Cultivating A New Generation

CHANGING STUDENTS' KNOWLEDGE, ATTITUDES AND BEHAVIOR IN RELATION TO FOOD

AN EVALUATION OF THE SCHOOL LUNCH INITIATIVE

September 2010

A REPORT BY THE DR. ROBERT C. AND VERONICA ATKINS CENTER FOR WEIGHT AND HEALTH, UNIVERSITY OF CALIFORNIA AT BERKELEY

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Final Report

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The School Lunch Initiative is a project of the Chez Panisse Foundation,
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ABOUT THE SCHOOL LUNCH INITIATIVE

The School Lunch Initiative was created in 2004 to connect formal academic subjects with experiential learning in instructional gardens, kitchen classrooms and the school classroom. It was formed as a public-private partnership among:

The Chez Panisse Foundation
Founded by Alice Waters in 1996, the Chez Panisse Foundation develops and supports educational programs that use food traditions to teach, nurture, and empower young people. The Foundation envisions a curriculum, integrated with the school lunch service, in which growing, cooking, and sharing the food at the table give students the knowledge and values to build a humane and sustainable future.

The Center for Ecoliteracy
The Center for Ecoliteracy, a leader in the green schools movement, has worked with schools and organizations in more than 400 communities during the past 15 years. Best known for its work with school gardens, lunches, and integrating sustainability into the curricula, the Center also offers books, teaching guides, professional development seminars, a sustainability leadership academy, and consulting services.

The Berkeley Unified School District
The mission of the Berkeley Unified School District, a diverse community deeply committed to public education, is to ensure that all students discover and develop their special talents, achieve their educational and career goals, become life-long learners, and succeed in a rapidly changing society.

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SUMMARY OF FINDINGS

The Dr. Robert C. and Veronica Atkins Center for Weight and Health at U.C. Berkeley conducted a prospective study of fourth and fifth graders over three years (2006-2009) with the aim of evaluating the School Lunch Initiative in the Berkeley Unified School District, California. The School Lunch Initiative, a collaborative partnership among the Chez Panisse Foundation, the Center for Ecoliteracy, and the Berkeley Unified School District, is a comprehensive program featuring hands-on cooking and gardening classes, system-wide changes in food and dining services, and integration of school lunch and hands-on learning with regular classroom lessons. The goal of the evaluation was to determine the effects of student exposure to the School Lunch Initiative on students' knowledge about nutrition, food and the environment; attitudes toward healthy eating and environmental responsibility; and eating behaviors.

The evaluation compared fourth- and fifth-grade students over three years from elementary and middle schools with highly developed School Lunch Initiative components to students at schools with lesser-developed School Lunch Initiative components. Schools with highly developed School Lunch Initiative components had more exposure to cooking and garden classes and made greater attempts to integrate all the components. The following describes the main findings.

Home and Family Influences

- **Families say they eat dinner together, but few involve their child in meal preparation at home.** More than half of the families of students in the study reported eating dinner together (in and outside the home) every day. However, fewer than 30% of households reported involving their child in preparing these meals.
- **Parents say the School Lunch Initiative affects their child's eating habits.** Parents with children in schools with highly developed School Lunch Initiative components were more likely than parents with children in schools with lesser-developed School Lunch Initiative components to agree that school had changed their child's knowledge about making healthy food choices (60% versus 36%) and their child's attitudes about food (42% versus 19%), and had improved their child's eating habits (35% versus 16%).

School Lunch Initiative Impacts

- *Student Knowledge*

  Nutrition knowledge scores were higher. Fourth-grade students attending elementary schools with highly developed School Lunch Initiative components had higher nutrition knowledge scores in Year One than those attending schools with lesser-developed School Lunch Initiative components. By Year Three, seventh-grade students attending the middle school with the most highly developed School Lunch Initiative program had increased their nutrition knowledge scores by 5% over the previous year, while students attending the other two middle schools, which had lesser-developed components, had decreased their knowledge scores by 6% in one school and 14% in the other.

- *Student Food Preferences*

  Younger students had a higher preference for fruits and vegetables. In Year One, preference for a variety of fruits and vegetables, especially green leafy vegetables, was clearly greater among students from schools with highly developed School Lunch Initiative components.

- *Student Attitudes*

  Middle school students had positive attitudes about school food, fresh produce and the environment. Students attending the middle school with highly developed School Lunch Initiative components in Year Three showed more positive attitudes toward eating the food served at school, liking the cafeteria, agreeing that produce tastes better in-season, and agreeing that eating choices can help or hurt the environment compared to students attending the other two middle schools, which had lesser-developed School Lunch Initiative components.

- *Student Eating Behaviors*

  Younger students increased fruit and vegetable intake by more than one serving daily. Fourth-grade students in the fifth grade in Year Two who attended the schools with highly developed School Lunch Initiative components had changed their eating behavior in the following ways:

  - Increased their eating of vegetables by nearly 1 serving, and increased their eating of both fruits and vegetables by about 1.5 servings, while those attending schools with lesser-developed School Lunch Initiative components had decreased their eating of both fruits and vegetables by 0.4 serving;
  - Increased their eating of fruits during out-of-school eating by 0.3 serving, while students attending schools with lesser-developed components decreased eating fruits by 0.4 serving;
  - Increased their eating of vegetables during in-school eating by 0.6 serving, while students attending schools with lesser-developed components decreased eating vegetables by 0.2 serving.

  Continued exposure in middle school may sustain fruit and vegetable intake. Seventh-grade students in the two middle schools with higher exposure to the School Lunch Initiative showed small increases in total fruit and vegetable consumption from the year before when they were in the sixth grade. Seventh-grade students in the other middle school, where the School Lunch Initiative exposure was less, showed a decrease in total fruit and vegetable consumption of about one serving per day.

Conclusions

The School Lunch Initiative is a comprehensive effort to integrate cooking and gardening education into the academic school day in Berkeley elementary and middle schools while revamping the school meal offerings and dining environment. The School Lunch Initiative is effective in increasing student nutrition knowledge, as well as preference for and consumption of healthy foods, particularly fruits and vegetables among elementary school students. Students' attitudes about the taste and health value of school lunch improved as the changes were put into place. Continued School Lunch Initiative exposure into middle school may be important in mitigating negative changes in eating behaviors in the middle school period.

INTRODUCTION

Food in Schools

Initiated in the 1940s, the U.S. National School Lunch Act has enabled public and non-profit private schools to serve free or low-cost meals to more than 30 million children a year [1].

Over the last decade, there has been a growing concern about the quality of food available to children at school. The dramatic rise in childhood obesity—nearly 18% of U.S. children ages 12 to 19 are obese [2]—coupled with a concern about the environmental impact of our food choices, have fueled an interest in teaching children about the entire food production cycle and introducing changes in school meals to help students make better eating decisions. The school setting can play an important role in reinforcing lifelong positive food choices and physical activity habits [3-9].

Schools around the country have attempted to make changes to the food served in schools. Some changes have shown promise, such as improving the nutritional quality of foods served in school, removing vending machines and sugar-sweetened beverages, reducing the presence of low-quality foods (e.g., high-calorie processed foods of low nutritional value) [10-11], or serving school breakfast to all students, which may help maintain a child's healthy weight [12]. However, these changes to school food have often been partial or incremental and not well integrated with environmentally themed or regular classroom lessons.

Schools in the Berkeley Unified School District made early attempts to comprehensively change the relationship children have with food and make the connection between food, health and academic achievement. The Edible Schoolyard, founded by Alice Waters, creator of the Chez Panisse Restaurant, is the most widely known among these efforts. The goal of programs like this is to expose children to the experience and techniques of growing and preparing food, with the objective of increasing children's willingness to try new foods, especially grains and peak-season produce grown in gardens at school.

Changing children's eating behaviors in this way may have potential health benefits. Eating ample whole grains, fruits and vegetables is thought to reduce the risk of developing diabetes and heart disease, and may reduce the risk of developing obesity [13-14]. But adolescents in the United States eat only about 3.5 servings of fruit and vegetables a day, compared to the recommended 7 to 8 servings [15-16], and fruit and vegetable consumption often declines during the teen years [17-18].

Today, gardens have become a popular addition to school campuses, and there are indications that garden programs may positively influence children's eating patterns. Studies that have looked at garden-based programs suggest that they may increase children's food knowledge and their preference for or comsumption of fruits and vegetables [19-23], although the effect seems to be more likely with fruits than with vegetables [24-26].

Efforts building upon the nascent work in Berkeley of the Edible Schoolyard, the Food Systems Project, and the subsequent School Lunch Initiative, the comprehensive program that is the subject of this evaluation study, are taking place across the country in an attempt to change school food choices or offer education about nutrition, gardening and cooking in schools. But there are few research reports of successful multi-component, community-driven, school-based programs that integrate lessons about food, the environment and nutrition taught in garden and cooking classes within the academic school day while simultaneously making extensive changes to the school food environment. This report attempts to answer some of the questions about the effectiveness of such a program.

History of Food and Garden Programs in the Berkeley Unified School District

The Berkeley Unified School District in Berkeley, California has a long history of environmental education in its schools. Efforts can be traced back to the innovative 1970s WEY Project (Washington Environmental Yard) at Washington Elementary School. That project removed the asphalt-dominated playground and renewed the site's ecological diversity, creating opportunities for hands-on environmental curricula in the school [27].

The Edible Schoolyard at Martin Luther King Middle School was started by Alice Waters in 1994 to address food in a whole-systems way in the curriculum. Support from Alice Waters and the Chez Panisse Foundation led to the installation of an extensive school garden and a large, well-equipped cooking classroom as well as the incorporation of regularly scheduled garden and cooking classes into the school day at Martin Luther King Middle School.

In 1998, the Center for Ecoliteracy convened 17 Berkeley community-based organizations to develop the Food Systems Project (FSP), a USDA-funded project. They introduced food policies at the school district and city levels, established salad bars and gardens at each of Berkeley's elementary schools, and brought fresh, organic produce to the lunchroom. The Berkeley Unified School District food policy was the first school district food policy in the nation. It informed the federal mandate for every school district participating in USDA's National School Lunch or School Breakfast Programs to implement a wellness policy.

The food policy ensured that "eating experiences, gardens, and nutrition education are integrated into the core academic curriculum at all grade levels" [28]. The Food Systems Project facilitated a number of changes to the school environment. With grants from multiple sources, including the California Nutrition Network (now called the Network for a Healthy California [29])—a program sponsored by the California Department of Public Health that funds efforts to increase fruit and vegetable consumption and prevent obesity and other diet-related chronic diseases in California—more school gardens were installed. Nutrition education was offered via hands-on gardening and cooking experiences focused on helping children understand how food moves from the garden to the table, including discussions about the culture, politics, history, mythology, flavor, ecology and environmental impact of food choices. The curriculum put less emphasis on didactic topics such as nutrients in food, and more emphasis on growing foods and preparing meals from a variety of vegetables, fruits, beans and whole grains.

The lessons learned were incorporated into a planning framework in the Center for Ecoliteracy's Rethinking School Lunch online guide in 2004, with support from the California Endowment.

The School Lunch Initiative

The goal of the School Lunch Initiative was to teach every child to grow, prepare, and eat nourishing, delicious, and sustainably grown food; to empower students to make healthy food choices; and to educate students about the connection between these choices and the health of their families, communities, and planet. The Chez Panisse Foundation[28].

Aiming to implement the Food Systems Project's policy changes district-wide, the Berkeley Unified School District, the Center for Ecoliteracy, the Chez Panisse Foundation and Children's Hospital Oakland Research Institute launched the School Lunch Initiative in 2004. The objectives of this private-public partnership were to design and implement curriculum and food service innovations to improve student health and support the development of a broader understanding of the importance of sustainable food systems to healthy human communities. The program was started in 2005 and phased into the school district from 2006 to 2009.

The School Lunch Initiative was designed to address health, environmental and social issues by bringing young people into a new relationship with food as part of their educational experience in school. It was based on the hypothesis that if young people are involved in the growing, cooking and sharing of food at the table—as well as learning about it in the curriculum—and it is reinforced with a healthy, nutritious school lunch, they will develop not only lifelong habits of healthy eating but also values that support a sustainable future.

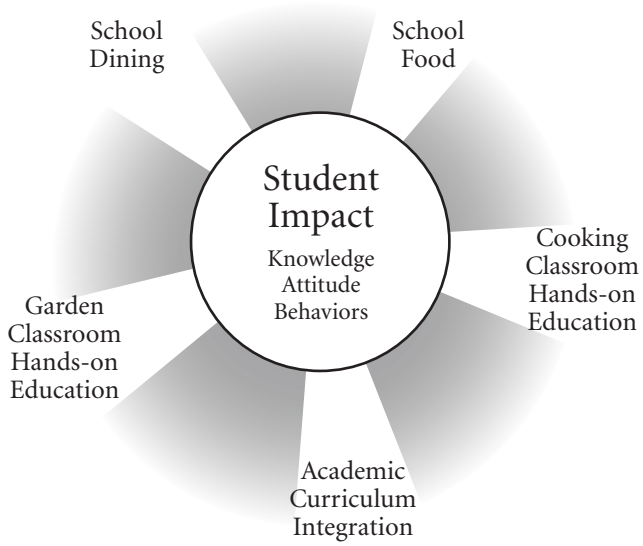
The School Lunch Initiative offers hands-on cooking and gardening classes throughout the district along with system-wide changes in food services. The approach is to demonstrate the entire "farm to table" process to students. For example, the school lunch is not only healthy, but it is also procured from local and sustainable sources, freshly prepared so it tastes good and entices students with aromas and appealing presentations and, where possible, is served in a relaxed and enjoyable social setting. To achieve these outcomes, professional development was offered to both teachers and food service staff. Other activities put in place included sending an annual menu calendar with recipes to the home of each student and coordinating food harvested from the garden with recipes that are both taught in cooking class and served for school lunch during the same month.

Each community partner played a role in the School Lunch Initiative. The Center for Ecoliteracy engaged Berkeley Unified teachers in a training to integrate environmental, gardening and cooking concepts into the curriculum. The Chez Panisse Foundation focused on overhauling the school nutrition services department by engaging professional chef Ann Cooper and integrating the garden and cooking curriculum with the school lunch service. The Network for a Healthy California provided funding for kitchen and garden staff in schools with greater than 50% of students eligible for free or reduced-price meals in the school food program. The garden and cooking program at one middle school was funded by the Chez Panisse Foundation and was enhanced with a new dining facility funded by a bond measure passed in 2000.

Figure 1 shows the five main components of the School Lunch Initiative. These components—school food, school dining, cooking programs, gardening programs and academic curriculum integration—were designed to change the way children learn about food and what they eat for lunch in school. Over the course of the project, the school food services department went from using prepared meals to a scratch-cooking model, began serving meals buffet-style, and installed a procurement system focused on obtaining organic, local and seasonal foods. Breakfast was provided and salad bars were installed in all schools. Improvements were planned to make the dining environments, where possible, more conducive to relaxed, sit-down dining. Gardens were installed in all 11 elementary and 3 middle schools. Facilities for 13 instructional kitchens (classrooms or portable cooking carts) were also put in place. Professional development and a conceptual framework for an integrated curriculum linking food, culture, health and the environment were offered to district teachers.

Integrated curriculum tools and teacher training were developed to link garden, cooking and academic subject lessons together. The Center for Ecoliteracy piloted a food and environment curriculum, developed a guide based on science standards called *Big Ideas: Linking Food, Culture, Health and the Environment*, created an instructional unit for the sixth grade on nutrition and food systems called *What's On Your Plate*, paid for a teacher liaison, and offered teacher training and coaching. The Chez Panisse Foundation produced *The Kitchen Companion: Inside the Edible Schoolyard Classroom* and *The Garden Companion: Inside the Edible Schoolyard Classroom* to connect school gardens and cooking classes with the curriculum, and created *Making Math Delicious*, a guide for middle school hands-on math activities, based on California Department of Education's mathematics content standards.

Figure 1: School Lunch Initiative Components



THE EVALUATION

Evaluation Goals and Research Questions

In 2005, the School Lunch Initiative partners engaged the University of California Berkeley's Dr. Robert C. and Veronica Atkins Center for Weight and Health to evaluate the student impact of the Berkeley School Lunch Initiative. The evaluation took place over a period of three years during implementation of the School Lunch Initiative (2006-2009). The evaluation's main goal was to determine the effects of exposure to the School Lunch Initiative on students in the following ways:

- Knowledge about nutrition, food and the environment;
- Attitudes toward healthy eating and environmental responsibility; and
- Behaviors with regard to food choices.

Secondary goals of the evaluation were to contribute to discussions about program enhancement over the three years of implementation and to develop recommendations for future program changes and replication. In addition, a further secondary goal was to explore possible impacts of the School Lunch Initiative on Body Mass Index and academic performance of students.[1]

Specifically, the hypotheses for the evaluation were that students most exposed to the School Lunch Initiative would show the following changes:

- Greater increases in food, nutrition and environmental knowledge;
- Positive changes in attitudes toward healthy eating behaviors and sustainable ways of procuring food; and
- Positive changes in foods consumed, specifically, more fruits and vegetables eaten in and out of school.

Evaluation Research Design

The evaluation hypotheses were tested using data collected in a three-year prospective study of fourth and fifth graders in the Berkeley Unified School District. This prospective design was chosen instead of a traditional randomized controlled trial to take advantage of the wide variability in the implementation of the School Lunch Initiative in district schools. The evaluation compared changes in the outcomes of interest among students who were differentially exposed to the School Lunch Initiative due to variation in program development at individual schools. This design allowed for the evolution

[1] The evaluation design was not powered to detect small changes in Body Mass Index or academic scores due to the limited number of students participating in the study.

of the School Lunch Initiative to take place "naturally" during the evaluation. Also, given the dynamic nature of school food changes and related policy changes at both the state and school levels, it is very difficult to establish "control" schools that do not also change over the course of a three-year study. The reason fourth and fifth graders were selected was to assess the cumulative impact of exposure to the School Lunch Initiative as elementary students make the transition into middle school, a critical period of change in children' eating habits.

The School Lunch Initiative differed in the degree to which the components were rolled out and developed at each school site. Varying levels of student exposure to the components of the Initiative—school food, hands-on gardening and cooking classrooms, and academic curriculum integration—were found from one school environment to another within the Berkeley Unified School District over the three years of the evaluation, from school year 2006-07 to school year 2008-09.

To measure this degree of variability, a review of all the elementary and middle schools in the district was conducted in school year 2005-06. Each elementary school in the district was ranked by the degree to which the School Lunch Initiative was developed. In Year One of the evaluation (school year 2006-07), students were recruited from the fourth and fifth grades in four elementary schools—two at which the School Lunch Initiative was considered "highly developed" and two at which it was considered of "lesser development." In the following school year, the same students were followed into the fifth grade (in an elementary school) and sixth grade (in a middle school). In Year Three (school year 2008-09), students continued in the study, now in the sixth and seventh grades in one of the three middle schools. Table 1 shows a brief description of the status of the School Lunch Initiative components at each of the study schools.

Table 1: School Lunch Initiative Exposure Categories by Study Schools

Level of Exposure to School Lunch Initiative by School	Components of Exposure
Lesser-Developed School Lunch Initiative (Elementary Schools A and B)	• School Food: healthy food served • School Dining: cafeteria seating present • Garden: no paid staff for study grades; garden area with minimal programming; time spent in garden none to < 9 hours/year • Cooking: no paid staff; no cooking classroom • Lesson Integration: few teachers integrate concepts into academic curriculum
Highly Developed School Lunch Initiative (Elementary Schools C and D)	• School Food: healthy food served • School Dining: cafeteria seating present • Garden and Cooking: dedicated classrooms with paid staff, students attend classes 22-56 hours/year • Lesson Integration: some teachers integrate concepts into academic curriculum
Middle School (School X)	• School Food: healthy food served • School Dining: new dining area opened in Year Three • Garden and Cooking: dedicated classrooms with paid staff, students attend classes 40-45 hours/year • Lesson Integration: most teachers integrate concepts into academic curriculum
Middle School (School Y)	• School Food: healthy food served • School Dining: cafeteria seating present • Garden and Cooking: dedicated classrooms with paid staff, students attend classes 48 hours/year (except in seventh grade – elective only) • Lesson Integration: few teachers integrate concepts into academic curriculum
Middle School (School Z)	• School Food: healthy food served • School Dining: cafeteria seating present • Garden and Cooking: dedicated classrooms with paid staff, students attend classes 20-26 hours/year • Lesson Integration: few teachers integrate concepts into the academic curriculum

Research Methods

A mix of qualitative and quantitative methods was used in this evaluation. What follows is a summary of the data-collection instruments for each level of evaluation—student, school and family/community. For a more detailed description of the research methodology, see Appendix A. For details on data collection and timeline, see Appendix B. Summaries of student and family questionnaires discussed below are included in Appendix C.

