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A cafeteria-based tasting program improved elementary school children's fruit preferences and self-efficacy to consume fruits and vegetables

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A CAFETERIA-BASED TASTING PROGRAM IMPROVED ELEMENTARY SCHOOL CHILDREN'S FRUIT PREFERENCES AND SELF-EFFICACY TO CONSUME FRUITS AND VEGETABLES

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ABSTRACT

This quasi-experimental study examined the impact of a fruit and vegetable (FV) tasting program on third and fifth grade children's preferences and psychosocial factors associated with FV intake. Four public schools in southeastern Louisiana participated. Two schools served as the intervention group where children were given a taste of four fruits or four vegetables on a rotating schedule for eight weeks followed by two weeks of tasting four months post-intervention (follow-up). Two control schools did not participate in tasting but received brightly colored FV posters which were posted in the cafeteria each week. A questionnaire administered at baseline, post-intervention, and after follow-up tastings assessed 38 FV preferences, self-efficacy, social norms, and outcome expectations for FV consumption. 161 children (52% third graders) who tasted fruit at least eight times and vegetables at least 20 times during the 8-week tasting program were included in the analysis. Significant differences were observed between the intervention and control groups toward preferences for less common ($p=0.03$) and common fruits ($p=0.02$). In the intervention group, preference for less common fruits such as apricots, avocados, cantaloupe, kiwi, mangos and papaya increased from baseline to post-intervention ($p=0.04$) and from baseline to follow-up ($p=0.01$). Children demonstrated greater self-efficacy to consume FV from baseline to follow-up ($p=0.01$) in the intervention group but no changes were observed in the control group. These findings suggest that a FV tasting program positively impacts fruit preferences and self-efficacy to consume FV.

CHAPTER ONE

INTRODUCTION

The current food environment in the United States exposes children to highly palatable foods that are rich in calories, sugar, fat and salt, and low in fiber (Hill & Peters, 1998). This situation makes it difficult to foster a preference for nutrient-dense high fiber foods such as fruits and vegetables (FV) (Bowman et al., 2004; World Health Organization (WHO), 2003). Teaching children to like FV is critical because it has been shown that children with higher preferences for FV are less likely to be categorized as overweight or obese when compared to children with lower FV preferences (Lakkakula et al., 2008).

Children's food preferences are strongly associated with their food intake (Domel et al., 1996; Drewnowski, 1997; Resnicow et al., 1997). Higher FV consumption has been shown to improve health and reduce risk for obesity and other chronic diseases (Epstein et al, 2001; WHO, 2003). Hence, food preferences and intake of FV can play an important role in preventing childhood obesity (Ludwig et al., 2001; Ricketts, 1997). Factors that impact food preferences and intake include sensory preferences (Perez-Rodrigo et al., 2003), social environment (Addessi et al., 2005), marketing (Cornwell & McAlister, 2011), accessibility, and parental behavior (Wardle & Cooke, 2008).

Schools play an essential role in shaping the social environment and influencing children's eating habits (Pilant, 2006). Children have shown increased knowledge of healthy nutrition practices and self-efficacy to consume FV (Tuuri et al., 2009) along with increased liking for vegetables (Lakkakula et al., 2010) and greater FV intake (Baranowski et al., 2000) after participating in school-based nutrition interventions. Most of these health promotion programs have been based on the Social Cognitive Theory (SCT) (Bandura, 1997).

The SCT is a learning theory which illustrates how behaviors are learned. SCT explores the reciprocal interactions between personal factors, the environment around a person and human behavior. It specifies a core set of determinants, the mechanism through which they work, and the optimal way of translating this knowledge into effective health practices (Bandura, 2004). These core values include knowledge of the health risks and benefits of different health practices, perceived self-efficacy, outcome expectations and social norms (Bandura, 2004).

This school-based intervention was based upon the SCT and was designed to provide repeated opportunities for third and fifth grade children to taste FV and experience modeling of positive health behaviors. The purpose of the present study was to evaluate the effectiveness of a FV tasting program offered in the school cafeteria during the regularly scheduled lunch period on increasing and maintaining FV preferences and psychosocial variables associated with children's FV consumption. In addition, this study examined the association between the FV preferences of third and fifth grade children and their risk of being overweight or obese.

