day other than Tuesday or Thursday. The schools do not serve fried potatoes with pizza; therefore it is likely the intervention school served fried potatoes on the opposing days of the plate waste observations and may have had fried potatoes just as often as the comparison school.

Multiple days of observation are associated with usual intake.44 Similar multi-component studies have observed lunch consumption on two days for both pre and post assessment24 and three days for each phase of the study.18 The plate waste observations in our study took place over six days in hopes to provide an accurate estimate of usual vegetable intake. Six days, however, may not have been long enough to accurately measure usual intake. Nelson et al. determined that children should be observed for nine to ten days to have a 0.9 correlation with energy intake.
The plate waste observations in this multi-component program were unique in that they included both a CP and a TVP. This allowed examination of differences in regularly served school lunch vegetables and target vegetables introduced during the intervention. When excluding fried potatoes, the intervention and comparison schools consumed insignificant differences in the amount of vegetables during the TVP compared to the CP and taken for the comparison school, but the intervention school took significantly more vegetables in the TVP. This could have been due to increased acceptance or willingness to try the target vegetables, although less than 25% of the fifth-graders at the intervention school took the target vegetables.

Despite the small changes in vegetable consumption (TVP excluding potatoes: +0.04 cup equivalents, \( P = 0.217 \)) between the intervention and comparison schools, the results of this study are comparable with similar multi-component school-based programs that used lunchtime observation as the assessment tool. The 5-a-Day Power Plus program which did not indicate excluding potatoes found insignificant differences in vegetable consumption (+0.16 more servings, \( P = 0.17 \)) between the intervention and comparison schools.\(^\text{19}\) The High 5 Project, which excluded potatoes, revealed an insignificant difference in vegetable consumption (-0.03 less servings, \( P < 0.63 \)) between intervention and the control group.\(^\text{33}\) The Fruit and Vegetable Promotion program, which did not indicate excluding potatoes, found a small but significant difference in vegetable consumption (+0.07 more servings, \( P < 0.01 \)) between the experimental group and the control during a year one follow-up, but no difference at a second year follow-up.\(^\text{18}\) The Fruit and Vegetable Promotion program attributed only seeing small increases in vegetable consumption to not focusing on increasing vegetable preferences and barriers
to vegetable consumption.\textsuperscript{18} Although our study focused on increasing vegetable preference, it did not see significant changes in consumption. Small sample size may be to blame for lack of significance. Also increased frequency of vegetable tasting opportunities may be needed.

Dose of exposure to tasting vegetables may have an effect of the success of multi-component programs. The Food Dudes study reported significant vegetable consumption increases with lunchtime observations.\textsuperscript{30} Lowe et al. found vegetable consumption increased from pre- to post-assessment by +0.48 portions or +29 g (P < 0.001) compared to the insignificant +0.06 cup equivalents or +5.2 g of vegetable consumption increased in this study. Reasons for disparities between this study and the Food Dudes may be from the level of exposure to the vegetables. This study offered vegetable tasting opportunities once a month in class and in the cafeteria. Lowe et al. in the Food Dudes study offered fruit or vegetable snacks daily in class, in addition to rewards offered daily for consuming at least some fruit and vegetables during lunch.\textsuperscript{30}

Parmer et al. implemented a garden-based multi-component program.\textsuperscript{24} Lunchtime vegetable consumption increased by 0.3 portions (P < 0.01), this could be credited to the experiential and sensory learning component with gardening and food preparation.\textsuperscript{24} Children were exposed to vegetables by hands-on learning as well as tasting opportunities.\textsuperscript{24} Our study offered an alternative to school gardens, by providing a vegetable-based farm field trip and farm to school vegetable tasting opportunities at the “Tasty Table.” The lack of consistency in the results of Parmer et al. and this study may also be due to the rate of implementation. Students in the garden-based program had interaction weekly (nutrition education lessons and gardening lessons on alternating
weeks)\textsuperscript{24} compared to monthly interaction in this study. Also, Parmer et al. reported changes in vegetable consumption in portions. Children self-served as many vegetables as desired during lunch and researchers recorded the amount of that portion consumed.\textsuperscript{24} Vegetable consumption changes reported in portions are difficult to compare to serving sizes and are challenging to assess actual amounts consumed. Cup equivalents, as used in this study, allow for a more exact comparison of changes in vegetable consumption than do portions.

The United States Department of Agriculture’s (USDA) MyPlate recommendations for daily vegetable consumption among ten year-old children who are physically active for at least 30 minutes a day is 2.5 cups.\textsuperscript{10} The NSLP must serve meals meeting one-third of the Dietary Reference Intakes for calories, protein, calcium, iron, vitamin A and C for all children and adolescents attending school.\textsuperscript{47-49} The recommendation for vegetable consumption among children at lunchtime, then could be calculated by taking 1/3 of the MyPlate vegetable recommendations which is equivalent to 0.83 cups. Consistent with national data,\textsuperscript{46} children in this study are not meeting the recommendations. During the CP when fried potatoes were included in the analyses, fifth-graders at the comparison school were consuming 54% of the recommendations, while the intervention school fifth-graders were only consuming 33%. Vegetable consumption dropped to about 17% for both schools, when excluding fried potatoes from the analyses. National data reported that children 6 to 11 years old consumed approximately 58% of the My Pyramid recommendations when fried potatoes are included.\textsuperscript{46} Disappointingly, children’s vegetable consumption remains low and fried potatoes make up a large proportion of that low consumption.
The small increases in vegetable taken during the TVP of the plate waste study may be contributed to not only to vegetable exposure by way of the vegetable-based farm tour, classroom educations, the “Tasty Table,” and family cooking classes, but also the theoretical framework of this study’s vegetable program. SCT emphasizes that peer-modeling and development of self-efficacy may produce behavior change. It has been stated that multiple models are more strongly associated with children mimicking a modeled behavior.\textsuperscript{37, 38} Peer-modeling of vegetable consumption by classmates, teachers, school staff, and research staff were achieved in this study through monthly classroom demonstrations and tasting opportunities at the “Tasty Table” in the cafeteria during lunch. No significant differences in vegetable consumption between the intervention and comparison schools were achieved in this study. The frequency of peer-modeling may have been deficient. Also, slightly older more prestigious models tend to be the most influential among observers,\textsuperscript{36, 50} consequently integrating middle school or high school students as models into this study possibly would have been beneficial. Lowe et al. incorporated videos with the “Food Dudes,” heroic vegetable eaters, into their program as models which were slightly older than the elementary school children in the program.\textsuperscript{30} This may have contributed to their success at increasing vegetable consumption.

Development of self-efficacy with vegetables may have been accomplished as children attended the vegetable-farm field trip, helped prepare vegetable recipes, and tasted a variety of vegetables prepared in new ways. Approximately 60% of the intervention school students reported that trying different vegetables throughout the intervention helped them to like and eat more vegetables, thus preference increased. Peer-modeling and development of self-efficacy in this study may have been linked to children
at the intervention school being more confident with trying and eating new vegetables introduced during the TVP of the plate waste study. Though this was not significant in the study results, it may prove more significant with a greater sample size and a longer duration of the study.

This study had several strengths including using lunchtime observations for evaluating changes in vegetable consumption. Lunchtime observations allow for the most precise assessment of food intake among children as it does not rely on memory like 24-hour food recalls or require the estimation of portion sizes as in food records, which is complicated for children. Baxter et al. found that fourth graders who completed three separate food recalls validated against meal-time observations matched only 35% of foods observed eaten, 24% of foods reported were intrusions, and 41% of foods eaten were not reported. The High 5 Project reported significant increases in vegetable consumption when using data from the children’s 24-hour food recalls, but no significance was found when analyzing lunchtime observations. Crawford et al. compared 24-hour recalls, 3-day food records, and FFQ against lunch-time observations in a validation study with 9-10 year-olds and found Spearman correlations for the FFQ were substantially lower than both the 24-hour recall and the 3-day food record (r = 0.11 – 0.50, r = 0.46 – 0.79, r = 0.78 – 0.94, respectively). Therefore, lunchtime observations should be used when feasible.

A further strength of this study was integrating components with parents and the school foodservice. A literature review of twenty-six school-based nutrition programs to assess effective strategies found that family components improve the effectiveness of the program, particularly with younger children. Our study involved parents by sending
home newsletters, recipes from the “Tasty Table,” family cooking classes, and free vegetable distributions. The three family cooking classes were not well attended, but attendance did increase with each class. A cross-sectional look at parental surveys showed that parents’ vegetable attitudes, consumption patterns, and home availability were analogous. Parents in the intervention school approached significance for more types of fresh/raw vegetables in their homes. The difference here may have resulted from exposing children and their parents to a variety of vegetables and recipes. The cafeteria component, the “Tasty Table,” connected the classroom vegetable demonstrations to consumption of delicious vegetables as part of the NSLP. The “Tasty Table” allowed for peer-modeling and helped the teachers and school and foodservice staff increase their motivation to eat vegetables and be more supportive of the program.

Auld et al. mentioned the importance of children having fun and looking forward to program implementation in their Integrated Nutrition Project, and how that can lead to internal motivation. Approximately 80% of fifth-graders in this study reported liking the classroom vegetable demonstrations and taste testing different vegetables. The fifth-graders had a lot of fun and were always excited to see the “vegetable people” coming down the hall to their classes. The time of day was ideal for the vegetable demonstrations, as it was mid-afternoon and the children were often hungry and eager to sample the vegetable recipes. Developing a program that the children are enthusiastic about and look forward to each time is critical to its success. Not only were the children excited about the program, but the fifth-grade teachers all reported liking to taste samples from the “Tasty Table” and would recommend the classroom demonstrations to other teachers.
Caution should be used in the interpretation of the results due to the several limitations of this study. This study was a pilot study and consequently had a small sample size, making it more difficult to assess significance. Following the plate waste observations it was discovered that children at the intervention school were served four ounce servings of cooked vegetables by lunch staff and self-served raw vegetables from the fruit and vegetable bar. Children at the comparison school self-served both cooked and raw vegetables. This may have affected the portions taken and consequently eaten between the two schools.

Assessment surveys were self-reported which could result in bias. Children filled out the assessments on their own; however it may have been beneficial to go through the survey with the children prior to them filling it out. Words such as “jicama” appear different than they sound and so fewer children may have acknowledged that they had really tried and like it. Another limitation is the length of time between sampling vegetables and then taking the preference questionnaire. Many months had passed between the initial target vegetables sampled and the preference survey. Parmer et al. used a “taste and rate” method to determine fruit and vegetable preferences. Students were given a sample of the target fruit or vegetable to taste and then were asked to rank their preference. This method would ensure that children remember exactly how well they liked the fruit or vegetable as they indicate their preference for it. Lowe et al. used photos of the fruit or vegetables for children as a means to help children remember the appearance of the fruit or vegetable. This method is a great alternative to the taste and rate, if resources aren’t available for taste testing.
Alternative findings at the plate waste observation may have resulted from children at intervention school being more familiar with research staff due to the monthly cafeteria “Tasty Table” and thus less likely to change eating habits during the observation periods. In contrast, the comparison school may have been more likely to alter their regular eating habits due to uncertainty of the researchers’ presence during the plate waste observation period. Assessment surveys were taken towards the end of the school year. On the day of post-assessment, at least one class at the invention school was having a pajama-day party and was busy playing games. The act of having to stop their party to take the survey assessment may have had a negative effect on their post-assessment responses. On the other hand, the comparison school was in the middle of reading and acted enthusiastic to stop and respond to the survey.

**IMPLICATIONS FOR RESEARCH AND PRACTICE**

Children are consuming far less than the recommended servings of vegetables.\(^{15, 46}\) This study implemented an elementary school-based multi-component program to increase vegetable acceptance and consumption among fifth-graders. Vegetable consumption has been found to be more challenging to increase than the consumption of fruit,\(^{22}\) as evidenced by previous studies.\(^{17-19}\) Research has supported sensory-based activities such as repeated tasting opportunities\(^ {27, 29, 55}\) and garden-based education\(^ {23, 24, 26}\) as being effective at increasing vegetable acceptance and consumption. This study incorporated monthly tasting opportunities in the classroom and cafeteria. An alternative approach to school gardens was used by developing and implementing a vegetable-farm
field trip. The vegetable-farm field trip allowed children to actively participate in the gardening process by weeding, harvesting, and eating the fresh locally grown produce. It may offer an effective substitute to gardening for schools with limited resources. Research has also supported the use of rewards with repeated tasting exposures to increase vegetable consumption.\textsuperscript{30, 38} Despite the evidence-based components implemented in this study, no difference was found in lunchtime vegetable consumption between the intervention and comparison schools.

Few studies show substantial increases in vegetable consumption following the implementation of a multi-component intervention.\textsuperscript{23, 24, 30} Developing a school nutrition policy is another approach that has the potential to significantly increase vegetable consumption. School policies can affect the overall health of the school environment by mandating food choices available to children and physical activity. The Texas Public School employed a nutrition school policy in middle schools that limited portion sizes of high-fat and sugar-dense foods (i.e. three oz servings of French fries no more than three times a week), only served 1% milk, and offered approximately five different types of fruits and vegetables each day.\textsuperscript{56} A middle socioeconomic status school consumed significantly more vegetables post policy implementation.\textsuperscript{56} The USDA proposed an update to the Nutritional Standards for School Meals in January 2011 that would make similar changes among all schools in the United States that participate in the NSLP.\textsuperscript{57} The changes would involve adding more fruits, vegetables, whole grains, fat-free and low-fat milk to the school meals.\textsuperscript{57} Future research should evaluate the effectiveness of these policy changes.
Data from the Behavior Risk Factor Surveillance Survey found that the likelihood that an individual would consume five or more servings of fruit and vegetables a day was approximately 50% greater for those who participated in intense physical activity compared to those who were physically inactive, 30% greater for nonsmokers in comparison with heavy smokers, 40% greater for those who have been screened for blood cholesterol levels compared with those who have not, and 50% greater for nondrinkers in relation to heavy drinkers. Our study did not assess other health indicators that may be associated with fruit and vegetable consumption; however this would be important to evaluate in future research.

Further research needs to be done using a randomized, larger sample size to detect significance. Studies intended to increase vegetable consumption would benefit from increased frequency of tasting exposure to target vegetables, a gardening activity, use of rewards, and implementation of a school nutrition policy for more substantial increases in vegetable acceptance and consumption.

REFERENCES


57. USDA Unveils Critical Upgrades to Nutritional Standards for School Meals; Washington; US Department of Agriculture; January 13, 2011; release number 0010.11.


CHAPTER 4

UNIVERSITY FARM TO KIDS: SENSORY-BASED EXPERIENCES WITH FRESH, LOCAL PRODUCE

ABSTRACT

Utah State University (USU) faculty and undergraduate dietetic students collaborated with the USU Student Organic Farm to develop and implement a vegetable-farm field trip for second- and fifth-grade students. Knowledge and acceptance of vegetables significantly increased. Teachers and students expressed the value of the vegetable-farm field trip.

