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Exploring Pulses Through Math, Science, and Nutrition Activities

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ABSTRACT

Purpose/Objectives
The Healthy, Hunger-Free Kids Act of 2010 includes pulses as a required component of the school lunch menu standard. Pulses are nutritionally important staple food crops, and include dry beans, dry peas, garbanzo beans, and lentils. This current study examined the short-term effectiveness of a Science, Technology, Engineering, and Mathematics (STEM)-focused school garden-based curriculum on student knowledge and preference for dry beans.

Methods
In Spring 2014, a STEM-focused school garden curriculum was developed and implemented in six fourth grade classes in Western Washington (n = 120). A student survey was administered pre- and post-education to evaluate changes in dry bean knowledge and preference. A control group (n = 19) of same aged students was established as a comparison. All matched student survey responses were analyzed using difference-in-difference (DID) estimator.

Results
Student survey results indicated the education program had a positive impact on the students' knowledge and preference for dry beans. Following the education program, 38% of students knew that beans are an excellent source of dietary fiber, and 17% reported learning that beans are found in pods of the bean plants. Also, 52% of students reported a positive change in their attitudes toward more dry beans being served in the school cafeteria, and 31% reported eating more beans after the educational program. The increase in knowledge and preference suggests participation in school garden-based education may increase student consumption of pulses when offered as part of a school meal.

Application to Child Nutrition Professionals
This school garden curriculum is an engaging and effective strategy to meet Next Generation Science Standards for Grade 4 students and can be a useful tool for increasing preference for and consumption of pulses among elementary students.

Keywords: childhood nutrition; healthy school lunches; pulses; garden-based learning; STEM; Healthy Hunger-Free Kids Act

INTRODUCTION

Exploring Pulses through Math, Science and Nutrition Activities
Obesity has more than doubled in children (age 6-11) and quadrupled in adolescents (age 12-19) in the past 30 years (Centers for Disease Control and Prevention [CDC], 2013a). Childhood obesity has long-term health effects. Obese youth are more likely to have risk factors for heart

disease and diabetes and are more likely to be obese in adulthood (CDC, 2013b). Ensuring food provided to children in schools is consistent with current dietary recommendations is an important national health focus (Institute of Medicine, 2010). Healthy eating habits learned at a young age are likely to persist and lessen the risk of health issues through adulthood (Birch, Savage & Ventura, 2010; Sandeno, Wolf, Drake, & Reicks, 2000). As of May 2015, 30 million students participated in the National School Lunch Program (NSLP), eating at least one meal a day at school (U.S. Department of Agriculture, Food and Nutrition Services [USDA-FNS], 2015). Thus, school meals play an important role in meeting the nutritional requirements for a large number of children and adolescents and provide an opportunity to shape students' eating habits.

With the Healthy, Hunger-Free Kids Act (HHFKA) (2010) implementation, updated nutrition standards in the NSLP have resulted in an increase of fruit and vegetable offerings on the school lunch menu (USDA-FNS, 2012). The new requirement includes offering 3.75 cups of vegetables and 2.5 cups of fruit per week per student for grades K-8 and five cups each of vegetables and fruit for grades 9-12. Schools are required to offer 1/2 cup of pulses per week per student as part of the vegetable subgroup component. Increasing the availability of pulses in school cafeterias increases the opportunity for students to improve their nutritional intake and improve their long-term health. Pulses are nutritionally important grain legumes that include dry beans, dry peas, garbanzo beans, and lentils. The term "pulse" comes from the Latin 'puls' meaning thick soup; pulses are crops in the legume family that produce dry edible seeds (Pulse Canada, 2015).

A plate waste study conducted in four schools in an urban, low-income school district both before and after the HHFKA standards went into effect found that students discarded roughly 60 to 75% of the vegetables and 40% of the fruit on their trays (Cohen, Richardson, Parker, Catalano, & Rimm, 2014), lending support to the widespread plate waste issue reported by the U.S. Government Accountability Office (2014). In a recent study of changes in foods selected and consumed after implementation of the new NSLP meal patterns in southeast Texas, students selected significantly more total fruit and 100% juice and red orange vegetables, but consumed significantly less other vegetables, legumes, and protein foods. There were no differences in waste of fruit, whole grains, or vegetables, with the exception of legumes. More legumes were wasted in 2013 than 2011 (Cullen, Chen, & Dave, 2015). Increasing young people's knowledge and consumption of pulses could improve student nutrition intake and decrease food waste in the cafeteria.

