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Food System Research Collaborative

at the University of Vermont Center for Rural Studies

Farm-to-School: Implications for Child Nutrition

Linda Berlin, Ph.D.
University of Vermont

Jane Kolodinsky, Ph.D.
University of Vermont

Kim Norris, Ph.D.
University of Maryland

Abbie Nelson
Vermont Food Education Every Day

ABSTRACT

Farm-to-School (F2S) programs are gaining attention for many reasons, one of which is the recognition that they could positively influence the trend of increasing prevalence of childhood overweight and obesity. Of the F2S programs that have been evaluated, most have demonstrated increased selection or intake of fruits and vegetables by students following the incorporation of farm produce into school salad bars, meal selections, or class-based education. With that said, the wide range of activities that are part of typical F2S programs makes it difficult to pinpoint which components have the greatest potential to improve student's health behaviors. Within the field of nutrition education, theory-based interventions that target what we know to be the key underlying factors influencing health behavior are considered to offer the most promise.

Therefore, this paper explores how components of Vermont F2S programs address key constructs of the Social Cognitive Theory. The types of activities that are part of F2S are found to touch upon many of the theoretical constructs in the Social Cognitive Theory, leading to the conclusion that F2S programs have great potential to facilitate movement towards desired dietary changes. However, in the current approach, the likelihood is low that a set of activities in any one F2S program addresses multiple constructs of the theory in a systematic manner. Hence, a more intentional inclusion of diverse activities would likely be beneficial. More research is needed to test these assertions.



KEY FINDINGS

- F2S programs address many of the constructs that are part of the Social Cognitive Theory, making it likely that the most comprehensive programs have a positive influence on health behaviors.
- Limited connection of F2S activities to the home environment may limit the opportunities for positive reinforcement of key messages.
- Further research that better links F2S with behavior change theory will enable a closer examination of some of these questions.

Introduction

The farm-to-school movement gained traction in the mid to late 1990s, and then flourished over the next decade, resulting in an estimated 2,000 programs in nearly 9,000 schools across the country by 2008 (Joshi and Azuma, 2009). Lacking a precise definition, Farm-to-School (F2S) programs are generally characterized as linking farmers and schools (K-12) with the primary purposes of contributing to nutritious meals for youth and better incomes for farmers who market locally. Additional goals include enhancing youth appreciation and awareness of agriculture, keeping money in the local economy, furthering youth's sense of connectedness to the community, and providing agricultural and food education.

consumers of food in this country. Positive attributes commonly associated with the food localization movement include improved food quality and safety, small-scale food production, bio-diversity, resource protection, community well-being, democratic participation, and regional palates (Hinrich, 2003). Despite the long list of attributes, the concepts of “local” and “regional,” as applied to food systems, are no more precisely defined than is the term “farm-to-school,” making it difficult to readily measure and compare associated outputs and impacts.

However, F2S programs are gaining attention for their potential role in halting the trend of increasing prevalence of childhood overweight and obesity. Comparing NHANES (National Health and Nutrition Examination Survey) data over almost 30 years (1976–1980 and 2003–2006), we see that the prevalence of obesity has increased for children aged 6–11 years, from 6.5% to 17.0%; and for those aged 12–19 years from 5.0% to 17.6% (NHANES; Ogden et al., 2008). Increased consumption of fruits and vegetables has been recognized as a successful strategy for reducing overweight and obesity (Lin and Morrison, 2003) and is of particular interest because access to more produce is often a core component of F2S efforts. In fact, the CDC has identified Farm to School Programs as an effective approach to improving student health through the creation of healthier school meals, and nutrition and eco-literacy training of students through hands-on and out-of-doors experiences (Dietz, 2009).