INTRODUCTION

Despite the health benefits of eating fruits and vegetables (FV), less than 20% of children between the ages of 9 to 13 years are consuming the recommended five or more servings of FV daily.¹ Research has shown that vegetable intake is more difficult to change than fruit intake.² Unlike many school-based FV programs, programs incorporating school gardens have shown significant increases in children’s vegetable consumption.³,⁴

School gardens present an opportunity for experiential learning through planting, weeding, harvesting, and food preparation, which consequently builds a personal connection with food.⁵ Children involved in these activities are more likely to enjoy the taste of vegetables and be accepting of them.⁶ Not all schools have the resources to
initiate a school garden. A farm field trip provides an alternative to school gardens. The purpose of this study was to evaluate the effectiveness of a vegetable-farm field trip on fifth-graders knowledge and acceptance of vegetables.

**PROGRAM DESCRIPTION AND IMPLEMENTATION**

Utah State University (USU) dietetics faculty and senior dietetic students in a practicum class collaborated with the USU Student Organic Farm to create a sensory-based farm field trip for one low-income elementary school in Northern Utah. All grades within the elementary school were invited to attend the farm field trip through coordination with the principal, and second and fifth-grade teachers expressed interest in participating.

The dietetic students were each responsible for developing one of seven different stations to be attended by children during the field trip. The farm stations included compost piles, plant parts, the field (weeding and watering), hoop-houses, a harvesting scavenger hunt, and two stations that focused specifically on senses of sight, smell, and taste with unfamiliar vegetables.

One-hundred second-graders (4 classes) arrived by school bus to attend the vegetable-farm field trip and a week later 76 fifth-graders (3 classes) arrived. The farm was approximately eleven miles from the school. Once at the farm, children visited each station for approximately seven minutes. Several of the stations provided an opportunity for students to personally harvest a vegetable that they could then take home to their family. Prior to the last two stations the children took a break to wash hands and drink
water. They then used their senses and sampled recipes prepared with vegetables freshly harvested from the farm. The entire experience lasted approximately one and a half hours.

**EVALUATION**

The effectiveness of the vegetable-farm field trip to increase fifth-graders vegetable knowledge and acceptance was assessed by pre-/post-surveys. Fifth-grade teachers administered the pre-survey in class approximately one week before attending the vegetable-farm field trip; dietetic students administered the post-survey immediately following the field trip. The analyses of data were done by using PASW (version 18.0, SPSS, Inc. Chicago, IL, 2007). Cross-tabulations and chi-square analyses were used to compare the differences and significance between the pre- and post-surveys. Significance was considered \( P < 0.05 \).

**RESULTS AND IMPLICATIONS**

Sixty-five (86%) fifth-graders completed both the pre- and post-assessment survey. There was a significant increase seen in children’s knowledge of how vegetables grow (\( P = 0.036 \)) in the post-survey. Knowledge of what belongs in compost piles increased by 46.6%. Fifty-nine percent of students said that they had eaten something at the field trip that they hadn’t eaten before and 28% ate something they didn’t think they would like, but did (see table 1). All of the fifth-grade teachers in an acceptability survey agreed that the field trip was an effective way for students to learn where their food
A vegetable-farm field trip was an effective means of increasing children’s knowledge and acceptance of vegetables and provided an opportunity for many students to try new vegetables. It is a valuable alternative to school gardens for elementary schools with limited resources and may provide similar benefits regarding increased vegetable consumption.
REFERENCES


CHAPTER 5
SUMMARY AND CONCLUSION

SUMMARY

The intention of this thesis project was to gain knowledge in the field of nutrition, specifically related to childhood obesity and vegetable consumption. A literature review was conducted on elementary-aged school-based multi-component programs aimed at attenuating childhood obesity by increasing fruit and vegetable (FV) consumption, theoretical frameworks of these nutrition programs, and assessment tools to evaluate consumption of FV. The literature review illustrated the magnitude of the obesity epidemic among children in the United States and related negative health implications associated with this epidemic.\textsuperscript{1-9} Interventions targeting increased consumption of FV have become a well-accepted approach. Fruit and vegetables are nutrient-dense, calorically low, and associated with reduced risk of chronic diseases, certain cancers, and weight maintenance.\textsuperscript{10-15} Consuming the recommended servings of FV may help displace higher-calorie, nutrient poor foods, resulting in a decreased energy intake which is associated with weight maintenance and loss.\textsuperscript{16} Schools provide an avenue for implementing FV interventions. Research has shown that effective school-based programs consist of multiple components.\textsuperscript{17}

Based on the findings of the literature review, a pilot school-based multi-component program was designed and implemented among fifth-graders in one school in the Cache County School District and compared cross-sectionally to another. The multi-
The multi-component program consisted of a vegetable-farm field trip, monthly classroom sensory-based vegetable demonstrations, cafeteria vegetable tasting opportunities at the “Tasty Table” with recipes sent home, locally grown free vegetable distributions to fifth-graders and families, semi-annual newsletters, three family vegetable-based evening cooking classes, and a vegetable school blog. The vegetable-farm field trip was used as an alternative to a school garden, while still helping children make a connection between the path food takes from the farm to the plate. The focus of this intervention was to increase children’s vegetable acceptance and consumption. Data were gathered by conducting a visual plate waste study consisting of a control phase (CP) and a target vegetable phase (TVP). A vegetable attitude/behavior/home availability survey was also administered cross-sectionally and pre- and post-intervention.

The results of the study demonstrated that the multi-component program was not effective at producing significantly more vegetable consumption at lunchtime among the fifth-graders at the intervention school compared to the comparison school. However, differences are more difficult to detect with a small sample size. Vegetable consumption was below the My Pyramid recommendations, which is consistent with national data. However, comparison of the CP to the TVP of the plate waste observations at the intervention school showed significant increases vegetables taken ($P = 0.002$) and more vegetables consumed, though not significant. This is in opposition to the comparison school that took and consumed slightly less vegetables during the TVP, but not significant. This can be interpreted as the intervention school had a somewhat higher acceptance of novel vegetables compared to the comparison school, which may in part be due to the sensory nature of the multi-component program. There were a higher
percentage of children and parents at the intervention school who reported that they liked to try new vegetables pre- to post-intervention and cross-sectionally compared to the comparison school. Previous studies have shown that hands-on activities such as food preparation, repeated tasting exposure, and gardening activities help to increase fruit and vegetable acceptance and consumption. Few other differences were seen in the survey cross-sectional and pre- to post-intervention.

The challenge of increasing vegetable consumption among children as seen in this study was consistent with other studies. This study had interaction with the children only once a month in the classroom and cafeteria. Studies with increased frequency of exposure to the intervention with repeated tasting opportunities have shown significantly better increases in vegetable consumption. Use of rewards have also been shown to have a positive effect on vegetable consumption.

CONCLUSION

Childhood obesity is a major health threat to our nation. Maintenance of an appropriate weight, reduction in risk of chronic diseases, and certain cancers may be obtained by consuming the recommended servings of vegetables. The children in this study were consuming far less than the recommendations. The multi-component program was not effective at increasing vegetable consumption; although small trends to increased target vegetable acceptance was seen. This was a pilot study with a small sample size. Future studies should aim for a larger randomized sample to better detect significant differences. School-based multi-component programs that provide frequent repeated
tasting opportunities, sensory/experiential learning, and rewards appear to be the most promising for increasing vegetable consumption.

REFERENCES


APPENDICES
Appendix A. Consent Forms
Letter of Information  
Canyon Colts Love Vegetables project

Introduction/Purpose: Dr. Heidi Wengreen in the Department of Nutrition and Food Sciences at Utah State University is conducting a research study to find out more about how to improve nutrition among elementary students attending public schools. All fifth graders at Canyon Elementary, including your child, are invited to participate.

Procedures: If you agree to let your child participate and he/she also agrees to do so, the following will occur. You and your child will be asked to complete short surveys about vegetables. Your child will complete the survey during class during a time assigned by his teacher. This survey will take approximately 10 minutes to complete. Your child will be asked to complete a similar survey at the end of the school year. We will send your survey home with your child in his/her homework folder and will ask you to return it to their teacher the same way. It will take you approximately 10 minutes to complete your survey.

New Findings: During the course of this research study, you will be informed of any significant new findings. If new information is obtained that is relevant or useful to you, or if the procedures and/or methods change at any time throughout this study, you will be notified and given the opportunity to withdraw from the study.

Risks: The risks of your child participating in this research are minimal. There is a risk of others gaining access to personal information but this is unlikely because of the measures to protect you and your child’s confidentiality.

Benefits: Children will receive a pencil, stickers, or an eraser as an incentive to participate. There may or may not be any other direct benefit to you or your child from this research at this time. The researchers, however, may learn more about how to better market healthy food choices and nutrition education to children. This may lead to positive changes throughout the Cache County School District that help improve the nutrition status of many children.

Explanation & offer to answer questions: If you have other questions or concerns regarding this research, you may reach Stacy Bevan, graduate research assistant, by phone (435-797-0896) or email (stacy.lyn.bevan@aggiemail.usu.edu).

Voluntary nature of participation and right to withdraw without consequence: Participation of your child in this research is entirely voluntary. You may refuse to have your child participate in this study at anytime or you may withdraw them from this research without consequence or loss of benefits.

Confidentiality: Research records will be kept confidential, consistent with federal and state regulations. Only authorized School District personnel will have access to identifying data, which will
be kept in a locked file cabinet in a locked room. Personal identifiable information will be kept for no more than three years. After that time, it will be destroyed.

**IRB Approval Statement** The Institutional Review Board (IRB) for the protection of human participants at USU has reviewed and approved this research study. If you have any pertinent questions or concerns about your rights or think the research may have harmed you, you may contact the IRB Administrator at (435) 797-0567 or email irb@usu.edu. If you have a concern or complaint about the research and you would like to contact someone other than the research team, you may contact the IRB Administrator to obtain information or to offer input.

**Investigator Statement** “I certify that the information contained in this form is correct and that we have provided trained staff to explain the nature and purpose, possible risks and benefits associated with taking part in this study and to answer any questions that may arise.”

Heidi Wengreen, Ph.D.  
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Stacy Bevan  
Student Researcher  
(435)-797-0896  
stacy.lynn.bevan@aggiemail.usu.edu

**Signature of Parent/Guardian** Your child will automatically be included in this study unless you wish to withdraw him or her. If you do not want your child to participate in this research for any reason, please check the box below, fill in your child’s name, sign where indicated, and return this form to your child’s teacher or to Heidi Wengreen at the address listed above.

☐ ☐ Please withdraw _______________ (your child’s name) from this research study.

Parent/Guardian Signature _______________ Date _______________
Letter of Information
Plate Waste Study in Cache County, Utah

Introduction/Purpose Dr. Heidi Wengreen in the Department of Nutrition and Food Sciences at Utah State University is conducting a research study to find out more about how to improve nutrition among elementary students. All fifth graders at Canyon Elementary, including your child, are invited to participate.

Procedures If you agree to let your child participate and he/she also agrees to do so, the following will occur. Researchers will identify your child at the beginning of his/her lunch period and will take a digital photograph of his/her tray after they have made their lunch selections, and again just before they dump their tray after eating. The lunchroom assessments will take place on six different days during January 2010 and February 2011.

New Findings During the course of this research study, you will be informed of any significant new findings (either good or bad). If new information is obtained that is relevant or useful to you, or if the procedures and/or methods change at any time throughout this study, you will be notified and given the opportunity to withdraw from the study.

Risks The risks of your child participating in this research are minimal. There is a risk of others gaining access to personal information but this is unlikely because of the measures to protect you and your child’s confidentiality.

Benefits Children will receive a pencil, sticker, or eraser as an incentive to participate. There may or may not be any other direct benefit to you or your child from this research at this time. The researchers, however, may learn more about how to better market healthy food choices and nutrition education to children. This may lead to positive changes throughout the Cache County School District that help improve the nutrition status of many children.

Explanation & offer to answer questions If you have other questions or concerns regarding this research, you may reach Stacy Bevan, graduate research assistant, by phone (435-764-4907) or email (stacy lyn bevan@aggiemail.usu.edu).

Voluntary nature of participation and right to withdraw without consequence Participation of your child in this research is entirely voluntary. You may refuse to have your child participate in this study at anytime or you may withdraw them from this research without consequence or loss of benefits.

Confidentiality Research records will be kept confidential, consistent with federal and state regulations. Only authorized research assistants will have access to identifying data, which will be kept in a locked file cabinet in a locked room. Personal, identifiable information will be kept for no more than three years. After that time, it will be destroyed.
College of Agriculture
Department of Nutrition and Food Science
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Utah State University

Letter of Information
Plate Waste Study in Cache County, Utah

IRB Approval Statement This research project has been reviewed by the Institutional Review Board for the protection of human participants at Utah State University and the Cache County School District. If you have any questions or concerns about your rights, you may contact the IRB at (435) 797-1821.

Investigator Statement “I certify that the information contained in this form is correct and that we have provided trained staff to explain the nature and purpose, possible risks and benefits associated with taking part in this study and to answer any questions that may arise.”

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Signature of Parent/Guardian Your child will automatically be included in this study unless you wish to withdraw him or her. If you do not want your child to participate in this research for any reason, please check the box below, fill in your child’s name, sign where indicated, and return this form to Heidi Wengreen at the address listed above or to your child’s teacher.

☐ Please withdraw ____________________ (your child’s name) from this research study.

Parent/Guardian Signature

Date
Letter of Information
Plate Waste Study in Cache County, Utah

Introduction/Purpose Dr. Heidi Wengreen in the Department of Nutrition and Food Sciences at Utah State University (USU) is conducting a research study to find out more about how to improve nutrition among elementary students. All fifth grade students attending Lincoln Elementary in the Cache County School District, including your child, are invited to participate.

Procedures If you agree to let your child participate and he/she also agrees to do so, the following will occur. Researchers will identify your child at the beginning of his/her lunch period and will take a digital photograph of his/her food tray only, after they have made their lunch selections, and again just before they dump their tray after eating. The lunchroom assessments will take place on six different days during January 2010 and February 2011. Children will receive a pencil, stickers, or an eraser as an incentive to participate.

Risks The risks of your child participating in this research are minimal.

Benefits There are no direct benefits to you or your child from participating in this research at this time. The researchers, however, may learn more about how to better market healthy food choices and nutrition education to children. This may lead to positive changes throughout the Cache County School District that help improve the nutrition status of many children.

Explanation & offer to answer questions If you have other questions or concerns regarding this research, you may reach Stacy Bevan, graduate research assistant, by phone or E-mail (435-797-0896 or stacy.lynn.bevan@aggiemail.usu.edu).

Voluntary nature of participation and right to withdraw without consequence Participation of your child in this research is entirely voluntary. You may refuse to have your child participate in this study at anytime or you may withdraw him/her from this research without any consequence or loss of benefits.

Confidentiality No personal information is being collected. Photos taken are of the lunch food trays only and not of the children.

IRB Approval Statement The Institutional Review Board for the protection of human participants at USU has approved this research study. If you have any pertinent questions or concerns about your rights or a research-related injury, you may contact the IRB Administrator at (435) 797-0567. If you have a concern or complaint about the research and you would like to contact someone other than the research team, you may contact the IRB Administrator to obtain information or to offer input at irb@usu.edu.

Investigator Statement “I certify that the information contained in this form is correct and that we have provided trained staff to explain the nature and purpose, possible risks and benefits associated with taking part in this study and to answer any questions that may arise.”
Letter of Information
Plate Waste Study in Cache County, Utah

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Signature of Parent/Guardian Your child will automatically be included in this study unless you wish to withdraw him or her. If you do not want your child to participate in this research for any reason, please check the box below, fill in your child’s name, sign where indicated, and return this form Heidi Wengreen at the address listed in the letterhead.