Student Level

For each of the three years of the evaluation, participating students completed an annual three-day food diary and a questionnaire about knowledge, attitudes and behaviors related to the objectives of the School Lunch Initiative. Annual student academic performance scores[2] and Body Mass Index from Fitnessgram[3] reports were obtained from the district. In the third year of the evaluation, a similar, anonymous questionnaire was administered to seventh graders in the district to provide a larger sample of students for a cross-sectional examination of the effects of exposure to the School Lunch Initiative in the middle school years.

School Level

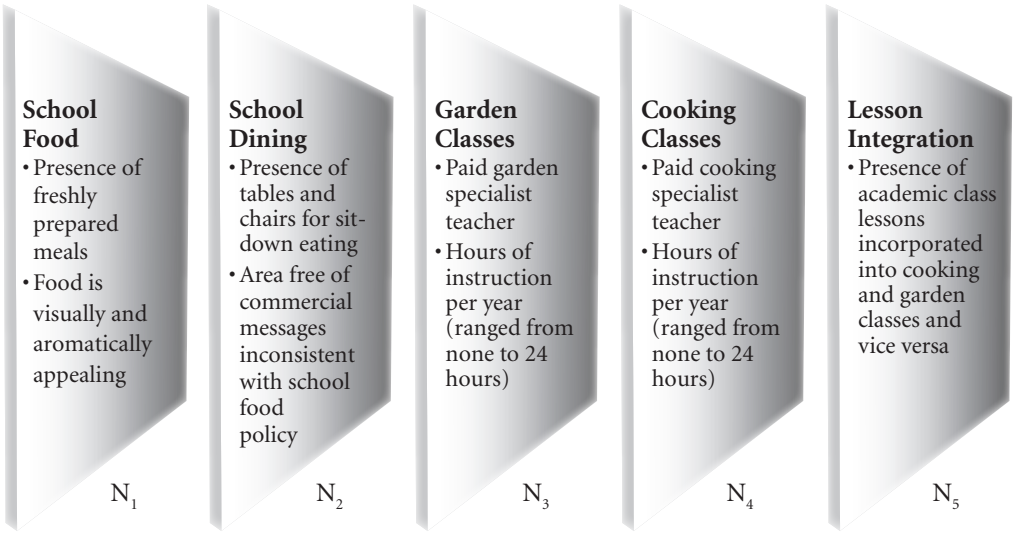
Semi-structured interviews were conducted annually with four to five school staff (including school food service staff, cooking and gardening teachers, and regular classroom teachers) at each of the four study elementary schools in Year One and Year Two of the evaluation and in all three of the middle schools in Year Two and Year Three. The same researchers completed these interviews each year. In addition, annual observational site visits were made to the food service environments at each study school. Interview and observation guides were used to standardize data collection. The purpose of the observations and interviews was to assess and record annually the length and breadth of a student's exposure to the School Lunch Initiative components that varied from one school to another in their School Lunch Initiative development. Figure 2 summarizes how the intervention components were ranked to indicate the degree of development. School rankings were confirmed with district and community partners.

[2] http://www.cde.ca.gov/ta/tg/sr/.

[3] http://www.cde.ca.gov/ta/tg/pf/pftprogram.asp.

Figure 2: How the Degree of School Lunch Initiative Exposure Was Assessed

Attributes of each School Lunch Initiative component were determined and then rated using a Likert scale. Ratings for each attribute were summed to provide a total assessment score. Examples of attributes rated for each component are shown below. The number of attributes rated varied from fourteen for School Food to six for Lesson Integration.



Degree of implementation = $N_1 + N_2 + N_3 + N_4 + N_5$ is the sum of the ratings for all attributes for each component.

Family/Community Level

Parents or guardians of participating students were asked to complete a one-time household questionnaire about family socioeconomic characteristics, family food and physical activity patterns, and related neighborhood characteristics. Most parents or guardians completed the questionnaire in the first year of the study; however, some completed it in Year Two or Year Three. These data were included in the analysis to provide a context for interpreting the findings.

Research Participants

The Berkeley Unified School District is a medium-sized, urban public school district, with an enrollment of about 9,000 students in grades K-12. The students are more diverse in terms of race/ethnicity and income than the city itself. Located in the San Francisco Bay Area of California, Berkeley's population is 108,000 and is 63% White, 10% African American, 18% Asian and 11% Hispanic/Latino; among children, more than 50% are non-White [30]. Berkeley's poverty rate is about 20%, compared to California's poverty rate of 14%. Table 2 shows that the enrollment of students in the schools participating in the evaluation is similar to the enrollment in the entire school district. The heterogeneity of the student population is due to Berkeley's long-standing efforts at integrating its schools. In 1968, the Berkeley Unified School District became the first major school district in the nation to voluntarily integrate its schools. Today, a school assignment plan based upon race, ethnicity, parent education and parent income level aims to bring a diverse mix of students into each Berkeley school [31].

Table 2: Race/Ethnicity and Free and Reduced-Price Meal Enrollment of School Lunch Initiative Research Schools and School District at Baseline (2006-07 School Year)

Race/Ethnicity	Percent in Research Schools	Percent in School District***
White	27.2	29.6
African American	21.4	29.1
Hispanic/Latino	12.8	16.9
Asian	7.7	7.9
Mixed* and Other/Unknown**	31.0	16.5
Enrollment in Free and Reduced-Price Meal Program	33.1 – 65.3	40.1

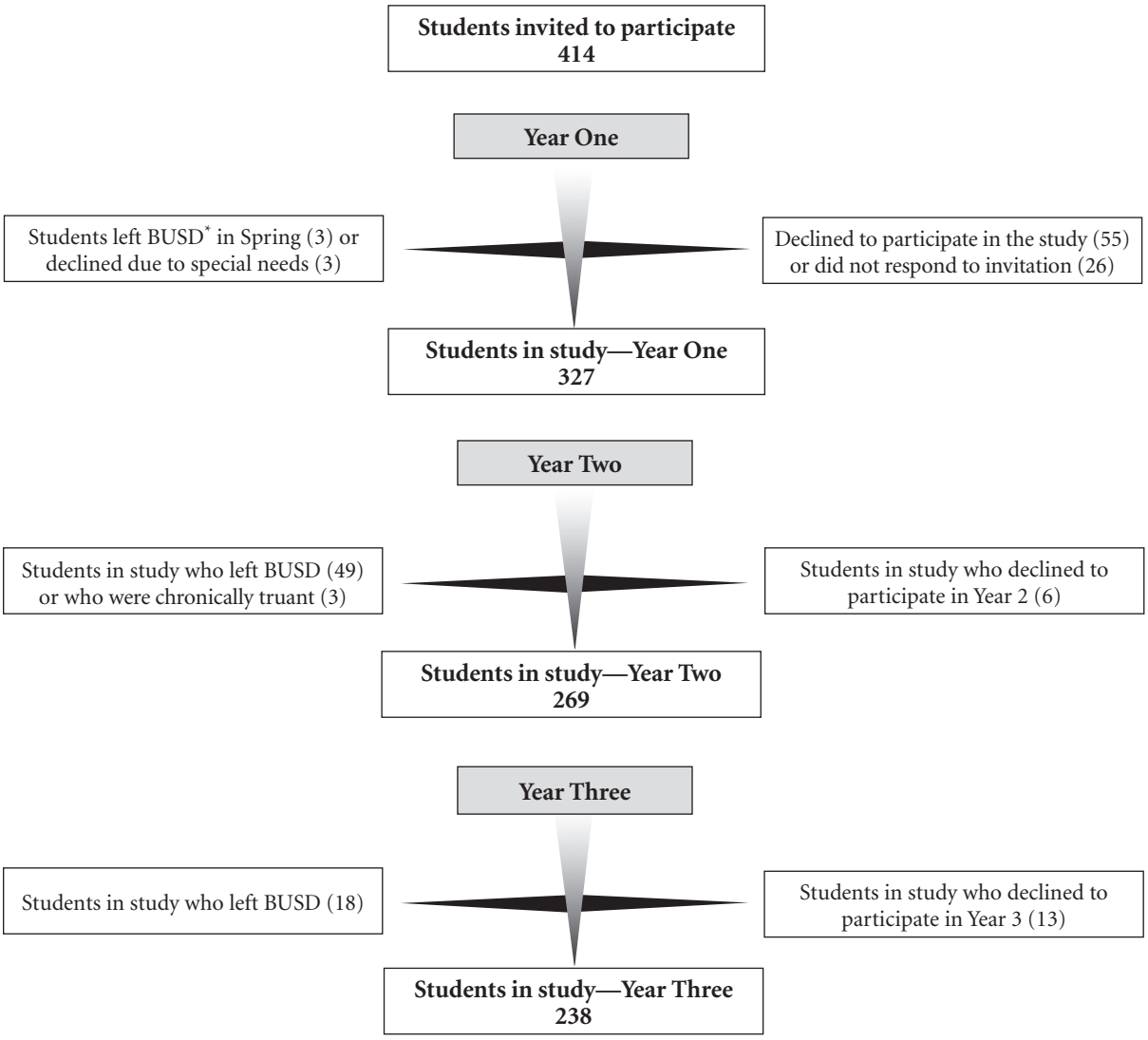
* Mixed-race students defined themselves as being a member of more than one of the other categories.

** Students who checked "Other" but provided a race/ethnic group defined by the U.S. Census Bureau were reclassified into the appropriate category. Remaining "Other/Unknown" students are those who either checked "Don't Know" or defined themselves as a group that was not classified as a race by the U.S. Census Bureau. Students who checked "Native American" (n=4) were combined with "Other" category due to small numbers.

***Source: California Dept. of Education, Dataquest for 2006-07 school year. http://www.cde.ca.gov/ds/sd/cb/dataquest.asp.

Four of the eleven elementary schools in the Berkeley Unified School District were selected for participation in the School Lunch Initiative evaluation. At the beginning of the evaluation, the School Lunch Initiative components were highly developed at two of these schools (referred to as "schools with highly developed School Lunch Initiative components") and minimally developed at the two other schools ("schools with lesser-developed School Lunch Initiative components"). All 414 fourth- and fifth-grade students at these four elementary schools were invited to participate in the School Lunch Initiative evaluation that began during the 2006-07 school year; they were followed for three years as they moved from elementary to middle school. In the first year of the evaluation, 327 fourth- and fifth-grade students agreed to participate. Of this sample, 134 (about 40%) of these students attended the two schools with highly developed School Lunch Initiative components. The other 193 students attended the two schools with lesser-developed School Lunch Initiative components. At the end of three years, 238 (73%) of the students remained in the study. The majority of students (75%) who did not complete the evaluation did so because they left the school district; only 6% of the original participants (who remained in the school district) chose not to complete the evaluation. Figure 3 displays the details of student participation in the study over time.

Figure 3: School Lunch Initiative Evaluation Project Participant Recruitment and Retention



* BUSD = Berkeley Unified School District

There were no differences in the distributions of gender and parents' educational levels between the schools with highly developed components and those with lesser-developed components. However, there were proportionately more students from non-Hispanic White and higher-income families in the schools with lesser-developed components than in those with highly developed components. This is due to the availability of funding from the Network for a Healthy California[4] for greater development of the School Lunch Initiative garden and cooking class components in schools with lower-income children. Table 3 shows sociodemographic and neighborhood characteristics of participating students at the beginning of the study.

[4] http://www.cdph.ca.gov/programs/cpns/Pages/AboutUs.aspx.

Table 3: Sociodemographic and Neighborhood Characteristics at Baseline (2006-07 School Year)

	Total N=327[1]	Schools with Lesser-Developed Components (N=193)	Schools with Highly Developed Components (N=134)	Significant difference[2]
Grade (% distribution)				
Fourth **Fifth**	52.9 47.1	51.8 48.2	54.5 45.5	NS
Gender (% distribution)				
Male **Female**	41.6 58.4	40.4 59.6	43.3 56.7	NS
Race/ethnicity (% distribution)				
White **African American** **Latino** **Asian** **Mixed/Other/Unknown**	26.6 21.4 13.5 7.9 30.6	31.1 14.0 13.5 6.7 34.7	20.2 32.1 13.4 9.7 24.6	**
Mother's/female guardian's education (% distribution)				
Not living with child **High school or less** **Some college** **College degree** **Graduate school**	1.0 17.3 27.3 18.3 36.0	1.1 15.4 23.1 27.2 42.1	0.9 20.3 34.2 32.7 26.6	*
Father's/male guardian's education (% distribution)				
Not living with child **High school or less** **Some college** **College degree** **Graduate school**	8.9 21.8 18.8 19.9 30.6	7.5 18.1 18.1 19.4 36.9	10.8 27.0 19.8 20.7 21.6	NS
Household income (% distribution)				
< $40,000 **$40,000-$79,999** **$80,000**	39.1 21.4 39.5	29.9 22.5 47.6	53.3 19.6 27.1	***
Number of stores that sell fresh produce within 10 minutes' walking distance from home (Mean ±S.D.)	4.33±2.78	4.56±2.77	3.94±2.77	NS
Number of safe parks within 10 minutes' walking distance from home (Mean ±S.D.)	3.21±2.16	3.55±2.43	2.60±1.41	***

[1] Ns may vary slightly due to missing values.

[2] Differences in distributions between schools with highly developed components and schools with lesser-developed components were assessed using the Chi-square test; significant differences are indicated by: *p<.05, **p<.01, ***p<.001.

School Settings

Schools have defining physical features and elements that may indirectly have an effect on the School Lunch Initiative outcomes. For example, new food offerings at a school where there is a brightly lit and spacious cafeteria may seem more appealing than at a school where the cafeteria is dark and cramped. Differences in the settings of the study schools should be considered in the interpretation of the results. Table 4 provides a description of the schools that were included in the School Lunch Initiative evaluation.

Table 4: School Setting of School Lunch Initiative Evaluation Schools

	Approximate percentage of children enrolled in Free or Reduced-Price Meal Program[1]	Approximate student enrollment[1]	School setting
Elementary Schools			
A*	35% - 40%	260 - 280	Older buildings, redesigned playground; K-2 Chinese bicultural program
B*	35% - 40%	390 - 420	Newly built campus; arts program; K-5 Spanish Immersion program
C**	60% - 65%	300 - 320	Older building; K-5 Spanish Immersion program; extensive gardens
D**	50%	230 - 250	Older, quaint buildings in a creek-side setting; some mixed-grade classrooms; programs for the deaf and the hard of hearing
Middle Schools			
X	30% - 40%	900 - 980	Remodeled buildings; no dining area until new dining and central kitchen opened in Year Three of evaluation
Y	50% - 60%	460 - 470	Older buildings; strong volunteer base from surrounding community and university
Z	55% - 60%	430 - 450	Older buildings; Spanish Immersion program; performing arts program; this is the only middle school where families can request enrollment***

[1] Source: California Dept. of Education, Dataquest. http://www.cde.ca.gov/ds/sd/cb/dataquest.asp.

* Elementary schools with lesser-developed School Lunch Initiative components.

** Elementary schools with highly developed School Lunch Initiative components.

***The Berkeley Unified School District has a school assignment plan based upon race, ethnicity, parent education and parent income level.

RESULTS

How the School Lunch Initiative Evolved Over Three Years

The School Lunch Initiative implemented the components of the program across the Berkeley Unified School District over a three-year period. The components incorporated in the study schools are presented in Table 6 on page 22.

At the elementary school level, enrollment in the schools with the most highly developed School Lunch Initiative components included more low-income students. This situation reflects the fact that funding was available to hire staff to teach cooking and gardening in schools where at least 50% of students qualified as low-income; other schools did not have such outside funding. In comparison, at the middle school level, all three middle schools had funding to hire staff to teach cooking and gardening.

Based on school staff interviews and annual school site-visit observations during the evaluation, the School Lunch Initiative and student exposure to its five components—school food, school dining, garden classroom, cooking classroom and academic curriculum integration—developed in the following ways:

School Food

The school food service component evolved quickly. By the first year of the evaluation, all students in elementary schools were receiving free breakfast; salad bars featuring fresh fruits and vegetables were installed in all cafeterias; swipe-card readers were installed in all cafeterias to ensure confidentiality for students who received free or reduced-price meals; and the meal service changed from heated meals in packaged containers to buffet-style service of freshly prepared meals. Other changes included offering only water and organic milk in all elementary and middle schools, and offering made-from-scratch soups in all middle schools. Accompanying these program changes were operational changes such as staff reorganization; equipment purchasing; staff training; and bulk, in-season food purchasing from local sources. Since these changes began in school year 2005-06, the number of total meals served increased by about 140%, largely due to the expansion of breakfast to all students and adding the snack service (Table 5). Overall meal participation rates increased slightly by the end of school year 2008-09 due to an increase of 67% among students buying school lunch at full price compared to school year 2005-06. However, there were also small decreases in free and reduced-price meal participation during the same time period. It is important to note that total meals served went up even though enrollment in the school district went down. The Chez Panisse Foundation discusses the story of the food service changes in more detail in their publication, *Lunch Matters: How to Feed our Children Better. The Story of the Berkeley School Lunch Initiative* [28].

Table 5: Berkeley Unified School District Meals Served and Participation Rates[1]

	2005-06	2006-07	2007-08	2008-09
District enrollment[2]	9,076	9,088	8,954	8,988
Total Meals Served	727,649	1,048,724	1,621,385	1,741,260
Breakfast	124,197	345,274	816,998	891,900
Lunch	395,461	351,681	365,171	393,120
Child Development	207,991	217,045	213,368	218,640
Snacks	0	134,724	225,848	237,600
Eligible for Free/Reduced-Price Meal	40.9%	39.4%	38.0%	39.7%
Meal Participation (percent of students)	24.5%	22.5%	23.1%	24.7%
Lunch-Paid	7.6%	8.4%	9.4%	12.7%
Lunch-Reduced	36.2%	33.4%	35.3%	32.6%
Lunch-Free	52.2%	46.0%	44.6%	43.9%

[1] Numbers reported by Berkeley Unified School District Nutrition Services Department on 6-1-2009.

[2] Source: California Dept. of Education, Dataquest for 2006-07 to 2008-09 school years.

School Dining

Changes to the dining room component were most evident in two schools. One of the elementary schools with highly developed School Lunch Initiative components offered washable tableware and pitchers of water and cups at every table and changed lunch time to follow recess. At one middle school, as a result of the passage of a city bond measure, a new dining and kitchen facility building was built. This dining room allows children to view their food being prepared and features large windows and small tables and stools to encourage relaxed, sit-down eating.

Garden Classroom Hands-On Education

At most of the schools, garden classrooms were part of the school curriculum. In the schools where this School Lunch Initiative component was more developed, there were paid staff members dedicated to garden maintenance and curriculum integration. The gardening classes often had the capacity for teaching cooking from the on-site gardens.

Cooking Classroom Hands-On Education

Some of the schools also had cooking and kitchen classrooms. In the schools where this School Lunch Initiative component was more developed, there were paid staff members instructing and integrating lessons when possible into the school curriculum. Cooking and kitchen classrooms were linked closely to the garden, and some schools offered up to 1.5 hours per week for cooking and gardening instruction.

Academic Curriculum Integration

The curriculum integration component had some successes, but was not fully developed by the third year of the evaluation. Several teachers at two elementary schools participated in a year of planning meetings and curriculum workshops to bring cooking and gardening into the regular academic curriculum. In one elementary school, a classroom teacher collaborated with the cooking and gardening teachers to integrate gardening, food and ecologically based learning throughout the day. A few sixth-grade teachers at Middle School X implemented selected lessons from a food-related applied mathematics curriculum, *Making Mathematics Delicious*, produced by the Chez Panisse Foundation. In addition, the sixth-grade teachers at this middle school implemented some lessons from *What's On Your Plate* that integrate classroom, cooking and gardening experiences with other projects, homework and field trips.

An example of integration and coordination across components occurred in one of the elementary schools with highly developed School Lunch Initiative components and one of the middle schools. Food grown in the garden was harvested and then used in a recipe taught in cooking class; this same dish was also served within the same month at lunch in the cafeteria.

