School Gardens: Can a Hands-on Teaching Tool Affect Students’ Attitudes and Behaviors Regarding Fruit and Vegetables?

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SUMMARY. Nutrition in the Garden is a program designed to help teachers integrate nutrition education into their classroom using a hands-on tool, the garden. The objectives of this research project were 1) develop a garden activity guide to help teachers integrate nutrition education, specifically as it relates to fruit and vegetables, into their curricula, 2) evaluate whether students developed more positive attitudes towards fruit and vegetables by participating in the garden program, and 3) evaluate whether students developed better nutritional behavior by eating more fruit and vegetables after participating in the garden program. Students’ nutritional attitudes regarding fruit and vegetables were measured with a fruit and vegetable preference questionnaire divided into three sections targeting vegetables, fruit, and fruit and vegetable snacks. Students’ nutritional behaviors regarding fruit and vegetables were evaluated through 24-hour recall journals. After gardening, students’ attitudes towards vegetables became significantly more positive. In contrast, no differences were detected in attitudes towards fruit. Students also had more positive attitudes towards fruit and vegetable snacks after gardening, with female students and younger students having the greatest improvement in snack attitude scores. Even though school gardening improved students’ attitudes towards vegetables, fruit and vegetable consumption of students did not significantly improve due to gardening. Overall, the average daily fruit and vegetable consumption of the students participating in the Nutrition in the Garden study was 2.9 servings per day. This falls short of the estimated national average for daily fruit and vegetable consumption for this age group (3.4 servings) and extremely short of the nationally recommended 5.0 servings per day.

Nutritional messages regarding the consumption of fruit and vegetables have become increasingly prevalent in our society due to new findings establishing a strong link between consumption and health. It has been known for some time that fruit and vegetables provide many essential vitamins and minerals (Dittus et al., 1995). In addition, recent studies show that fruit and vegetables may be associated with lower risks of cancer and coronary heart disease (McPherson et al., 1995). In order to take advantage of these health benefits, it is recommended that individuals consume at least five fruit and vegetables a day. Despite this new information, many Americans do not meet this recommended daily intake. As a result, a national campaign has been initiated called “5 a Day—for Better Health,” which encourages the consumption of five or more fruit and vegetables a day (Domel et al., 1993a). Children are one of the targets of this campaign, since it is estimated that they consume an average of only 3.4 servings of fruit and vegetables a day (Foster et al., 1998). On average, only 6.8% to 20% of all children and adolescents eat five or more servings of fruit and vegetables a day (Domel et al., 1993a).

One objective of this research project was to develop an activity guide to help teachers integrate nutrition education, specifically as it relates to fruit and vegetables, into their curricula. School gardens provide opportunities for hands-on learning activities that are vital in nutrition education (Conte, 1995). Gardens can be used to teach children about the origin of fruit and vegetables and give them opportunities to practice preparing and eating fruit and vegetables. They also increase children’s exposure to fruit and vegetables which impacts

 nutritive messages especially in regard to fruit and vegetables. Studies show that consumption of fruit and vegetables, as a habit in childhood, is an important predictor of higher fruit and vegetable consumption as adults (Hiemendinger et al., 1995).

Because children spend much of their time in school settings, schools have the opportunity to influence nutritional attitudes and behaviors through education. In addition to nutritional messages children learn at home, much of the nutritional information that children acquire comes from schools. One study indicated that 95% of children reported that they learned about nutrition from their school, 86% learned from parents, and 73% learned from doctors and nurses (MCPerson, 1995). A number of curricula and teaching strategies can be used to present nutritional messages including school gardens. Gardening has been an effective tool to teach nutrition to various populations. A senior gardening program resulted in improved nutritional attitudes and consumption in the participants (Ackman and Wagner, 1990). Another nutrition study of an urban garden program found that individuals who gardened ate more vegetables than those who did not garden (Blair et al., 1991). School gardens may be effective tools for teaching nutrition education to children, particularly in presenting information about fruit and vegetables.

One objective of this research project was to develop an activity guide to help teachers integrate nutrition education, specifically as it relates to fruit and vegetables, into their curricula. School gardens provide opportunities for hands-on learning activities that are vital in nutrition education (Conte et al., 1995). Gardens can be used to teach children about the origin of fruit and vegetables and give them opportunities to practice preparing and eating fruit and vegetables. They also increase children’s exposure to fruit and vegetables which impacts...
development of attitudes and eating behaviors (Birch et al. 1995).

Additional objectives of this study were to evaluate whether students developed more positive attitudes about fruit and vegetables and better nutritional behaviors by eating more fruit and vegetables after participating in the garden program.