☐ Please withdraw ________________ (your child’s name) from this research study.

__________________________________________  ____________________________
Parent/Guardian Signature  Date
Informed Consent Form For Adult Cooking/Nutrition Classes Focus Group

What is the Purpose? The purpose of this discussion group is to learn what parents in the Canyon Elementary School region think about evening cooking/nutrition classes that have been and will be offered. Parent’s ideas about how to get more participation in the program and what are ideal locations for the classes also are needed.

What does participation involve? Participation involves taking part in an informal discussion group with 6-11 other parents for about 90 minutes. These conversations will be audio recorded to ensure complete, accurate information is gathered.

Guarantees: I understand that:
1. Being part of this focus group will not cost me anything; there are no known risks involved.
2. I will receive a stipend of $20 in recognition for my time.
3. The results of this focus group will be reported to the Utah State University Nutrition Department. The results of this focus group may be combined with results from other focus groups to provide a broader understanding of how to provide a successful adult/parent cooking/nutrition class.
4. Names will not be used in any reports to protect confidentiality. Audiotapes will be destroyed after they have been transcribed. Focus group transcripts will be kept in locked cabinets for three years.
5. Being part of this study is voluntary and I may decide to terminate my involvement at any time without consequence. I do not need to provide any information that would make me feel uncomfortable.

Questions? If you have any questions about your participation in the study, we encourage you to contact Heidi Wengreen at Utah State University (1.435.797.1806), or Tammy Vitale (1.435.797.3467).

Heidi Wengreen, Ph.D., RD
Principal Investigator

Tammy Vitale, RD
Co-Principal Investigator

Consent: I have read the above description of the purpose of this focus group. By signing this consent form, I agree to participate in this focus group. I understand this consent form is valid for one year from the date of the signature.

Participant Signature

Participant Name (Printed)

Address

Phone Number

Date
Appendix B. Farm Tour Outline
USU ORGANIC FARM TOUR

LESSON PLAN

OUTLINE

1. Children will be divided into five equal groups (10 kids/group of 50 or 16 kids/group of 80) with a dietetic student (plus a helper or two) as their farm tour-guide. The children will be sent to one of five stations. The children will be able to visit each station as they will rotate every ten minutes.
2. The five different stations that will be visited include: the compost piles, the plant parts station, the field, hoop-houses, and the harvesting scavenger hunt.
3. After visiting each station, the children will load the buses to travel to the ASTE building for the three more stations, which will be a 1) Garden Display Table, 2) Pepper-mania, and 3) Tasting Table.
4. The children will end their visit to the USU Organic Farm by taking home the vegetables they harvested in the scavenger hunt to share with their families along with recipes to prepare the vegetables.

STATIONS (total time 50 minutes)

STATION 1: Compost Piles (10 minutes)

MINI LESSON:
- What is compost?
- What are the benefits of compost?
- When and how to use compost?
- How do you make compost?
  - Tools needed
  - Ingredients that SHOULD and SHOULD NOT be used to make compost
  - Turning the pile

ACTIVITY IDEAS:
- Smell/feel compost at various stages- allow the children to see how it turns from stinky garbage-looking stuff to nice, crumbly, black dirt that smells good and is not icky (do this activity!).
- Stir the compost pile.
- Have children add something to the compost pile as you explain what materials can be used and what can’t be used in a compost pile.
- Play “I-Spy” and have the children locate recognizable items in the compost pile then see how those items decompose as you move to an older pile.
STATION 2: Plant Parts (10 minutes):

MINI LESSON:
- What are the six parts of a plant? Seeds, root, stem, leaves, flowers, fruit
- What are the functions of each plant part?
- What plant parts do we eat?

ACTIVITY IDEAS:
- Have demonstration table set up to show a few good examples of whole plants, including all their parts. Let the children identify the edible part(s) of each plant. Plants to maybe include on demo table: chard with their long root and big leaves, beets, cabbage, beans, potatoes, root vegetables, etc. *Blake will know*.
- Cut open a few plants to show how the fruit protects the seeds. Let the children hold some seeds.
- Guessing game: Show various plant parts and have children guess what part of the plant it is. (For example: tomato-fruit, carrots-roots, beets-leaves/root, sunflower seeds-seeds, etc.)

STATION 3: The Field (10 minutes):

MINI LESSON:
- What are the four ingredients that plants need to survive? Air, nutrients/soil, water, sunlight (have children find the four ingredients in the area around them).
- Explain why the farm is organic and what organic means- plants grow with less/no chemicals.
- Explain the irrigation system
  - How does it work?
  - Where does the water come from?
  - How often do you have to use the irrigation system? (How often do you water the plants?) Less often due to compost’s ability to hold water.

ACTIVITY IDEAS:
- Give tour of garden- show watering techniques, how to pull weeds and how long it takes, show black plastic/straw uses, and how to control weeds by pulling or digging (no chemicals- reason it is organic)

STATION 4: Hoop-Houses (10 minutes):

MINI LESSON:
- What are hoop-houses?
- Why have hoop-houses? (Season extension in our climate.)
  - What is humidity?
  - How does humidity assist in the growth of plants?
• Show the children the solar panel next to the hoop-houses. Explain the purpose of the solar panel and its benefits.

ACTIVITY IDEAS:
• Tour inside of hoop-house.
• Compare the inside temperature and humidity of the hoop-house to the outdoor temperature and humidity.

STATION 5: Harvesting Scavenger Hunt *(10 minutes)*:

MINI LESSON:
• Rules explained for scavenger hunt

ACTIVITY IDEAS:
• Have a scavenger hunt while harvesting some vegetables (clues/questions below on pg. 9).

**Cooking/Tasting Activity** *(total time 45 minutes)*

ACTIVITIES AT ASTE: (We will have three stations here and have the children visit each for 15 minutes). Allow time at each station for children to ask questions.

**STATION 1: Garden Display Table**

SET-UP/EQUIPMENT NEEDED:
• A display table with a variety of vegetables/herbs of different colors, textures, and smells.
• Have a few vegetables cut in half so the children can see the interior of the vegetables, their seeds, and smell them.

ACTIVITIES:
• The children will use many of their senses to explore the different colors, textures and aromas of the various vegetables and herbs.
• Talk about the names and varieties of the vegetables and what plant part they are.
• Pass around some vegetables and allow the children to feel the texture. Then pass around some cut in half vegetables. Explain how the vegetable/fruit protects the seeds as the children look at the interior of the vegetable/fruit (i.e. tomatoes, squash, and beans).
• Have the children smell some herbs and allow them to taste if they want to. Talk about how the herbs may be used (for seasoning). Tell the children examples of how the herbs season foods. For example: basil- tomatoes and spaghetti sauce and dill- pickles, tuna salad, etc.

**STATION 2: The Tasting Table**

SET-UP/EQUIPMENT NEEDED:
• Variety of peppers (colors, sizes, shapes)
• 2 Peppers to demo cutting, cutting board, knife
• Spicy Black Bean Salad
• Mini-cups, napkins, spoons x 200 each
• Recipe handouts
• Teacher Information Handout
• Tomatoes for testing (three kinds)
• Few store bought tomatoes
• Plates for tomatoes

ACTIVITIES:

• PEPPERS
  o **ASK:** How many of you have tasted peppers before? How many of you like to eat peppers?
  o Explain that some peppers are hot and others are mild and even sweet. Hot peppers are called chiles.
  o Explain some people become addicted to the spiciness of peppers and we call them “chile heads”. So if you know someone who loves to eat spicy peppers, you can call them “chile heads”.
    ▪ Show the children the many different varieties of peppers available to eat.
    ▪ Show that large, mature (red/orange) peppers are milder than small, green ones.
      • Some examples: **Mild**- bell peppers, banana peppers, paprika peppers; **Mild to Medium**- poblano, Anaheim, Ancho, New Mexico; **Hot Peppers/Chiles**- Jalapeno, Chipotle, Serrano; **Very Hot**- Habanero, Cayenne, Thai
    ▪ The seeds and veins are the hottest part of the pepper, so if you like the spicy flavor, leave them in or remove them prior to eating to mild the flavor.
  o Demonstrate how to cut open a bell pepper, show them the seeds and how to remove.
  o Taste test the red, orange, versus, green.
    ▪ Vote on the one they liked the best and ask why.
  o While the children taste the peppers, remind them when they taste an unfamiliar pepper to only take a tiny taste, in case it is too spicy for them.
    ▪ If the pepper is ever too hot for them, what should they drink to calm the burn?
      • Milk or dairy product, or biting into a lime
• Drinking water or soda does not help

• **TOMATOES**
  - Show the children some tomatoes
  - **ASK:** What foods have tomatoes in them?
    - Ketchup, spaghetti sauce, pizza sauce, salsa, etc.
  - Explain the path that tomatoes take to be made into these processed products.
    - Example: ketchup → Trucked from manufacturing plant → produced and bottled in manufacturing plant → transported from farm → picked from plant
    - Explain that in each step some of the natural nutrients in tomatoes are lost. The less steps from being picked from the farm to eaten, the better the tomato tastes and the more nutritious it is.
  - Show a store bought tomato versus a tomato from the USU Student Organic Farm.
  - **ASK:** What are the differences you see?
    - Size, flavor, color, weight/density, etc.
  - Explain the three different varieties we have from the USU Student Organic Farm (beef steak tomatoes, plum tomatoes, etc.)
    - Have the children taste each one and then vote on which they prefer for:
      - Sweetest flavor, Favorite taste, Best texture, Favorite Color
  - **Explain what Zesty Black Bean Salad is and have the children taste it.**
    - Remind the children that the salad has both the peppers and the tomatoes in it.
Appendix C. Lesson Plans and Handouts for the Sensory-Based Classroom Vegetable Demonstrations
Classroom Vegetable Education—

POTATOES

MATERIALS / PREP NEEDED
- Grate ½ cup potato so it discolors (at least 30 minutes before class)
- Scrub about 3-5 potatoes per class that the kids will be grating
- Pre-portion ingredients for recipe

CLASS CONTENT—15 minutes

Learning about Potatoes

Tell the children that today there are over 5000 different kinds of potatoes worldwide (show the kids the different kinds you brought). People of all different cultures and wealth (rich or poor) enjoy them. Potatoes are inexpensive and can be cooked in a variety of ways.

- Ask: What are some of the ways you like eating potatoes? (French fries, baked, mashed, scalloped, roasted, au gratin, hash browns, etc.)

Tell the children that we will be making potato pancakes. Ask if anyone has tried them before.

Give each child a copy of the recipe and have them follow along as you discuss the ingredients. Show the kids the pre-grated potato. Explain how potatoes discolor (enzymatic activity exposed to oxygen) after they have been peeled and set out for awhile. Tell the children it is best to peel and grate the potatoes right before they plan to use them.

Pick two volunteers to help you grate the potatoes. Have them wash their hands first!

- As the children are grating the potatoes remind them that you should always wash the potato before cooking/using them.
- While the kids are grating the potatoes, carefully mix the rest of the ingredients together in a medium sized bowl. Add the grated potatoes.

Pour the potato mixture onto the griddle forming 5 to 8 pancakes (will divide each into 4 pieces equaling 24-32 samples depending on your class size). Let the pancakes cook 3-5 minutes on each side. While the pancakes are cooking tell the children the history of potatoes (listed below). Serve the pancakes with a sauce of your choice.

Thank the class for letting you come and help them clean-up any messes.
History of Potatoes

- The following information on the history of potatoes can be shared as the pancakes are cooking:
  - Inca Indians in Peru were the first to grow potatoes about 3000 years ago and called the potato "papa" (Spanish).
  - Sir Francis Drake (the Englishman to sail around the world) was the first European to taste the potato. He brought them back to England, but no one knew how to cook them. Queen Elizabeth I's cook threw away the potato and cooked the leaves. The leaves, stems, sprouts, and fruits are full of goitrogens that mostly are solanine which is toxic. When eaten the toxins may cause headaches, diarrhea, cramps, and even severe coma and death. So needless to say, the potato was not very popular at first.
  - Many believed it was a food only for the peasants (very poor people). However, when they realized that potatoes could last through periods of extremely cold weather, unlike other crops (because it grew underground protected from the frost), the potato began to gain popularity. It later became a main food source for people in England and Ireland.
  - Potatoes are nutrient dense, so they were a good food to have as a main source. They are fat-free, salt-free, and low in calories.
    - ASK: Why do we need protein? It is needed to build strong muscles and to grow.
    - They are also a good source of vitamin C.
      - ASK: Why is vitamin C so important? Vitamin C is needed to form collagen, a connective tissue our bodies need to hold us together.
      - Vitamin C also helps our bodies not bruise as easily.
    - Potatoes also good sources of fiber, iron, and potassium (more potassium in a potato than a banana). It's great to think we get all those nutrients for not many calories.
  - In 1845, almost all of the potatoes developed a fungus causing them to blacken and die in the fields. Since many people relied on potatoes as their main food source, the loss of potatoes resulted in a famine (a period of starvation/not enough food for everyone). This famine lasted about 3 years causing the death of about 1 million people in Ireland.
  - Scientists soon found the cause of the fungus and put an end to the potato famine and now potatoes are grown successfully around the world.
Potato Pancakes

Ingredients
- 3 large baking potatoes (4 ½ cups grated potatoes)
- 1 green onion
- 2 eggs
- ¼ tsp salt
- ¼ tsp black pepper
- 1 tbsp vegetable oil
- ¾ cup whole wheat flour
- Additional vegetable oil or cooking spray

Directions
1. Wash and peel the potatoes. Use the side of the grater with the largest holes to grate potatoes directly into a large bowl.
2. Wash the green onion and trim both ends. Chop the green onion.
3. In a large bowl, mix together the green onion, eggs, salt, pepper, and vegetable oil. Add the flour, whisking to form a smooth batter. Stir in the potatoes and mix well.
4. Heat an electric skillet to high. Spread 2 tbsp of oil evenly over the surface of the skillet or spray skillet with a cooking spray. Spoon about 2 tbsp of the potato mixture to form each potato pancake. Flatten the pancakes with a spatula and cook 4 to 5 minutes on each side, until dark golden brown and cooked through.

Try these as toppings:
- Applesauce
- Ketchup
- Cheese
- Low-fat sour cream

-Recipe by Cooking with Kids

Brought to you by USU Dept. of Nutrition, Dietetics, and Food Sciences and the Carol R White Grant
Classroom Vegetable Education -
SQUASH

MATERIALS NEEDED

- Butternut Squash Fries – cooked a head of time

CLASS CONTENT—35 minutes

Learning about Squash (5 min)

- Tell the children: There are two kinds of squash - summer and winter squash. Summer squash consists of Zucchini, Crookneck squash and others. The kind of squash we gave away out of the truck earlier in the school year. Today we are going to focus on winter squash.
  - Show the kids the different kinds of winter squash you brought. Tell them the name of each kind of squash you have.
- Squash has been grown for thousands of years. Squash originated in South America and slowly found its way up to Northern America, where the Massachuset Indians called it “askutasquash”, which means “eaten raw or uncooked”.
  - Tell the kids to say “askutasquash” together.
- Tell the story of The Three Sisters and Show Pictures (attached):
  - Native American men would often till the land and get it ready to plant the crops. The men would then leave to hunt, so it was up to the women to plant the crops. They would plant corn, beans, and squash together. They would build a mound and plant the corn and beans on it. The beans would take nitrogen from the air and put it into the soil. This would act as food for the corn helping them grow better. The vine beans could use the corn as a support, allowing them to grow better. The women would then plant the squash around the corn and beans mound. As the squash grew, its large vines and leaves would cover the ground preventing weeds from growing and harming the other plants. These three plants grew and worked so well together, that they were named the Three Sisters.
    (http://www.evergreen.ca/en/181/Corn.html)
• When the squash was harvested by the Native Americans, the little girls would specifically choose a squash whose top was white or yellow with a different colored bottom for a doll. They would carry it around and treat it as a baby.