Justification

Most studies conducted in European countries and the United States have focused on preschool-aged children and have shown that exposure to FV through tasting increased liking for these items (Skinner et al, 2002; He et al, 2009). However, there has been little research examining the impact of a FV tasting program on FV preferences and psychosocial variables associated with consuming these items among elementary aged children conducted in a school-based environment. Furthermore, many intervention programs have not been designed to have a comparable control group.

The present study utilized a quasi-experimental design with schools assigned to either an intervention or control group and incorporated a validated survey instrument based on the

constructs of the SCT. Preferences for a variety of FV and self-efficacy, social norms and outcome expectations to consume FV were compared between children in the intervention and control groups. It was anticipated that after participating in the program, preferences for FV would increase and be maintained. The results from this study will provide useful information to parents, researchers and policymakers including the United States Department of Agriculture Child Nutrition Program as they work to improve the current food environment and encourage FV consumption by elementary school children.

Research Question

What is the immediate and long-term impact of a school cafeteria-based FV tasting program on low-income public elementary school children's FV preferences?

Hypotheses

1. Third and fifth grade children in the intervention group will report increased preferences for FV at the end of the 8-week FV tasting program and will maintain higher preference scores for FV 12-weeks following the intervention when compared to third and fifth grade children in the control group.
2. Third and fifth grade children with higher preference scores for FV will be less likely to be categorized as overweight or obese than children with lower preferences for these foods.

Assumptions

- The children will understand the survey questions and be able to follow instructions.
- The children will be honest in their responses.
- Children will be willing to participate in tasting.

Limitations

- The four schools will not be randomly assigned to the intervention or control groups.
- The results of the present study, to be conducted with low-income public elementary school students in the southern United States, will not be generalizeable to other regions and socio-economic groups in the United States.
- The self-reported data will be limited by the honesty and truthfulness of the children's responses to the questionnaire items.

Definitions

- Body Mass Index (BMI) is an anthropometric measure defined as one's weight in kilograms divided by the square of one's height in meters (Centers for Disease Control and Prevention, 2010).
- The BMI-for-age percentile is used with children and teens to assess the status of being underweight, healthy weight, overweight, or obese (Centers for Disease Control and Prevention, 2010). The BMI-for-age percentile is used to interpret BMI because BMI is both age-and sex-specific for children and teens. The following categories are used to define weight status:
    - Underweight: BMI-for-age $< 5^{th}$ percentile
    - Healthy weight: BMI-for-age 5^{th} percentile to $<85^{th}$ percentile
    - Overweight: BMI-for-age 85^{th} percentile to $< 95^{th}$ percentile
    - Obesity: BMI-for-age $\geq 95^{th}$ percentile
- Social Cognitive Theory (SCT) describes a dynamic, ongoing process in which personal factors, environmental factors, and human behavior influence each other. According to

the SCT, the following three main factors affect the likelihood that a person will change a health behavior (Bandura, 1997):

- Self-efficacy: The belief that one is able to control challenging environmental demands by means of taking adaptive action (Bandura, 1997)
- Outcome expectations: One's perceptions of the possible consequences of one's own actions (Bandura, 1997)
- Social norms: The rules used to define appropriate and inappropriate values, beliefs, attitudes, and behaviors for a particular group (Bandura, 1997)

CHAPTER TWO

LITERATURE REVIEW

Today's obesegenic food environment encourages the development of food preferences that are high in sugar, fat, salt and calories (Hill & Peters, 1998; Cornwell & McAlister, 2011). This situation makes it difficult to encourage children to develop preferences for fiber- and nutrient-dense foods like FV (Bowman et al., 2004; Cornwell & McAlister, 2011). Studies have shown that food preferences and patterns of food consumption developed in childhood persist into adulthood (Nicklaus et al., 2004; Skinner et al., 2002). Hence, teaching children to prefer FV and other nutrient-dense foods is essential. Children's FV preferences are strongly associated with their FV consumption (He et al., 2009; Perez-Rodrigo et al., 2003; Wardle & Cooke et al, 2003) and higher FV consumption is linked to reduced risk of obesity and other chronic diseases (Riboli & Norat, 2003; WHO, 2003).