Garden-based learning and the development of school gardens are at the convergence of two overlapping strands of public interest: science education and health promotion. Implementation of a garden-based curriculum results in improved fruit and vegetable consumption through hands-on learning and can be used as part of an effective strategy to improve children's nutrition intake through access to, knowledge about, and preference for fruit and vegetables (Heim, Stang, & Ireland, 2009; Lineberger & Zajicek, 2000; McAleese & Rankin, 2007; Ozer, 2007; Poston, Shoemaker, & Dzewaltowski, 2005; Somerset & Markwell, 2008; Wright & Rowell, 2010; Williams & Dixon, 2014; Langellotto & Gupta, 2012). Additionally, there is a need for Science, Technology, Engineering, and Mathematics (STEM) focused learning opportunities. A clear priority has been articulated for STEM education: within a decade, American students must move from the middle to the top of the pack in science and math (U.S. Department of Education, 2015). School garden education provides a potential to incorporate STEM learning to ensure students meet academic outcomes while increasing their awareness and preference for healthy food choices, especially fruit, vegetables, and pulses.

The goal of this study was to determine if a three-week garden based pulse nutrition and biology curriculum had a positive impact on knowledge of and preference for dry beans by fourth-grade students. Studies have demonstrated that garden-based nutrition and science education can be an effective tool for teaching students healthy eating habits which include learning about fruit and vegetables (Blair, 2009; Jaenke, et al., 2012; Hyland, Stacy, Adamson, & Moynihan, 2006; Morgan, et.al., 2010; Morris, Neustadter, & Zidenberg-Cherr, 2001; Morris, Briggs, & Zidenberg-Cherr, 2002; Parmer, Salisbury-Glennon, Shannon, & Struempler, 2009; Radcliff, Merrigan, Rogers & Goldberg, 2011; Robinson-O'Brien, Story, & Heim, 2009); however, this literature review uncovered no studies focusing on pulses in general and dry beans in particular. The present study developed and implemented a school garden-based and STEM-focused curriculum for fourth grade with dry beans as the model crop.

METHODOOGY

"Pulse on Health" Curriculum

The "Pulse on Health" curriculum was developed in response to the need for a STEM-based curriculum that could promote increased acceptance and consumption of pulses now offered on school menus. Because school cafeterias are required to offer ½ cup of pulses per student per week as a vegetable or a meat alternative, where ¼ cup beans equals 1 ounce of meat, increased student acceptance and consumption of pulses will reduce waste and improve nutrition. Research indicates that an increased consumption of fruit and vegetables may be influenced by several factors such as increased familiarity, a greater sense of choice, and higher intrinsic motivation (Abbey, Gustsfson, & Heelan, 2015; Gutherie, Mancino, Wansink, & Just, 2011; Reinaerts, Nooijer, Candel, & Vries, 2007; Gripshover & Markman, 2013). For this study, the premise was that building familiarity with pulses through garden activities might increase students' curiosity and willingness to consume them.

The "Pulse on Health" STEM-based curriculum (Miles, Riddle, & Atterberry, 2014) provided lessons aligned to the Grade 4 Next Generation Science Standards (NGSS). Fourth grade was chosen because it was believed teachers would be more likely to incorporate the school garden curriculum into their lesson plans to meet student learning objectives for plant science. Students planted, cared for, and harvested dry beans as part of the curriculum. The curriculum included three weeks of cross-disciplinary nutrition, biology, and math lessons in both the classroom and the school garden. Lessons include math – calculations and comparisons; science – observation and prediction; and nutrition – vegetable sub-grouping identification and focus on the health benefits of fiber. The curriculum included learning targets, success criteria, and "big ideas" that summarized the learning standards for each lesson.