• Squash are now grown all around the world in all shapes, colors and varieties. They can become very large, with the largest squash known of being 962 pounds which was grown in Ontario, Canada. Or they can be very small like the baby pumpkin ones that are often used as decorations.

**Cooking Demonstration (20 minutes)**

• Explain that we will be making butternut squash fries today for all to try.

  o **Butternut Squash Fries:** Show the kids which squash is the butternut squash.
    - Show them that it can be difficult to peel the skin off the squash. Have one kid try to peel the skin with a vegetable peeler. It can be done, but is hard.
    - Explain that sometimes you need to poke a bunch of holes in squash and microwave for a few minutes in order to easily remove the skin.
      - Pass a squash and a fork around the class allowing each kid to poke the squash a couple times with the fork.
    - Show the kids a squash that has been microwaved.
      - Have a couple kids come and try using the vegetable peeler on it. It is much easier to remove the skin now.
    - After the skin has been removed, cut the top and bottom off the squash, and then cut it in half. Show the kids the seeds and fibers in the inside.
      - Let a couple kids come remove the seeds and fibers with a spoon. Discard in the trash can.
    - **Demo:** Cutting the squash into French Fry shapes (just do half of the squash to save time).
      - Tell the kids the ingredients of the recipe: butternut squash, olive oil, and salt.
        - Have a kid come up and drizzle the heart hearty extra virgin olive oil on the top of the squash fries.
        - Then have another kid come up and sprinkle salt on them.
        - Finally have one more kid come and mix them together with a spatula.
        - Tell the kids that the squash fries need to cook for 30-40 minutes at 425 degrees (until the edges begin to turn brown), turning the fries with the spatula again about halfway through the cooking time, so the fries will cook evenly.
• **Explain** to the kids that we cooked some fries ahead of time so they could try them.
  - Tell the kids that when they make the butternut squash fries they don’t have to throw the seeds away. They are edible and can be prepared and cooked the same way as the butternut squash fries, except they are cooked at a lower temperature and take a little less time to cook.
  - Tell the kids that different spices can be used to flavor the fries and roasted seeds (seasoned salt, cumin, Old Bay seasoning, pepper, rosemary and thyme, cinnamon, allspice, nutmeg, etc.)
  - Explain that as they come up to get samples of the fries and seeds, that they can look at some of the different spices and smell them. This will help them decide how they will want to spice their recipes when they make them at home.

• **ASK**: Does anyone have any questions?
• Clean up and thank the teacher and the class for letting us come!
**Butternut Squash Fries**  
Recipe from Viva Vegetables

**Ingredients**
- 1 butternut squash
- Olive oil
- Salt
- Cooking spray
- Ketchup or syrup, to serve

**Directions**
1. Preheat oven to 425°F.
2. Peel the butternut squash with a vegetable peeler or sharp knife. Slice squash in half and scoop seeds out.
3. Cut it up into French fry shapes. Toss with a little bit of olive oil.
4. Place on a cookie sheet sprayed with non-stick spray. Cover lightly with salt.
5. Place tray in your pre-heated oven and bake for 40 minutes or so, flipping with spatula halfway through baking.
6. Fries are done when they are starting to brown on the edges about 30-40 minutes.
7. Serve with ketchup or syrup if desired.

*This recipe also works well with sweet potatoes.*

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**Fiery Pumpkin Seeds**  
Recipe from How to Cook Everything

**Ingredients**
- 2 cups (approximately) fresh pumpkin seeds or any fresh winter squash seeds
- 2 tablespoons olive oil
- 1 teaspoon salt, or to taste
- 1 teaspoon cayenne, or more if you like
- 1/2 teaspoon cumin, optional

**Directions**
1. Preheat the oven to 350°F. Line a baking sheet with parchment paper or aluminum foil.
2. After removing the seeds from the squash, rinse with water and remove any strings and bits of squash. Dry the seeds between paper towels.
3. Mix the olive oil with salt, cayenne, and cumin, and toss the seeds with this mixture until they are coated. (Then wash your hands well.)
4. Bake* seeds on baking sheet for 30 to 45 minutes, tossing occasionally, until they are tan and crisp. Seeds will crisp up further as they cool.

*Seeds can also be spread between 2 layers of paper towels and microwaved on high for 10 to 15 minutes, stirring every 5 minutes, until seeds are tan and crisp.

**Also Try These Seasonings:** Seasoning salt; chili powder; curry powder; garlic salt with Worcestershire sauce; or cinnamon, nutmeg, allspice, and sugar.

For more great recipes and ideas go to: http://usextensionfoodpreparation.blogspot.com/  
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Classroom Vegetable Education-

**ONIONS**

**MATERIALS NEEDED**
- Onions to give away
- 2 Recipes for Tropical Salsa
- 2 big bowls to mix salsa
- 2 Cutting boards
- 2 large knives to demo cutting onions and mangos
- 2 Large onions
  - Variety of types of onions for them to look at: White, Yellow, Red, Green, scallion, pearl, garlic, chives
- Gloves
- Measuring spoons
- Plates, napkins, forks?

**PREPARATION NEEDED**
- Chop all vegetables/fruit for the recipes
- Make Recipe Handout
- Gather onions to give away

**CLASS CONTENT—15 minutes**

**Learning about Onions**
- **Ask:** Do any of you like onions? How do you eat onions? What ways do they eat them prepared? (on hamburgers or sandwiches, in fajitas, salsa, caramelized on pizza, etc.)
- **Explain:** There are many different kinds of onions and they are in the vegetable family with shallots, garlic, leeks and chives (pass around onions, garlic and leeks for children to explore with senses).
  - Onions come in many sizes, color, and tastes (spicy, sweet, mild, or mild and sweet).
- **Tell the Class:** There are two basic types of onions: 1) spring/summer and 2) storage onions (SHOW different types of onions as you name the name).
  - Spring/summer are very mild and sweet and include: Maui (Hawaiian), Vidalia (Georgia), and Walla Walla (Washington)
CUTTING ONIONS (Be interactive, asking children’s opinions)

- **Ask:** Have you ever cried from when cutting onions or your mom was cutting onions? Why do onions make you cry?
  - Onions make you cry because acids in the onion turn into a gas which irritates nerve endings in the eye and make them sting. Tear glands produce tears to dilute and flush out the acids.

- **Ask:** How can you limit or prevent onions from making you cry?
  - To keep from crying when you cut onions, use a very sharp knife this will limit the cell damage and the release of acids that drive the irritation response.
  - Chill them before cutting to prevent the enzymes from activating, limiting the amount of gas generated.
  - Wear goggles or safety glasses

- **Demonstrate Cutting an Onion:** If uncertain how to do this watch Tammy and Janet’s Viva Vegetable video on onions: [http://www.vimeo.com/6910598](http://www.vimeo.com/6910598).
  - When cutting stress how to correctly and safety hold knife. Show how to tuck fingers under so you don’t cut yourselves. Emphasize for them to ask for parent’s help and permission to do this at home.
    - Slice onion in half from the root to the top end.
    - Split the onion in 2 equal halves, leaving the root ends attached.
    - Take off the onion skin. Place onion halves onto cutting board with flat sides down.
    - Slice evenly in parallel cuts. Don’t cut through the root.
    - Move your fingers and grip the onion at the root end. Make a parallel cut.
    - Make a second parallel slice above the first one you just made.
    - Grip the onion and slice across in parallel cuts, starting opposite the root end.
    - Repeat the first steps for the other onion half.

MAKING RECIPES AND TASTE TESTING

- **Tropical Salsa**
  - Explain that Tropical Salsa is a salsa that is made of both vegetables (onions and peppers) and fruit (pineapple, mango, and kiwi) that gives it a deliciously tangy taste that can be eaten with tortilla chips, on top of chicken or fish, with rice, or in wraps!
  - Tell the children you will demonstrate how to easily cut some of the ingredients in addition to the onion already cut (mango, kiwi, and jalapeno pepper).
    - **MANGOS**
• Ask: Who has eaten a mango before? Who knows how you cut one open?

• **Demonstrate** how to cut open the mango by making two cuts parallel to the pit, and then make slices in a cube manner not cutting through the peeling. Turn the mango inside out and easily remove the mango squares. (Will discuss at prep session on Wednesday night.)
  • Tell the children that this is a good way to cut them if you are eating them plain. However, in the recipe we are making, we peeled them first and then cubed them.

• **Kiwi**

  • Ask: Who has seen a kiwi before (show unpeeled kiwi)? Cut the kiwi in half and pass around so kids can see the inside.
  • **Demonstrate** how to use a spoon to easily remove peeling off the kiwi.

• **Jalapeno Pepper**

  • **Demonstrate** how to cut open a jalapeno pepper.
    • **Explain** that the seeds are the hottest part of the pepper, so if you don’t like spiciness, remove them.
      o It is important not to touch your eyes or anything else on your face while cutting jalapenos as they will cause them to burn.
      o Be sure to wash your hands with soap and water when done cutting. If possible wear gloves when cutting them.

  • Tell the children that they are going to have an opportunity to help make the recipe. Explain that we chopped all the vegetables and fruit before coming because of limited time, but we still need help mixing them together and measuring and adding lemon juice, salt, and pepper.

  • While some children are helping to mix ingredients, explain all the ingredients in the recipe.

  • **Send** around some fresh cilantro for the children to see what it is and to smell it.
    • **Invite** different children to dump each of the ingredients into a large bowl. Then have three different children measure and add the lemon juice, salt, and pepper. Finally choose someone else to stir the ingredients together.

• Tell the children that they now can taste the salsa they helped make and a chunk of mango we just cut.

  • Thank the teachers and class for letting you come and encourage them to try making this recipe at home with their families.
  • Leave the class with recipes and boxes of onions for each student.
Tropical Salsa

Ingredients:
- 1 pineapple, chopped (can use canned if needed)
- 1 mango, chopped (or other seasonal fruit such as peaches or melons)
- 1 large sweet onion, chopped (or 2 cups sliced green onions)
- 2 kiwis, chopped
- 1/4 jalapeno pepper*, minced (or more to taste)
- 1 red pepper, chopped
- 1/2 bunch cilantro, chopped
- 2 Tbsp lemon or lime juice
- Salt and pepper
* Can substitute cayenne pepper or Tabasco sauce.

Directions:
1. Combine all ingredients in large bowl.
2. Cover and refrigerate several hours or overnight. Adjust seasonings.
Classroom Vegetable Education—CUCUMBERS

MATERIALS NEEDED
- Cucumbers
- Seasoned rice vinegar
- Plates, napkins, forks
- Cutting board
- Knives
- Vegetable peelers
- Spoon to scoop seeds
- Salt and pepper

CLASS CONTENT—20 minutes

Learning about Cucumbers

- **ASK:** How many of you know what a cucumber is? How do you like to eat them?

- Hold up a cucumber and explain that although we often refer to cucumbers as a vegetable, they are actually a fruit (seeds inside, grow from flower, etc.).
  - Cucumbers were first grown in India 3000 years ago.
  - Christopher Columbus brought the cucumber to the U.S. and then the American Indians and European colonists began to grow them.

- The cucumber plant grows flowers, which then produce cucumbers. The flowers must be visited by bees 20 to 20 times a day for cucumbers to grow well, making them delicious for us to eat (show picture of cucumber flower and growing cucumber).
  - There are many different types of cucumbers that grow into a variety of shapes and sizes. They grow anywhere from 1 inch up to 20 inches.
long. (Use your hands to show the kids the length of 1 inch and 20 inches.)

- Types (Show Pictures):
  - Gherkins: little ones (used to make the small dill pickles)
    - **Ask:** Did you know pickles were bottled cucumbers?
  - Armenian (long and curvy)
  - Slicing varieties (field and greenhouse grown): grown for eating fresh, the kinds we usually see in grocery stores.

- Most cucumber plants contain a bitter substance called 'Cucurbitacin' (pronunciation: kyoo-kur-bi-tay-shin).
  - Cucurbitacin can be present in the cucumber if the plant is under stress during growth from not being watered enough and too hot of temperatures.
  - The bitter taste in cucumbers can cause people to burp.

  - **Ask:** Have you ever burped because of a bitter cucumber?

- Explain: Some people get embarrassed when they burp and don't like the effects of bitter cucumbers, so the smart food scientists created a cucumber called 'Burless' cucumbers.

  - **Ask:** Is that the kind of cucumber you want to eat?
  
    - Next time you are in the grocery store with your parents, ask them to help you find the 'Burless' cucumber or ask them to buy some 'Burless' cucumber seeds for your garden this summer since cucumbers are really easy to grow in Cache Valley.

  - If you get a bitter cucumber, cutting off the stem-end and peeling the skin off with a vegetable peeler will remove a lot of the bitterness.

  - There are some people who believe if you rub the cut portions of the cucumber together it will become sweeter, getting rid of the bitter flavor. However, this is just a myth.
DEMONSTRATION and TASTE TESTING—5 minutes
Exploring Cucumbers with Your Senses

- Show the children a whole Cucumber
  - Explain that you are going to show them a few different ways cucumbers can be sliced.
  - Review basic knife safety skill with the children before starting demonstration (use sharp knife-dull lead to more injuries, keep fingers tucked back, always ask parents before using a knife, etc.).
  - Demonstrate how to make 'stripes' with fork on the cucumber before slicing, so it has alternating color pattern on each slice.
- Cucumbers at the grocery store often have a wax put on the skin or outer peeling to make them look shiny and protect them.
  - To avoid eating the wax, the cucumber should be peeled. Cucumbers that we grow in our gardens or buy from our farmer's market are not waxed, so they don't need to be peeled.
  - Demonstrate to the children how to peel a cucumber with a vegetable peeler.
    - Ask a couple kids to come try peeling it with the vegetable peeler and have them tell the rest of the class how easy it is.
  - Cut the cucumber in half and show the class the seeds inside.
    - Explain that the seeds are edible or okay to eat, but some people don't like to eat them. Bigger cucumbers tend to have bigger seeds.
  - Show: If they don't like the seeds, then they can use a spoon to scrape the seeds out of the center of the cucumber. (Demonstrate)
Tasting the Cucumber

- **ASK:** Who likes pickles? Did you know that pickles are bottled cucumbers with vinegar and spices added?

- **ASK:** What are other ways you could enjoy eating cucumbers?
  - Pickled (pickles are bottled cucumbers), added to green salads, added to sandwiches and hamburgers; with sour cream, yogurt, or fresh tomatoes. Some people even like them cooked.

- **Explain** we are going to try cucumbers in two ways: plain and with seasoned rice vinegar. Seasoned rice vinegar is a really mild kind of vinegar that has a little salt and sugar added. See if you think the cucumbers with seasoned rice vinegar taste somewhat like pickles.