Wang and colleagues (2002) found that the percentage of overweight and obese children in the United States has increased by three-fold in the past three decades. According to the 2007 National Survey of Children's Health, 35.9% of children in Louisiana between 10 and 17 years were overweight or obese (CHMI, 2011). Furthermore, Healthy People 2010 reported that only 26% of children aged 6 to 11 years old consumed two or more serving of fruits daily and 24% of girls and 27% of boys in the same age group consumed at least three servings of vegetables each day (USDHHS, 2000). However, Skinner et al (2002) found that the foods most preferred by children were French fries, chocolate, pizza, cake and ice cream which are all rich in energy and low in nutrient value. The combination of eating too many foods high in fat, sugar, salt and energy and the underconsumption of FV may promote overweight and obesity among children.

In order to reduce the prevalence of childhood obesity, parents, health professionals and policy-makers should help children learn to increase their preferences for low calorie, water-rich and nutrient-dense FV. Unfortunately, many children may not be exposed to an environment that encourages the shaping of preferences for and consumption of these foods. Lack of accessibility to FV in the home may lead to unfamiliarity with these foods and their underconsumption (Bere & Klepp, 2005; Drewnowki, 2007; Larson, Story & Nelson, 2009). Meanwhile, children have access to FV through the National School Lunch Program and FV are required to be served at every meal. Furthermore, there is a strong relationship between self-efficacy and health behavior change and maintenance (Strecher et al, 1986). Helping children improve psychosocial variables such as self-efficacy, social norms and outcome expectations may promote positive health behavior changes and increased consumption of FV.

Food Preferences

Food preference is defined as the selection of one food item over another item (Birch, 1999). Food preference plays a critical role in food selection (Loewen & Pliner, 1999; Wardle & Herrera et al, 2003) and can predict eating habits of individuals (He et al, 2009; Perez-Rodrigo et al, 2003). Food preferences are learned through tasting a food instead of just viewing a picture or talking about the item (Loewen & Pliner, 1999). An individual's food preferences are usually established as early as 3 years of age and the ability to accept new foods increases as children grow older (Skinner et al, 2002). The characteristics of foods that are typically preferred by young children include sweetness, saltiness, and high fat content. (Nisbett & Gurwitz, 1970; Beauchamp & Moran, 1985). Taste preference and food choices are thought to be influenced by age, maturation and hormonal status (Drewnowski, 1997).

The consumption of FV can be inhibited by food neophobia which is the fear of consuming new foods (Birch, 1999). Studies have shown that food neophobia declines from early childhood to adulthood (Koivisto & Sjodén, 1996; Pliner & Loewen, 1997). Food neophobia can be overcome after repeated taste exposures; therefore repeated tasting of foods particularly new FV, may be important to eliminate neophobia and increase children's preference (Pliner & Loewen, 1997). A previous study (Wardle & Cooke et al, 2003) with two- to six-year-old children showed that the exposure group, who completed a minimum of 10 out of 14 tasting sessions of the targeted vegetable daily (carrots, cucumbers, tomatoes, celery, green peppers and red peppers) increased their liking for the test vegetables compared to children who received only written and verbal information. Also, Wardle, Herrera and colleagues (2003) conducted another study to assess if providing rewards would increase preferences for FV in children aged 5 to 7 years. In this study, the exposure group and reward group were offered tastes of sweet red peppers for eight sessions. The children in the reward group received stickers if they tasted the peppers. Results showed that the preferences of both groups for sweet red peppers increased significantly compared to the control group but there was no difference in sweet red pepper preference between the exposure and reward groups (Wardle & Herrera et al, 2003). In a recent school-based cafeteria intervention, Lakkakula and colleagues (2011) were able to achieve increased liking for targeted FV in a group of elementary school children by seeking the child's personal opinion about the targeted item's taste.

A Canadian study focused on increasing healthy food consumption in 10 to 14 year-old children by offering free FV snacks in the classroom during school hours (He et al, 2009). Children were divided into one of the following groups: (1) received both free FV snacks and enhanced nutrition education, (2) received only free FV snacks and (3) served as a control group.