The framework of this curriculum was based on pedagogy typical of garden-based learning: experiential education and environmental education (Bell, 2001; Desmond, Grieshop, & Subranmanian, 2004). The hands-on activities and project-based learning incorporated into this curriculum supported experiential learning. Environmental learning, such as how pulses impact the environment through nitrogen fixation, connects students with the concepts of soil quality and fertilization. Students were expected to demonstrate grade-appropriate proficiency in asking questions; developing and using models; planning and carrying out investigations; analyzing and interpreting data; constructing explanations and designing solutions; engaging in argument from evidence; and obtaining, evaluating, and communicating information. Lessons include planting, harvesting, and threshing dry beans in the school garden as well as hands-on activities with beans in the classroom. The curriculum works well for any pulse crop to be planted in a school garden. Dry beans were chosen as the model pulse crop for the curriculum because of their large seed size (easy handling for students), their diversity in colors and shapes, their reliable germination, and ease of production in most regions.

Implementation

The curriculum was developed and implemented over a two-year period in a total of five schools in Whatcom and Skagit Counties in northwest Washington. Schools were selected based on the availability of garden space, previous connections with principals and teachers, and high participation rates in the free and reduced lunch program. The curriculum was developed in 2012 and pilot-tested in Spring term 2013 in two Grade 4 classrooms over three weeks. The curriculum was revised and expanded based on experiences from the pilot phase.

In Fall term 2013 and Spring term 2014, classroom teachers in three schools and six classes (n=123) were given the complete curriculum and materials to conduct lessons over a three-week period. The curriculum includes step-by-step directions for teachers to quickly understand how to deliver the lessons. Individual teachers received instruction on the curriculum by the researcher, and the researcher was available to respond to questions throughout the curriculum delivery period. However, fidelity of implementation among individual teachers was not documented. All supplies needed for the lessons were provided (beans, gardening tools, props, and student worksheets). One teacher was randomly selected as a control classroom (n=19) and was not provided the curriculum and did not use the garden-based curriculum in the classroom.

Student Survey Design

To determine the impact of the “Pulse on Health” curriculum on knowledge and preference of dry beans, all students that participated in this study in Spring and Fall 2014 were assessed immediately before and after delivery of the three-week curriculum with a simple paper survey. Most students completed each survey within ten minutes. The eight-question survey included a combination of Likert-type scale, multiple-choice, and true or false questions (See Figure 1 for the survey tool). The survey questions were pilot tested with the two Grade 4 classes in the pilot phase of the study for readability and relevance to the subject matter taught in the curriculum. Topics in the survey included biology, nutrition, and preferences and perceptions regarding dry beans. Students were asked about nitrogen fixation, plant parts and function, dry bean classification regarding food groups, dietary fiber content, student preferences towards eating dry beans, actual dry bean consumption, and students’ perception of health attributes associated with eating dry beans. A student control group was established in one of the three schools. The students in the control group completed the pre- and post-survey at the same time as the students who engaged with the curriculum. Neither the teacher nor the students in the control classroom had access to the curriculum or participated in the lesson plans. Institutional Review Board approval for human subject interviews was obtained for this study.

First Name______________ **Last Name**__________

Date____________________

Student Survey- Grade 4

1. How would you feel if the school cafeteria was to serve more beans? (Circle the best choice)

   Very unhappy! — Unhappy — Can take it or leave it — Satisfied — Highly Satisfied!

2. Where do you find beans on the plant?
   1. In a pod
   2. On an underground root
   3. In a fleshy berry
   4. I don't know

3. Beans are in both the protein *and* the vegetable food groups.
   1. True
   2. False
   3. I don't know

4. Beans are an excellent source of dietary fiber
   1. True
   2. False
   3. I don't know

5. What nutrient does the bean plant absorb from the atmosphere through their roots? (Circle one) (Hint: It is essential to protein synthesis)
   1. Phosphorus
   2. Nitrogen
   3. Potassium
   4. I don't know

6. I eat beans: (Circle the *best* choice)

Never	Rarely	Once a month	Once a week	Once a day

7. I would like to eat beans: (Circle the *best* choice)

Never	Rarely	Once a month	Once a week	Once a day

8. Do you think beans are a healthy food choice? (Circle the *best* choice)

   Absolutely not! — Probably not — Neutral — Probably yes — Absolutely yes!

Thank you for helping me with my research project!