- Provide each child with a plate and a sample of cucumber slices with seasoned rice vinegar and plain cucumber slices.
  - Tell the children to wait to eat their samples until everyone has one.

- Let the children try each sample and then discuss what they liked about each one or didn’t like about them.
  - **ASK:** Which sample did you like best? (Have them raise their hand if they liked the rice vinegar one better. Then have the others raise their hands if they liked the plain ones better)
  - **ASK:** Did the cucumbers with vinegar remind you of pickles?

- Thank the class for letting you come and let those who want seconds of cucumbers have some.
CUCUMBERS

Cucumber Serving Suggestions

- Drizzle cucumber slices with seasoned rice vinegar. Seasoned rice vinegar is a mild vinegar that has a little salt and sugar added.
- Sprinkle with sesame salt*.
- Cut into cucumber sticks and dip with other vegetables (radishes, celery, carrots, jicama, etc.) in low-fat ranch dip, dill dip, or a peanut dip*.
- Sprinkle cucumber slices with soy sauce.
- Make an easy side dish with chopped cucumbers and tomatoes stirred into a plain low-fat yogurt.

*See school vegetable blog (www.canyoncoldsloveveggies.blogspot.com) for recipe.

Burpless Cucumbers!

Cucumber plants often contain a bitter substance called 'cucurbitacin' (pronounced kyoo-oo-kur-bi-tye-cin). Cucurbitacin can be present in the cucumber if the plant is under stress during growth from not being watered enough and too hot of temperatures. This bitter taste in cucumbers makes some people burp! Since burping can be embarrassing a 'Burpless' variety of cucumbers was created. So next time you are in the grocery store look for some 'Burpless' cucumbers or buy seeds to plant and grow some yourself.

Try Eating Cucumbers On:
- Green Salads
- Sandwiches
- Hamburgers
- Pasta Salads
- Tacos
- In lemonade

Preparing Cucumbers
- Cucumbers at the grocery store often have a wax put on their skin or outer peeling to make them look shiny and protect them.
- To avoid eating the wax, the cucumber should be peeled.
- Cucumbers that we grow in our gardens or buy from our farmers market are not waxed, so they don't need to be peeled.

Brought to you by USU Dept of Nutrition, Dietetics, and Food Sciences and the Carol M. White Grant.
Classroom Veggie Education—
**BROCCOLI**

**MATERIALS NEEDED**

- Serving spoons
- 1-2 Recipes of Pasta salad with broccoli
- Sample of plain raw broccoli, shocked broccoli, and pasta salad for each child
- Example of mushy, overcooked broccoli (2)
- Plates, napkins, forks

**PREPARATION NEEDED**

- Prepare 1-2 recipes of pasta salad with broccoli
- Prepare two different broccoli samples (raw and shocked)
  - Place each in different container

**CLASS CONTENT—10 minutes**

**Learning about Broccoli** *(Broccoli information from www.Dole.com)*

- **ASK:** How many of you like broccoli? What is your favorite way to eat it?
  - Dip raw broccoli in hummus, salsa, or low-fat dip.
  - Add chopped broccoli to omelets, quiche, mixed green salads, lasagna, casseroles or on top of pizza.
  - Eat steamed or microwaved as a side dish with meat or pasta.

- **Suggest** that sometimes we don’t like a food or vegetable because we have only tried it prepared in one or two ways (i.e. mushy overcooked broccoli). Tell the children that if they think they don’t like broccoli, we will give them a few new ways to try it today. Then they can decide if they like it prepared in a new way.
DEMO\NSTRATION and TASTE TESTING—5 minutes

Exploring Broccoli with Your Senses

- Tell the children they are going to have an opportunity taste broccoli prepared in two different ways (raw, plain and shocked, partially cooked).
- Pass out a napkin with both samples to each child. Remind them to wait to eat it until you tell them to.

**Raw Broccoli**

- Have the children eat the raw (plain) broccoli. Tell them to focus on the texture, color, and taste.
  - Ask the children what they liked about it.

**Shocked (partially cooked) Broccoli**

- Tell the children you are now going to try a partially cooked broccoli, called 'shocked' broccoli.
- Before having them taste the 'shocked' broccoli, explain to the children how you prepared the 'shocked broccoli'.
  - Bring water to boil, drop broccoli in boiling water for 12 minutes or just until tender. When to desired tenderness, drop in cold water for a few seconds.
  - Cooking broccoli this way:
    - Makes it bright green
    - Enhances flavor
    - Keeps it slightly crisp
- Have each child try the shocked broccoli. Remind them to focus on the texture, color and taste.
  - Ask: What did you notice different about this sample? Did it taste different? What did you like about it?

**Overcooked Broccoli**

- Ask: What does overcooked broccoli look, taste, smell and feel like? (olive green color, yucky, stinky, and mushy)
Pass around sample of overcooked broccoli for everyone to look at. Have the kids examine the color, texture and smell.

Teach the children that broccoli contains something called volatile acids. Volatile means readily evaporates. These acids are present in the plant tissues.

- When the broccoli is heated the acids are released. If the broccoli is exposed to heat or cooked for too long, the acids cause broccoli to turn the yucky olive green color and the heat causes broccoli to get mushy.
- Also hydrogen sulfide (sort of like stinky sulfur at Yellowstone) is released giving broccoli a disgusting smell. So we don’t want to overcook our broccoli, then we won’t have that smell.

**Cooking Broccoli to Perfection**

- Bring water to boil before adding broccoli
  - Make sure just enough water to cover the broccoli (this helps to dilute the acids—they are lost in the first few minutes of cooking).
- Cook your broccoli in an uncovered pan (don’t put the lid on)
  - This helps the broccoli to keep its beautiful bright green color.
- Cook your broccoli until just tender or to your desired tenderness.
  - This will prevent mushy broccoli.

**Tasting Broccoli Pasta Salad**

- Tell the students if they would like to try a pasta salad with ‘shocked’ broccoli they are welcomed to.
- As the children are eating the pasta salad, begin cleaning up.
  - Ask the children which sample was their favorite (raw or shocked broccoli, or pasta salad).
- **Challenge** the class to ask their parents to prepare broccoli in a new way for them, perhaps one of the ways they tried it today.
- **Thank** the class for letting you come and clean up any messes.

**Fun Facts to Tell While Passing Samples and Cleaning Up**

- Broccoli has been around for more than 2000 years. It was one of the ancient Romans' favorite foods. Over hundreds of years, broccoli’s fame spread throughout Europe.
  - **ASK:** When do you think broccoli was first grown in the U.S.?
    - About 90 years ago (1920's). It was brought to the U.S. by Italians seeking homes in the U.S. They planted it in their gardens in New York.
    - Three years later Italians living in Northern California began to grow it. They soon shipped it all over the U.S.
    - Today California grows about 90% of all broccoli in the U.S., however many other states can grow broccoli also.

**Remember to keep the class to 15 minutes, including clean-up and leaving.
Try Broccoli:
- Chopped in omelets, salads, lasagna, pasta, or on top of pizza
- Dipped in hummus, salsa, or low-fat dip
- Steamed or microwaved as side dish to lunch or dinner

**BROCCOLI**

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**Why Broccoli Can Get Yucky, Mushy, and Stinky**

- Broccoli contains 'volatile acids' in its plant tissues.
  - Volatile means readily evaporates.
  - When the broccoli is heated, the acids are released.

- If the broccoli is cooked for too long:
  - Volatile acids are released, causing broccoli to turn the yucky, olive green color.
  - Too much heat causes broccoli to get mushy.
  - Hydrogen sulfide (like stinky sulfur at Yellowstone) is released giving broccoli a disgusting smell.

- Cooking with the lid on causes more yucky colors and smells!

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**Cooking Broccoli to Perfection**

1. Bring water to a boil before adding broccoli.
2. Only add just enough water to cover the broccoli.
3. Cook your broccoli in an uncovered pan (this helps the broccoli keep its beautiful, bright green color).
4. Steam, boil, or microwave your broccoli just until barely tender, and serve immediately (this will prevent mushy and stinky broccoli).
5. If you can't serve immediately, rinse it with cold water and drain well. This is called 'shocked' broccoli. Many people prefer shocked broccoli to raw broccoli, since it's easier to chew and is a very bright green color. It can be stored in the refrigerator this way for later use.

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**Broccoli Pasta Salad**

Adapted from Allrecipes.com

- 1 (16 oz) pkg uncooked pasta
- 1 head fresh broccoli, cut into bite size pieces
- 1 red onion, chopped
- 1/2 cup minced garlic
- 1 (8 oz) pkg cheddar cheese, cut into cubes
- 1 (6 oz) can large pitted black olives, drained and sliced
- 1/2 cup olive oil
- 1/4 cup red wine vinegar, or to taste
- Salt and pepper to taste
- Italian seasoning to taste

Directions
1. Bring pot of lightly salted water to a boil. Place pasta in the pot, cook according to package directions until al dente*, drain and rinse with cold water. Transfer to bowl, cover, and chill 1 hour in refrigerator.

2. Toss chilled pasta with the remaining ingredients. Season with salt, pepper and Italian seasoning. Chill in refrigerator until serving.

* al dente pasta is firm to the bite, chewy, and slightly undercooked.
Classroom Veggie Education

SALAD GREENS

MATERIALS NEEDED

- Variety of salad greens for taste testing
  - Spinach
  - Butter lettuce
  - Arugula
  - Romaine
- Salad dressing: poppy seed
- Sunflower Seeds
- Lettuce Seeds
- Salad poster or pictures
- Whole heads of lettuce for display (butter lettuce, romaine, red leaf)
- Salad spinners (2)
- Dish towels for demo
- Bowls for lettuce
- Gloves
- Plates, Napkins, Forks

PREPARATION NEEDED

- Prepare poppy seed salad dressing ahead of time
- Sort lettuce samples into varieties

CLASS CONTENT

Learning about Salad Greens

- **ASK:** How many of you have eaten salad before? How many of you like salad?
Salads are fast and easy to make (any one of you could make one), and delicious!

- **ASK:** What is your favorite kind of salad and how do you make it?
- **ASK:** Do you know how salad grows?
- **Explain:** Salad greens grow from tiny seeds (SHOW SEEDS and pass around).
  - As the salad plants grow and get to be about 3-4 inches high, they can be harvested by cutting the tops off the leaves with a knife, leaving 1-2 inches in the ground. The salad greens will grow back and this process can be repeated 3 to 4 times. (SHOW PICTURE)
  - These are “baby greens”, but sometimes the plants are allowed to grow into large “heads” (SHOW PICTURE).

**DEMONSTRATION AND TASTE TESTING**

**Salad Preparations**

- **Explain:** There are many different kinds of salad greens available to eat. (Show salad poster and the whole heads of lettuce: butter lettuce, romaine, and red leaf).
  - **ASK:** Today we are going to try four different kinds of salad greens, but before you eat any fruit or vegetable what do you need to do?
    - Wash them.
  - We are going to teach you a few tricks to washing and drying your salad greens, so they are clean but not dripping in water.
    - This is important for two reasons:
      - The dressing sticks to dry greens better.
      - Your plate doesn’t get soggy!
    - The first trick is to use a salad spinner.
      - **ASK:** Have any of you used a salad spinner before?
      - Remove the colander part of the salad spinner and put in the sink. Run water over (use sink in the Classroom), and then
drain the cleaned lettuce. Insert back into the spinner. Then demo how to spin!

- **Have** a volunteer help spin the salad spinner to get all the water off.
- Show the class how much water is in the bowl of the salad spinner and explain that the spinning motion helps remove the water from the salad.
- If you don’t have a salad spinner, another way to get the water off your lettuce is to use a dish towel.
  - Put rinsed salad greens in a dish towel and twirl it around.
  - Have a child from the class come and try.

**Explain:** Now that the salad greens are clean, we can prepare them for a salad. The great thing about preparing salad greens is that you don’t need a knife. You can tear them with your hands.

- Tear a few leaves for them to see and then have a few kids come help (use the torn lettuce for the sample salad).

**Taste Testing**

- Tell the children we are now going to taste four different kinds of lettuce: spinach, butter lettuce, arugula, and romaine.
  - Pass around plates with one of each kind of lettuce for them to try. Tell the children to wait to try their samples until you tell them to.
  - **Explain:** Each of these salad greens have a different taste, texture, and look. As you try each sample, think about which one is the crispest or softest, and which one you like the best and why.
    - Have the class try each sample.
  - **Discuss:** Which salad green did you like best and why? Which was the most crisp?
- **Arugula**: tender with a peppery, slightly bitter flavor. Delicious with fruity dressings. It may take a few times of eating it to develop a liking for the flavor.

- **Romaine**: key ingredient in Caesar salads. Crisp, strong taste, and nutrient packed (dark green leaves have the most vitamins and minerals)

- **Spinach**: two varieties: savoy (Curly leaf) and flat (smooth leaf). Can be eaten raw or cooked

- **Butter Lettuce**: loose heads, softer lettuce, buttery texture, mildly-flavored.

- **Explain** to the class we have prepared a poppy seed salad dressing for them to try on a salad with a mixture of salad greens. This dressing has lots of flavor and is a little bit sweet, so a lot of people think it tastes good on salad greens that might seem a little “bitter”.

- **Tell the children** there are sunflower seeds, if they want to add a few to their salad.
  - **Have children come up** and get a sample of the salad. Allow them to add the sunflower seeds to their salad by themselves.

- **Clean-up** and thank the class for letting you come.
Appendix D. Vegetable Newsletters and Recipe Handouts from the “Tasty Table”
Making Meals with Fall/Winter Vegetables

What Are Fall/Winter Vegetables?
- Arugula
- Broccoli
- Cabbage
- Carrots
- Cauliflower
- Collard Greens
- Kale
- Lettuce
- Leeks
- Onions
- Potatoes
- Rutabaga
- Spinach
- Swiss Chard
- Tomatoes
- Turnips
- Winter Squash
- Zucchini

What to do, what to eat?
- Adding a grain and a protein to your fall vegetables creates a colorful, scrumptious, filling meal the whole family will enjoy.
- Tasty grains to add include: couscous, barley, brown rice, bulgur, millet, quinoa, whole wheat pasta, whole wheat tortillas, and wild rice.
- Savory proteins to try include: canned beans, chicken, eggs, fish, lean beef, nuts, pork, and tofu.

Eating produce in the season it is grown results in fresher, tastier, less expensive, and more nutritious dense produce. Fall vegetables add a lot of color, texture, nutrients and delightful flavor to a meal.

Why Fall Vegetables?
Why me? Why now?

Cutting Winter Squash
- Cut squash in half using a big sharp knife. Some squash varieties have very thick skins making them difficult to cut open. For your safety, cut on a flat surface.
- Scrape out seeds and stringy fibers with a spoon.
- Cut into squash, bearing down. Cut next to the stem, not through it.
- If a squash is too tough to cut and will fit into your oven or microwave, you can bake or microwave the squash just until it’s soft enough to cut into pieces.
- LAST RESORT—If squash is too big and tough, you can drop it on the floor to break it open. It’s messy, but effective! Consider placing squash in a plastic trash bag before dropping to contain the mess.