Integration across academics, gardens, cooking, dining, and school meals did occur in the middle school with the most highly developed School Lunch Initiative components. Cooking and gardening classes were taught by paid staff on a regular basis, meals in the cafeteria were prepared from fresh foods in a dining area conducive to relaxed eating, and teachers integrated selected lessons in regular subjects with lessons in the cooking and gardening classes. Table 6 shows how the features of the School Lunch Initiative components developed in all the study schools over three years.

Table 6: School Lunch Initiative Component Development in Evaluation Schools Over Three Years

	Paid cooking and gardening staff			Hours in cooking and gardening annually			Dining environment improvements			Curriculum integration			Food Service Changes[1]		
YEAR	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Elementary Schools with Lesser-Developed School Lunch Initiative															
School A			n/a[2]	0	0	n/a						n/a	✓	✓	✓
School B			n/a	8.5	0	n/a						n/a	✓	✓	✓
Elementary Schools with Highly Developed School Lunch Initiative															
School C	✓	✓	n/a	24	24	n/a				✓	✓	n/a	✓	✓	✓
School D	✓	✓	n/a	22	56	n/a	✓ (minor)				✓	n/a	✓	✓	✓
Middle Schools															
School X	n/a	✓	✓	n/a	40.5 (6th grade)	45 (6th grade) 30 (7th grade)			✓ (new dining room)	n/a	✓	✓	✓	✓	✓
School Y	n/a	✓	✓	n/a	48 (6th grade)	48 (6th grade) 0 (7th grade)[3]				n/a			✓	✓	✓
School Z	n/a	✓	✓	n/a	19.5 (6th grade)	26 (6th grade) 19.5 (7th grade)				n/a			✓	✓	✓

1 Food service changes included salad bars, universal breakfast and freshly prepared meals served buffet style.

2 "n/a" = not applicable. By the third year, these students were in middle school.

3 Cooking and gardening in the seventh grade at this school was an elective. Two students in the study took this elective, but were not included in the data analysis.

Influence of the School Lunch Initiative

Data collected from each student's parent or guardian regarding the home environment and from students' food diaries and questionnaires show that the School Lunch Initiative had positive results. More detailed results and data tables are in Appendix D.

Influences of the Home Environment

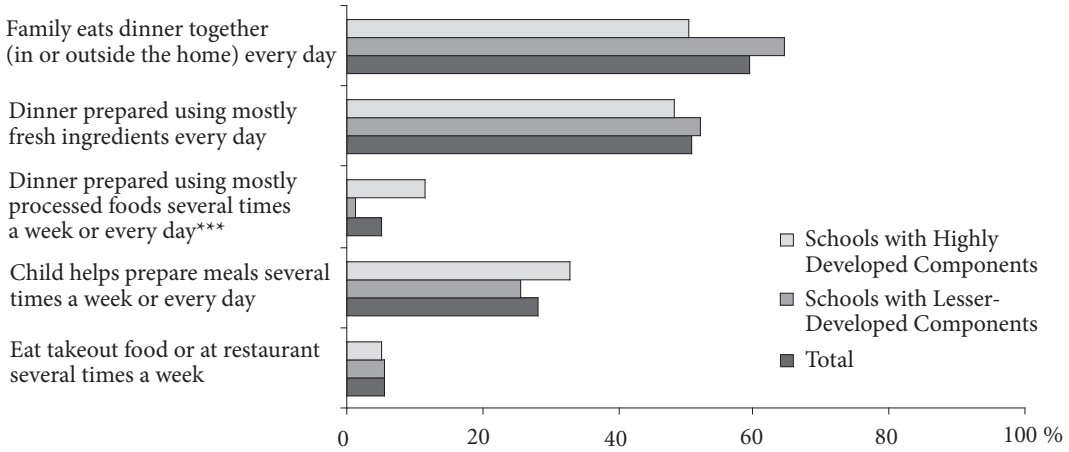
Parents are powerful influencers on a child's experiences with food because they shape their children's eating environments in a variety of ways. Parental feeding practices have been found to be associated with child obesity [32-33]. Findings from the household questionnaire indicated that families dine together and often eat fresh produce. The more developed the School Lunch Initiative was in a child's school, the more families reported these behaviors.

Parents' perception of neighborhood safety is associated with children's physical activity [34]; lower-income neighborhoods tend to have fewer safe parks for children to play in and children living in these neighborhoods may spend more of their waking hours engaged in sedentary behaviors such as watching television [35]. Findings of the household questionnaire revealed that parents' encouragement of their child's physical activity in outdoor play was impeded by fear for their children's safety.

Families are eating dinner together.

More than half of the families of students in the study reported eating dinner together (in and outside the home) every day. Fewer than 5% of families reported eating takeout or restaurant food "several times a week." This pattern is not inconsistent with a study looking at dinner preparation in the United States that found that 70% of dinners were prepared at home [36]. About half of the families said that dinner is prepared using mostly fresh ingredients every day and fewer than 10% said they used mostly processed foods. However, fewer than 30% of households report involving their child in preparing these meals (Figure 4).

Figure 4. Parent-Reported Characteristics of Family Dinner (N = 257-258)[1,2]



[1] The numbers of respondents vary by question.

[2] For more detail, see Appendix D, Table 1.

Significant difference between schools with lesser-developed School Lunch Initiative components and those with highly developed School Lunch Initiative components at ***p<.001.

Parents value eating fresh produce each day.

More than 90% of all the parents reported that it was "very important" to serve their child fresh fruits and vegetables every day, more than 75% thought it was very important to serve whole grains, and almost half thought it was very important to serve locally grown foods. Parents with children in schools with highly developed School Lunch Initiative components were more likely to think it was very important to serve whole grains and in-season fruits and vegetables (Appendix D, Table 2).

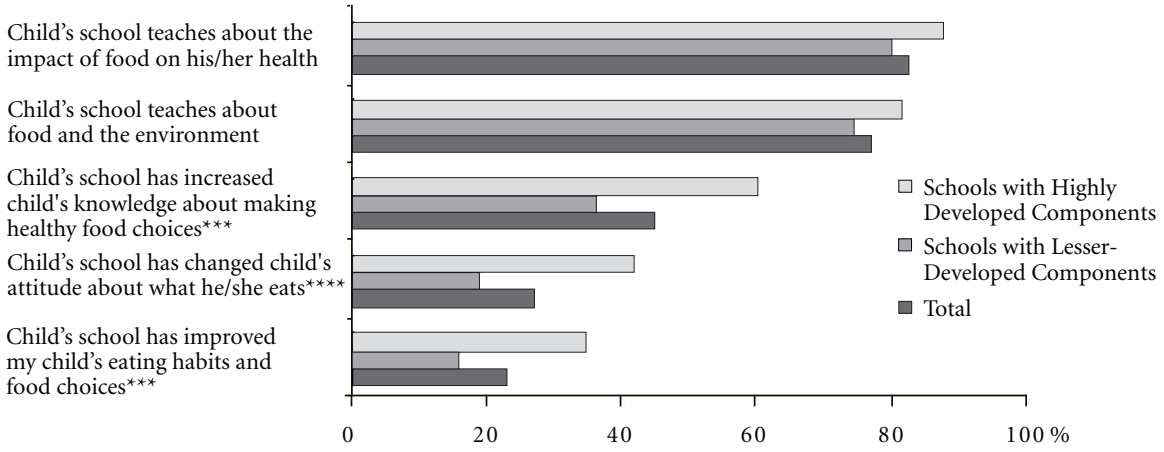
Most families say they purchase fresh, local and seasonal foods.

About 90% of the parents said they purchased whole grains and fresh fruits and vegetables on a weekly basis. More than 70% said they purchased locally grown food and more than 80% said they purchased seasonal foods, but there were no differences in these reported behaviors between parents of children attending schools with highly developed School Lunch Initiative components and parents of children attending schools with lesser-developed School Lunch Initiative components (Appendix D, Table 3).

More parents with children in schools with highly developed School Lunch Initiative components noticed changes in their child's eating habits.

Parents with children in schools with highly developed School Lunch Initiative components were more likely to strongly agree that their child's school had changed their child's knowledge about making healthy food choices and their child's attitude about what he/she eats, and had improved their child's eating habits. For example, about 35% of parents with children from schools with highly developed School Lunch Initiative components felt that the school had improved their child's eating habits and food choices in contrast to about 16% of parents with children in schools with lesser-developed School Lunch Initiative components (Figure 5).

Figure 5. Parent's Attitudes Regarding Child's Learning About Food, Health and the Environment: Percent Who Answered "Very Important" or "Strongly Agree" (N=253-258)[1,2]



[1] The numbers of respondents vary by question.

[2] For more detail, see Appendix D, Table 4.

Significant difference between schools with lesser-developed components and those with highly developed components at ***p<.001; ****p<.0001.

Parents say their children are physically active, but there are barriers.

More than 65% of parents reported that their child participated in organized physical activity, such as dance and sports. However, fewer than 50% encouraged their child to play outside every day and fewer than 60% set limits on sedentary behaviors such as watching television. A potential barrier to physical activity is neighborhood safety—nearly 40% of families from schools with highly developed components and about 20% of families from schools with lesser-developed components had concerns about neighborhood safety for outdoor play (Appendix D, Table 5).

Impacts of the School Lunch Initiative on Students

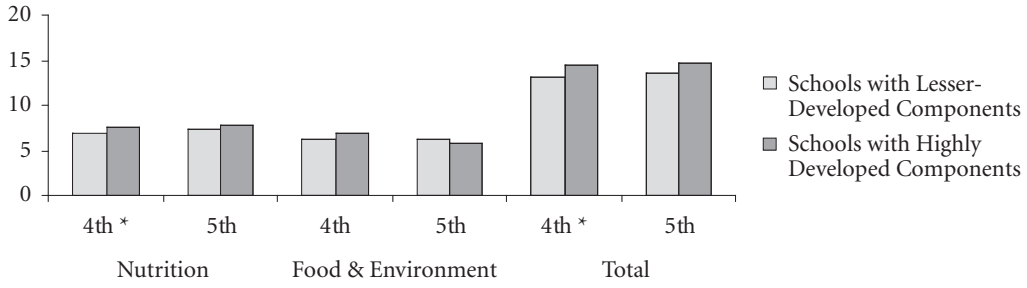
The most positive findings are related to students' increased nutrition knowledge and a higher preference for and consumption of fruits and vegetables, especially for the children in earlier grades from the schools with highly developed School Lunch Initiative components. These elementary schools happen to be those with more lower-income students and therefore qualify for funding sources for regular cooking and gardening classes with paid teachers.

Student Knowledge

Greater exposure to the School Lunch Initiative was associated with higher nutrition knowledge scores among fourth graders and seventh graders.

Fourth-grade students attending the elementary schools with highly developed School Lunch Initiative components had higher nutrition knowledge scores than those attending the schools with the lesser-developed School Lunch Initiative components (Figure 6). This difference was also observed among fifth-grade students, but the difference was not statistically significant. As the fifth-grade students moved to the next grade, their nutrition knowledge scores generally stayed the same or showed small increases. By Year Three, seventh-grade students who had attended Middle School X, the middle school with the most highly developed School Lunch Initiative components (where students spent more time in cooking and gardening programs), had increased their nutrition knowledge scores by 5% over the previous year, while students attending the other two middle schools with lesser-developed School Lunch Initiative components had decreased their knowledge scores by 6% and 14%, respectively (Appendix D, Table 8). In addition, the cross-sectional survey of seventh-grade students conducted in Year Three showed that mean knowledge scores about food and the environment were higher among students attending Middle School X (Figure 7).

Figure 6. Student Knowledge Scores by Grade in Year One[1,2,3]



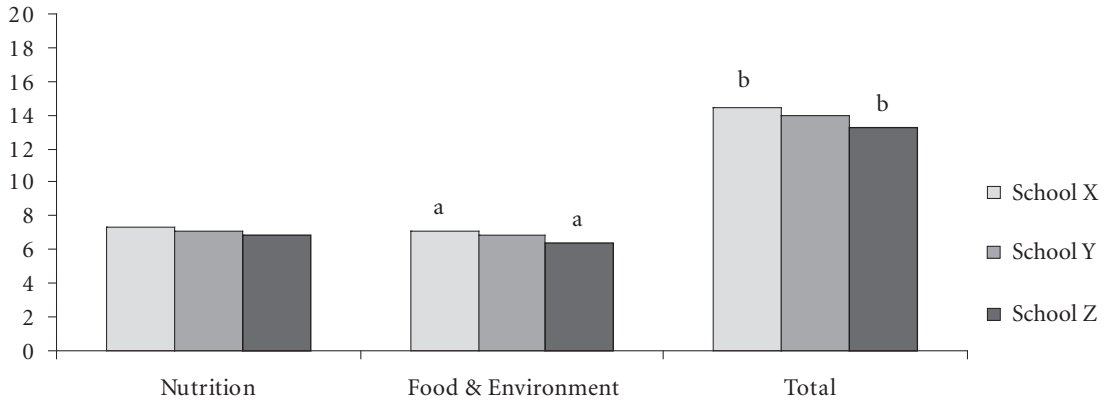
1 Adjusted for race and education.

2 Maximum scores possible = 20: nutrition knowledge = 8; food and environment = 12.

3 For more detail, see Appendix D, Table 6.

Significant difference between schools with highly developed components and those with lesser-developed components in Year One at *p<.05.

Figure 7. Nutrition and Food and Environment Knowledge Scores Among All Seventh Graders in Year Three[1,2,3,4,5]



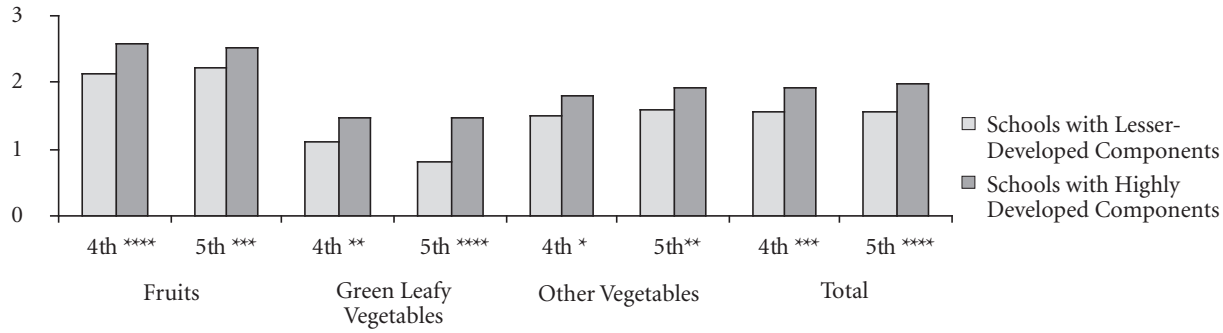
[1] Maximum scores possible = 20: nutrition knowledge = 8; food and environment = 12.
[2] The School Lunch Initiative was most highly developed at School X.
[3] Adjusted for gender, race and whether participating in the School Lunch Initiative evaluation study.
[4] Data were gathered in a one-time cross-sectional survey of all seventh graders willing to participate.
[5] For more detail, see Appendix D, Table 26.
[a,b] Matching alphabetic superscripts indicate significant difference at $p<.05$.

Student Food Preference

Elementary school students from the schools with highly developed School Lunch Initiative components clearly expressed a higher preference for fruits and vegetables, but by seventh grade, preference for fruits and vegetables was similar among the various exposure groups.

In Year One, preference for fruits and vegetables was clearly greater among students from schools with highly developed School Lunch Initiative components (Figure 8). Fourth-grade students from schools with highly developed School Lunch Initiative components showed significantly greater increases in preference for green leafy vegetables in particular as they moved into fifth grade, compared to fourth-grade students from schools with lesser-developed School Lunch Initiative components (Appendix D, Table 11). Fifth-grade students from schools with highly developed School Lunch Initiative components also increased their preference for green leafy vegetables as they moved into the sixth grade but, statistically, this increase was not significant. By seventh grade, preference for fruits and vegetables was similar among the various exposure groups, except preference for green leafy vegetables was associated with higher exposure to School Lunch Initiative components (Figure 9).

Figure 8. Mean Student Food Preference Scores by Grade in Year One[1,2,3,4]



1 Adjusted for race and education.

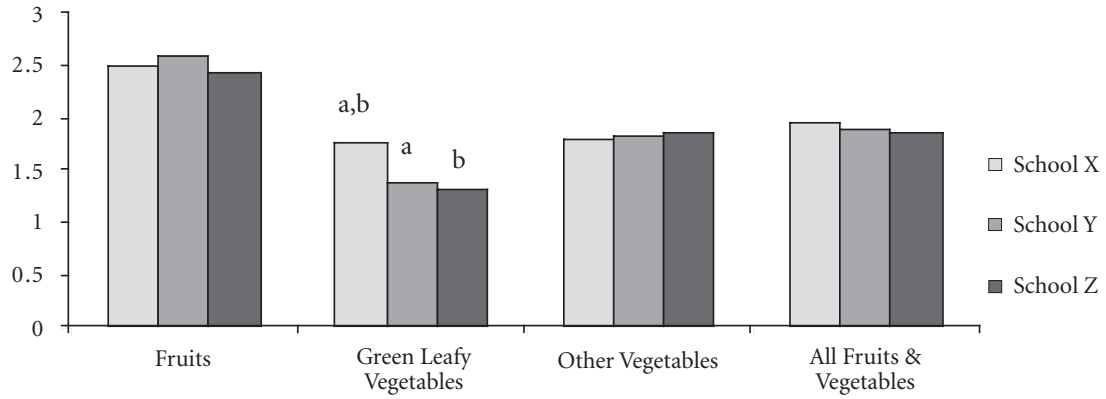
2 Students were asked how much they liked certain fruits and vegetables; responses were scored on a scale of 0-3 (the higher the score, the greater the preference).

3 Sample sizes in Year One differ from those used in examining changes in outcomes.

4 For more detail, see Appendix D, Table 10.

Significant difference between schools with highly developed components and those with lesser-developed components in Year One at *p<.05; **p<.01; ***p<.001; ****p<.0001.

Figure 9. Food Preferences Among all Seventh Graders in Year Three[1,2,3,4,5]



1 Adjusted for gender, race and whether participating in the School Lunch Initiative evaluation.

2 Students were asked how much they liked certain fruits and vegetables; responses were scored on a scale of 0-3 (the higher the score, the greater the preference).

3 The School Lunch Initiative was most highly developed at School X.

4 Data were gathered in a one-time cross-sectional survey of all seventh graders willing to participate.

5 For more detail see Appendix D, Table 28.

[a,b] Matching alphabetic superscripts indicate significant difference at p<.01.

Student Attitudes

Students attending the middle school with highly developed School Lunch Initiative components in Year Three tended to show positive trends in attitudes about food, the environment and school food.

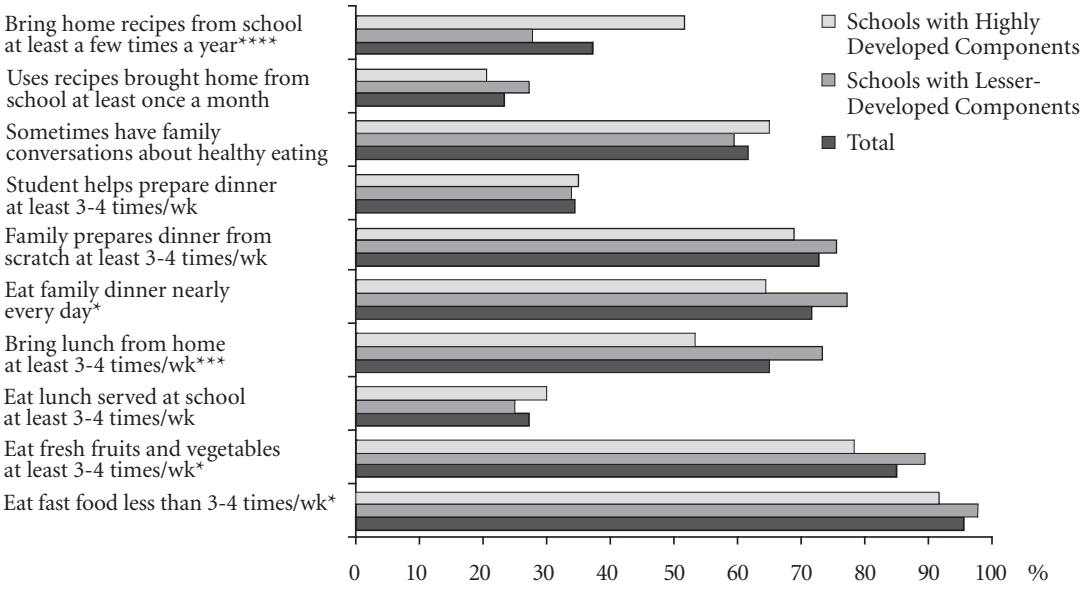
There were no consistent differences in attitudes about food, health, the environment or school between students attending schools with highly developed School Lunch Initiative components and students attending schools with lesser-developed School Lunch Initiative components over the three years of the evaluation. However, proportionately more students attending Middle School X, with highly developed School Lunch Initiative components, in Year Three tended to show positive attitudes toward eating the food served at school and liking the cafeteria at school, as well as agreeing that produce tastes better in-season and that eating choices can help or hurt the environment (Appendix D, Table 9).