Figure 1. ***Pre- and Post-Survey Tool Completed by Students in the Treatment Group (n=120) and Control Group (n=19)***

Survey questions 1, 6, 7, and 8 explored the preference for eating beans, frequency of eating beans, and associated health knowledge: (Question 1) How would you feel if the school cafeteria was to serve more beans?; (Question 6) How often would you like to eat beans?; (Question 7) How often do you eat beans?; (Question 8) Do you consider dry beans a healthy food choice? Survey questions 2, 3, 4, and 5 explored knowledge gained: (Question 2) Where do you find beans on the plant?; (Question 3) Beans are in both the protein and the vegetable subgroup; (Question 4) Beans are an excellent source of dietary fiber; (Question 5) What nutrient does the bean plant absorb from the atmosphere through its roots?

Statistical Analysis

To evaluate the impact of the curriculum on learning outcomes and changes in preference, the difference-in-difference (DID) estimators for each of the eight questions was utilized. The DID estimator is a measure of the difference in average outcome between the treatment group before and after treatment minus the difference in average outcome in the control group before and after treatment (Buckley & Shang, 2003). In this study, the treatment group was the group that received the "Pulse on Health" curriculum versus the control group that did not. The primary advantage of the DID estimator is that by differencing the change in average effects between the treatment and control groups, one is able to account for any treatment group-specific effect (e.g. teacher effects, prior exposure to information) and any time trend common to control and treatment groups (e.g. over time individuals learn better irrespective of whether they are in treatment or control group).

The categories were arranged so a higher value indicated accurate knowledge or higher satisfaction or higher frequency of consumption. In a true or false question, 'true' was coded as a '1' and 'false' was coded as a '0'. In a 5-point Likert scale question, '5' denoted the maximum satisfaction or the highest level of consumption. A total of 123 students received the education and 120 students completed the pre/post test. Only responses from those individuals who answered both pre- and post-surveys were analyzed. Because of the small sample, a response of 'Don't know' was coded as missing and excluded from the statistical analysis. Finally, clustered standard errors were estimated. The clustering was an "at group-time" level to account for correlated errors.

RESULTS AND DISCUSSION

In Spring 2014, students (n = 120 in the treatment group; n = 19 in the control group) anonymously completed a survey on two occasions, time one (pre-education) and time two (post-education). Most students completed each survey within ten minutes. Each question on the survey was analyzed separately, and pre- and post-application results were compared to see if the curriculum had an impact on students' knowledge of and preference for dry beans. The control group of same aged-students took the test but did not receive the curriculum or participate in the lesson plans.

As seen in Table 1, there were significant differences between the treatment and control groups in the baseline for Questions 1, 2, and 4, and there were significant differences between the two groups in the follow-up for all questions except 6 and 7. After controlling for time effects and treatment group-specific effects, the difference in average outcomes was higher at follow-up for the treatment group for Questions 1, 4, and 8 indicating the "Pulse on Health" curriculum had a significant positive impact on the treatment group. For Outcomes 1 and 4, the treatment group outperformed the control group at both baseline and follow-up. For Question 8, there was no statistical difference between the treatment and control groups at baseline, but there was a significant gain in knowledge among the treatment group students at follow-up, indicating significant impact from the curriculum on the treatment group. Although the treatment group outperformed the control group in knowledge in Question 2 at both baseline and follow-up, the difference in average outcomes decreased at follow-up, resulting in a statistically significant negative effect on Question 2. That is, a higher proportion of students from the control group answered this question correctly at follow-up compared to treatment group students. The R^2

values are generally low for all treatment effects due to the absence of any covariate in the regression models.