Cauliflower-Cheese Soup
- 1 Tbsp olive oil
- 1 1/2 C onions, chopped
- 1 clove garlic, chopped fine
- 2 medium large potatoes, peeled and diced
- 1 large cauliflower, cut/ broken into florets (put aside 2 cups)
- 1 medium carrot, peeled and chopped
- 1 1/2 C whole milk
- 4 C water or broth
- 1 C grated sharp cheddar cheese (plus extra for garnish)
- 3/4 C low fat milk
- salt and pepper to taste
- 1/4 C green onions, sliced

Directions:
1. Place oil in a large saucepan and heat to medium high. When pan is hot, add onions and garlic.
2. Cook, stirring occasionally, until onions are lightly browned and tender. Add the potatoes, cauliflower (except 2 cups reserved), carrots, salt, and water. Bring to a boil and simmer until vegetables are very tender.
3. Puree in a blender or food processor (or mash with a potato masher if you prefer a chunky soup) and transfer back to pan.
4. Break reserved cauliflower into small pieces and steam or microwave just until tender. Add cauliflower, cheese and milk to the soup.
5. Heat gently over low heat just until heated, stirring frequently.
6. Add salt and pepper to taste. Serve immediately.

To Serve: Top with grated cheese and sliced green onions.
KIDS CAN COOK TOO!

Follow These Simple Steps to Cook Winter Squash

- Preheat oven to 400°F.
- Place squash pieces on a cookie sheet. (Optional: line the cookie sheet with foil for easier clean-up.)
- Bake squash using one of two methods:
  1. Rub squash with a little olive oil and bake uncovered. This provides a "roasted" flavor and some browned, caramelized sections.
  2. Add about 1/2 cup of water to the pan and cover with foil. This method results in moister "steamed" squash.
- Check for tenderness with a fork after about 45 minutes. This is probably long enough for smaller squash, but larger squash may need up to 90 minutes to become tender.
- When tender, cube or mash squash.

* Squash can also be microwaved until fork tender.

Seasoning King/Queen Zone

Try seasoning your winter squash with one of the following flavor combinations for an irresistible taste:
- Salt, pepper, and little butter or olive oil
- Sweet: choose some spices like cinnamon, nutmeg, allspice, or ginger. Then drizzle with honey or maple syrup, or add butter and brown sugar.
- Savory: Try seasonings like chili powder, garlic, grated cheese, or herbs—parsley, oregano, or sage. Then add butter or drizzle with olive oil.
- Try adding milk or cream, orange juice, or apple juice for a different consistency and flavor.

Spaghetti Squash with Marinara*

Put a twist on spaghetti by substituting noodles with spaghetti squash.

**Ingredients**
- 2 Cups Cooked Spaghetti squash
- 1 Cup prepared marinara sauce
- 2 Tbsp grated Parmesan cheese

**Directions**
1. Place hot squash on plate.
2. Cover with hot marinara sauce.
3. Sprinkle with Parmesan cheese and enjoy!

*Serve with salad and garlic bread to make into a meal!

YUMMMY!
THE BUZZ ON BEANS

The Many Varieties of Dried/Canned Beans
- Adzuki bean
- Anasazi bean
- Black beans
- Black-eyed peas (Cowpeas)
- Chick peas
- Chili beans
- Edamame
- Fava beans
- Garbanzo beans
- Great Northern beans
- Lentils
- Lima beans
- Navy beans
- Pinto beans
- Red kidney beans
- Refried beans
- Soy beans
- White kidney beans
- AND MANY MORE...

What to do, what to eat?
- Impress your family’s taste buds by adding canned or cooked dried beans to a variety of dishes.
- Make a Southwestern stir-fry by sautéing together black beans, corn, and fresh vegetables like onions, bell peppers, zucchini, and garlic.
- Add some zing to lettuce greens, rice and pasta salads by tossing with your favorite kind of bean.
- Make soups, stews and casseroles more hearty by adding black or pinto beans, or whatever beans you have in the house.
- Make a low-fat bean dip to enjoy with fresh vegetables, whole-wheat crackers, or tortilla chips (see recipe on back).

Why beans? Why me? Why now?
- Beans are nutrient-dense and are very inexpensive.
- Beans are a rich source of protein, making them a healthy alternative for meat.
- They are an excellent source of fiber, helping us stay full longer and keep us “regular”.
- Canned beans are generally high in added sodium. TIP: Purchase canned beans that are low in sodium or rinse the beans before eating to reduce the sodium.

Rush-Hour Chili

Ingredients
- 3/4 lb extra-lean ground beef
- 1 can (15 oz) kidney beans*, drained, rinsed
- 1 can (14.5 oz) diced tomatoes, undrained
- 1 can (6 oz) tomato paste
- 2 cups cold water
- 2 teaspoons chili powder

Directions
1. In a 3-quart nonstick saucepan or Dutch oven, cook beef over medium-high heat 5 to 7 minutes, stirring frequently, until thoroughly cooked; drain if necessary.
2. Stir in remaining ingredients. Heat to boiling. Reduce heat to medium-low; cover and simmer 5 to 7 minutes, stirring occasionally, until hot. Makes 4 servings.

* Beans are fairly interchangeable, add your favorite kind of bean or what you have on hand. One 15 oz can equals 2 cups cooked dried beans.

Recipe by Pillsbury Fast & Healthy Cookbook

Cooking Dried Beans

Ingredients
- 1 pound (~2 cups) any dried beans or peas, washed and picked over
- Salt and freshly ground black pepper

Directions
The Quick-Soak Way
1. In a large pot with a tight-fitting lid, cover beans with cold water by 2-3 inches. Bring to boil, then remove lid and continue to boil for 2 minutes. Cover pot and turn off heat, allowing the beans to soak for about 2 hours.
2. Taste a bean. If the beans are still raw, cover with about 2 inches of water and continue to soak until tender. If tender, add a large pinch of salt and several grinds of black pepper and make sure the beans are covered with about an inch of the soaking water (if not, add some water).
3. Bring the pot to a boil, then reduce the heat so that the beans bubble gently. Partially cover and cook, stirring occasionally, checking the beans for doneness every 10 or 15 minutes, and adding a little more water if necessary.
4. Stop cooking when the beans are done the way you like them, taste and adjust the seasoning, and use immediately or store (see back page).

By Mark Bittman. How to Cook Everything Vegetarian
KIDS CAN COOK TOO!

Here are some ways you can help your parents select, prepare and store dried and canned beans:

Selecting—Always rinse and sort dried beans before use.

- Buy in bulk for a cheaper price.
- Use canned beans when in a rush. Avoid buying dented cans.

Storing—Store dried beans in an airtight container in a cool, dry, dark place for up to one year; store unopened canned beans in a cool, dry place for 2 to 5 years.

- Opened canned beans/cooked beans can be refrigerated for a week.
- Store leftover cooked dried beans in sealed container in the freezer for 6 months.

Less ‘Gas’ in Beans—These tips help to reduce gas:

- Soak dried beans for at least several hours.
- Cook beans thoroughly. Cook them until you can smash one on the roof of your mouth with your tongue.
- Drain liquid from the canned beans and drain the soaking water from dry beans. Cook them in fresh water.

Bean Double Puzzle

Delicious and Easy Bean Dip

Ingredients

- 1 15 oz can of pinto beans
- 1 cup salsa
- 3-4 green onions, chopped
- 1/2 teaspoon cumin
- Salt and pepper to taste

Directions

1. Drain beans.
2. Put all ingredients in a food processor and blend until smooth.
3. Serve with tortilla chips, put on/in a burrito or enchiladas.

Recipe from Viva Vegetables
**Mom's Zucchini Bread**

Recipe from Allrecipes.com

Yield: 2 loaves (24 servings)
Prep Time: 20 minutes
Cook Time: 40-60 minutes

**Ingredients**
- 3 cups all-purpose flour
- 1 teaspoon salt
- 1 teaspoon baking soda
- 1 teaspoon baking powder
- 1 tablespoon ground cinnamon
- 3 eggs
- 1 cup vegetable oil
- 2 1/4 cups white sugar
- 1 tablespoon vanilla extract
- 2 cups grated zucchini
- 1 cup chopped walnuts (optional)

**Directions**
1. Grease and flour two 8 x 4 inch pans. Preheat oven to 325 degrees F.
2. Sift flour, salt, baking powder, soda, and cinnamon together in a bowl.
3. Beat eggs, oil, vanilla, and sugar together in a large bowl. Add sifted ingredients to the creamed mixture, and beat well. Stir in zucchini and nuts until well combined. Pour better into prepared pans.
4. Bake for 40 to 60 minutes, or until tester inserted in the center comes out clean. Cool in pan on rack for 20 minutes. Remove bread from pan, and completely cool.

**Nutrition Facts per Serving:**
- Total Calories: 223
- Total Fat: 10g
- Saturated Fat: 4g
- Sodium: 180mg
- Total Carbohydrates: 31.4g
- Dietary Fiber: 0.7g
- Protein: 2.5g
- Vitamin A: 1%
- Vitamin C: 3%
- Calcium: 3%
- Iron: 9%

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**Roasted Vegetables**

*Roasting vegetables brings out the natural sweetness in vegetables. Try 'em—you'll love 'em!*

Cut a combination of any of the following vegetables into large chunks—about 1” X 2”.
- parsnips
- carrots
- potatoes
- onions
- green beans (whole)
- rutabagas
- winter squash
- peppers (green or red)
- turnips
- whole cloves of garlic
- eggplant
- asparagus
- beets
- zucchini

**Directions**
1. Oil a large roasting pan, add all vegetables. Drizzle with a small amount of olive oil and salt/pepper to taste.
2. Add herbs such as thyme or rosemary if desired. Toss.
3. Roast in 400°F oven for 30-50 minutes (or until tender and golden brown), turning vegetables with spatula every 10-15 minutes.
4. Adjust seasonings and serve immediately.

* Some vegetables take longer to cook than others. For example, potatoes take longer to cook than zucchini. To prevent mushy zucchini, don’t add the zucchini until the last 15-20 minutes of cooking.
**SOUTHWEST TOMATO SALSA**

* Use this Southwest Tomato Salsa as a master mix for the other listed recipes and enjoy the sweet flavor of tomatoes in each dish.

**Ingredients**
- 3-4 tomatoes (fresh, chopped) OR 2 cans tomatoes, diced (can use a variety of seasoned canned tomatoes such as Mexican-seasoned, with added peppers, with roasted garlic, etc.)
- 2 C corn (fresh, thawed frozen corn, or drained canned corn)
- 1 can black beans, drained and rinsed
- Southwest-type seasonings (optional) — cumin, oregano, chili powder, garlic (start with about 1/4 teaspoon and adjust as needed)

**Directions**
- Stir all ingredients together in a bowl. Serve as a dip with tortilla chips or quesadillas.

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**SOUTHWEST BURRITOS OR QUESADILLAS**

**Ingredients**
- 1 flour tortilla (whole wheat tortillas are a good source of fiber).
- 1 C Southwest Tomato Salsa
- 1/2 C grated cheese
- Optional Ingredients — avocado or guacamole, olives, chopped onions or green onions, chopped green or red peppers

**Directions**
- Place tomato mixture and cheese on top of tortilla.
- Roll for a burrito or fold in half for a quesadilla.
- Fry in a small skillet in 1 Tbsp canola oil until lightly browned, or microwave on a plate. Enjoy!

---

**TORTILLA CASSEROLE**

**Ingredients**
- 4 to 5 C Southwest Tomato Salsa, including juice
- 4 to 5 flour or corn tortillas, torn up (can substitute tortilla chips — 2 to 3 large handfuls)
- Grated cheese, about 1 to 1 1/2 C

**Directions**
- In a medium baking dish or casserole dish, place 1 cup tomato mixture in the bottom.
- Top with layer of tortillas, then layer of cheese.
- Repeat layers 2 or 3 times, ending with cheese.
- Bake in oven at 350°F for 20 to 30 minutes, or until cheese melts and mixture is bubbling.

---

**QUICK AND SPICY TOMATO SOUP**

**Ingredients**
- 2 to 3 C Southwest Tomato Salsa, including juice.
- 1 C cooked rice or pasta (whole wheat is a good source of fiber).
- Tomato juice as needed to thin soup.

**Directions**
- Heat all ingredients together in a saucepan.
- Serve with grilled cheese sandwiches.

**Also Try:** Topping your baked potato with the Southwest Tomato Salsa, a little cheese, and/or low-fat sour cream.
Simple Sautéed Peppers and Onions*

Once you start adding peppers—cooked or raw to your meals, you'll be hooked!

Ingredients
- 1-2 Tbsp extra-virgin olive oil
- 3-4 large red and green bell peppers, stemmed, seeded, and cut into thin strips
- 1-2 large onions, cut into thin strips
- Salt and pepper to taste

Directions
1. Place oil in large, deep skillet and turn heat to medium-high. After 1 minute, add peppers and onions.
2. Cook, stirring occasionally, until peppers and onions are lightly browned and very tender.
3. Season with salt and pepper.

*Try adding cooked chicken and this fajita mix to your sautéed peppers and onions:

Fajita Seasoning Mix:
Mix the following ingredients together and sprinkle on chicken and sautéed pepper mix.
- 2 Tbsp chili powder
- 1 Tbsp salt
- 1/2 tsp cayenne pepper
- 1/4 tsp crushed red pepper flakes
- 1/2 tsp cumin

Southwestern Coleslaw

Yield: 10 Servings

Ingredients
- 1 head cabbage, shredded or chopped
- 1 lime, cut in half
- 1 green or red pepper, chopped
- 1 bunch cilantro, chopped
- 1-2 jalapeño peppers, chopped fine
- 1/2 C olive oil or canola oil
- Salt and pepper to taste

Optional Ingredients:
- Corn, tomatoes, carrots red or green onions

Directions
1. Place cabbage in a large mixing bowl. Squeeze lime juice over cabbage and stir well.
2. Add remaining ingredients and mix well. Add salt and pepper to taste.
3. Refrigerate until flavors blend.
4. Garnish with pepper rings and a sprinkle of chili powder if desired.

Note: Recipe can be halved, but this salad keeps in the refrigerator for several days and just seem to get better as it "ages".

Brought to you by USU Dept of Nutrition, Dietetics, and Food Science.
Carrot Raisin Salad
Yields: 6-8 servings

Ingredients
- 4 large carrots, shredded (3 cups)
- 1/2 cup raisins
- 1/2 cup coarsely chopped pecans
  (or any nut or seed of your choice)
- 2 tsp grated lemon zest
- 1 Tbsp fresh lemon juice
- 3/4 tsp salt
- Black pepper to taste
- 1 cup sour cream or 1/2 cup sour cream plus
  1/2 cup light mayonnaise

Directions
1. In a medium bowl, combine shredded carrots, raisins, pecans, lemon zest, lemon juice, salt and pepper.
2. Cover carrot mixture and toss with sour cream or mayonnaise. Chill a few hours before serving.

Recipe adapted from Joy of Cooking

Carrot Cake Cookies
Yields: 3 dozen cookies

Ingredients
- 1/2 cup butter, softened
- 1 cup brown sugar
- 2 eggs
- 1 (8 ounce) can crushed pineapple, drained
- 3/4 cup shredded carrots
- 1 cup raisins
- 2 cups all-purpose flour
- 1 teaspoon baking powder
- 1/2 teaspoon baking soda
- 1/2 teaspoon salt
- 2 tablespoons ground cinnamon
- 1 cup chopped walnuts (optional)

Directions
1. Preheat oven to 350°F. Grease cookie sheets or line with parchment paper.
2. In a large bowl, cream together the butter and brown sugar until smooth. Beat in the eggs one at a time, stir in the crushed pineapple, carrots and raisins. Combine the flour, baking powder, baking soda, salt and cinnamon; stir into the carrot mixture. Mix in the walnuts, if desired.
3. Drop by rounded soup spoonfuls onto the prepared cookie sheets. Bake for 15 to 20 minutes in the preheated oven, until bottoms begin to brown and cookies are set.
4. Allow cookies to cool for a few minutes on the cookie sheets before removing to wire racks to cool completely.