Nutrition Education Interventions for Children

One of the most explicit goals of F2S is to positively benefit child nutrition. Programs designed to influence child nutrition may attempt to increase knowledge and awareness, change attitudes, improve skills, alter behaviors, and ultimately have a positive impact on health measures. Despite the interest in having F2S positively affect child nutrition, the research specifically designed to identify child nutrition impacts of F2S programs has been limited (Joshi and Azuma, 2008). Fur-

Over the past 30 years, the prevalence of obesity has increased from 6.5% to 17.0% for children aged 6–11 years and 5.0% to 17.6% for those aged 12–19 years.

As a result of diverse approaches and the grassroots nature of the programs, the types of activities that are encompassed by F2S programs across the country are quite varied. This variety may be due to a view that F2S efforts benefit from being designed from the ground up. However, despite the diversity, a key component that is consistently a part of F2S is serving foods in the school cafeteria that were produced locally. Types of foods often highlighted are fresh or processed fruits and vegetables, (e.g. kale, squash, tomato sauce), dairy and meat products, eggs, beans, and other value-added items produced nearby (e.g. pesto, granola). In addition to food served in the cafeteria, F2S activities common to many programs include taste tests, lessons on healthful food choices, farm visits, school gardens, recycling activities, and starting a composting system.

F2S is not unique in its recent efforts to develop linkages across the food system. Rapid expansion of F2S has been part of a broader food system localization movement in this country that has resulted in the revival of farmers' markets, development of direct marketing relationships between farmers and restaurateurs, formation of “community supported agriculture” farms, and numerous other connections among producers, processors, distributors, and

thermore, the diverse array of approaches that fall under the Farm-to-School umbrella make it challenging to compare results across the studies that have been done.

Of the F2S programs that have been evaluated, most have demonstrated increased selection or intake of fruits and vegetables by students following the incorporation of farm produce into school salad bars, meal selections, or class-based education (Joshi & Azuma, 2008). In addition, of the five programs that also examined student dietary behavior outside of school, four found increases in the selection or intake of fruits and vegetables by the children. Another study of seven school-based nutrition intervention studies showed a net increase of 0.45 servings of fruits and vegetables per student (Howerton, et al., 2007).

Fortunately, many of the individual activities that are sometimes a part of F2S programs, such as school gardens, have been researched outside of the F2S context to identify any possible public health implications, including their impacts on nutrition knowledge, food preference, and dietary behaviors. So what do we know?

School Gardens

A review of 11 gardening studies conducted between 1990 and 2007, five of which were school-based involving children ages 5-15, showed mixed results of the impact of gardening on produce consumption (Robinson-O'Brien et.al., 2009). Of the four studies that looked at actual changes in fruit and vegetable intake, three found evidence of increases. Of the six studies that considered fruit and vegetables preferences, two showed increased preferences. Of the three studies that examined willingness to taste fruits and vegetables, two reported increased willingness to taste. Furthermore, garden education programs have been shown to improve attitudes toward fruits and vegetables for second through fifth graders (Nolan, 2006).

More recent research has provided reason for optimism. A 12-week pilot intervention for fourth to sixth graders through a

summer YMCA program showed improvements in the number of fruits and vegetables “ever eaten,” vegetable preferences, and fruit and vegetable asking behavior at home (Heim et al., 2009). A 28-week study of second graders in a school setting showed that the youth involved in gardening and nutrition education in the classroom were more likely to choose and consume vegetables in the cafeteria compared to the control group and the group who just received classroom nutrition education (Parmer et al., 2009). The group that participated in gardening also showed improved nutrition knowledge and taste ratings compared to the control group.



Vermont Food Education Every Day (VT-FEED)

While the positive nature of the results of these studies are cause to celebrate, study limitations prevent conclusive statements from being made. Limitations include problems such as small samples sizes, lack of long-term follow-up, convenience samples, and absence of control groups.

School lunch option, taste tests, classroom nutrition education

School-based interventions to improve dietary intake often incorporate more than one approach, including some combination of classroom nutrition education, tastes tests in the classroom or cafeteria, and/or different food choices available in the cafeteria. Any of these approaches have the potential to improve children’s diets. Given the current U.S. dietary goals to improve children’s suboptimal intake of fruits and vegetables, much of the recent research on the impacts of school food interventions has examined produce consumption.