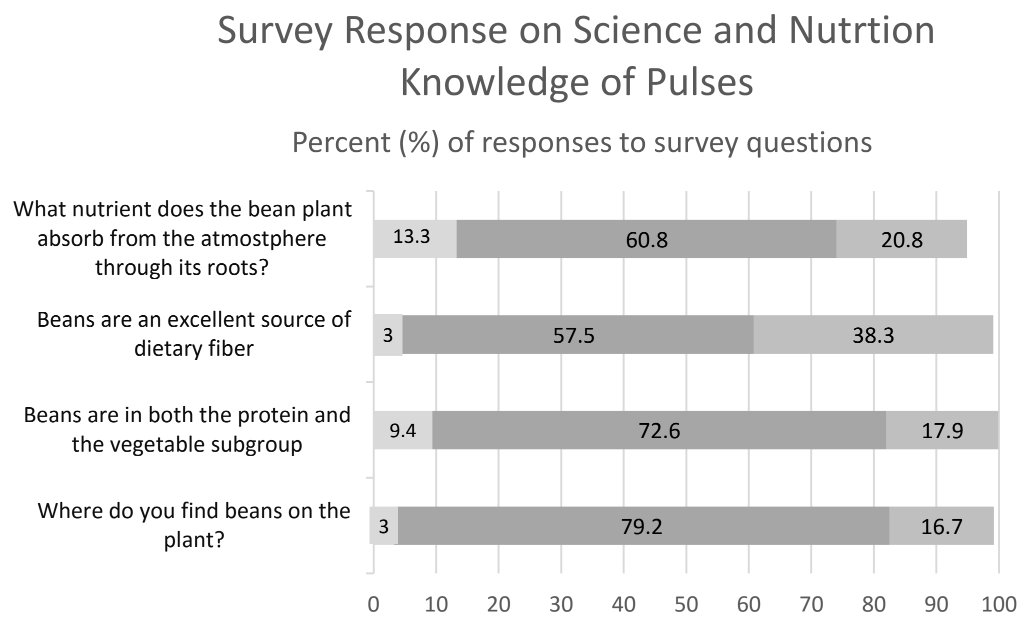
Table 1: ***Estimated Coefficients and Standard Errors from DID Estimation***

Survey Questions	Pre-treatment Difference	Post-treatment Difference	Treatment Effect	R^2
1. How would you feel if the school cafeteria was to serve more beans?	0.423 (0.163)**	0.889 (0.087)***	0.467 (0.184)**	0.10
2. Where do you find beans on the plant?	0.331 (0.027)***	0.249 (0.012)***	–0.082 (0.029)**	0.13
3. Beans are in both the protein and the vegetable subgroup	0.057 (0.095)	0.152 (0.039)***	0.094 (0.103)	0.01
4. Beans are an excellent source of dietary fiber	0.128 (0.036)***	0.380 (0.032)***	0.253 (0.048)***	0.14
5. What nutrient does the bean plant absorb from the atmosphere through its roots?	0.034 (0.081)	0.147 (0.056)**	0.113 (0.098)	0.02
6. How often would you like to eat beans?	0.186 (0.120)	0.190 (0.134)	0.004 (0.180)	0.02
7. How often do you eat beans?	–0.133 (0.111)	0.047 (0.082)	0.180 (0.138)	0.01
8. Do you consider dry beans a healthy food choice?	0.186 (0.101)	0.648 (0.054)***	0.461 (0.115)***	0.11

*** $p<0.01$; ** $p<0.05$

Change in Knowledge

As shown in Figure 2, students exhibited a significant increase of knowledge from pre- to post-education when asked a true or false question ‘Are beans an excellent source of dietary fiber?’; Forty-five students (38.3%) positively changed their response from an incorrect (pre-education) to a correct (post-education) answer. When asked ‘Are beans in both the protein and the vegetable food group?’, students showed a nonsignificant change of dry bean nutrition knowledge from pre- to post-education; 19 students (17.95) positively changed their response from an incorrect (pre-education) to a correct (post-education) answer, 75 (72.6%) answered it incorrectly both times, and 11 (9.4%) changed their response from correct to incorrect.