Also Try: Substituting raisins for dried cranberries or chocolate chips.

Recipe adapted from Allrecipes.com

The 'HOW TO' with Carrots

Selecting: Choose firm, crisp carrots with fresh green tops.
Storing: Refrigerate in plastic bag, with green tops removed, for up to 2 weeks.
Eating: Eat them raw-plain or with dip, steam them, roast them, grill them, toss in with a stir-fry, etc.

Try Some of These Ways to Spice Up Your Carrots!
- Sprinkle with dill pickle juice
- Sprinkle with seasoned rice vinegar
- Toss with sesame salt*

Sesame Salt*
This salt is a delicious condiment for salads, vegetables, soups, or stir fry. Once you start using it, you will discard your plain old salt shaker forever.

Ingredients
- 4 Tbsp sesame seeds
- 2 tsp salt

Directions
1. Toast sesame seeds lightly in a dry skillet or in a toaster oven.
2. Add salt and lightly grind together in a small mill, blender, food processor, or mortar and pestle.

Recipe by Tammy Vitale
Canyon Elementary students sampled these herbed potatoes today during lunch. Ask your child if they tasted and liked them!

**Herbed Potato Wedges**

Roasted potatoes are quick & tasty... try this method with sweet potatoes or any other root vegetables.

**Ingredients**
- 3 to 4 medium-sized potatoes
- 1 tbsp olive oil
- Salt and pepper to taste
- Herbs (fresh or dried)*

**Directions**
1. Scrub potatoes clean with a vegetable brush.
2. Cut potatoes into large wedges or other desired shapes (rectangular, wedges, circles, etc).
3. Place cut potatoes on a sheet pan coated lightly with olive oil. Drizzle potatoes with olive oil, and toss with hands to evenly coat each wedge. Sprinkle with desired amount of herbs, salt, and pepper.
4. Bake at 450°F, stirring every 10 minutes, for 25-30 minutes or until potatoes are tender and starting to turn brown and crispy.

* Rosemary and thyme are herbs that pair well with potatoes, or be brave and try chili powder, garlic, or any other family favorites.

Brought to you by USU Dept. of Nutrition, Dietetics, and Food Sciences and the Carol M. White Grant

---

**Veggies with Hummus Dip**

Add some "zip" with this dip!

**Hummus Dip**

**Ingredients**
- 2 16-oz cans garbanzo beans, drained and rinsed
- 1 clove garlic, peeled
- 1/3 C tahini*
- 1 tsp salt
- Juice of 1 lemon
- 1/4 tsp cayenne pepper, ground
- 1/4 tsp cumin, ground
- 1/4 tsp black pepper, ground
- 1/3 C extra virgin olive oil
- 1 handful parsley
- 3-4 green onions, cut into 1" pieces
- water as needed (approx 1/3 C)

**Directions**
1. Place all ingredients in food processor or blender. Add water as needed to form a smooth paste. Adjust seasonings to taste.
2. Garnish with parsley if desired. Serve with pita bread wedges and fresh vegetables.

*Tahini is a smooth paste made from sesame seeds. It is usually found by the peanut butter in grocery stores.

**Eating Veggies with Hummus Dip**

- Eating fresh vegetables with the hummus provides a delicious snack packed with protein and fiber.
- Try eating hummus with cucumbers, carrots, jicama sticks, pepper strips, snap peas, or your favorite vegetable.
- Hummus is also tasty on pita triangles or as a spread on sandwiches.
- If you don’t have time to make hummus from scratch, it is available in most grocery stores.

Brought to you by USU Dept. of Nutrition, Dietetics, and Food Sciences and the Carol M. White Grant.
# Asparagus

## How to Prepare:
- Rinse asparagus thoroughly with cold water.
- Snap off tough stem ends. Stalks naturally break where the woody part ends, and tender part begins.

## How to Cook:

<table>
<thead>
<tr>
<th>Method</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steamed</td>
<td>Bring an inch of water to boil in a pan with a steamer inserted in the bottom.</td>
</tr>
<tr>
<td></td>
<td>Cover pan and steam.</td>
</tr>
<tr>
<td>Microwaved</td>
<td>Lay asparagus on microwave-proof plate or shallow dish with about 2 Tbsp water; cover with lid or plate. Microwave.</td>
</tr>
<tr>
<td></td>
<td>Shake the container at 1-minute intervals.</td>
</tr>
<tr>
<td>Grilled</td>
<td>Brush with olive oil and arrange in rows on wooden or metal skewers, if desired.</td>
</tr>
<tr>
<td></td>
<td>Grill on hot grill, turning once or twice.</td>
</tr>
</tbody>
</table>

## How to Tell Cooking is Complete:
- In each cooking method, cook for 2-5 minutes or just until the thickest stalks can be pierced with a knife (or use the 'bite-test'—carefully bite into a stalk to determine if desired tenderness).
- Do not overcook! Asparagus should be tender but maintain a crunch.
- Season (see suggestions in the box to the left) and serve immediately.

---

**Seasoning Suggestions**
- Soy Sauce and Green Onions
- Sesame Oil and Sesame Seeds
- Parmesan Cheese
- Lemon Juice

---

Brought to you by USU Dept. Nutrition, Diestetics, and Food Science and the Carol M. White Grant
Appendix F. Assessment Surveys
Canyon Colts Love Vegetables

NAME: _______

Pre-assessment

Fall 2009

Are you a boy or a girl?
O Boy
O Girl

Please completely fill in the bubble to the left of your answer for each question. Please write inside the boxes when appropriate.

1. Does your family grow any fruits or vegetables to eat at your home?
   O No
   O Yes

2. Have you ever eaten a fruit or vegetable you picked from a plant?
   O No
   O Yes

3. Did you eat any vegetables at lunch today?
   O No
   O Yes. What kind did you eat?

4. Do you USUALLY eat any vegetables with your lunch?
   O No
   O Yes

5. Did you eat any vegetables with your dinner last night?
   O No
   O Yes. What kind did you eat?

6. Do you USUALLY eat any vegetables with your dinner?
   O No
   O Yes

7. What is your favorite vegetable to eat?

8. Please write down all of the vegetables you like to eat.
9. Count the vegetables that you wrote down in the box above in question number 9. How many different kinds of vegetables did you write down?
   - None
   - One or two
   - Three or four
   - Five or six
   - More than six

Please fill in the circle (O) that best describes how you feel about the following statements. The big smiley face means that you very strongly agree with the statement, the smiley face means that you agree with the statement, the straight face means that you neither agree nor disagree with the statement; the frowning face means that you disagree with the statement, and the big frowning face means that you strongly disagree with the statement.

10. I like to eat vegetables.
   O O O O O

11. I think vegetables taste good.
   O O O O O

12. There are lots of vegetables to eat at my home.
   O O O O O

13. I like to try new foods I have never eaten before.
   O O O O O

14. I like to try new vegetables I have never eaten before.
   O O O O O

15. Which of the following vegetables grows under the ground?
   - broccoli
   - zucchini
   - tomato
   - carrot

16. Which of the following vegetables is the fruit part of a plant?
   - broccoli
   - potato
   - tomato
   - carrot

17. Which of the following things would you NOT put in a compost pile?
   - vegetable scraps
   - meat scraps
   - cow manure
   - egg shells

THANK YOU FOR COMPLETING OUR SURVEY.
1. What was your favorite part of your field trip today?


2. Did you see any vegetables today that you haven’t eaten before that you would like to try?
   O No
   O Yes. What one?


3. Did you eat anything today that you haven’t eaten before?
   O No
   O Yes. What?


4. Did you eat anything today that you didn’t think you would like, but did like?
   O No
   O Yes. What?


5. Which of the following vegetables grows under the ground?
   O broccoli
   O zucchini
   O tomato
   O carrot


6. Which of the following vegetables is the fruit of a plant?
   O broccoli
   O zucchini
   O tomato
   O carrot


7. Which of the following things would you NOT put in a compost pile?
   O vegetable scraps
   O meat scraps
   O manure
   O egg shells
Canyon Colts Love Vegetables

NAME: ____________

Post-assessment
Spring 2010

Are you a boy or a girl?
O Boy
O Girl

Please completely fill in the bubble to the left of your answer for each question or write on the lines when appropriate.

1. Does your family grow any fruits or vegetables to eat at your home?
   O No
   O Yes

2. Have you ever eaten a fruit or vegetable you picked from a plant?
   O No
   O Yes

3. Did you eat any vegetables at lunch today?
   O No
   O Yes. What kind did you eat? ________________________________

4. Do you USUALLY eat any vegetables with your lunch?
   O No
   O Yes

5. Did you eat any vegetables with your dinner last night?
   O No
   O Yes. What kind did you eat? ________________________________

6. Do you USUALLY eat any vegetables with your dinner?
   O No
   O Yes

7. What is your favorite vegetable to eat? ________________________________

8. Circle all of the vegetables you like to eat.
   Lettuce       Tomatoes       Peppers       Corn       Spinach
   Broccoli     Asparagus      Cucumbers     Zucchini    Green beans
   Potatoes     Onions         Squash        Radishes    Celery
   Jicama       Peas           Carrots       Cabbage     Avocado
   Cauliflower  Beets         Artichoke     Yams        Eggplant
9. Count the vegetables that you circled above in question number 8. How many different kinds of vegetables did you circle?
   - O None
   - O One or two
   - O Three or four
   - O Five or six
   - O More than six

Please fill in the circle (O) that best describes how you feel about the following statements. Each circle face represents:

- Very strongly agree with the statement
- Agree with the statement
- Neither agree nor disagree with the statement
- Disagree with the statement
- Strongly disagree with the statement

<table>
<thead>
<tr>
<th>Statement</th>
<th>Very Strongly Agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. I like to eat vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>11. I think vegetables taste good.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>12. There are lots of vegetables to eat at my home.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>13. I like to try new foods I have never eaten before.</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<td>O</td>
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<tr>
<td>14. I like to try new vegetables I have never eaten before.</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<td>O</td>
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<tr>
<td>15. I liked having the classroom vegetable demonstrations in my class.</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>16. I liked taste testing the different vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>17. I liked learning about vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>18. I liked the vegetables I tried at the Tasty Table in the cafeteria.</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>19. Trying different vegetables this year in school helped me to like vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>20. Trying different vegetables this year in school helped me to eat more vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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</tbody>
</table>
21. Have you ever eaten this food? | What do you think about this vegetable? |
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
<td>I really do not like it!</td>
<td>I do not like it</td>
<td>It is OK</td>
<td>I like it a little</td>
</tr>
<tr>
<td>Asparagus</td>
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<tr>
<td>Bell Peppers</td>
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<tr>
<td>Broccoli</td>
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<tr>
<td>Butternut Squash</td>
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<tr>
<td>Carrots</td>
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<tr>
<td>Cucumbers</td>
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<tr>
<td>Jicama</td>
<td></td>
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<tr>
<td>Onion</td>
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<tr>
<td>Potatoes</td>
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<tr>
<td>Salad Greens</td>
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<tr>
<td>Snow Peas</td>
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<tr>
<td>Tomatoes</td>
<td></td>
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<td></td>
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<tr>
<td>Zucchini</td>
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</tr>
</tbody>
</table>

22. In the past FEW MONTHS, did you ask someone in your family to: |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>NO</td>
<td>I don’t have to ask, they already do this</td>
</tr>
<tr>
<td>Prepare a vegetable for a meal?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buy vegetables?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23. How often are the following true? |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardly Ever</td>
<td>Sometimes</td>
<td>Often</td>
<td>Almost Always</td>
</tr>
<tr>
<td>We have vegetables in my home.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my home, vegetables are served at meals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my home, vegetables are available as a snack.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my home, there are cut-up vegetables in the fridge for me to eat.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I tried vegetables from the Tasty Table in the cafeteria.</td>
<td></td>
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</tr>
</tbody>
</table>
24. What did you **like** about the classroom vegetable classes?

25. What did you **not like** about the classroom vegetable classes?

26. Would you like to have the vegetable classes again next year? Why or why not?

27. What do you think would make the vegetable classes better next year?

THANK YOU FOR COMPLETING OUR SURVEY.
Lincoln Vegetable Survey

NAME: ______________________

Spring 2010

Are you a boy or a girl?

O Boy

O Girl

Please completely fill in the bubble to the left of your answer for each question or write on the
lines when appropriate.

1. Does your family grow any fruits or vegetables to eat at your home?
   O No
   O Yes

2. Have you ever eaten a fruit or vegetable you picked from a plant?
   O No
   O Yes

3. Did you eat any vegetables at lunch today?
   O No
   O Yes. What kind did you eat? ______________________________________

4. Do you USUALLY eat any vegetables with your lunch?
   O No
   O Yes

5. Did you eat any vegetables with your dinner last night?
   O No
   O Yes. What kind did you eat? _________________________________________

6. Do you USUALLY eat any vegetables with your dinner?
   O No
   O Yes

7. What is your favorite vegetable to eat? _________________________________________

8. Circle all of the vegetables you like to eat.

   Lettuce  Tomatoes  Peppers  Corn  Spinach
   Broccoli  Asparagus  Cucumbers  Zucchini  Green beans
   Potatoes  Onions  Squash  Radishes  Celery
   Jicama  Peas  Carrots  Cabbage  Avocado
   Cauliflower  Beets  Artichoke  Yams  Eggplant
9. Count the vegetables that you circled above in question number 8. How many different kinds of vegetables did you circle?
   - O None
   - O One or two
   - O Three or four
   - O Five or six
   - O More than six

Please fill in the circle (O) that best describes how you feel about the following statements. Each circle face represents:

- Very strongly agree with the statement
- Agree with the statement
- Neither agree nor disagree with the statement
- Disagree with the statement
- Strongly disagree with the statement

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>10. I like to eat vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>11. I think vegetables taste good.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>12. There are lots of vegetables to eat at my home</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>13. I like to try new <strong>foods</strong> I have never eaten before.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>14. I like to try new <strong>vegetables</strong> I have never eaten before.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
28. Have you ever eaten this food? | What do you think about this vegetable?
---|---
| YES | NO | I really do not like it! | I do not like it. | It is OK | I like it a little. | I really like it a lot! |
Asparagus | | | | | | |
Bell Peppers | | | | | | |
Broccoli | | | | | | |
Butternut Squash | | | | | | |
Carrots | | | | | | |
Cucumbers | | | | | | |
Jicama | | | | | | |
Onion | | | | | | |
Potatoes | | | | | | |
Salad Greens | | | | | | |
Snow Peas | | | | | | |
Tomatoes | | | | | | |
Zucchini | | | | | | |

29. In the past FEW MONTHS, did you ask someone in your family to:
| YES | NO | I don't have to ask, they already do this. |
---|---|---|
Prepare a vegetable for a meal? | | |
Buy vegetables? | | |

30. How often are the following true?
| Hardly Ever | Sometimes | Often | Almost Always |
---|---|---|---|
We have vegetables in my home. | | | |
In my home, vegetables are served at meals. | | | |
In my home, vegetables are available as a snack. | | | |
In my home, there are cut-up vegetables in the fridge for me to eat. | | | |
Home Vegetable Inventory

Students, please complete the following inventory with your parent or guardian who usually prepares most of the food for your family. The children who bring the survey back by **Wednesday, May 19th** will receive a special prize from USU researchers. Thank you for your help and support.