Student Eating Behaviors

Elementary school students from schools with lesser-developed School Lunch Initiative components reported eating dinner with family every day and bringing lunch from home.

Significantly more elementary school students from schools with lesser-developed School Lunch Initiative components said they eat family dinner nearly every day, bring lunch from home at least 3 to 4 times a week, eat fresh fruits and vegetables at least 3 to 4 times a week, and eat fast food less than 3 or 4 times a week (Figure 10). This observation may be related to students' socioeconomic backgrounds, which were higher among students in the schools with lesser-developed School Lunch Initiative components. However, increases in the proportion of students reporting these healthy behaviors were observed consistently from Year One to Year Two among students attending schools with highly developed School Lunch Initiative components (Appendix D, Tables 14 and 15).

Figure 10. Student-Reported Food-Related Activities/Behaviors in Year One[1,2]



[1] Ns vary from 286-313 due to missing values.

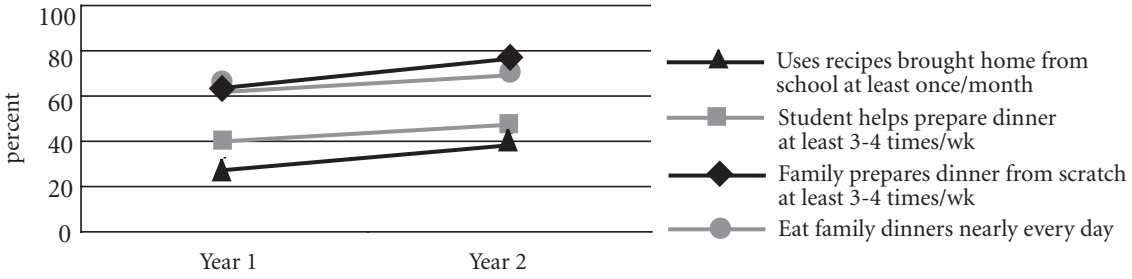
[2] For more detail, see Appendix D, Table 13.

Significant difference between schools with lesser-developed components and those with highly developed components in Year One at *p<.05; ***p<.001; ****p<.0001.

There were positive trends in student-reported home dinner behaviors among elementary students from schools with highly developed School Lunch Initiative components.

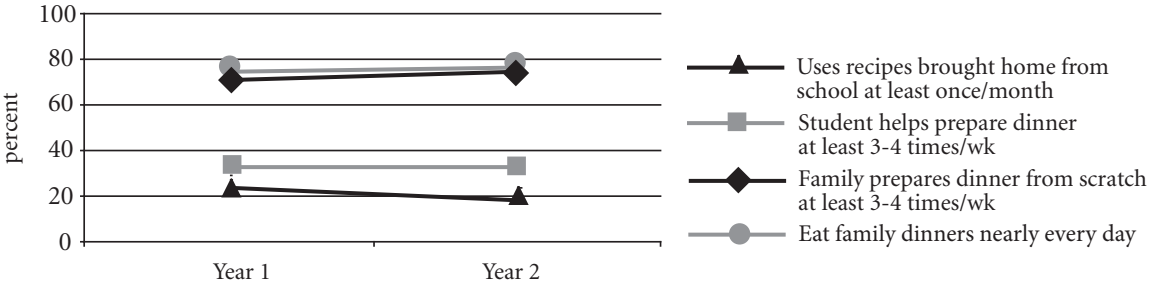
As they became fifth-grade students in Year Two, fourth-grade students from schools with highly developed School Lunch Initiative components showed upward trends in family dinner prepared from scratch, eating family dinner nearly every day, using recipes from school at home and helping prepare dinner (Figure 11). In contrast, fourth-grade students from schools with lesser-developed School Lunch Initiative components did not show increasing trends in these behaviors from the fourth to fifth grade, although more students from these schools said they ate family dinner nearly every day and this remained consistent from Year One to Year Two (Figure 12).

Figure 11. Schools with Highly Developed School Lunch Initiative Components: Trends in Student-Reported Family Dinner and Home Cooking Behaviors from Year One to Year Two (Fourth Grade to Fifth Grade)[1]



[1] For more detail, see Appendix D, Table 14.

Figure 12. Schools with Lesser-Developed School Lunch Initiative Components: Trends in Student-Reported Family Dinner and Home Cooking Behaviors from Year One to Year Two (Fourth Grade to Fifth Grade)[1]



[1] For more detail, see Appendix D, Table 14.

Elementary school students increased their fruit and vegetable consumption by more than one-half cup (one serving) from fourth to fifth grade.

In Year One, fourth- and fifth-grade students in schools with highly developed School Lunch Initiative components and those in schools with lesser-developed School Lunch Initiative components all ate about the same amount of fruit and vegetable servings per day (about 4 servings, or 2 cups) (Appendix D, Table 16). In Year Two, the younger students (fourth graders who had moved into fifth grade) attending the schools with highly developed School Lunch Initiative components had increased their consumption of vegetables by nearly 1 serving (0.4 cups), and for both fruits and vegetables by about 1.5 servings (0.7 cups), while those attending schools with lesser-developed School Lunch Initiative components had decreased their consumption of both fruits and vegetables by nearly 0.4 servings (-0.2 cups) (Figure 13).

A related photography study of the contents and consumption of student lunches chosen at school and brought from home was conducted for the Network for a Healthy California at the evaluation elementary schools in Year Two.[5] The Network funds the cooking and garden programs at the schools with highly developed School Lunch Initiative components. Students at the schools with highly developed School Lunch Initiative garden and cooking components had more vegetables on their plate and consumed about 0.25 cup more vegetables than at the schools with lesser-developed School Lunch Initiative garden and cooking components. Students who ate school lunch consumed more than three times as many vegetables as students who brought lunch from home.

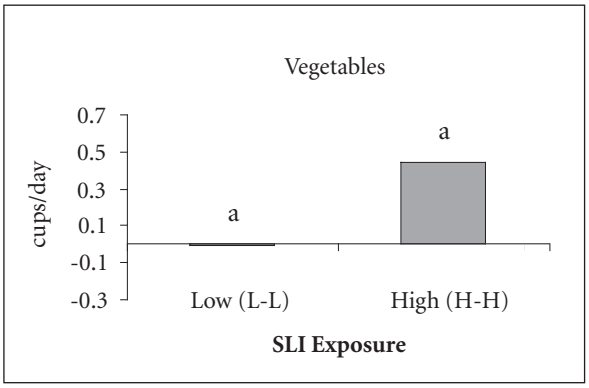
Example of lunch chosen at school.

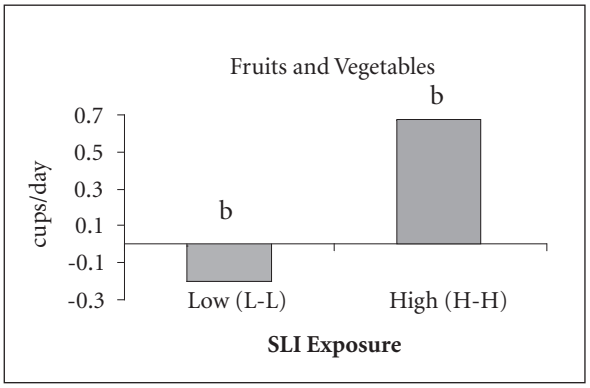
Example of lunch brought from home.

[5] Martin AC, Rauzon S, Wang M. Network for a Healthy California–BUSD Evaluation Report 2007-2008, October 2008.

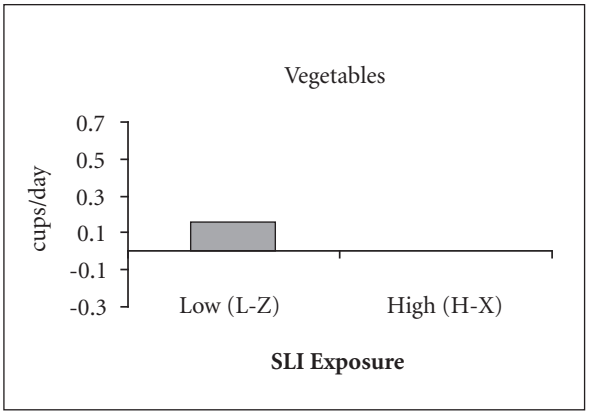
Figure 13. Change in Mean Consumption of Fruits and Vegetables from Year One to Year Two[1,2,3,4]

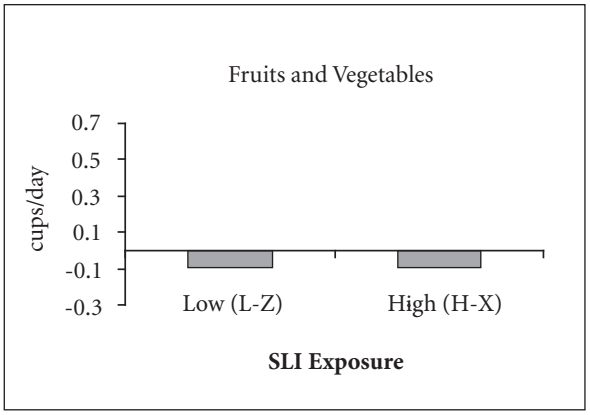
Fourth to Fifth Grade





Fifth to Sixth Grade





1 Adjusted for race and education and relevant Year Two consumption; multiple comparisons were assessed using Bonferroni's procedure.

2 Standard cups/day (1 standard cup = 2 standard servings).

3 H = elementary school with highly developed School Lunch Initiative components; L = elementary school with lesser-developed School Lunch Initiative components; X, Y and Z = middle schools as described. Middle schools shown had the greatest difference.

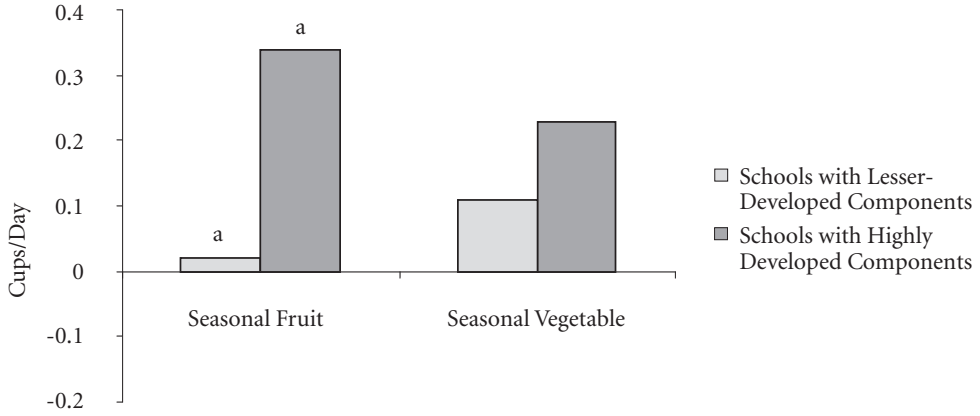
4 For more detail, see Appendix D, Table 17.

[a,b] Matching alphabetic superscripts indicate significant difference at $p<.01$.

About 80% of the increase in consumption of fruits and vegetables among elementary school students came from in-season fruits and vegetables.

As the fourth-grade students from schools with highly developed School Lunch Initiative components moved to the fifth grade, they increased their consumption of fruits and vegetables by nearly 1.5 servings (0.7 cups) (Figure 13). About 80% of this increase consisted of in-season fruits and vegetables, with consumption of these foods increasing by more than 1 serving (0.6 cups). The increase in their in-season consumption was particularly evident for fruit (Figure 14). Examples of fruits and vegetables in season at the time students completed their food diaries (January-April) include asparagus, Brussels sprouts, carrots, potatoes, grapefruit and navel oranges.

Figure 14. Change in Mean Consumption of Seasonal Fruits and Vegetables from Year One to Year Two[1,2,3]



1 Adjusted for race and education and relevant baseline consumption; multiple comparisons were assessed using Bonferroni's procedure.

2 Standard cups/day (1 standard cup = 2 standard servings).

3 For more detail, see Appendix D, Table 19.

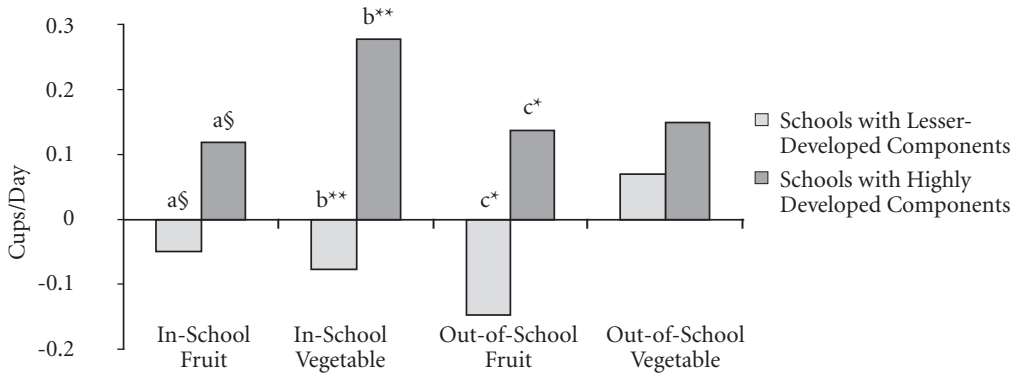
a Matching alphabetic superscripts indicate significant difference at $p<.05$.

The increase in consumption of fruits and vegetables among fourth graders occurred both in-school and out-of-school for fruits and in-school for vegetables.

Students in fourth grade attending schools with highly developed School Lunch Initiative components increased their consumption of fruits by about 0.2 servings, or 0.1 cups, both in-school and out-of-school from Year One to Year Two, compared to students attending the schools with lesser-developed School Lunch Initiative components. The fourth-grade students in Year Two also showed increases in their consumption of vegetables from Year One to Year Two, compared to students attending the schools with lesser-developed School Lunch Initiative components.

However, the increase in in-school vegetable consumption of about 0.6 servings, or 0.3 cups, was significantly greater only in students attending schools with highly developed School Lunch Initiative components. During this time, students attending schools with lesser-developed components decreased their consumption of in-school vegetables by about -0.2 servings, or -0.1 cups (Figure 15).

Figure 15. Change in Mean Fruits and Vegetables Eaten In-School and Out-of-School Among Fourth Graders from Year One to Year Two[1,2,3]



[1] Adjusted for race and education and relevant baseline consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Standard cups/day (1 standard cup = 2 standard servings).

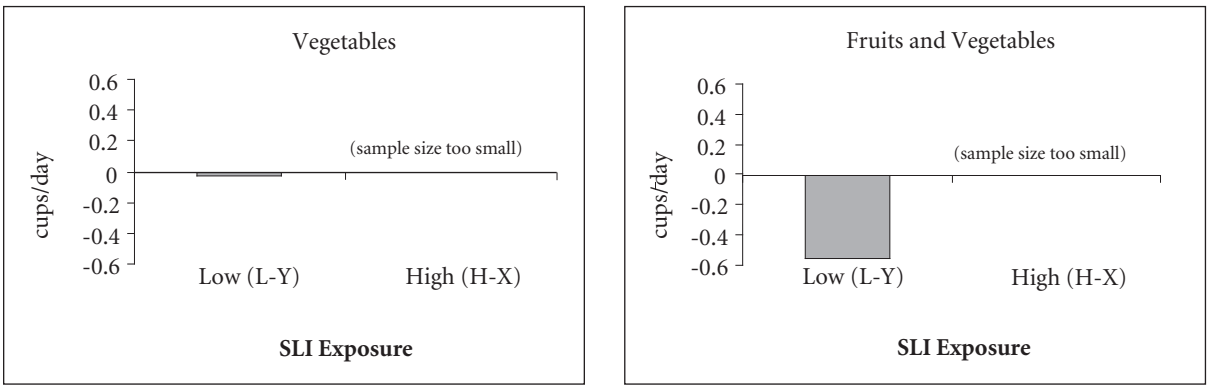
[3] For more detail, see Appendix D, Table 21.

[a-c] Matching alphabetic superscripts indicate significant difference: §p<.10; *p<.05; **p<.01.

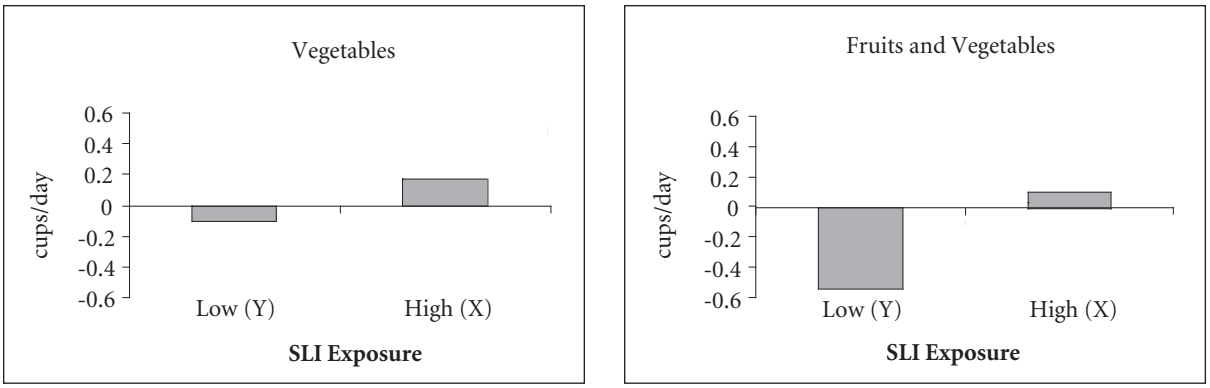
Continued exposure to the School Lunch Initiative in middle school appears to be important to sustain any increases in fruit and vegetable consumption achieved in fourth and fifth grades. Sixth-grade students showed no significant increase in fruit and vegetable consumption compared to the previous year, but seventh-grade students in the middle school with the most highly developed School Lunch Initiative components showed small increases in total fruit and vegetable consumption, putting them at a consumption level of about 4.5 servings of fruit and vegetables daily. Seventh-grade students in the other middle school, where there was less exposure to School Lunch Initiative components, showed a mean decrease in both fruit and vegetable consumption of about one serving per day (Figure 16). The current recommendation is that adolescents consume 7 to 8 servings of fruits and vegetables a day [15], but American children eat only an average of 3.5 servings of fruits and vegetables daily [16]. The need for continued exposure to the School Lunch Initiative into middle school is further supported by the observation that at the one middle school where seventh-grade students showed a mean decrease in fruit and vegetable consumption of about one serving per day, the cooking and garden programming was offered only as an elective.

Figure 16. Change in Mean Consumption of Fruits and Vegetables from Year Two to Year Three[1,2,3,4]

Fifth to Sixth Grade



Sixth to Seventh Grade



1 Adjusted for race and education and relevant Year Two consumption; multiple comparisons were assessed using Bonferroni's procedure.

2 Standard cups/day (1 standard cup = 2 standard servings).

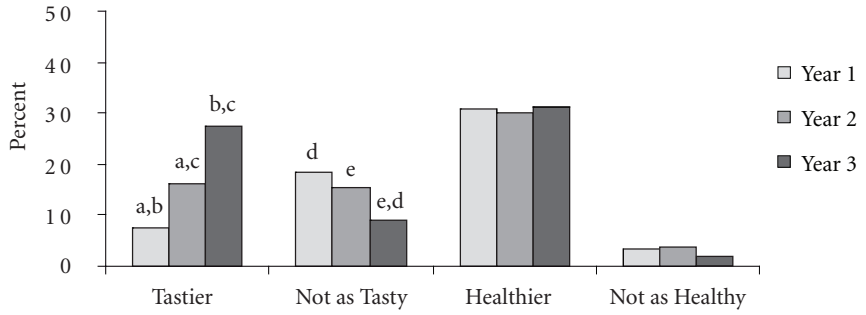
3 H = elementary school with highly developed School Lunch Initiative components; L = elementary school with lesser-developed School Lunch Initiative components; X, Y and Z = middle schools as described. Middle schools shown had the greatest difference.