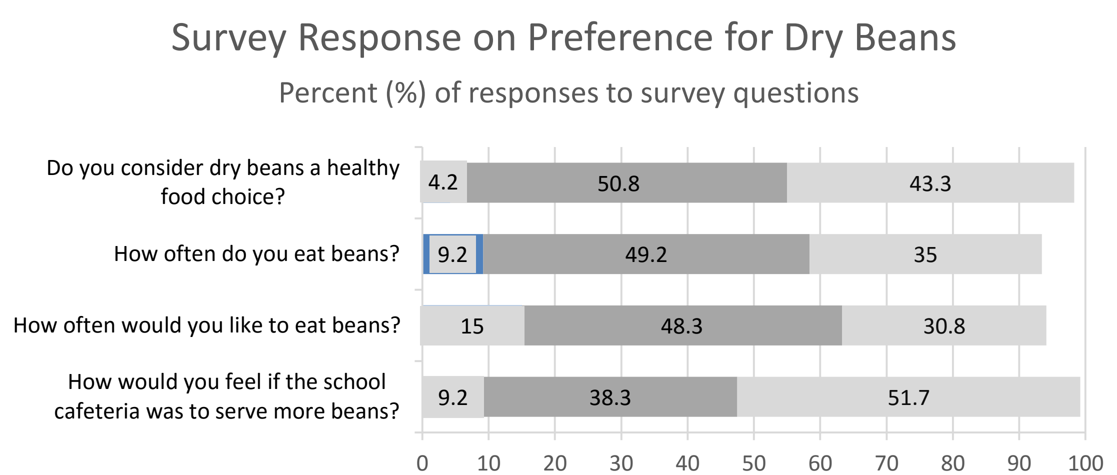


	Where do you find beans on the plant?	Beans are in both the protein and the vegetable subgroup	Beans are an excellent source of dietary fiber	What nutrient does the bean plant absorb from the atmostphere through its roots?
Decreased knowledge	3.3	9.4	3.3	13.3
No change	79.2	72.6	57.5	60.8
Increased knowledge	16.7	17.9	38.3	20.8

Figure 2. ***Change in Student Knowledge (n=120) from Pre- to Post-education in Spring 2014***

For one of the two dry bean biology questions, students demonstrated an increase in knowledge from pre- to post-education. When asked ‘Where do you find beans on the plant?’, 19 students (16.7%) positively changed their response from an incorrect (pre-education) to a correct (post-education) answer, while a large proportion of students (93; 79.2%) answered this question correctly both times (pre- and post-education). Interestingly, the control group demonstrated an increase in knowledge on this question from the pre and post-survey responses. One possible explanation could be that students were curious about the answer when the question was posed on the pre-survey and learned the correct answer which was reflected in the correct response in the post-survey. When asked, ‘What nutrient does the bean plant absorb from the atmosphere through their roots?’, 24 students (21%) positively changed their response from an incorrect (pre-education) to a correct (post-education) answer, but this change was not significant. In addition, 61 students (60.8%) answered it incorrectly both times, and 16 (13.3%) changed their response from correct to incorrect.

It is not surprising that students were unable to correctly answer the Question 5 regarding nodule nitrogen fixation. In Spring 2014, the beans in the school garden had not yet developed root nodules and this part of the curriculum was not presented. It could be that students did not have this knowledge prior to the lesson, and the curriculum could be a valuable tool for teaching this aspect of plant biology. The curriculum places an emphasis on the high fiber content of beans, which accounts for the increase in the number of students who learned this concept. Teachers observed that students were engaged during the fiber lesson with increased participation in discussion of the digestive system and bowel movements which appeared to capture their attention.



	How would you feel if the school cafeteria was to serve more beans?	How often would you like to eat beans?	How often do you eat beans?	Do you consider dry beans a healthy food choice?
Decreased preference	9.2	15	9.2	4.2
No change	38.3	48.3	49.2	50.8
Increased preference	51.7	30.8	35	43.3

Figure 3. ***Change in Student Preference (n=120) from Pre- to Post-education in Fall 2013/Spring 2014***

Change in Preference

Students significantly increased their preference towards dry beans being offered on the cafeteria menu from pre- to post-education. When students were asked ‘How would you feel if the school cafeteria was to serve more beans?’ on a scale from 1 to 5 (1 = strongly disagree and 5 = strongly agree), the median score increased from 3 (pre-education) to 4 (post-education), and 52% of students reported a positive change of opinion regarding more menu items made with dry beans in the school cafeteria. There was a noted increase in pre- and post-education response on student’s frequency to eat beans as illustrated in Figure 3, but not at a significant level.

When students were asked ‘How often do you eat beans?’ the median score increased from 2 (pre-education) to 3 (post-education), and 31% of students reported consuming an increased amount of dry beans after the education program. When students were asked ‘How often would you like to eat beans?’ the median score did not change (*Mdn* = 4 pre- and post-education); however, the 25th percentile increased from 2 to 3, the 75th percentile increased from 4 to 5, and 35% of students reported they would like to increase their frequency of eating dry beans. When asked ‘Do you think beans are a healthy food choice?’ the median score increased from 2 (pre-education) to 3 (post-education), and 43% of students increased their agreement with the statement that dry beans are a healthy food choice.