A summary of F2S evaluations completed by the Community Food Security Coalition in 2008 (Joshi and Azuma, 2009) reported that seven studies showed students who participated in F2S programs were offered more fruits and vegetables in the cafeteria than prior to F2S, and they subsequently chose

them. One study in this review reported that, on salad bar days, approximately 85% of students selected fruits and vegetables, and, on average, 49% of the fruits and vegetables that were served at the salad bar were consumed. Additionally, fruits and vegetables selected by students from the salad bar were 80-90% unprocessed, while hot lunch fruits and vegetables selected were only 10-20% unprocessed (Feenstra and Ohmart, 2004). Similar studies in Compton, California showed that students choosing foods from F2S salad bar lunches selected between 90 and 140% of USDA recommended servings of fruits and vegetables, while just 40-60% of the recommended servings were met through hot lunch choices, with both groups taking close to the recommended amounts of proteins and grains (Feenstra and Ohmart, 2005).



Across the nation, salad bar lunches consistently offer nearly twice the recommended daily servings of fruits and vegetables than hot lunch options provide (Feenstra and Ohmart, 2004).

In Oregon, the average servings of fruits and vegetables taken by students after a salad bar program had been implemented as part of F2S rose from 1.24 to 2.26 (New on the Menu, 2006). In Los Angeles schools, students self-report eating an average 4.09 daily servings of fruits and vegetables when participating in salad bar lunch projects, compared to 2.97 daily servings prior to the introduction of the salad bar (Slusser et al., 2007). Those students selecting the salad bar also reported consuming fewer daily total calories, cholesterol and fats. Parents surveyed in Pennsylvania reported their children receiving F2S interventions opted for healthier foods, specifically noting they were eating fewer foods high in fats and salt (Food Trust, 2007).

As a boon to school lunch programs, F2S programs consistently show increases (between 4 and 16%) in school meal participation rates (Feenstra and Ohmart, 2006; Center for Food and Justice, 2006; Flock et al., 2003). Furthermore, one California school meal cost analysis showed that participation

rate increases of merely 8% or more can offset additional costs of labor related to a F2S salad bar program (Center for Food and Justice, 2006).

Little research exists describing the effect on student behavior of taste tests within F2S. Anecdotally speaking, taste tests can introduce students to nutritious food choices and provide opportunities for learning about what makes food healthy while allowing food service providers to assess the feasibility of serving those foods.

Clinical taste test research conducted in the United Kingdom demonstrated that daily exposure (eight times) to a vegetable through taste tests led to increased preference for that vegetable compared to reward methods, and when compared to control groups (Wardle et al., 2003). Taste tests held in the school setting in Burlington, Vermont have led to integrating new, healthy food items into school lunch menus, including pesto pasta and pesto pizza, chicken Caesar salads, minestrone soup, and granola-yogurt parfaits (Croom et al., 2004).

Studies have also shown benefits of transferring education from the cafeteria into the classroom. Classroom-based nutrition education programs yielded slight increases in fruit and vegetable consumption among students from 0.2 to 0.99 servings/day (Knai et al., 2006; Stable et al., 2005). A comparison of classroom-based nutrition education and hands-on gardening activities for fourth-grade students showed “a significant and lasting increase in knowledge and preference for vegetables among students who received nutrition education and those who participated in nutrition education combined with gardening, as compared to a control group” (Morris and Zidenberg, 2002).

Farm-to-School and Behavior Change Theory

A current best practice in the field of nutrition education is to develop theory-based interventions that target what we know to be the key underlying factors that influence health behavior. The Social Ecological

Model describes five levels of influence on health-related behaviors and conditions that might be considered (Contento, 2007). The five levels are intrapersonal, interpersonal, institutional, community, and public policy. There are multiple theories that address how change might happen at each of these levels of influence. However, some theories or models are particularly suited for certain types of interventions.