The intervention program lasted 21 weeks and the free FV snacks were offered based on three week rotations (1st week- carrot sticks, broccoli florets and unsweetened applesauce cups; 2nd week- celery sticks, cauliflower florets and whole pear fruit cups; 3rd week- tri-colored peppers, sliced apples and peach cups). Higher consumption of FV was observed among children who received both free FV snacks and enhanced nutrition education compared to children in the control group. FV preferences among children in both intervention groups shifted from 'never tried' to 'like' for the following tasted items: cauliflower, applesauce and peach cup.

Insight provided by these intervention studies suggests that repeated exposure to novel foods leads to increased preference for previously rejected items (Wardle & Cooke et al, 2003; Wardle & Herrera et al, 2003; He et al, 2009). Repeated exposure to FV has the potential to increase children's familiarity with and preferences for these foods (Wardle & Herrera et al, 2003). Interventions designed to improve preference for FV have the potential to positively impact children's FV consumption (Perez-Rodrigo et al, 2003).

Social Cognitive Theory

Behavioral change strategies to help children eat more FV are likely to be more successful if they are based upon the concepts of an established and appropriate health promotion theory. Dietary interventions directed at school-aged children have used the Social Cognitive Theory (SCT) to achieve positive behavior change. The SCT explores the reciprocal interactions between personal factors, the environment around a person and human behavior (Bandura, 1986). The conceptual model, summarized in Figure 1, includes personal and environmental factors and behavior. Examples of personal factors include taste preferences and self-efficacy to make healthy food choices and develop positive attitudes. The social and physical environments describe environmental factors. Within the social environment are influences such as family,

friends and peers. Social influences and physical structures within the environment may influence human expectations, beliefs and cognitive competencies (Bandura, 1986). Children may easily convey information about FV consumption and change their self-beliefs through factors like modeling, instruction and social persuasion. At the same time, observational learning occurs when children watch their peer's behaviors (i.e. consume FV) and the reinforcements associated with the behaviors.

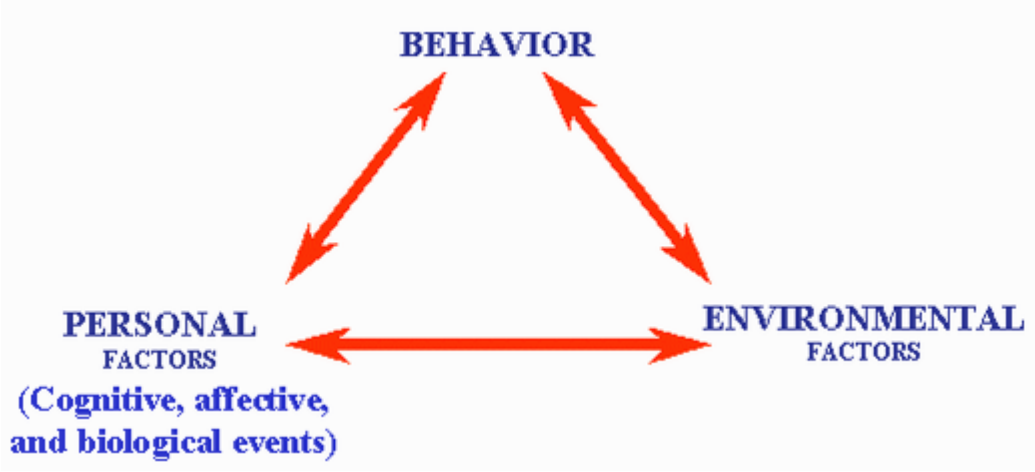


Figure 1. Conceptual model of Social Cognitive Theory (Pajares, 2002).

According to this theory (Bandura, 1986), eating is a behavior that may be explained and predicted by several key concepts including self-efficacy and outcome expectations. It is believed that "skills provide the capability to perform the behavior; outcome expectations provide the motivation for the behavior and self-efficacy provides the confidence that barriers can be overcome" (Baronowski, 1990). Hence, when a person has a high level of self-efficacy or confidence that he/she can perform a new behavior such as consuming FV, change is likely to occur (Bandura, 1986). An individual's self-efficacy and outcome expectations are also influenced by their social norms. Social norms are defined as the rules that determine what is considered to be right and wrong as well as the beliefs and behaviors of a particular group of individuals (Bandura, 2004). Behavior changes made by an individual are highly associated with

what people in the surrounding social environment identify as normal (Resnicow et al, 1997). The relationship of self-efficacy and outcome expectations with behavior changes is summarized in Figure 2 below (Bandura, 2004).