4 For more detail, see Appendix D, Table 18.

Students liked the changes to the school lunch meals.

More students in Year Three said the school lunches, overall, were tastier than in Year One of the evaluation. At the same time, fewer students in Year Three compared to Year One said the food was not as tasty (Figure 17). More elementary school students attending schools with highly developed School Lunch Initiative components thought the school lunches were tastier in Year Two compared to the year before (Figures 18 and 19). Of note in Year Three, students who attended School X, the middle school with highly developed School Lunch Initiative components, were more likely to report that the school lunch was tastier in Year Three compared to the year before (Figure 20).

Figure 17. Student Perception of School Lunch from Year One, Year Two and Year Three[1,2]



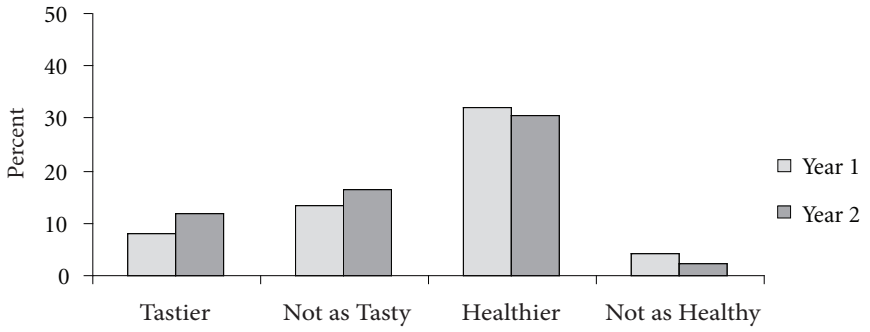
[1] The differences between years were assessed using the Chi square test or Fisher's exact test based on the frequencies/counts.

[2] For more detail, see Appendix D, Table 30.

[a] Matching superscripts indicate differences at $p<.05$.

[b-e] Matching superscripts indicate differences at $p<.01$.

Figure 18. Student Perception of School Lunch in Elementary Schools with Lesser-Developed Components from Year One to Year Two[1,2]



[1] The differences between years were assessed using the Chi square test or Fisher's exact test based on the frequencies/counts.

[2] For more detail, see Appendix D, Table 31.

No significant differences were found.

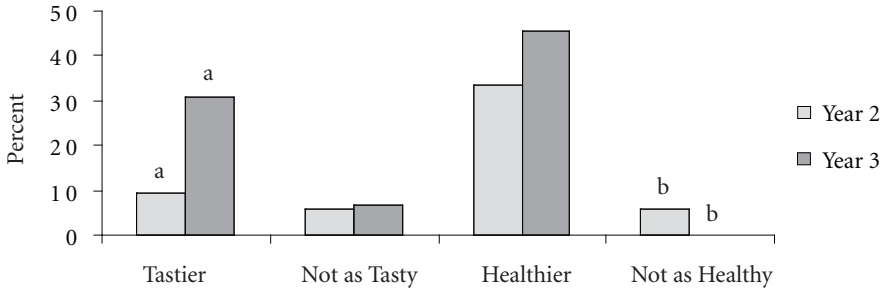
Figure 19. Student Perception of School Lunch in Elementary Schools with Highly Developed Components from Year One to Year Two[1,2]

[1] The differences between years were assessed using the Chi square test or Fisher's exact test based on the frequencies/counts.

[2] For more detail, see Appendix D, Table 31.

[a] Matching superscripts indicate differences at p<.01.

Figure 20. Student Perception of School Lunch at Middle School X from Year Two to Year Three [1,2]



[1] The differences between years were assessed using the Chi square test or Fisher's exact test based on the frequencies/counts.
[2] For more detail, see Appendix D, Table 32.
[a] Matching superscripts indicate differences at p<.01.
[b] Matching superscripts indicate differences at p<.05.

Associations of exposure to the School Lunch Initiative with increased academic test scores and decreased Body Mass Index were not observed.

We examined change in test scores on California Standards Tests for English Language Arts and Mathematics for students from schools with highly developed School Lunch Initiative components versus students from schools with lesser-developed School Lunch Initiative components and did not detect a difference (Appendix D, Table 34). An observed effect would likely require a larger sample of study students followed over a longer period of time while controlling for other school and family variables known to be associated with school achievement and standardized test scores, such as school and home resources. In a recent review of the literature on children's gardening, some quantitative studies showed positive outcomes of school-based gardening initiatives in the areas of science achievement [37]. However, we were unable to examine change in the California Standards Test for Science because the test is administered starting in the fifth grade and then not again until the eighth grade; therefore, it was only taken once by our study participants during the three-year evaluation period.

We also examined change in Body Mass Index (BMI) using Fitnessgram assessment data for students from schools with highly developed School Lunch Initiative components versus students from schools with lesser-developed School Lunch Initiative components and were not able to detect a difference (Appendix D, Table 35). The reported changes in food knowledge, food preferences and eating behaviors between these groups does suggest that, over time, it might be possible to see a change in BMI if the sample of study students was larger, the accuracy of Fitnessgram measurement of height and weight was improved, and other risk factors for obesity were controlled for, such as physical activity. A variety of strategies targeting the built environment and physical activity and eating behaviors both in and out of school and working in concert throughout the day are likely needed to reverse the obesity trend.

Limitations

As in all research studies, there are limitations to consider when interpreting the results of this evaluation. There were limitations in four general areas. First, while the difference in the degree of program development among schools (and therefore the amount of student exposure to it) was considerable at the elementary school level, it was smaller among middle schools. These differences in the variability of program development may have affected the ability to detect differences at the middle school level. Second, the food diaries kept by students did not include weekend days, when students often change eating patterns, and therefore represent only school-day intake. Third, some students in younger grades had difficulty completing the food diaries. This limitation was somewhat ameliorated, however, by the fact that a trained researcher reviewed the diaries with each student in a one-on-one session. Fourth, the measures of student height and weight used to assess changes in Body Mass Index may not be accurate. Measurements are done by school teachers during physical fitness testing called the Fitnessgram. Although the evaluation offered training, equipment and assistance in taking these measurements to improve measurement accuracy, these efforts were not sufficient to have produced research-quality data. The Fitnessgram was designed to monitor broad changes in the physical fitness of California students, not to gather measures for research purposes. Similarly, in exploring associations with academic performance, the use of the state's academic test scores limited the evaluation's ability to track changes over time, as the tests are not designed to compare test score results from one grade to the next [38].

CONCLUSIONS

The School Lunch Initiative is a comprehensive effort to integrate cooking and gardening education into the academic school day while revamping the school meal offerings and dining environment. The results from this three-year evaluation of the School Lunch Initiative are encouraging. The School Lunch Initiative is effective in increasing elementary school students' nutrition knowledge and broadening their taste preferences for and consumption of fruits and vegetables, especially vegetables. Students' attitudes about the taste and health value of school lunch became more positive as the food service and dining environment changes were put into place. It is important to note that this evaluation detected these positive changes among elementary school students with more exposure to the School Lunch Initiative and that these same schools serve more low-income students.

A fully developed School Lunch Initiative program that provides cooking and gardening classes taught by paid and trained staff, serves freshly cooked meals and offers fresh fruits and vegetables served in an appealing way during lunch, and to some degree integrates learning about food and the environment into the academic curriculum, is effective in increasing food knowledge and preference for and consumption of healthy foods, in particular fruits and vegetables, especially among elementary school students.

The transition into middle school is a challenging time for many students. Consumption of fruits and vegetables may decline during this period. Continued School Lunch Initiative exposure into middle school during this critical developmental period may be important in mitigating negative changes in eating behaviors during the middle school period.

RECOMMENDATIONS

Based on the School Lunch Initiative evaluation findings, the following recommendations are offered for use in discussions about program enhancements or replication of the School Lunch Initiative in other school districts, for policy implications, and for further research needed.

Program Enhancements

- **Sustain an integrated approach.** Continue to create synergies between school food and garden and cooking classes. Further develop curriculum integration with core academic subjects.

- **Ensure teaching and regular student attendance in school gardens and kitchen classrooms.** It is not enough to build a school garden or kitchen classroom. Paid staff to conduct hands-on learning in these environments with children attending regularly is critical for effective program implementation.

- **Maintain School Lunch Initiative programming into middle school.** Middle school is often a time when eating habits worsen as children move into adolescence. To sustain gains in healthy eating made by program exposure in the younger grades, continued learning and availability of healthy food options can help overcome the pull toward poor habits.

- **Add a program component to reach parent and community members.** Integrating a parent-involvement component into the School Lunch Initiative is a strategy to support healthy food choices for students away from school and at home. More insight is needed to understand why children are not helping with cooking meals at home and about how dinner meals are prepared at home. Most families report having home-cooked meals versus take-out or fast foods for dinner; however, what is not known is the extent to which they rely on packaged convenience foods, which are often higher in fat and salt, to make those meals rather than use fresh ingredients.

- **Devise ways to improve the quality of food brought from home to school.** It is important to learn more about what foods are brought from home to school and the extent to which parents and students are each involved in the decisions about food brought to school—not just for lunch, but also for celebrations, fundraisers and other events.

- **Explore ways to increase student physical activity during garden and cooking classes.** Assess the amount of physical activity children engage in while gardening and cooking at school, and consider building in modeling and lessons about the value of physical activity and how to be active every day, which has the potential to improve students' physical fitness—a key factor in preventing obesity. Consider ways to integrate with the school's physical education program.

- **Reinforce a wide variety of healthy eating behaviors.** Inherent in gardening and cooking with foods harvested from the garden is a focus on fresh fruits and vegetables. Increasing the emphasis on reducing the consumption of low-quality processed foods and sweetened beverages along with practical tips about obtaining and choosing high-quality foods in a society with an abundance of inexpensive, low-quality food options would complement these lessons.

Policy

- **Increase student participation in the school meal program.** It is important to know more about how students and parents view the school meals, the characteristics of the students choosing these meals, and what and how much of the school meal students are actually eating. Then, pilot strategies to change school practices and policies aimed at increasing school meal participation.

Research

- **Assess the cost and replicability of the School Lunch Initiative.** Conducting a retrospective analysis of the costs of implementing the School Lunch Initiative over the three years of this evaluation and identifying the program components most important for replicability will help determine the financial feasibility of replication and build the case for increasing the federal and state meal reimbursement rate. The model should be tested in other settings with a diverse student population.

- **Evaluate program effects at younger ages and young adulthood.** Assess the impact of the School Lunch Initiative in the early grades (K-3) to determine whether the impact at these ages is greater than with older children. Explore how exposure to the School Lunch Initiative in elementary and middle school affects eating behaviors in high school and young adulthood.

ACKNOWLEDGMENTS

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APPENDICES

APPENDIX A. RESEARCH METHODOLOGY

Student Knowledge, Attitudes and Preference

Student knowledge about and attitudes toward nutrition, food and the environment, and student preference for fruits and vegetables were evaluated using a student questionnaire that was developed in collaboration with school staff and project partners responsible for the relevant curricula; this questionnaire was administered during class time. Curricular learning objectives provided the basis for developing the knowledge and attitude questions (see questions in Appendix C). Students' preferences for a list of 12 fruits and vegetables used or introduced in cooking or gardening classes were assessed using a 4-point scale (never tasted=0, don't like it=1; like it a little=2; like it a lot=3). The questionnaire was reviewed by school staff and pretested for wording among students of similar age as the participants.

Student Food Behavior

Food behavior was assessed annually in spring using a three-day food diary previously developed for similar-aged children for the National Heart, Lung and Blood Institute Growth and Health Study.[1] To achieve quality food records and a high response rate, trained research staff met with participating students in the classroom for about 45 minutes on a Monday to train the students to record their food intake for the following three days (Tuesday through Thursday); classroom teachers reminded the students daily to record their food intake. On the Friday of the same week, during another 45-minute classroom session, individuals from a research team of about five to eight members reviewed the food diary with each student individually and collected the diaries. During this time, the participants also completed the student questionnaire. To address language barriers, at least one bilingual assistant was present. To support the timely return of food records, participants received appropriate incentives each year and reminders from their teachers during class and from research staff via phone.

Family Characteristics

Parents or guardians of students were asked to complete a questionnaire (English or Spanish) that sought information about sociodemographic characteristics and home environment, including family attitudes and behaviors with regard to food preparation and eating patterns. The questionnaire was reviewed for wording clarity and relevance by research and school staff, and by a small convenience sample of parents.

Student Exposure

Student exposure to the various components of the School Lunch Initiative was assessed using two methods. In the first method, students were asked to recall their exposure to school cooking and garden programs from first through third or fourth grade in order to obtain exposure history. However, the reliability of these self-reported data was questionable and these data were not used in further

[1] Crawford PB, Obarzanek E, Morrison J, et al. Comparative Advantage of 3-Day Food Records over 24-Hour Recall and 5-Day Food Frequency Validated by Observation of 9- and 10-year-old Girls. J Am Diet Assoc 1994; 94:626-630.

analysis. The second method assessed the development of the School Lunch Initiative at each grade in participating schools. Specifically, site observations and interviews with school staff were conducted annually over the three years of the study to determine exposure to the various types of kitchen, garden and food-related programs by participating students at each grade and at each school. Information obtained from these site observations and interviews with school staff was used to categorize the groups by levels of development of the School Lunch Initiative components.

Operationalizing Variables

Student knowledge about and attitudes toward nutrition, food and the environment, and student preference for fruits and vegetables were operationalized by giving scores to relevant questions and summing the scores. The nutrition and food environment knowledge scores were derived by summing the number of correct answers, while attitude and fruit and vegetable preference scores were derived by appropriately summing Likert-scale responses.

Student food behavior was determined by averaging three days of student food diary entries. Foods were quantified by the average number of standard eight-ounce cups of fruits, vegetables and other food groups, and the average number of ounces of grains consumed per day.

Family sociodemographic and home environment characteristics were represented by categorical responses to relevant questions administered to parents/guardians or students. Parent's education was represented by mother's (female guardian's) education except when only father's education was available.

Student exposure to the School Lunch Initiative was operationalized by categorizing the participating elementary schools as having "highly developed" or "lesser-developed" components of the School Lunch Initiative in place and then tracking movement of the participating students into the three middle schools (X, Y and Z). For example, a student who attended an elementary school with highly developed School Lunch Initiative components in Year One was tracked as he/she moved to School Y in Year Two and then stayed in School Y in Year Three. The School Lunch Initiative was highly developed at School X, but varied from year to year at the other two middle schools.

Data Management and Analysis

All questionnaire data were double-entered using Epidata (v2.1, Denmark). Food diary data were managed using a customized relational database (Access, 2003; Microsoft Corporation, Redmond, WA) designed for analyzing dimensions of foods not usually considered in standard nutrient analysis programs (e.g. seasonal versus non-seasonal fruits and vegetables). Nutrition students were trained and closely supervised by a registered dietitian to enter the food diaries. For quality control purposes, each year at least 25 food diaries were randomly selected by the dietitian, who checked the entered data against the food diaries. An additional layer of data quality control was imposed by detecting outlying values, which were checked against raw data and then omitted from analysis after discussion among

senior research team members. These outlying values were determined by visually inspecting box plots of fruits and vegetables, dairy food, and grain intakes. The statistical software SAS, version 9.1 (SAS Institute, Cary, NC), was used to analyze the data. A total of 21 food diaries were re-examined. Of these, two diaries were incorrectly entered, and one (estimating 25 cups of vegetable intake) was considered questionable and dropped from analysis.

Food groups (fruits and vegetables, dairy foods, and grains) were defined to be consistent with USDA's "My Pyramid" food groupings[2]; fruit juice was included in the estimation of fruit servings. Controversial plant-based items such as potato chips and ketchup were not included in the vegetable estimates.

Student characteristics were summarized using means and standard deviations for continuous variables and frequency distributions for categorical variables. Two approaches were used to compare changes in knowledge, attitudes and behavior and relate them to exposure to the School Lunch Initiative. One approach employed multivariate procedures to examine the association of cumulative years of exposure with cooking or gardening programs, controlling for school history (same school from kindergarten vs. different schools). The second approach grouped the students according to the schools attended (schools with highly or lesser-developed School Lunch Initiative components) and used analysis of covariance to examine group differences in changes in knowledge and attitude scores and in food consumption. Both approaches controlled for baseline values and sociodemographic characteristics. Multiple comparisons were adjusted for using Bonferroni's test at a procedure-wise error rate of 5%. The first approach yielded few associations between School Lunch Initiative exposure and the outcomes of interest. Only findings resulting from the second approach are described in this report.

Sample Size and Approvals

Power calculations estimated that a final sample of 174 participants would be needed to detect a difference of 0.5 servings in fruit and vegetable consumption between two groups, assuming a standard deviation of 1.15, type I error of 0.05, and type II error of 0.20. Based on past experiences with other longitudinal studies of elementary and middle school children, we anticipated an average yearly attrition rate of 22.5% and an exclusion rate of 10% (due to incomplete or poor-quality data), resulting in a targeted initial sample size of 330.

The protocol for this evaluation project was approved by the University of California at Berkeley's Committee for the Protection of Human Subjects.

[2] U.S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary Guidelines for Americans, 2005. 6th Edition, Washington, DC: U.S. Government Printing Office, January 2005.

APPENDIX B. DATA COLLECTION METHOD AND TIMELINE

Table 1 contains a summary description of how the research was conducted, including the sequence and frequency of data collection for qualitative and quantitative measures.

Table 1. Data Collection Timeline

What	Why	When	Who	Where	How Long	How Conducted
Stakeholder Interviews and Site Observations	Assess and record the process and procedures for the School Lunch Initiative (SLI) project and student participation in activities.	Year 1: Oct-June 2006/07 Year 2: Aug-June 2007/08 Year 3: Aug-June 2008/09	Approximately 50 people – principals, food service employees, school organization leaders, school board, administrators, teachers, parents, principals and custodians and other project partners from the school district and the study schools.	Berkeley Unified School District schools and school district office	Approx. 30 minutes to 1 hour per person	Telephone or in-person interviews including site observations; conducted by trained study staff
Student Food Records	Assess the food behaviors of students exposed to variations in SLI program exposure.	Year 1: Jan-June 2007 Year 2: Jan-June 2008 Year 3: Jan-June 2009	Approximately 300 fourth- and fifth-grade students from four study schools in year one. Students completed the same record in Year 2 and Year 3.	Berkeley Unified School District school classrooms	Approx. 1 hour training, followed by 30 min to 1 hour meeting to review and collect records	In-person; conducted by trained study staff
Student Questionnaire	Assess the SLI-related knowledge, attitudes and behaviors of students exposed to variations in SLI program exposure.	Year 1: Jan-June 2007 Year 2: Jan-June 2008 Year 3: Jan-June 2009	Approximately 300 fourth- and fifth-grade students from four study schools in year one. Students completed the same or similar questionnaire in Year 2 and Year 3.	Berkeley Unified School District school classrooms	Approx. 20-30 minutes	In-person; conducted by trained study staff
Seventh-Grade Questionnaire	Assess SLI-related knowledge, attitudes and behaviors of all seventh-grade school students.	Year 3: Sept-June 2008/09	Approximately 450 seventh-grade students from three middle schools in Year Three.	Berkeley Unified School District school classrooms	Approx. 20-30 minutes	In-person; conducted by trained study staff
Household Questionnaire	Assess the demographic and neighborhood characteristics of subject households.	Years 1-3: Jan 2007-May 2009	Approximately 300 parents/guardians of fourth- and fifth-grade students in the study from the 4 study schools.	At home or school	Approx. 15-30 minutes	Self-administered at home, at school or via telephone interview by trained study staff
Body Mass Index and Academic Performance	Explore SLI associations with weight status and academic test scores.	Year 1: Spring 2007 Year 2: Spring 2008 Year 3: Spring 2009	All fifth- and seventh-grade students in the school district have height and weight measurements taken. All California students complete standardized tests to assess academic performance each year.	Berkeley Unified School District school classrooms	Varied	Teachers trained by study staff on height and weight measures; standardized tests administered by school staff

APPENDIX C. STUDENT AND HOUSEHOLD QUESTIONNAIRES

STUDENT QUESTIONNAIRE (ABRIDGED)

Knowledge Questions

Nutrition

How many servings of fruits and vegetables are healthy to eat each day?