Materials and methods

Garden activity guide. A garden activity guide, Nutrition in the Garden (Lineberger and Zajicek, 1998), was developed to help teachers integrate nutrition education into their curricula. The activities in this guide are divided into 10 units that combine horticulture and nutrition subjects with detailed background information for teachers. In total, 34 different activities are included in the 10 units, with each activity requiring an average of 20 min to complete. The guide can be used year round; however, some of the activities require use of a garden or an indoor grow lab.

For this study, teachers were required to introduce information from each of the 10 units to their class. They were free to adapt the material to accommodate their class and to choose any of the activities they wanted to complete, but they did have to discuss the subject matter in each of the 10 units in their class to participate in the study.

Sample population. This study was conducted during the spring semester of 1998 through spring semester of 1999. Third and fifth grade teachers from five elementary schools in Texas volunteered their classes to participate. One hundred and eleven students completed a pretest questionnaire and journal before gardening and a posttest questionnaire and journal after the garden program was completed. Between the testing, the children participated in gardening and lessons from Nutrition in the Garden. Only students who completed all of the testing were included in the data and analysis.

Instrumentation. Students’ nutritional attitudes regarding fruit and vegetables were measured with a fruit and vegetable preference questionnaire developed by Dr. Tom Baranowski, Professor of Behavioral Science, University of Texas M.D. Anderson Cancer Center (Domel et al., 1993b). The Fruit and Vegetable Preference Questionnaire is comprised of three distinct sections. The first section consists of a list of 17 commonly consumed vegetables and the second section consists of a list of 13 commonly consumed fruit. These two sections of the questionnaire measured questions on a Likert-type scale (Likert, 1967). The activity guide, Nutrition in the Garden activity guide, children responded that they liked vegetables more than before gardening. The effect size calculations ($r^2$) show that 47.6% of the variation in scores was due to gardening (Table 1). Due to this finding, additional comparisons were made to investigate the differences between pretest and posttest scores.

Before gardening, children’s attitudes about vegetables were significantly different depending on what school they attended (Table 2). However, after gardening, these differences were no longer apparent. The eta$^2$ effect size calculations, which are analogous to $r^2$ in paired t tests or multiple regression (Kirk, 1996), show that 13.8% of the variance in nutritional attitude pretest scores was due to the school attended. After gardening, this variance was reduced to 3.3%. These results indicate that initial differences between schools were equalized with the treatment and the students with lower scores showed more improvement than students with higher scores.

Each Fruit and Vegetable Preference Questionnaire had a cover sheet that asked the students for demographic information. It included questions about their gender, ethnicity, age, place of residence, and previous gardening experience. After the questionnaires and journals were returned to the researcher, they were matched according to student name, coded with a different identification number for each student, and coversheets were removed to provide confidentiality.

Data analysis. The data collected from the treatment groups was analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows Release 7.5 (SPSS, 1997). Statistical procedures included frequencies, paired t tests and ANOVA tests to show any differences or relationships between scores.

Results and discussion

Each section of the Fruit and Vegetable Preference Questionnaire was analyzed separately to investigate differences in fruit, vegetable, and snack preferences.

Vegetable preference. Significant differences were found in vegetable preference scores of children before and after participating in the garden program (Table 1). After participating in gardening and activities from Nutrition in the Garden activity guide, children responded that they liked vegetables more than before gardening. The effect size calculations ($r^2$) show that 47.6% of the variation in scores was due to gardening (Table 1). Due to this finding, additional comparisons were made to investigate the differences between pretest and posttest scores.

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Greater improvement in nutritional attitudes by students with initially lower scores has been found by previous research (Shannon and Chen, 1988), and provides additional indication that nutritional programs, including gardening and Nutrition in the Garden, have a positive effect on students, especially those with the most need for improvement.

FRUIT PREFERENCE. In contrast, fruit preference scores of children did not significantly improve after participating in gardening activities (Table 1). Both the pretest and posttest fruit preference scores were high, indicating that children had a positive attitude towards fruit before and after participating in the gardening program. The existing positive attitudes towards fruit, and the fact that children grew mainly vegetables in the school gardens, may help to explain the lack of improvement in the fruit preference scores.

FRUIT AND VEGETABLE SNACK PREFERENCE. Along with the increase in attitudes regarding vegetables, there was a statistically significant increase in snack preference scores of children after participating in the garden program (Table 1). The effect size calculations show that 37.7% of the variation in scores was due to gardening (Table 1). After gardening, children were more apt to choose a fruit or vegetable as the preferred snack item over other snack items, compared to before gardening. Further analyses were conducted to explore the difference between the pretest and posttest scores.

Significant differences were found in snack preference scores based on grade level (Table 3). Third grade students had a statistically significantly lower pretest mean score than the fifth grade students by 0.668 points. At the posttest this difference was no longer evident and third grade students' mean score was only 0.066 points lower than the fifth grade score. This indicated that the third grade students had a greater increase in their snack preference attitude scores. Greater improvement in students' nutritional attitudes from education programs in lower grade levels has been reported (Shannon and Chen, 1988; Domel et al., 1993b). Younger students may be more open to new ideas and experiences and have more flexible opinions and attitudes. This is an important finding and supports the need to increase nutrition education programs, particularly those that target fruit and vegetables, at a young age.