Fill in the bubble for the fresh or raw vegetables you had in your home last week.  
Fill in the bubble for the frozen vegetables you had in your home last week.  
Fill in the bubble for the canned vegetables you had in your home last week.

<table>
<thead>
<tr>
<th>Packages of mixed vegetables</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

| Carrots |  |  |  |
| Peas |  |  |  |
| Beans |  |  |  |
| Corn |  |  |  |
| Tomatoes |  |  |  |
| Spinach |  |  |  |
| Lettuce or salad greens |  |  |  |
| Peppers |  |  |  |
| Broccoli |  |  |  |
| Cauliflower |  |  |  |
| Potatoes |  |  |  |
| Summer squash (zucchini or yellow squash) |  |  |  |
| Winter squash (acorn, butternut) |  |  |  |
| Celery |  |  |  |
| Onions |  |  |  |
| Root vegetables (turnips, rutabagas, parsnips) |  |  |  |

Please list anything other vegetables you have in your home not on this list:

Parent Signature_______________________________
Parent Vegetable Survey

Fall 2009

We would like this survey to be completed by the parent or guardian who usually prepares most of the food in your home. Your child will receive a special prize for returning this survey to his or her teacher by September 18th.

1. Are you usually responsible for preparing food for your family?
   - O No
   - O Yes

Please rank how strongly you agree with the following statements. Do you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree or Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I like to eat vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>3. I think vegetables taste good.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>4. I like to try new foods I have never eaten before.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>5. I like to try new vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>6. My children like to eat vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>7. My children like to try new vegetables.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

8. Over the last month, how often did you eat lettuce salad (with or without other vegetables)?

<table>
<thead>
<tr>
<th></th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>1-3 times per month</td>
<td>1-2 times per week</td>
<td>3-4 times per week</td>
<td>5-6 times per week</td>
<td>1 time per day</td>
<td>2 times per day</td>
<td>3 times per day</td>
<td>4 times per day</td>
</tr>
</tbody>
</table>
9. Over the last month, how often did you eat french-fries or fried potatoes?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-3 times per month</th>
<th>1-2 times per week</th>
<th>3-4 times per week</th>
<th>5-6 times per week</th>
<th>1 time per day</th>
<th>2 times per day</th>
<th>3 times per day</th>
<th>4 times per day</th>
<th>5 or more times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

10. Over the last month, how often did you eat other potatoes (not fried potatoes), either baked, broiled, mashed or in potato salad or soup?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-3 times per month</th>
<th>1-2 times per week</th>
<th>3-4 times per week</th>
<th>5-6 times per week</th>
<th>1 time per day</th>
<th>2 times per day</th>
<th>3 times per day</th>
<th>4 times per day</th>
<th>5 or more times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

11. Over the last month, how often did you eat dishes that included vegetables such as sandwiches, casseroles, stew, stir-fry, omelets and tacos?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-3 times per month</th>
<th>1-2 times per week</th>
<th>3-4 times per week</th>
<th>5-6 times per week</th>
<th>1 time per day</th>
<th>2 times per day</th>
<th>3 times per day</th>
<th>4 times per day</th>
<th>5 or more times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

12. Over the last month, how often did you eat other vegetables? Do not count lettuce salad, potatoes, or vegetables you eat as part of another dish.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-3 times per month</th>
<th>1-2 times per week</th>
<th>3-4 times per week</th>
<th>5-6 times per week</th>
<th>1 time per day</th>
<th>2 times per day</th>
<th>3 times per day</th>
<th>4 times per day</th>
<th>5 or more times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
13. What is your favorite vegetable to eat?

14. What vegetables do you like but can’t afford?

15. What vegetables do you like but can’t find to buy?

16. What vegetables do you like but don’t know how to prepare?

17. What vegetables do you like but don’t prepare for your family?
Canyon Colts Love Vegetables
Parent Vegetable Survey
Spring 2010

5th Grade Student’s Name: _______

Is your 5th grade student a boy or a girl?
O Boy
O Girl

We would like this survey to be completed by the parent or guardian who usually
prepares most of the food in your home. Your child will receive a special prize for
returning this survey to his or her teacher by May 19, 2010.

1. Are you usually responsible for preparing food for your family?
   O No
   O Yes

2. Did you know Canyon Elementary was participating in a program this year that tried to
get children to like and eat more vegetables?
   O No
   O Yes

Please rank how strongly you agree with the following statements.
Do you strongly agree, agree, neither agree nor disagree, disagree, or strongly
disagree?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree or Disagree</th>
<th>Neither Agree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I like to eat vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. I think vegetables taste good.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. I like to try new foods I have never eaten before.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5. I like to try new vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6. My children like to eat vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7. My children like to try new vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Question</td>
<td>Never</td>
<td>1-3 times per month</td>
<td>1-2 times per week</td>
<td>3-4 times per week</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>8. Over the last month, how often did you eat lettuce salad (with or without other vegetables)?</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>9. Over the last month, how often did you eat french-fries or fried potatoes?</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>10. Over the last month, how often did you eat other potatoes (not fried potatoes), either baked, broiled, mashed or in potato salad or soup?</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>11. Over the last month, how often did you eat dishes that included vegetables such as sandwiches, casseroles, stew, stir-fry, omelets and tacos?</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>12. Over the last month, how often did you eat other vegetables? Do not count lettuce salad, potatoes, or vegetables you eat as part of another dish.</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>

13. How many servings of vegetables (1 serving is about a cup of leafy vegetables or half a cup of cooked vegetables like carrots/potatoes) do you eat during a typical day?

- 0
- 1
- 2
- 3
- 4
- 5 or more

14. How many servings of vegetables (1 serving is about a cup of leafy vegetables or half a cup of cooked vegetables like carrots/potatoes) does your child eat during a typical day?

- 0
- 1
- 2
- 3
- 4
- 5 or more
How often do you prepare these vegetables for your family?

<table>
<thead>
<tr>
<th>Has your child asked you to buy or prepare these vegetables since learning about or tasting them in school?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you noticed your child being more willing to eat these vegetables during the last six months?</td>
</tr>
<tr>
<td>Have you tried any of the recipes sent home with your child that includes the following vegetables?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>hardly ever</th>
<th>1 time per month</th>
<th>2-3 times per month</th>
<th>1 time per week</th>
<th>more than 3 times per month</th>
<th>YES</th>
<th>NO</th>
<th>YES</th>
<th>NO</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Bell Peppers</td>
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<tr>
<td>Broccoli</td>
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<tr>
<td>Butternut Squash</td>
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<td>Carrots</td>
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<tr>
<td>Cucumbers</td>
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<tr>
<td>Jicama</td>
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<tr>
<td>Onions</td>
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</tr>
<tr>
<td>Potatoes</td>
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<td></td>
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<tr>
<td>Salad Greens</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Snow Peas</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Tomatoes</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Vegetables:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Have you prepared any of the recipes you tried that were sent home more than one time? If yes, which ones?

Do you plan to prepare any of the recipes you tried again? If yes, which ones?
The **Canyon Colts Love Veggies** program at Canyon Elementary has increased my child's interest in vegetables.

The **Canyon Colts Love Veggies** program at Canyon Elementary has increased my child's liking of vegetables.

My child eats more vegetables now than before participating in the **Canyon Colts Love Veggies** program.

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The <strong>Canyon Colts Love Veggies</strong> program at Canyon Elementary has increased my child's interest in vegetables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <strong>Canyon Colts Love Veggies</strong> program at Canyon Elementary has increased my child's liking of vegetables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child eats more vegetables now than before participating in the <strong>Canyon Colts Love Veggies</strong> program.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How often do you prepare vegetables for your lunch-time meals?</th>
<th>Always</th>
<th>Often</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you prepare vegetables for your dinner-time meals?</td>
<td>Always</td>
<td>Often</td>
<td>Rarely</td>
<td>Never</td>
</tr>
<tr>
<td>How often do you have vegetables available for children to snack on?</td>
<td>Always</td>
<td>Often</td>
<td>Rarely</td>
<td>Never</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preference: My family and/or I don't like vegetables</th>
<th>Cost</th>
<th>Don't know how to prepare them</th>
<th>Vegetables take too long to prepare</th>
<th>Don't have proper kitchen equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments:**
Lincoln Elementary
Parent Vegetable Survey
Spring 2010

5th Grade Student’s Name: _______
Is your 5th grade student a boy or a girl?
O Boy
O Girl

We would like this survey to be completed by the parent or guardian who usually prepares most of the food in your home. Your child will receive a special prize for returning this survey to his or her teacher by May 19, 2010.

1. Are you usually responsible for preparing food for your family?
   O No
   O Yes

Please rank how strongly you agree with the following statements. Do you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree or Disagree</th>
<th>Neither Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I like to eat vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. I think vegetables taste good.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. I like to try new foods I have never eaten before.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5. I like to try new vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6. My children like to eat vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7. My children like to try new vegetables.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Question</td>
<td>Never</td>
<td>1-3 times per month</td>
<td>1-2 times per week</td>
<td>3-4 times per week</td>
<td>5-6 times per week</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>15. Over the last month, how often did you eat lettuce salad (with or without other vegetables)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Over the last month, how often did you eat french-fries or fried potatoes?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Over the last month, how often did you eat other potatoes (not fried potatoes), either baked, broiled, mashed or in potato salad or soup?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Over the last month, how often did you eat dishes that included vegetables such as sandwiches, casseroles, stew, stir-fry, omelets and tacos?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Over the last month, how often did you eat other vegetables? Do not count lettuce salad, potatoes, or vegetables you eat as part of another dish.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. How many servings of vegetables (1 serving is about a cup of leafy vegetables or half a cup of cooked vegetables like carrots/potatoes) *do you* eat during a typical day?

   - 0
   - 1
   - 2
   - 3
   - 4
   - 5 or more

21. How many servings of vegetables (1 serving is about a cup of leafy vegetables or half a cup of cooked vegetables like carrots/potatoes) *does your child* eat during a typical day?

   - 0
   - 1
   - 2
   - 3
   - 4
   - 5 or more
<table>
<thead>
<tr>
<th>Vegetables:</th>
<th>How often do you prepare these vegetables for your family?</th>
<th>Has your child asked you to buy or prepare these vegetables?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hardy ever</td>
<td>1 time per month</td>
</tr>
<tr>
<td>Asparagus</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Bell Peppers</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Broccoli</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Butternut Squash</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Carrots</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Jicama</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Onions</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Potatoes</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Salad Greens</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Snow Peas</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Zucchini</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Other Vegetables:</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How often do you prepare vegetables for your lunch-time meals?</th>
<th>Always</th>
<th>Often</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you prepare vegetables for your dinner-time meals?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>How often do you have vegetables available for children to snack on?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
What are reasons/barriers for not preparing/serving vegetables more often? Mark all that apply.

<table>
<thead>
<tr>
<th>Preference: My family and/or I don’t like vegetables</th>
<th>Cost</th>
<th>Don’t know how to prepare them</th>
<th>Vegetables take too long to prepare</th>
<th>Don’t have proper kitchen equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**Additional Comments:**

THANK YOU FOR COMPLETING OUR SURVEY.
Thank you for helping USU students implement the *Canyon Colts Love Veggies* program this school-year. Please answer the following questions to help us know whether the program was effective and if so, how we can improve it. Please return this survey to the main office by **Wednesday, May 19th**.

Please check the following position you hold at Canyon elementary:

- _____ Principle of other administrator
- _____ Teacher
- _____ Teacher’s aide or other helper

1. If you are a teacher, did you participate in the classroom demonstration provided by USU students on different vegetables?
   - _____ Yes
   - _____ No

2. If yes, did you think having the classroom demonstrations once a month was an appropriate frequency?

3. Circle what vegetable recipes you sampled from the *Tasty Tables* in the cafeteria?
   - Zucchini bread
   - Carrots with sesame salt
   - Carrot raisin salad
   - Southwest coleslaw
   - Southwestern salsa
   - Jicama, bell peppers, and snow peas with hummus
   - Mixed green salad with poppy-seed dressing
   - Baked potato wedges
   - Roasted asparagus
<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>The ‘Tasty Table’ in the cafeteria is an effective way to encourage students to eat more vegetables.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>5.</td>
<td>I liked the vegetables I sampled from the ‘Tasty Table’.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>6.</td>
<td>The classroom vegetable demonstrations are an effective way to encourage students to eat more vegetables.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>7.</td>
<td>The classroom vegetable demonstrations should prove effective in improving students’ vegetable knowledge.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>8.</td>
<td>The classroom vegetable demonstrations should prove effective in improving students’ vegetable preparation skills.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>9.</td>
<td>I would recommend the classroom vegetable demonstration component to other teachers.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>10.</td>
<td>School teachers, administrators, and food service personnel should encourage students to eat healthier in school.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>11.</td>
<td>I am willing to have the classroom vegetable demonstrations in my classroom again in the future.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>12.</td>
<td>The classroom vegetable educations took away too much time from other important educational priorities in my classroom.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>13.</td>
<td>The classroom vegetable educations and ‘Tasty Table’ in the cafeteria made me more aware of my own vegetable consumption.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>14.</td>
<td>The classroom vegetable educations and ‘Tasty Table’ in the cafeteria helped me to eat more vegetables.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>15.</td>
<td>The vegetable-farm field-trips were an effective way for children to learn where their food comes from.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>16.</td>
<td>I would want to take my class on the vegetable-farm field trip again next year.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

17. Please describe what you felt was especially good about the classroom vegetable educations and the Tasty Tables.

18. Please explain what you did not like about the classroom vegetable educations and the Tasty Tables.

19. What do you think would improve these programs?
Canyon Colts Love Vegetables

Program Evaluation- Foodservice Staff
Spring 2010

Thank you for your assistance this school-year in making the Canyon Colt's *Tasty Table* possible. We could not have done it without your help and support! Please answer the following question to help us know how we can improve this program.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Slightly Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Giving vegetables to students via the <em>Tasty Table</em> during lunch is a good way to help them try more vegetables.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2. Most students need encouragement to eat more vegetables in school.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>3. I want to continue to provide vegetables via the <em>Tasty Table</em> at lunch next year.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>4. Handing out vegetable samples at the <em>Tasty Table</em> during lunchtime did not take too much time.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>5. I liked having the <em>Tasty Table</em> during lunchtime.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>6. I think having the <em>Tasty Table</em> once a month was frequent enough.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>7. I think that other schools should have <em>Tasty Tables</em> for their students during lunchtime.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>8. Having the <em>Tasty Table</em> resulted in students eating more vegetables during lunch throughout the school-year.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>9. Having the Tasty Table helped students to eat a greater variety of vegetables during lunch throughout the school-year.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

10. Please describe what you liked about the *Tasty Table* during lunch.

11. Please describe what you did not like and what you think we could do to improve the *Tasty Table*.

THANK YOU FOR COMPLETING OUR SURVEY.