Which food has the most sugar?

Which food has the most fat?

Which food has the most fiber?

Which lunch has the most variety of healthy foods?

Which statements are true about high fiber food?

Which statements are true about trans fats?

Which food would be the healthiest to give you energy you need for exercise?

Food/Environment

Where does corn in a corn tortilla come from?

How do fresh tomatoes become canned tomato soup?

Which food is the best for the environment; which food is least "processed?"

What does a plant use to capture energy from the sun?

Apples and pumpkins are ripe in California in which season?

Peas and asparagus are ripe in California in which season?

Lemons and oranges are ripe in California in which season?

Peaches and zucchini are ripe in California in which season?

What do plants need to survive?

What is the first thing you should do to make a salad?

How do you think people can help make less trash and waste?

Pollinators in the garden include which of the following?

Which of the following is the best example of sustainable agriculture?

Attitude Questions

(Agreement Scale: minimum = 0; maximum = 3)

Food

I like to eat fruits and vegetables.

I like to try new foods.

I like whole grain foods.

I like to eat homemade meals.

Health

There are people in my life who encourage me to eat healthy.

What I eat can help or hurt my health.

Students who eat breakfast do better in school.

It is important to be physically active on most days of the week.

Environment

I know what plant or animal my food comes from.

Fruits and vegetables taste better when they are in season.

Taking care of the environment is important to me.

What I eat can help or hurt the environment.

I try to recycle, compost, and pick up trash.

School

How has the food served during lunch by your school changed this school year? (tastier, healthier)

I enjoy eating the food served at school.

I look forward to going to school.

I like the cafeteria where food is served at school.

Behavior Questions

Physical Activity

How often do you play sports, run, dance, do martial arts or do any activity that makes you sweat or breathe hard?

How many hours do you usually watch TV?

How many hours do you usually use a computer?

How often do you talk with your family about getting physical exercise?

How physically active are you compared to your friends?

Family Eating Habits

How often does your family prepare dinner from scratch?

How often do you help prepare food at home?

How often does your family eat fresh fruit and vegetables?

How often does your family eat fast food?

How often do you talk with your family about healthy eating?

How often do you eat dinner with your family?

School Eating Habits

How often do you eat the lunch food served at your school?

How often do you bring lunch from home to eat at school?

Other

How often do you bring recipes home from school?

How often do you or your family make these recipes?

Preference Questions

(Likeability Scale: Lowest score = 0–never tasted; Maximum score = 3–like a lot)

Fruit
How much do you like: strawberries, persimmons, pears?

Green Leafy Vegetables
How much do you like: chard, spinach, kale?

Other Vegetables
How much do you like: beets, winter squash, peas, bell peppers, radishes, green beans?

HOUSEHOLD QUESTIONNAIRE (ABRIDGED)

School Meal Questions

How often does your child usually eat breakfast served by the school?

What are the reasons that your child does not eat breakfast served by the school every day or nearly every day?

In general, how healthy do you think the breakfast meals served at your child's school are?

How tasty do you think the breakfast meals served at your child's school are?

How often does your child usually eat lunch served by the school?

What are the reasons that your child does not eat lunch served by the school every day or nearly every day?

In general, how healthy do you think the lunch meals served at your child's school are?

How tasty do you think the lunch meals served at your child's school are?

Home Meals Questions

How often does your child eat fresh fruit?

How often does your child eat fresh vegetables?

How often does your child eat whole grains (100% whole wheat bread, brown rice, whole wheat pasta, oatmeal)?

How often do you encourage your child to try new foods?

How many stores and markets close to where you live sell fresh fruits and vegetables (within a 5-minute drive)?

How often is dinner at your home prepared using *mostly* processed food (frozen dinners, boxed macaroni and cheese, instant potatoes)?

How often is dinner at your home prepared using *mostly* fresh ingredients?

How often does your child help prepare meals at home?

Family Practice Questions

How often does your family sit down and eat dinner together in or outside the home?

How often does your family eat dinner from takeout food or at a restaurant (including fast food)?

Were there any days last month when your family didn't have enough food to eat or enough money to buy food?

How often do you limit the amount of time your children watch TV?

How often do you encourage your child to play outside?

How many parks and playgrounds are close to where you live?

How many of these parks and playground (close to where you live) would you let your child play in?

How safe do you think your neighborhood is for your child to play outside?

How easy would it be for you to find affordable and convenient sports, dance, and other physical activity programs for your child?

How often does your child play sports, run, dance, do martial arts or any physical activity that makes him or her sweat and breathe hard?

Compared to other kids the same age as your child, how physically active would you say he/she is?

Food Attitudes

(Very Important to Not Important on a 4-point scale)

How important do you think it is to serve children fresh fruits and vegetables every day?

How important do you think it is to serve children foods that are locally grown?

How important do you think it is to serve children fruits and vegetables at the time of year that they are usually grown in California?

How important do you think it is to serve children whole grains (brown rice, whole wheat bread, oatmeal)?

(Yes/No)

I purchase fresh fruits and vegetables at least once a week

I purchase foods that are locally grown.

I purchase fruits and vegetables at the same time of year that they are grown in California.

I purchase whole grain foods for my child (brown rice, whole wheat bread, oatmeal).

School Attitudes

(Very Important to Not Important on a 5-point scale)

How important is it to you that your child's school teaches math, science, English and reading?

How important is it to you that your child's school teaches about the impact of food on his/her health?

How important is it to you that your child's school teaches about the relationship between food and the environment?

How important is it to you that your child's school teaches about the relationship between physical activity and health?

(Agreement Scale: Strongly Agree to No Opinion on a 5-point scale)

My child's school has increased my child's knowledge about the relationship between food and the environment.

My child's school has increased my child's knowledge about making healthy food choices.

My child's school has changed my child's attitude about what he/she eats.

My child's school has improved my child's eating habits and food choices.

My child's school has increased my child's interest in taking care of the environment.

My child's school has improved my child's team work and social skills.

Household Questions

How many people live in your household at this time, including yourself, the child in the study, and all other adults and children?

Who lives in the household where the child in the study lives most of the time?

In addition to this home, are there other households where the child in this study usually lives part of the time?

What is the highest grade of school completed by the mother (or female guardian) living with the child in this study?

What is the highest grade of school completed by the father (or male guardian) living with the child in this study?

How many hours does the mother (or female guardian) living with the child in this study work?

How many hours does the father (or male guardian) living with the child in this study work?

What was the approximate total income, before taxes, of your household last year?

APPENDIX D. DETAILED RESULTS

This appendix presents more detail on the data collected in the School Lunch Initiative Evaluation, including the household and student questionnaires, student food diaries, academic test scores and Body Mass Index data from Fitnessgram physical fitness assessments.

1. The Home Environment

The outcomes of school programs to change children's food behaviors may be affected by home environments and family influences. Tables 1-5 show how parents of children participating in the School Lunch Initiative evaluation responded to questions about aspects of the home environment and their own attitudes that may affect student knowledge, attitudes and behaviors regarding food, nutrition, the environment and physical activity.

Eating and Preparing Family Dinner

With the exception of the use of mostly processed foods for dinner, there were no significant differences in behaviors related to preparing or eating family dinner between parents whose children attended schools with highly developed School Lunch Initiative components and those whose children attended schools with lesser-developed School Lunch Initiative components (Table 1).

Table 1. Parent-Reported Characteristics of Family Dinner (N=257-258[1]) (percent)

	Eat takeout food or at restaurant several times a week	Child helps prepare meals several times a week or everyday	Dinner prepared using mostly processed foods several times a week or everyday	Dinner prepared using mostly fresh ingredients everyday	Family eats dinner together (in or outside the home) everyday
Schools with-lesser developed components	5.6	25.6	1.2***	52.2	64.4
Schools with highly developed components	5.3	33.0	11.6***	48.4	50.5
Total All Schools	5.5	28.3	5.1	50.8	59.3

[1] The numbers of respondents vary by question.
Significant difference denoted by ***p<.001.

Parents' Attitudes Toward Serving Healthy Foods and Food-Purchasing Behaviors

Proportionately more parents of children attending schools with highly developed School Lunch Initiative components thought it was "very important" to serve seasonal fruits and vegetables and whole grains than did parents of children attending schools with lesser-developed School Lunch Initiative components (Table 2). However, in terms of *purchasing* whole grains as well as seasonal, fresh, locally grown foods or *serving* fresh produce, there were no differences in attitudes between parents of children attending schools with highly developed School Lunch Initiative components and parents of children attending schools with lesser-developed School Lunch Initiative components (Tables 2 and 3).

Table 2. Parents' Attitudes Toward Serving Healthy Foods to Child–Percent Who Answered "Very Important" (N=252-255[1])

"I think it is very important to…"				
	Serve children whole grains	**Serve children fruits and vegetables at the time of year that they are usually grown in California**	**Serve foods that are locally grown**	**Serve children fresh fruits and vegetables every day**
Schools with lesser-developed components	69.6***	48.5***	42.5*	95.0
Schools with highly developed components	88.3***	71.3***	55.4*	96.8
Total All Schools	76.5	56.9	47.2	95.7

[1] The numbers of respondents vary by question.
Significant difference denoted by *p<.05; ***p<.001.

Table 3. Parents' Food-Purchasing Behavior (N=244-259[1]) (percent)

	Purchase whole grains	**Purchase seasonal produce**	**Purchase locally grown foods**	**Purchase fresh fruits and vegetables weekly**
Schools with lesser-developed components	89.3	84.6	72.9	96.3
Schools with highly developed components	92.5	81.7	71.9	97.9
Total All Schools	90.5	83.5	72.5	96.9

[1] The numbers of respondents vary by question.
No significant difference found.

Parents' Attitudes Toward Learning About Food, Health and the Environment

About 80% of parents think it is very important that their child's school teaches about the impact of food on his/her health and about the relationship between food and the environment. However, proportionately more parents of children attending schools with highly developed School Lunch Initiative components strongly agree that their child's school had changed their child's knowledge about making healthy eating choices, changed their child's attitude about what he/she eats, and improved their child's eating habits and food choices (Table 4).

Table 4. Parents' Attitudes Regarding Child's Learning About Food, Health and the Environment– Percent Who Answered "Very Important" or "Strongly Agree" (N=253-258[1])

	Child's school teaches about the impact of food on his/her health	Child's school teaches about food and the environment	Child's school has increased child's knowledge about making healthy food choices	Child's school has changed child's attitude about what he/she eats	Child's school has improved my child's eating habits and food choices
Schools with lesser-developed components	79.8	74.2	36.2***	19.0****	16.1***
Schools with highly developed components	87.4	81.1	60.2***	41.8****	34.8***
Total All Schools	82.6	76.7	44.9	27.2	22.9

[1] The numbers of respondents vary by question.

Significant difference denoted by ***p<.001; ****p<.0001.

Parents' Attitudes and Perceptions Regarding Their Child's Physical Activity

Parents' attitudes about their child's physical activity were generally positive, regardless of the school attended by the child (Table 5). However, fewer than 50% of parents said they encouraged their children to play outside nearly every day and fewer than 60% reported that they set limits on television watching by their children. These percentages did not differ between parents whose children attended schools with highly developed School Lunch Initiative components and those whose children attended schools with lesser-developed School Lunch Initiative components. However, a higher percentage of parents with children attending schools with highly developed School Lunch Initiative components believed that their neighborhood was not very safe for their children to play outside compared to parents with children attending schools with lesser-developed School Lunch Initiative components (38% versus 18%, p<.01).

Table 5. Parents' Attitudes and Perceptions Regarding Child's Physical Activity (N=254-259[1]) (percent)

	"Very important" that child's school teaches about the relationship between physical activity and health	Child is "more active" or "a lot more active" than other kids the same age	Child plays sports, dances, does martial arts or any physical activity that makes him or her sweat and breathe hard "4-5 times a week" or "(nearly) everyday"	"Very easy" to find affordable and convenient sports, dance and other physical activity programs for child	Think neighborhood is "not very safe" or "not safe" for child to play outside	Encourage child to play outside nearly everyday	Families that "set limits" on the amount of time their children watch TV
Schools with lesser-developed components	86.5	42.9	68.7	38.4	18.4**	46.9	59.6
Schools with highly developed components	85.3	42.6	65.2	28.4	38.1**	48.4	53.8
Total All Schools	86.1	42.7	67.5	34.8	25.5	47.5	57.5

[1] The numbers of respondents vary by question.

Significant difference denoted by **p<.01.

2. Students' Knowledge, Attitudes and Preferences About Food and the Environment

Student Knowledge

At baseline

At the beginning of the evaluation in Year One (baseline), differences in nutrition knowledge were observed; nutrition knowledge scores were significantly higher among fourth-grade students attending elementary schools with highly developed School Lunch Initiative components ($p<.05$) (Table 6).

Table 6. Student Knowledge Scores by Grade in Year One[1]

	Nutrition (maximum score = 14)		Food and Environment (maximum score = 12)		Total (maximum score = 26)	
	4th Grade	5th Grade	4th Grade	5th Grade	4th Grade	5th Grade
Schools with lesser-developed components	6.9*	7.4	6.3	6.3	13.2*	13.6
Schools with highly developed components	7.6*	7.8	6.9	5.7	14.5*	14.6

[1] Adjusted for race and education.

Significant difference denoted by *$p<.05$.

Change from Year One to Year Two

In the second evaluation year, mean knowledge scores increased among all fourth-grade students moving to fifth grade. Change in knowledge scores about food and the environment appeared to be twice as great in students attending schools with highly developed School Lunch Initiative components as in students attending schools with lesser-developed School Lunch Initiative components ($p<.10$). However, there was no evidence to suggest that exposure to the School Lunch Initiative improved knowledge scores among fifth-grade students moving to sixth grade (Table 7).

Table 7. Change in Adjusted[1] Mean Knowledge Scores from Year One to Year Two

	N	Nutrition (maximum score = 14)		Food and Environment (maximum score = 12)		Total (maximum score = 26)	
		Year 1 Score	**Change by Year 2**	Year 1 Score	**Change by Year 2**	Year 1 Score	**Change by Year 2**
4th to 5th grade							
Elementary schools with lesser-developed components	85	6.86	**0.57**	6.31	**0.67§**	13.16	**1.35**
Elementary schools with highly developed components	61	7.58	**0.58**	6.91	**1.29§**	14.49	**1.77**
5th to 6th grade							
Elementary schools with lesser-developed components to Middle School X or Y	54	7.55	**0.20**	6.39	**1.27**	13.94	**1.50**
Elementary schools with lesser-developed components to Middle School Z	18	7.07	**-0.17**	5.57	**0.58**	12.64	**0.85**
Elementary schools with highly developed components to Middle School X	9	6.91	**-1.01**	7.25	**1.04**	14.16	**0.21**
Elementary schools with highly developed components to Middle School Y or Z	28	7.99	**0.24**	6.60	**0.83**	14.59	**1.02**

[1] Adjusted for race and education and relevant baseline knowledge.

Marginal difference denoted by §$p<.10$.

Change from Year Two to Year Three

As in the second evaluation year, there was no association between School Lunch Initiative exposure and change in knowledge scores among fifth-grade students moving into sixth grade in the third year of the evaluation. However, among sixth-grade students moving into seventh grade, students attending the middle school with the most highly developed School Lunch Initiative components (Middle School X) showed an increase in adjusted mean nutrition knowledge scores, while students attending a school with lesser-developed School Lunch Initiative components showed decreases in adjusted mean nutrition knowledge scores (Table 8). Changes in food and environment knowledge scores were not different among exposure groups.

Table 8. Change in Adjusted[1] Mean Knowledge Scores from Year Two to Year Three[2]

	N	Nutrition (maximum score = 14)		Food and Environment (maximum score = 12)		Total (maximum score = 26)	
		Year 2 Score	**Change by Year 3**	Year 2 Score	**Change by Year 3**	Year 2 Score	**Change by Year 3**
5th to 6th grade							
Elementary schools with lesser-developed components to Middle School X or Z	57	7.51	**0.23**	7.14	**0.45**	14.65	**0.70**
Elementary schools with lesser-developed components to Middle School Y	13	8.56	**0.62**	6.44	**0.70**	15.00	**1.03**
Elementary schools with highly developed components to Middle School X	--[3]	--	**--**	--	**--**	--	**--**
Elementary schools with highly developed components to Middle School Y or Z	50	7.91	**0.18**	8.10	**0.10**	16.01	**0.28**
6th to 7th grade							
Middle School X	49	7.60	**0.39***	7.76	**0.53**	15.36	**0.99§**
Middle School Y	17	8.28	**-1.17***	7.75	**0.52**	16.02	**-0.77**
Middle School Z	32	7.82	**-0.49**	7.02	**0.10**	14.85	**-0.50§**

1 Adjusted for race and education and relevant knowledge in year 2.

2 From Year 2 to Year 3, two of the middle schools traded rankings in terms of School Lunch Initiative development. The school that was ranked at the middle level of development in Year 2 changed its programming activities and was ranked least developed in Year 3.

3 Unstable estimates for this group of students due to small sample size.

Marginal and significant differences denoted by §p<.10; *p<.05.

Student Attitudes

There were no consistent, significant differences in attitudes about food, health, the environment or school between students from highly developed School Lunch Initiative schools and those from lesser-developed schools over three years. However, proportionately more students attending the highly developed Middle School X in Year Three tended to show positive attitudes about eating food served at school, liking the school cafeteria, and agreeing that produce tastes better in-season and eating choices can help or hurt the environment (Table 9).

Table 9. Students' Attitudes Toward Food, Health, Environment and School from Year One to Three (percent)

	Year One		Year Two					Year Three		
	Elementary[1]		Elementary[1]		Middle Schools			Middle Schools		
Agree a little/Agree a lot	High (N=127)	Low (N=185)	High (N=59)	Low (N=85)	X (N=52)	Y (N=18)	Z (N=34)	X (N=99)	Y (N=54)	Z (N=76)
Food										
I like to eat fruits and vegetables.	98.4	96.8	100.0	97.6	96.4	94.7	100.0	97.0	94.4	98.7
I like to try new foods.	87.4	90.3	93.4	88.2	94.6[a§]	79[a§]	91.2	86.0	79.6[b§]	92.1[b§]
I like whole grains foods.	84.9	83.6	83.3	84.7	82.1	84.2	78.8	80.0	85.2	81.6
I like to eat homemade meals.	97.6	97.8	98.3	100.0	100.0	100.0	100.0	97.0	100.0	98.7
Health										
There are people in my life who encourage me to eat healthy.	98.4[c§]	94[c§]	98.3	95.3	96.4	100.0	97.1	94.0	88.9	34.0
What I eat can help or hurt my health.	84.8	85.3	83.3	83.3	85.7	79.0	85.3	94.0	88.9	86.8
Students who eat breakfast do better in school.	87.3	87.9	85.3	90.6	92.9	79.0	91.2	89.9	87.0	88.2
It is important to be physically active most days of the week.	93.7[d§]	97.8[d§]	98.4	96.5	98.2	100.0	94.1	94.0	94.4	97.4
Environment										
I know what plant or animal my food comes from.	85.8	89.7	91.5	91.8	89.3	88.9	91.2	94.0	92.6	90.8
Fruits and vegetables taste better when they are in season.	93.7	91.1	93.4	97.6	98.2	100.0	97.1	98[e*]	90.6[e*f*]	100[f*]
Taking care of the environment is important to me.	93.7	95.7	96.7	98.8	96.2	88.9	94.1	97.0	92.6[g*]	100[g*]
What I eat can help or hurt the environment.	70.1[h*]	81.3[h*]	75.4	77.7	78.6	66.7	81.8	90[i*j*]	75.5[i*]	76[j*]
I try to recycle, compost, and pick up trash.	86.6[k*]	93.5[k*]	90.2	91.8	91.1	94.7	82.4	90.9	76.6	86.8
School										
I enjoy eating the food served at school.	48.0	38.8	47.5	35.3	40.0	33.3	41.2	56.6[l**m*]	30.2[l**]	40.8[m*]
I look forward to going to school.	84.3	82.1	85.3	82.4	80.4	84.2	91.2	74[n*]	75.9[o§]	89.5[n*o§]
I like the cafeteria at school.	59.8[p§]	48.9[p§]	59.0	45.9	44.2	55.6	50.0	69.0[q**r**]	40.7[q**]	46.0[r**]

[1] "High" refers to schools with highly developed School Lunch Initiative components. Low refers to schools with lesser-developed School Lunch Initiative components.