CONCLUSIONS AND APPLICATION

The current study examined the short-term effectiveness of a science and nutrition school garden curriculum on student preference for dry beans and interdisciplinary knowledge in domains of nutrition, math, and biology. Due to individual teacher experience (number of years teaching), distinct teaching styles, and time constraints during the school day, there was substantial variability between how each teacher taught each lesson. Additionally, there was variation between lessons taught by the same teacher. The suggested time frame for each lesson was one hour. However, each teacher modified the timeframe. One teacher took longer to teach the lessons than the two other teachers, however, this variability did not have a significant effect on student learning and perception outcomes. All the garden activities (planting, measuring plant emergence and plant height, etc.) were delivered as part of the garden lessons during this study. This indicates that the hands-on multidisciplinary garden lessons were a strong basis for change in student knowledge and preference in this study.

There was a significant increase in preference for eating dry beans among students who participated in the "Pulse on Health" curriculum, which suggests the consumption of pulses can be improved through these lessons. This curriculum, which focuses on growing a target plant and includes lessons in the school garden and classroom setting, provides a positive method for forming healthy eating habits in children, which could reduce diet-related health issues in adulthood such as heart disease, diabetes, and obesity. To determine the impact on long-term changes in eating behavior, similar lessons should be implemented over several years, and the students should be evaluated throughout their education.

There are several aspects affecting the success of school garden curricula targeting dietary behavior change. Changing dietary behavior through education and a school meal program requires the cooperation of school administration, food service directors, and staff and teachers. In a study of school principals in California, the most frequent reason for having a garden was reported as an enhancement of academic instruction (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005). Gardens were most commonly used for teaching science, environmental studies, and nutrition. Principals surveyed strongly agreed that resources such as curriculum materials linked to academic instruction and lessons on teaching nutrition in the garden would assist in the school garden being used for academic instruction; however, principals deemed the garden as being only slightly effective at enhancing the school meal program. The data from this study supports the premise that students not only gain science and nutrition knowledge following the implementation of garden lessons, but demonstrates this curriculum has a significant influence on student preference for dry beans when offered in the school cafeteria.

For teachers to take advantage of school garden-based curricula, the lessons need to be aligned with grade-specific learning objectives. In this way, school gardens can be utilized as a classroom setting that enhances learning in a hands-on way. Fourth-grade teachers were able to incorporate this school garden curriculum to meet student learning objectives for plant science. Students were introduced to dry beans in multiple ways and increased their preference for dry beans as a food. Students also strengthened their math skills by using calculators and rulers in the garden to solve plant growth-related math problems within the curriculum. These tangible problem-solving experiences were appreciated by teachers and students alike.

There was an unanticipated lack of participation by teachers in Fall 2014 due to inadvertent loss of bean plants from school gardens, time constraints, and poor weather conditions in October when the curriculum was to be delivered. Schools in northwest Washington would have greater success implementing the fall curriculum in mid-September before the rainy season starts. Signage is needed in the school garden to prevent confusion of crop type (differentiate between green beans and dry beans) and to ensure a timely harvest. Harvest information is included in the curriculum, and this information should be provided to summer school volunteers. In areas with wildlife, adequate fencing is needed to protect the crop from predation. In Fall 2015 one of the teachers who participated in the study incorporated the bean curriculum into all her fourth and fifth-grade science classes.

The control group sample size was a weakness of this study. Only one of the three schools that participated in the study had a control group selected for participation. The statistical analysis would be stronger if the study design included both a treatment and control group from each school offering the curriculum for comparison and analysis.

Future Directions

Teachers provided valuable feedback throughout this study and their expertise served as a guide for curriculum revisions. The revised curriculum is available online and will be used in a separate study in the region, targeted at increasing pulse consumption at school meals to improve health and reduce waste.

Schools seeking to implement programs that affect dietary behavior are encouraged to consider the multi-tiered model that engages schoolwide systems and reaches beyond simply teaching children one practice while reinforcing another. Communication of scientific details needed for effective study is complex in the school setting where there are many people involved; however, there was excitement about this study from those who participated.

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