In addition to differences based on grade level, there were also differences based on gender (Table 4). Female students had higher snack preference scores than male students at the pretest, and the difference was even

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**Table 1. Paired t test comparison of pretest and posttest Fruit and Vegetable Preference Questionnaire scores of students participating in the Nutrition in the Garden study.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Students (no.)</th>
<th>Mean score</th>
<th>sd</th>
<th>df</th>
<th>t</th>
<th>P (two-tailed)</th>
<th>% Eta²</th>
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<tbody>
<tr>
<td>Vegetable preference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>111</td>
<td>0.979</td>
<td>0.419</td>
<td>110</td>
<td>-2.195</td>
<td>0.030*</td>
<td>0.476</td>
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<td>Posttest</td>
<td>111</td>
<td>1.046</td>
<td>0.394</td>
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<td></td>
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<td>Fruit preference</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>111</td>
<td>1.499</td>
<td>0.479</td>
<td>110</td>
<td>-0.529</td>
<td>0.598</td>
<td>0.168</td>
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<tr>
<td>Posttest</td>
<td>111</td>
<td>1.525</td>
<td>0.461</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack preference</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>111</td>
<td>0.395</td>
<td>0.284</td>
<td>110</td>
<td>-2.658</td>
<td>0.009*</td>
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<td>0.456</td>
<td>0.271</td>
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</table>

²Scores range from 0.000 to 1.000.
*Statistically significant at P = 0.05.

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**Table 2. ANOVA comparison of the pretest and posttest vegetable preference scores of the students participating in the Nutrition in the Garden study.**

<table>
<thead>
<tr>
<th>School</th>
<th>Students (no.)</th>
<th>Mean score</th>
<th>sd</th>
<th>df</th>
<th>F</th>
<th>P</th>
<th>Eta²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School 1</td>
<td>28</td>
<td>1.206</td>
<td>0.312</td>
<td>4</td>
<td>4.247</td>
<td>0.003*</td>
<td>0.138</td>
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<tr>
<td>School 2</td>
<td>10</td>
<td>0.883</td>
<td>0.357</td>
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<tr>
<td>School 3</td>
<td>41</td>
<td>0.832</td>
<td>0.424</td>
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<tr>
<td>School 4</td>
<td>16</td>
<td>0.915</td>
<td>0.530</td>
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<td>School 5</td>
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<td>1.085</td>
<td>0.308</td>
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<td></td>
</tr>
<tr>
<td>Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School 1</td>
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<td>1.147</td>
<td>0.385</td>
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<td>0.896</td>
<td>0.469</td>
<td>0.033</td>
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<td>0.480</td>
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<td>School 3</td>
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<td>0.372</td>
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<td>School 4</td>
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<td>0.967</td>
<td>0.479</td>
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<tr>
<td>School 5</td>
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<td>1.103</td>
<td>0.310</td>
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</tbody>
</table>

²Scores range from 0.000 to 1.000.
*Eta² effect size calculations are analogous to r² in paired t tests or multiple regression.
*Statistically significant at P = 0.05.
greater at the posttest, echoing a gender difference in food preferences, with girls tending to have better nutritional attitudes (Worsley et al., 1984). Females may be more receptive to nutrition and health education because they are more concerned about physical appearances (Perry et al., 1998).

**FRUIT AND VEGETABLE BEHAVIORS.** No significant differences were found between the pretest and posttest fruit and vegetable behavior/intake of children participating in the garden program. Changing consumption patterns is hard to accomplish due to the complex nature of eating behaviors and therefore the absence of change is not surprising (Howison et al., 1988). A more intense, comprehensive program with special emphasis on behavioral change may be needed to increase fruit and vegetable consumption.

**ADDITIONAL FINDINGS.** Comparisons were made between the mean fruit and vegetable intake data from this study and data from national surveys (Table 5). The mean of the total fruit and vegetable intake for the students in this study was 2.0. This mean is well below the estimated national average for daily fruit and vegetable consumption of 3.4 servings and the nationally recommended five a day (Foerster et al., 1998). The number of students that consumed the recommended five or more fruit and vegetables a day in this study was also low in comparison to national data. Only 10.8% of the students who participated in the garden program ate five or more fruit and vegetables a day, falling at the lower end of the national range of 6.8% to 20% (Reynolds et al., 1999). This information emphasizes the need for positive nutritional messages regarding fruit and vegetables to be delivered to these students. Although this research found that gardening, with directed activities, could improve nutritional attitudes, additional programs and interventions are needed to increase fruit and vegetable consumption.

**Literature cited**