[a-r] Matching alphabetic superscripts indicate marginal and significant difference at §p<.10;*p<.05;**p<.01.

Student Food Preferences

At baseline

Students' preferences for fruit, green leafy vegetables and other vegetables were consistently greater among both fourth- and fifth-grade students attending elementary schools with highly developed School Lunch Initiative components than similar-grade students attending schools with lesser-developed School Lunch Initiative components (Table 10).

Table 10. Mean Student Food Preference Scores by Grade in Year One[1,2,3]

	Fruit		Green Leafy Vegetables		Other Vegetables		Total Fruits and Vegetables	
	4th Grade	5th Grade	4th Grade	5th Grade	4th Grade	5th Grade	4th Grade	5th Grade
Schools with lesser-developed components	2.13****	2.21***	1.1**	0.8****	1.5*	1.58**	1.56***	1.55****
Schools with highly developed components	2.59****	2.53***	1.46**	1.47****	1.8*	1.91**	1.91***	1.98****

1 Adjusted for race and education.

2 Students were asked how much they liked certain fruits and vegetables; responses were scored on a scale of 0-3 (the higher the score, the greater the preference).

3 Sample sizes in Year One differ from those used in examining changes in outcomes.

Significant difference denoted by *p<.05; **p <.01; ***p <.001; ****p <.0001.

Change from Year One to Year Two

From Year One to Year Two, fourth-grade students attending schools with highly developed School Lunch Initiative components moving into fifth grade clearly showed an increased preference for fruit and vegetables, and especially green leafy vegetables, while their counterparts in schools with lesser-developed School Lunch Initiative components showed no increase in preference for fruit and vegetables. This tendency for a change in (increased) preference for fruit and vegetables among students attending schools with highly developed School Lunch Initiative components was also observed among fifth-grade students moving into sixth grade; however, these increased preferences were not statistically significant (Table 11).

Table 11. Change in Adjusted[1] Mean Food Preference Scores[2] from Year One to Year Two

	N	Fruits		Green Leafy Vegetables		Other Vegetables		Total Fruits and Vegetables	
4th to 5th grade		Year 1 Score	**Change by Year 2**	Year 1 Score	**Change by Year 2**	Year 1 Score	**Change by Year 2**	Year 1 Score	**Change by Year 2**
Elementary schools with lesser-developed components	85	2.12	**0.01**[a*]	1.15[b*]	**-0.19**[c**]	1.55	**0.04**	1.59[d**]	**-.04**[e**]
Elementary schools with highly developed components	61	2.61	**0.24**[a*]	1.43[b*]	**0.35**[c**]	1.80	**0.17**	1.91[d**]	**0.23**[e**]
5th to 6th grade									
Elementary schools with lesser-developed components to Middle School X or Y	54	2.20[f*]	**0.17**	0.69[g**]	**0.40**	1.46	**0.13**	1.45[i**]	**0.22**
Elementary schools with lesser-developed components to Middle School Z	18	2.17	**0.10**	0.63[h**]	**0.32**	1.57	**0.14**	1.51	**0.17**
Elementary schools with highly developed components to Middle School X	9	2.33	**0.25**	1.25	**0.62**	1.88	**0.28**	1.92	**0.34**
Elementary schools with highly developed components to Middle School Y or Z	28	2.58[f*]	**0.08**	1.37[g,h**]	**0.24**	1.82	**0.03**	1.91[i**]	**0.07**

[1] Adjusted for race and education and relevant baseline preference score.

[2] Students were asked how much they liked certain fruits and vegetables; responses were scored on a scale of 0-3 (the higher the score, the greater the preference).

[a-i] Matching alphabetic superscripts indicate marginal and significant differences denoted by §p<.10; *p<.05; **p<.01.

Change from Year Two to Year Three

In Year Two and Year Three of the evaluation, fifth-grade students in elementary schools with highly developed School Lunch Initiative components moving into sixth grade did not show a similar increase in preference for fruit and vegetables as they did moving from fourth to fifth grade a year earlier. At the same time, sixth-grade students moving into seventh grade showed little change in preference for fruits or vegetables. Students attending the middle school with the most highly developed School Lunch Initiative components showed an increase in preference for green leafy vegetables, but this increase was not significantly different from the change in preference for green leafy vegetables observed among the other middle school students (Table 12).

Table 12. Change in Adjusted[1] Mean Food Preference Scores[2] from Year Two to Year Three

	N	Fruits		Green Leafy Vegetables		Other Vegetables		Total Fruits and Vegetables	
		Year 2 Score	**Change by Year 3**	Year 2 Score	Change by Year 3	Year 2 Score	**Change by Year 3**	Year 2 Score	**Change by Year 3**
5th to 6th grade									
Elementary schools with highly developed components to Middle School X	--[3]	--	**--**	--	**--**	--	**--**	--	**--**
Elementary schools with highly developed components to Middle School Y or Z	50	2.79***	**0.11**	1.61***	**0.16**	1.88	**0.00**	2.04***	**0.02**
Elementary schools with lesser-developed components to Middle School X or Z	57	2.15***	**0.04**	0.87***	**0.01**	1.61	**0.06**	1.55***	**0.05**
Elementary schools with lesser-developed components to Middle School Y	13	2.35	**0.05**	1.49	**0.02**	1.90	**0.04**	1.92	**0.05**
6th to 7th grade									
Middle School X	49	2.53	**0.03**	1.32	**0.39**	1.76	**-0.05**	1.84	**0.08**
Middle School Y	17	2.50	**-0.04**	1.41	**0.05**	1.88	**-0.13**	1.90	**-0.07**
Middle School Z	32	2.37	**0.15**	1.26	**0.01**	1.78	**0.17**	1.80	**0.13**

[1] Adjusted for race and education and relevant preference in Year 2.

[2] Students were asked how much they liked certain fruits and vegetables; responses were scored on a scale of 0-3 (the higher the score, the greater the preference).

[3] Unstable estimates for this group of students due to small sample size.

Significant difference at ***p<.001.

3. Students' Eating Behaviors

Information was collected from students about their food-related activities and behaviors that could influence the effects of the School Lunch Initiative. In Year One, proportionately more students from the elementary schools with lesser-developed School Lunch Initiative components said they eat family dinner nearly every day, bring lunch from home at least 3 to 4 times a week, eat fresh fruits and vegetables at least 3 to 4 times a week, and eat fast food less than 3 or 4 times a week compared to students from the elementary schools with highly developed School Lunch Initiative components. In contrast, proportionately more students from the elementary schools with highly developed School Lunch Initiative components brought home recipes from school at least a few times a year compared to students from the elementary schools with lesser-developed School Lunch Initiative components (Table 13).

Table 13. Student-Reported Food-Related Activities/Behaviors in Year One (percent)[1]

	Eat fast food less than 3-4 times/ wk	Eat fresh fruits and vegeta-bles at least 3-4 times/ wk	Eat lunch served at school at least 3-4 times/ wk	Bring lunch from home at least 3-4 times/ wk	Eat family dinner nearly every day	Family prepares dinner from scratch at least 3-4 times/ wk	Student helps prepare dinner at least 3-4 times/ wk	Some-times have family conver-sations about healthy eating	Bring home recipes from school at least a few times a year	Uses recipes brought home from school at least once a month
Schools with lesser-developed compo-nents	97.3*	89.0*	24.9	73.0***	76.8*	75.1	33.5	59.3	27.6****	20.3
Schools with highly developed compo-nents	91.4*	78.1*	29.9	53.1***	64.1*	68.8	34.7	64.8	51.2****	26.8
Total All Schools	94.9	84.5	26.9	64.9	71.6	72.5	34.0	61.5	37.2	23.1

[1] Ns vary from 286-313 due to missing values.
Significant difference denoted by *p<.05; ***p <.001; ****p <.0001.

Trends in student-reported, food-related activities and behaviors following the fourth-grade students in Year One (younger cohort) and fifth-grade students in Year One (older cohort) for all three years of the evaluation are shown in Tables 14 and 15. There were no consistent, statistically significant trends noted for either cohort group over all three years.

Table 14. Trends in Student-Reported Family Dinner and Home Cooking Behaviors from Year One to Year Three (percent)

	N[1]	Family prepares dinner from scratch at least 3-4 times/wk	Student helps prepare dinner at least 3-4 times/wk	Eat family dinner nearly every day	Bring home recipes from school at least a few times/yr	Uses recipes brought home from school at least once/ month
YOUNGER COHORT						
Year 1						
Schools with lesser-developed components	86-96	70.2	32.6	75.0[a§]	31.3[b**]	24.4
Schools with highly developed components	68-72	63.9	40.3	62.5[a§]	54.9[b**]	27.9
Year 2						
Schools with lesser-developed components	84-85	74.1	32.9	76.5	29.4[c****]	19.1[d*]
Schools with highly developed components	57-61	77.2	47.5	68.9	65.0[c****]	38.3[d*]
Year 3						
Middle School X	47-50	80.0	22.0[e**]	69.4	16.0[f*]	10.6
Middle School Y	32-33	78.1	31.3	72.7	25.0	15.2
Middle School Z	44	72.7	47.7[e**]	70.5	38.6[f*]	18.2
OLDER COHORT						
Year 1						
Schools with lesser-developed components	77-89	80.4	34.5	78.7	23.6[g**]	15.6
Schools with highly developed components	55-56	75.0	27.3	66.1	46.4[g**]	25.5
Year 2						
Middle School X	56	83.9	30.4	80.4	32.1	30.4
Middle School Y	19	78.9	36.8	78.9	38.2	21.1
Middle School Z	32-34	73.5	26.5	70.6	31.6	15.6
Year 3						
Middle School X	50-51	90.0	33.3	68.0	39.2[h*]	16.0
Middle School Y	20-21	71.4	23.8	80.0	9.5[h*]	9.5
Middle School Z	32	84.4	31.3	68.8	25.0	12.5

[1] Ns vary due to missing values.

[a-h] Matching alphabetic superscripts indicate marginal and significant differences denoted by §p<.10; *p<.05; **p<.01; ****p<.0001.

Table 15. Trends in Student-Reported Eating Behaviors/Family Conversations About Healthy Eating Year One to Year Three (percent)

	N[1]	Eat fast food less than 3-4 times/ wk	Eat fresh fruits and vegetables at least 3-4 times/wk	Bring lunch from home at least 3-4 times/wk	Eat lunch served at school at least 3-4 times/wk	Sometimes have family conversations about healthy eating
YOUNGER COHORT						
Year 1						
Schools with lesser-developed components	95-96	94.7	82.3	68.8	32.3	58.3
Schools with highly developed components	72	90.3	77.8	55.6	36.1	58.3
Year 2						
Schools with lesser-developed components	85	98.8	91.8[a*]	76.4[b***]	17.7	74.1[c§]
Schools with highly developed components	58-61	96.6	79.3[a*]	47.5[b***]	55.7	59.3[c§]
Year 3						
Middle School X	49-50	91.8	82.0	38.8	51.0	49.0
Middle School Y	31-32	97.0	78.1	53.1	33.3	45.2
Middle School Z	44	97.7	84.1	54.6	29.5	63.6
OLDER COHORT						
Year 1						
Schools with lesser-developed components	86-89	100[d*]	96.5[e**]	77.5[f***]	16.9	60.2
Schools with highly developed components	56	92.9[d*]	78.6[e**]	50.0[f***]	23.2	73.2
Year 2						
Middle School X	55-56	100[g§]	94.6[h§]	71.4[i*]	25.0	61.8
Middle School Y	34	100	82.4[h§]	55.9	47.4	61.8
Middle School Z	18-19	89.5[g§]	89.5	36.8[i*]	35.3	61.1
Year 3						
Middle School X	50-51	100	92.2	52.0	27.5	68.6[j,k**]
Middle School Y	21	90.5	81.0	42.9	28.6	33.3[j**]
Middle School Z	32	100	84.4	46.9	37.5	34.4[k**]

[1] Ns vary due to missing values.

[a-k] Matching alphabetic superscripts indicate marginal and significant differences denoted by §p<.10; *p<.05; **p<.01; ***p<.001.

At baseline

Consumption of fruits and vegetables recorded in the student food records was similar between students attending schools with highly developed School Lunch Initiative components and students attending schools with lesser-developed School Lunch Initiative components (Table 16).

Table 16. Student Consumption of Fruits and Vegetables by Grade (cups/day) in Year One

	N[1]		Fruits		Vegetables		Fruits and Vegetables	
	4th Grade	5th Grade	4th Grade	5th Grade	4th Grade	5th Grade	4th Grade	5th Grade
Elementary schools with lesser-developed components	56	88	1.21	1.18	0.87	0.86	2.07	2.04
Elementary schools with highly developed components	70	96	1.19	1.23	0.78	0.93	1.98	2.17

[1] Numbers shown are means adjusted for race and education.

No significant differences found.

Change from Year One to Year Two

From Year One to Year Two, increases in fruit and vegetable consumption were observed among fourth-grade students attending the schools with highly developed School Lunch Initiative components as they moved into fifth grade. In particular, after adjusting for differences in race and parent's education, fruit and vegetable consumption increased by nearly 0.7 cups (1.4 standard servings) per day, with vegetables accounting for more of this change than fruit, among students attending schools with highly developed School Lunch Initiative components. Among fifth-grade students moving into sixth grade, fruit and vegetable consumption stayed the same or even decreased in all schools (Table 17).

Table 17. Change in Mean Consumption of Fruits and Vegetables from Year One to Year Two[1,2]

	N	Fruit		Vegetable		Fruit and Vegetables	
		Year 1 (cups)	**Change by Year 2**	Year 1 (cups)	**Change by Year 2**	Year 1 (cups)	**Change by Year 2**
4th to 5th grade							
Elementary schools with lesser-developed components	85	1.26	**-0.20[a*]**	0.89	**-0.01[b**]**	2.16	**-0.21[c**]**
Elementary schools with highly developed components	61	1.21	**0.25[a*]**	0.76	**0.44[b**]**	1.98	**0.69[c**]**
5th to 6th grade							
Elementary schools with lesser-developed components to Middle School X or Y	54	1.32	**-0.03**	0.80	**0.03**	2.12	**-0.01**
Elementary schools with lesser-developed components to Middle School Z	18	1.06	**-0.24**	0.87	**0.16**	1.93	**-0.09**
Elementary schools with highly developed components to Middle School X	9	1.56	**-0.10**	0.89	**0.00**	2.46	**-0.09**
Elementary schools with highly developed components to Middle School Y or Z	28	1.14	**-0.41**	0.90	**0.18**	2.04	**-0.23**

[1] Adjusted for race and education and relevant baseline consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Standard cups/day (1 standard cup = 2 standard servings).

[a-c] Matching alphabetic superscripts indicate significant differences denoted by *p<.05; **p<.01.

Change from Year Two to Year Three

From Year Two to Year Three of the study, mean consumption of fruits and vegetables stayed the same or decreased for fifth-grade students moving to sixth grade. For sixth-grade students moving into seventh grade, a decrease in fruit and vegetable consumption was observed only among students attending School Y, where School Lunch Initiative cooking and garden components were only offered as an elective in Year Three; this decrease was significantly different from the increase observed at Middle School Z, where students did attend cooking and gardening classes. At Middle School X and Middle School Z, mean increases in fruit and vegetable consumption were 0.11 cups and 0.27 cups, respectively (Table 18).

Table 18. Change in Mean Consumption of Fruits and Vegetables from Year Two to Year Three[1,2]

	N	Fruit		Vegetable		Fruit & Vegetables	
		Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**
5th to 6th grade							
Elementary schools with lesser-developed components to Middle School X or Z	57	0.86[a**]	**-0.19**	0.69[b**c*]	**0.12**	1.56	**0.01**
Elementary schools with lesser-developed components to Middle School Y	13	1.08	**-0.47**	1.38[c*]	**-0.03**	2.46	**-0.56**
Elementary schools with highly developed components to Middle School X	--[3]	--	**--**	--	**--**	--	--
Elementary schools with highly developed components to Middle School Y or Z	50	1.51[a**]	**0.12**	1.13[b**]	**-0.07**	2.64	**0.02**
6th to 7th grade							
Middle School X	49	1.40	**-0.09**	0.92	**0.17**	2.32	0.11
Middle School Y	17	0.89	**-0.40**	1.04	**-0.10**	1.94	**-0.54[d§]**
Middle School Z	32	1.03	**-0.09**	1.18	**0.39**	2.20	**0.27[d§]**

[1] Adjusted for race and education and relevant Year Two consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Standard cups/day (1 standard cup = 2 standard servings).

[3] Unstable estimates for this group of students due to small sample size.

[a-d] Matching alphabetic superscripts indicate marginal and significant differences denoted by §p<.10; *p<.05; **p<.01.

Trends in seasonal fruit and vegetable consumption

Fourth-grade students from highly developed School Lunch Initiative schools increased their consumption of fruits and vegetables by 0.69 cups per day when they moved to the fifth grade (see Table 17); about 80% of this increase was attributable to consumption of in-season produce, which increased by 0.57 cups per day (Table 19). However, positive trends in in-season fruit and vegetable consumption were not as clear as fifth-grade students moved into the sixth grade from Year One to Year Two or from Year Two to Year Three (Table 19 and 20). In Year Three, a small increase in seasonal fruit and vegetable consumption was observed among sixth-grade students attending Schools X and Z (but not School Y) as they moved into the seventh grade.

Table 19. Mean Consumption of Seasonal Fruits and Vegetables from Year One to Year Two[1,2]

	N	Seasonal Fruit		Seasonal Vegetable		Seasonal Fruit and Vegetable	
		Year 1 (cups)	**Change by Year 2**	Year 1 (cups)	**Change by Year 2**	Year 1 (cups)	**Change by Year 2**
4th to 5th grade							
Elementary schools with lesser-developed components	85	0.15	**0.02***	0.33	**0.11**	0.48	**0.13**
Elementary schools with highly developed components	56	0.11	**0.34***	0.27	**0.23**	0.38	**0.57**
5th to 6th grade							
Elementary schools with highly developed components to Middle School X or Y	48	0.10	**-0.02**	0.26	**0.12**	0.36	**0.1**
Elementary schools with lesser-developed components to Middle School Z	18	0.12	**0.12**	0.31	**0.01**	0.43	**0.13**
Elementary schools with highly developed components to Middle School X	9	0.36	**0.00**	0.40	**0.31**	0.76	**0.31**
Elementary schools with highly developed components to Middle School Y or Z	27	0.10	**-0.02**	0.34	**0.03**	0.44	**0.01**

[1] Adjusted for race and education and relevant baseline consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Standard cups/day (1 standard cup = 2 standard servings).

Significant difference at *p<.05.

Table 20. Mean Consumption of Seasonal Fruits and Vegetables from Year Two to Year Three[1,2]

	N	Seasonal Fruit		Seasonal Vegetable		Seasonal Fruit and Vegetable	
		Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**
5th to 6th grade							
Elementary schools with highly developed components to Middle School X or Z	57	0.18	**-0.12**	0.27	**0.04**	0.45	**-0.08**
Elementary schools with lesser-developed components to Middle School Y	13	0.24	**-0.31**	0.36	**0.05**	0.60	**-0.26**
Elementary schools with highly developed components to Middle School X	--[3]	--	**--**	--	**--**	--	**--**
Elementary schools with highly developed components to Middle School Y or Z	49	0.35	**-0.03**	0.54	**-0.08**	0.89	**-0.11**
6th to 7th grade							
Middle School X	45	0.50§	**-0.01**	0.38	**0.21**	0.88	**0.20**
Middle School Y	16	0.16§	**0.00**	0.34	**0.04**	0.50	**0.04**
Middle School Z	30	0.26	**0.03**	0.30	**0.35**	0.56	**0.38**

[1] Adjusted for race and education and relevant Year Two consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Standard cups/day (1 standard cup = 2 standard servings).

[3] Unstable estimates for this group of students due to small sample size.

Marginal difference denoted by §p<.10.