The Social Cognitive Theory, although primarily focused on the “interpersonal” sphere of influence, also encompasses factors that have to do with the intrapersonal, institutional and community levels as well. The Social Cognitive Theory has frequently been used as the framework around which youth-related food and nutrition interventions are designed because of: 1) its emphasis on approaches that are important to youth, such as “positive reinforcement,” and; 2) its applicability to public health issues. It is, therefore, a good fit for considering the factors associated with F2S impacting student food-related decision-making and behavior.

In its most distilled form, Social Cognitive Theory addresses the relationship among three factors that have to do with how people acquire and maintain health-related behaviors: the environment, personal characteristics, and personal experience (Baranowski et al., 1997). The theory indicates that these three factors operate in a reciprocal manner, with each influencing the others. These factors are translated into a number of specific constructs which can help shape the components of an intervention. For example, an intervention built on the Social Cognitive Theory might incorporate a changed environment (institutional and community level), positive reinforcements for new behaviors (intrapersonal level), and opportunities to build or enhance behavioral capability (intrapersonal level), self control (intrapersonal level), and self efficacy, such as through modeling (interpersonal level).

In Vermont, much of the F2S work has been initiated or supported by the VT FEED program, which encourages schools to promote F2S and approach school change through the “three C’s,” i.e., classroom,

cafeteria, and community. Schools with the most comprehensive programs that incorporate all “three C’s” would likely touch upon the intrapersonal, interpersonal, and community spheres of influence addressed in the theoretical models. Although Vermont F2S interventions were not (consciously) designed around health behavior-change theory, and no research has been identified that considers F2S in this light, this paper will explore how components of Vermont F2S programs do (or do not) address key constructs of the Social Cognitive Theory, and then discuss the likelihood of influencing long-term health behavior change.

To understand the relationship between key constructs of the Social Cognitive Theory and F2S activities, the following list provides a basic definition of the constructs, and how they might apply to dietary behavior change that incorporates more local, healthful foods:

- Behavioral Capability – youth having the knowledge and skills that are necessary to choose and consume a diet that incorporates local, healthful foods;
- Expectations – youth having beliefs about what will be the likely outcomes of consuming a healthful diet that includes local foods;
- Expectancies – youth valuing the results of eating a diet consisting of healthful, local foods;
- Locus of Control – youth’s perception of who holds the control over reinforcement of continuing to consume local, healthful foods;
- Reciprocal Determinism – an interaction between a youth and his or her environment that results in consumption of more healthful, local foods;
- Reinforcement – a youth’s response related to the consumption of local, healthful foods that increase the chance of the behavior being repeated; reinforcement can be provided internally (by oneself) or externally (by another);

VT FEED encourages schools to promote F2S and approach change through the three C’s:

- **CLASSROOM**
- **CAFETERIA**
- **COMMUNITY**

- Self Control or Self Regulation – monitoring and adjustment of personal behaviors (consumption of local, healthful foods) by the youth to gain control;
- Self Efficacy – youth’s confidence in his or her ability to consume local, healthful foods; and
- Emotional Coping Response – how youth deal with the sources of anxiety that surround their consumption of local, healthful foods.

Table 1 provides a description of the types of activities that are often incorporated into F2S programs, and then describes whether each activity takes place in the classroom, cafeteria, or community, and which, if any, of the

constructs of the Social Cognitive Theory are addressed when the activity is carried out.

As noted previously, the activities incorporated into each F2S program are not consistent across programs, making it impossible to draw a conclusion about the extent to which the constructs of the Social Cognitive Theory are addressed through F2S. However, some generalizations can be made by examining Table 1.