Trends in in-school and out-of-school consumption

The increased consumption of vegetables among fourth-grade students from Year One to Year Two was due mostly to in-school consumption of vegetables. There was an increase of 0.28 cups compared to a decrease of 0.08 cups in schools with lesser-developed School Lunch Initiative components ($p<.01$) (Table 21). Out-of-school consumption of vegetables and fruit was greater among students attending schools with highly developed School Lunch Initiative components, but the difference was statistically significant only for fruit (an increase of 0.14 cups of fruit compared to a decrease of 0.15 cups among students in schools with lesser-developed School Lunch Initiative components) (Table 21).

The trends were less clear from Year Two to Year Three when fifth-grade students went to the sixth grade and sixth-grade students went into the seventh grade. The amount of in-school and out-of-school fruit and vegetable consumption dropped or stayed about the same (Table 22).

Table 21. Change in Mean Consumption of Fruits and Vegetables Eaten In-School and Out-of-School from Year One to Year Two[1,2]

	N[3]	In-School Fruit		Out-of-School Fruit		In-School Vegetable		Out-of-School Vegetable	
		Year 1 (cups)	Change By Year 2	Year 1 (cups)	Change By Year 2	Year 1 (cups)	Change By Year 2	Year 1 (cups)	Change By Year 2
4th to 5th grade									
Elementary schools with lesser-developed components	85	0.61	**-0.05**§	0.66	**-0.15***	0.28	**-0.08****	0.61	**0.07**
Elementary schools with highly developed components	56	0.55	**0.12**§	0.66	**0.14***	0.21	**0.28****	0.55	**0.15**
5th to 6th grade									
Elementary schools with lesser-developed components to Middle School X or Y	48	0.50	**-0.10**	0.82	**0.06**	0.23	**0.00**	0.58	**0.01**
Elementary schools with lesser-developed components to Middle School Z	18	0.61	**-0.28**	0.45	**0.06**	0.30	**0.04**	0.57	**0.08**
Elementary schools with highly developed components to Middle School X	9	0.82	**-0.12**	0.75	**0.02**	0.40	**0.03**	0.50	**-0.08**
Elementary schools with highly developed components to Middle School Y or Z	27	0.74	**-0.34**	0.40	**-0.06**	0.22	**0.16**	0.68	**0.03**

[1] Adjusted for race and education and relevant baseline consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Standard cups/day (1 standard cup = 2 standard servings) Year Two to Year Three.[1, 2]

[3] Ns may be different from those in earlier tables showing mean consumption of fruits and vegetables due to missing information needed for distinguishing in-school from out-of-school consumption.

Marginal and significant differences denoted by §p<.10; *p<.05; **p<.01.

Table 22. Mean Consumption of Fruits and Vegetables Eaten In-school and Out-of-school from Year Two to Year Three[1,2]

	N[3]	In-School Fruit		Out-of- School Fruit		In-School Vegetable		Out-of-School Vegetable	
		Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**	Year 2 (cups)	**Change by Year 3**
5th to 6th grade									
Elementary schools with lesser-developed components to Middle School X or Z	57	0.48	**-0.22**	0.38	**0.00**	0.18	**-0.04**	0.51	**0.15**
Elementary schools with lesser-developed components to Middle School Y	13	0.55	**-0.31**	0.48	**-0.19**	0.1	**-0.12**	0.69	**0.11**
Elementary schools with highly developed components to Middle School X	--[4]	--	**--**	--	**--**	--	**--**	--	**--**
Elementary schools with highly developed components to Middle School Y or Z	49	0.71	**0.08**	0.80	**0.07**	0.45	**-0.09**	0.68	**0.03**
6th to 7th grade									
Middle School X	45	0.61	**-0.05**	0.73	**-0.05**	0.37	**0.02**	0.57	**0.16**
Middle School Y	16	0.37	**-0.08**	0.50	**-0.30**	0.40	**-0.18***	0.73	**0.06**
Middle School Z	30	0.52	**-0.06**	0.79	**-0.05**	0.25	**0.20***	0.68	**0.19**

1 Adjusted for race and education and relevant Year Two consumption; multiple comparisons were assessed using Bonferroni's procedure.

2 Standard cups/day (1 standard cup = 2 standard servings).

3 Ns may be different from those in earlier tables showing mean consumption of fruits and vegetables due to missing information needed for distinguishing in-school from out-of-school consumption.

4 Unstable estimates for this group of students due to small sample size.

Significant difference denoted by *p<.05.

Student Consumption of Sweetened Beverages

At baseline

Consumption of sweetened beverages tended to be greater among students attending the schools with highly developed School Lunch Initiative components (Table 23).

Table 23. Student Consumption of Sweetened Beverages (fluid ounces/day) by Grade in Year One

	4th Grade*	5th Grade
Schools with lesser-developed components	2.82	2.32
Schools with highly developed components	4.89	3.01

Significant difference denoted by *p<.05.

Change from Year One to Year Two

Fourth-grade students attending the schools with highly developed School Lunch Initiative components decreased their mean consumption of sweetened beverages slightly. Interestingly, although sweetened beverage consumption increased for most students, it decreased among students who had attended an elementary school with highly developed School Lunch Initiative components and moved to the middle school with highly developed School Lunch Initiative components (Middle School X). However, this decrease was not significantly different from the increases in sweetened beverage consumption observed among other students (Table 24).

Table 24. Mean Consumption of Sweetened Beverages (fluid ounces/day) from Year One to Year Two[1]

	N	Sweetened Beverages	
		Year 1 (fluid ounces)	**Change by Year 2**
4th to 5th grade			
Elementary schools with lesser-developed components	85	2.91	**1.10**
Elementary schools with highly developed components	61	4.67	**-0.51**
5th to 6th grade			
Elementary schools with lesser-developed components to Middle School X or Y	54	2.44	**1.95**
Elementary schools with lesser-developed components to Middle School Z	18	2.86	**3.09**
Elementary schools with highly developed components to Middle School X	9	1.65	**-3.66**
Elementary schools with highly developed components to Middle School Y or Z	28	4.61	**2.77**

[1] Adjusted for race and education and relevant baseline consumption; multiple comparisons were assessed using Bonferroni's procedure.

Change from Year Two to Year Three

Changes in sweetened beverage consumption were not significantly associated with the School Lunch Initiative development due in part to the wide variation in consumption (Table 25).

Table 25. Mean Consumption of Sweetened Beverages (fluid ounces/day) from Year Two to Year Three[1]

	N	Sweetened Beverages	
		Year 2 (fluid ounces)	**Change by Year 3**
5th to 6th grade			
Elementary schools with lesser-developed components to Middle School X or Z	57	3.93	**1.35**
Elementary schools with lesser-developed components to Middle School Y	13	4.18	**1.61**
Elementary schools with highly developed components to Middle School X	--[2]	--	**--**
Elementary schools with highly developed components to Middle School Y or Z	50	3.37	**3.17**
6th to 7th grade			
Middle School X	49	4.00	**0.34**
Middle School Y	17	5.42	**-0.49**
Middle School Z	32	7.39	**-0.13**

[1] Adjusted for race and education and relevant Year Two consumption; multiple comparisons were assessed using Bonferroni's procedure.

[2] Unstable estimates for this group of students due to small sample size.

No significant difference found.

4. Seventh-Grade Survey: Knowledge, Attitudes and Preferences About Food and the Environment

In the 2008-09 school year, the third year of the evaluation, a survey of seventh graders was conducted asking questions similar to those asked annually in the three-year longitudinal study. Findings from this survey mostly confirmed the findings from the longitudinal analysis or revealed associations between School Lunch Initiative exposure and food-related activities and behaviors that were not observed with the longitudinal cohort.

Seventh-Grade Student Knowledge

Mean knowledge scores about food and the environment (adjusted for race, gender, and participation in the longitudinal cohort) were higher among students attending the middle school with highly developed School Lunch Initiative components (Middle School X) (Table 26).

Table 26. Nutrition and Food and Environment Knowledge Scores Among All Seventh Graders in Year Three[1,2]

	Nutrition	Food & Environment	Total
School X[3]	7.26	7.12[a*]	14.38[b*]
School Y	7.08	6.89	13.97
School Z	6.89	6.42[a*]	13.31[b*]

[1] Maximum scores possible = 26: nutrition knowledge = 14; food and environment = 12.

[2] Adjusted for gender, race and whether participating in the School Lunch Initiative evaluation study.

[3] The School Lunch Initiative was most highly developed at School X.

[a,b] Matching alphabetic superscripts indicate significant differences denoted by *p<.05.

Seventh-Grade Student Attitudes

Attitudes toward food and health did not differ among students attending the three middle schools. Attitudes toward the environment-related statements were more positive at Middle School X, the middle school with the most highly developed School Lunch Initiative components, compared to Middle School Y, where cooking and gardening activities were offered as an elective course for seventh graders in Year Three. Attitudes toward school were also more positive among students attending the Middle School X compared to those attending the other two middle schools (Table 27).

Table 27. Attitudes Toward Food, Health, the Environment and School Among All Seventh Graders in Year Three[1,2]

	Food	Health	Environment	School
School X[3]	2.41	2.55	2.42[a*]	1.79[b,c**]
School Y	2.41	2.45	2.24[a*]	1.35[b**]
School Z	2.43	2.54	2.35	1.42[c**]

[1] Students were asked if they agreed with relevant statements and were given 4 responses on a Likert scale which were scored on a 0-3 scale (the greater the score, the more positive the attitude).

[2] Adjusted for gender, race and whether participating in the School Lunch Initiative evaluation study.

[3] The School Lunch Initiative was most highly developed at School X.

[a-c] Matching alphabetic superscripts indicate significant difference at *p<.05;**p<.01.

Seventh-Grade Student Food Preferences

Student food preferences among all seventh-grade students are consistent with those in the longitudinal cohort. In particular, higher exposure to School Lunch Initiative components is associated with greater preference for green leafy vegetables (Table 28).

Table 28. Food Preferences Among All Seventh Graders in Year Three[1,2]

	Fruits	Green Leafy Vegetables	Other Vegetables	All Fruits & Vegetables
School X[3]	2.47	1.74[a,b**]	1.79	1.95
School Y	2.57	1.36[a**]	1.82	1.89
School Z	2.41	1.30[b**]	1.84	1.85

[1] Adjusted for gender, race and whether participating in the School Lunch Initiative evaluation study.

[2] Students were asked how much they liked certain fruits and vegetables; responses were scored on a scale of 0-3 (the higher the score, the greater the preference).

[3] The School Lunch Initiative was most highly developed at School X.

[a,b] Matching alphabetic superscripts indicate significant differences denoted by **p<.01.

Seventh-Grade Student Food-Related Activities and Behaviors

Students at the middle school with highly developed School Lunch Initiative components (Middle School X) were more likely to report engaging in positive food-related behaviors than students at the other middle schools (Table 29). For example, a higher percentage of students at Middle School X reported eating fresh fruits and vegetables at least 3 or 4 times a week, eating family dinner nearly every day, preparing dinner from "scratch," and having family conversations about healthy eating.

Table 29. Student-Reported Food-Related Activities/Behaviors Among All Seventh Graders in Year Three (N=413) (percent)

	Eat fast food less than 3-4 times/ wk****	Eat fresh fruits and vegeta-bles at least 3-4 times/ wk**	Bring lunch from home at least 3-4 times/ wk*	Eat school lunch at least 3-4 times/ week	Eat family dinner nearly every day***	Family prepares dinner from scratch at least 3-4 times/ wk*	Student helps prepare dinner at least 3-4 times/ wk	Sometimes have fam-ily con-versations about healthy eating*	Uses recipes brought home from school at least a few times/ yr*	Bring home recipes from school at least a few times/ yr**
School X[1]	96.3	85.5	48.7	36.3	73.0	85.5	33.0	52.9	33.7	35.5
School Y	90.2	75.9	33.2	29.6	64.6	77.0	33.9	31.9	30.4	30.4
School Z	96.4	76.4	34.5	28.2	58.2	77.3	29.9	39.0	17.3	17.3

[1] The School Lunch Initiative was most highly developed at School X.

Significant difference denoted by *p<.05; **p<.01; ***p<.001; ****p<.0001.

5. Perception of the School Lunch Program

When asked about how school lunch had changed, students who took part in the three-year study thought that school lunches were tastier over the three years. At the same time, the percentage of students who found school lunches to be not as tasty decreased (Table 30). More elementary school students attending schools with highly developed School Lunch Initiative components thought the school lunches were tastier in Year Two compared to the year before (Table 31). More students attending Middle School X, the middle school with the most highly developed School Lunch Initiative components, thought school lunch was tastier in Year Three compared to the year before (Table 32). This was also the year that Middle School X opened a new dining facility on campus.

Table 30. Student Perception of School Lunch from Year One, Year Two and Year Three (percent)[1]

	Tastier	Not as Tasty	Healthier	Not as Healthy
Year 1 (N= 313)	7.7[a*, b**]	18.5[d**]	30.7	3.5
Year 2 (N=255)	16.1[a*, c**]	15.3[e**]	30.2	3.9
Year 3 (N=231)	27.3[b**, c**]	9.1[d**, e**]	31.2	1.3

[1] The differences between years were assessed using the Chi square test and Fisher's exact test based on the frequencies/counts.
[a-e] Matching alphabetic superscripts indicate significant difference at *p<.05; **p<.01.

Table 31. Student Perception of School Lunch from Year One to Year Two (percent)[1]

	Tastier	Not as Tasty	Healthier	Not as Healthy
Elementary schools with lesser-developed components				
Year 1 (N=185)	8.1	13.5	31.9	4.3
Year 2 (N=85)	11.8	16.5	30.6	2.4
Elementary schools with highly developed components				
Year 1 (N=128)	7.0[a**]	25.8	28.9	2.3
Year 2 (N=61)	22.9[a**]	23.0	42.6	4.9

[1] The differences between years were assessed using the Chi square test or Fisher's exact test based on the frequencies/counts.
[a] Matching alphabetic superscripts indicate significant difference at **p<.01.

Table 32. Student Perception of School Lunch from Year Two to Year Three (percent)[1]

	Tastier	Not as Tasty	Healthier	Not as Healthy
Middle School X				
Year 2 (N=56)	9.3[a**]	5.6	33.3	5.6[b*]
Year 3 (N=101)	30.7[a**]	6.9	45.5	0.0[b*]
Middle School Y				
Year 2 (N=19)	10.5	5.3	0.0	10.5
Year 3 (N=76)	29.6	9.3	20.4	0.0
Middle School Z				
Year 2 (N=34)	26.5	20.6	17.7	0.0
Year 3 (N=54)	21.1	11.8	19.7	4.0

[1] The differences between years were assessed using the Chi square test or Fisher's exact test based on the frequencies/counts.
[a -b] Matching alphabetic superscripts indicate significant difference at *p<05; **p<.01.

Seventh-Grade Student Perception of School Lunch

Responses from seventh graders who participated in the cross-sectional survey also confirmed that proportionately more students attending Middle School X, the middle school with the most highly developed School Lunch Initiative components, thought school lunch was tastier and healthier (Table 33). This was also the year that Middle School X opened its new dining facility on campus.

Table 33. Student Perception of School Lunch by All Seventh Graders in Year Three (N=413) (percent)

	Tastier	Not as Tasty	Healthier	Not as Healthy
School X[1]	31.6[a***b*]	8.4[cd§]	35.8[e****f**]	2.1
School Y	13.3[a***]	15 [c§]	8.9[e****g*]	4.4
School Z	19.1[b*]	15.5[d§]	18.2[f**g*]	3.6

[1] School X had the most highly developed School Lunch Initiative components compared to the other middle schools in Year Three.

[a-g] Matching alphabetic superscripts indicate significant differences denoted by §p<.10; *p<.05; **p<.01; ***p<.001; ****p<.0001.

6. Student Academic Performance

There were no consistent trends in School Lunch Initiative exposure and student academic performance, suggesting that other powerful influences are affecting test score results. Table 34 shows that mean academic performance scores (English Language Arts and Mathematics) were generally higher among students attending the schools with lesser-developed School Lunch Initiative components, which had lower proportions of children from low-income families. This trend held even after adjusting for parents' education and race/ethnicity.

Table 34. Mean Academic Performance Test Scores[1,2]

	N			English Language Arts (ELA)			Mathematics		
	Yr 1	**Yr 2**	**Yr 3**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 1**	**Yr 2**	**Yr 3**
YOUNGER COHORT[3]				**4th grade**	**5th grade**	**6th grade**	**4th grade**	**5th grade**	**6th grade**
Elementary Schools with Lesser-Developed Components									
Elementary School A	41	41	--	383[a]	391[b]	--	426[r,s]	445[t]	--
Elementary School B	23	20	--	372	369	--	365[r]	444[u]	--
Elementary Schools with Highly Developed Components									
Elementary School C	28	28	--	348[a]	339[b]	--	357[s]	354[t,u]	--
Elementary School D	17	17	--	381	371	--	385	387	--
Middle Schools									
Middle School X[5]	--	--	42	--	--	381[c]	--	--	400[v]
Middle School Y	--	--	36	--	--	349[c]	--	--	362[v]
Middle School Z	--	--	30	--	--	368	--	--	376
OLDER COHORT[4]				**5th grade**	**6th grade**	**7th grade**	**5th grade**	**6th grade**	**7th grade**
Elementary Schools with Lesser-Developed Components									
Elementary School A	35	--	--	352	--	--	394[w]	--	--
Elementary School B	26	--	--	389[d]	--	--	408[x]	--	--
Elementary Schools with Highly Developed Components									
Elementary School C	17	--	--	333[d]	--	--	312[w,x]	--	--
Elementary School D	8	--	--	392	--	--	397	--	--
Middle Schools									
Middle School X[5]	--	45	45	--	360	356	--	373	359
Middle School Y	--	27	25	--	353	373	--	357	383
Middle School Z	--	14	14	--	367	380	--	367	380

1 Adjusted for education and race.

2 Test scores are California Standards Tests administered annually through the Standardized Testing and Reporting (STAR) program in California. The English Language Arts and Mathematics tests have a scaled score range from 150 to 600. The goal is for the scaled mean to be 350 or above (proficient or above).

3 Fourth grade in Year 1, fifth grade (Year 2), sixth grade (Year 3).

4 Fifth grade in Year 1, sixth grade (Year 2), seventh grade (Year 3).

5 Middle school with highly developed School Lunch Initiative components.

[a-d, r-x] Matching alphabetic superscripts indicate significant difference at $p<.05$.

7. Student Weight Status

Height and weight measures from the school district's Fitnessgram assessments taken in the fifth and seventh grades were examined. Data collected during Year One of the study were questionable and were not included in the analysis. Height and weight measures in Year Two and Year Three were used to calculate Body Mass Index to assess weight status and rates of overweight and obesity, as shown in Table 35. Caution must be used in interpreting these results due to potential measurement errors and the lack of information on pubertal stage development, which naturally affects the rate of weight gain among adolescents.

Table 35. Overweight and Obesity Rates[1] by Sex, Grade and School in Year Two and Year Three[2]

	Year 2 (N=141)			Year 3 (N=100)		
	Percent overweight	**Percent obese**	**Percent overweight and obese**	**Percent overweight**	**Percent obese**	**Percent overweight and obese**
BOYS						
5th grade boys						
Schools with highly developed components	26.67	16.67	43.34			
Schools with lesser-developed components	16.13	16.13	32.26			
7th grade boys						
School X				11.11	22.22	33.33
School Y				14.29	28.57	42.86
School Z				11.11	22.22	33.33
GIRLS						
5th grade girls						
Schools with highly developed components	17.24	17.24	34.38			
Schools with lesser-developed components	15.22	10.87	26.09			
7th grade girls						
School X				7.14	7.14	14.28
School Y				14.29	7.14	21.43
School Z				9.52	9.52	19.04
TOTAL						
5th grade boys and girls						
Schools with highly developed components	22.03	16.95	38.98			
Schools with lesser-developed components	15.58	12.99	28.57			
7th grade boys and girls						
School X				8.70	13.04	21.74
School Y				14.29	14.29	28.58
School Z				10.00	13.33	23.33

[1] Overweight and obesity are defined as a Body Mass Index [weight(kg/height(cm)^2] at or above the 85th percentile and lower than the 95th percentile and a Body Mass Index at or above the 95th percentile for children of the same age and sex using CDC growth charts, respectively. http://www.cdc.gov/obesity/childhood/defining.html

[2] Data from Year One was not used in the analysis due to probable measurement errors.

No significant difference found.

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