First, the types of activities that are part of F2S do touch upon many of the theoretical constructs in the Social Cognitive Theory, and often an activity has the potential to address a number of constructs. Second, and most importantly, F2S programs are likely

Table 1 Matching Social Cognitive Theory to F2S activities

Activity	Classroom, Cafeteria or Community?	Social Cognitive Theory construct
Taste tests	Classroom or cafeteria	Behavioral capability; positive reinforcements; expectancies; self efficacy
Students help design and build school gardens	Outdoor “classroom”	Behavioral capability; self efficacy
Students tend school gardens	Outdoor “classroom”	Behavioral capability; self efficacy
Students help to harvest from school garden or local farm	Outdoor “classroom”	Behavioral capability; self efficacy
Local foods in the cafeteria	Cafeteria	Behavioral capability; self efficacy; locus of control; reciprocal determinism
Nutrition Education in the classroom	Classroom	Positive reinforcements; Expectations; expectancies; self efficacy
“Eat your colors” week	Cafeteria	Expectancies
Salad bar training for students	Cafeteria	Behavioral capability; self efficacy
Breakfast program employing whole fresh foods	Classroom	Reciprocal determinism; locus of control
Teachers model by eating school lunch	Cafeteria	Expectancies
Local farm visits	Community	Reciprocal determinism
In-class food preparation and sharing	Cafeteria	Behavioral capability; expectations; expectancies; self efficacy
Cooking club	Classroom	Behavioral control; expectations; expectancies; self efficacy
Farmers visit cafeteria or classroom on a regular basis	Classroom, cafeteria, community	Expectancies
School sponsored community tasting	Community	Expectancies
Farm-to-School bulletin board	Classroom, cafeteria	Expectations
Students apprentice on local farm	Community	Behavioral control; expectancies; reciprocal determinism; self efficacy
Community celebrations and meals featuring local foods	Classroom, cafeteria, community	Behavioral capability; reciprocal determinism; expectancies; self efficacy

to modify the student's food environment while simultaneously providing opportunities for students to learn through observation of others (modeling) during taste tests, eating in the cafeteria, gardening, and cooking. Together these approaches have great potential to facilitate movement towards the desired dietary change. However, more research is needed to test these assertions.

Less apparent is whether there are any worthwhile approaches, based on the Social Cognitive Theory, that are missing in most F2S programs. A few relevant questions come to mind:

- 1) Is the parent involvement in F2S adequate to enable reinforcement of key messages at home, and thereby help establish a stronger sense of control ("locus of control") in the students?
- 2) Is there enough scientifically founded knowledge about the true "value" of local foods from a nutrition perspective to use the classroom setting to develop expectations and expectancies?
- 3) Are students provided with positive reinforcement for their good choices made in the cafeteria?

Further research that better links F2S with behavior change theory will enable a closer examination of some of these questions.

Discussion

F2S programs that incorporate a number of diverse activities are apt to lead to positive dietary behavior change. However, in the current approach, the likelihood is low that a set of activities in any one F2S program

addresses multiple constructs of the Social Cognitive Theory in a systematic manner. Hence, a more intentional inclusion of diverse activities would likely be beneficial. Additional research on the value of individual components of a F2S program, and the synergistic effect of combining components will help to shape future practices for F2S models.

Despite the current theoretical shortcomings, foods served as part of a F2S program will have nutritional advantages over those served previously if either of the following criteria is met:

- 1) Different types of foods that better meet dietary guidelines are served and selected when F2S is in place, compared to prior to its onset;
- 2) The local foods served are more nutritious than those previously incorporated into school meal programs.

Although local foods are frequently conflated with better nutritional quality, the research to support this claim is currently lacking. Yet another way that students may improve their diets is if they learn to select more wisely from the same options that existed before.

Clearly there remains a need for further research on the potential nutrition and health benefits of participation in F2S. Incorporation of a theoretical framework such as the Social Cognitive Theory framework suggested here provides the opportunity to provide a more robust body of knowledge around the effects, and the factors influencing these effects for youth, of F2S programs.

There remains a need for further research on the potential nutrition and health benefits of participation in F2S.

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Center for Rural Studies
206 Morrill Hall
University of Vermont
Burlington VT 05405
Tel: (802) 656-3021
E-mail: crs@uvm.edu

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