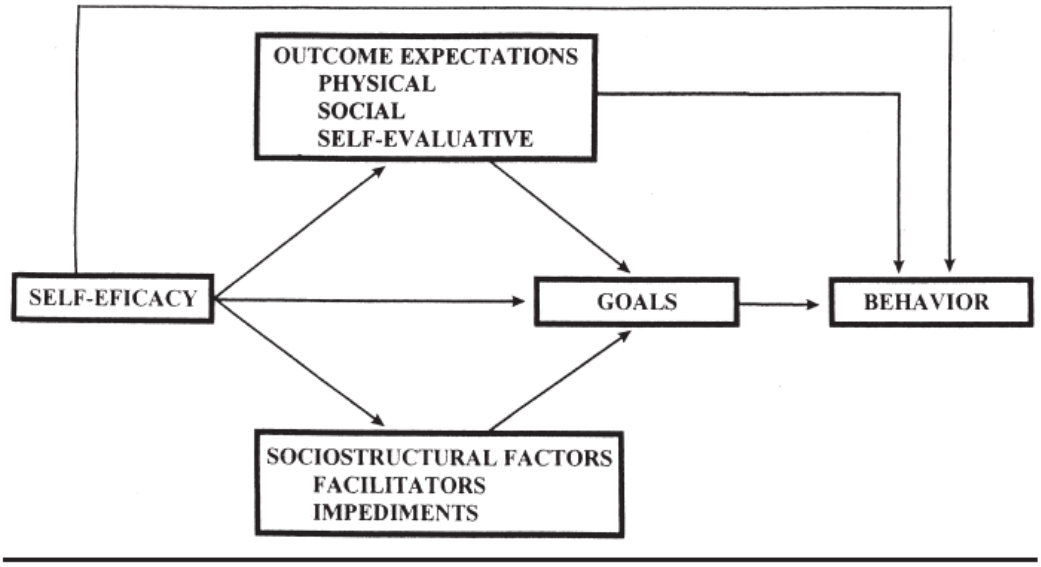


Figure 2. Structural paths of influence wherein perceived self-efficacy affects health habits both directly and through its impact on goals, outcome expectations, and perception of sociostructural facilitators and impediments to health-promoting behavior (Bandura, 2004).

School-based Nutrition Intervention

Bandura (2004) noted that schools can play an important role in promoting the nutritional health of a nation. Schools provide a natural setting where children can be easily accessed. In 2009, more than 31.3 million children in the United States received lunches through the National School Lunch Program (USDA, 2011). More importantly, children who participate in the National School Lunch Program have access to FV. School nutrition interventions based upon the concepts of the SCT have shown promising results in changing children's self-efficacy to consume fruits, juices and vegetables (Baronowski et al, 2000; Tuuri et al, 2009) and positively impact their nutrition behavior (Baronowksi et al, 2000; Perry et al, 2004).

The 5-a-Day Power Plus program was a 2-year multi-component school-based intervention that aimed to increase FV consumption (Perry et al, 2004). Fourth and fifth grade students in 20 schools (10 interventions and 10 controls) participated in the study. The program consisted of a behavioral classroom curriculum, parental involvement, a food service intervention (e.g. increased FV variety and choices) and industry support (FV tasting, home snack packs and provided FV variety). There was a significant increase in lunchtime FV servings consumed ($p< 0.05$) by the children who participated in the intervention. However, based upon children's 24-hour food records, only fruit intake in the intervention schools was significantly higher ($p=0.02$). Vegetables consumption did not change.

Gimme 5 was another intervention designed to impact FV consumption and psychosocial variables associated with FV intake among children in the fourth and fifth grades (Baronowki et al, 2000). A FV promotion curriculum, newsletters, videotapes and point-of-purchase education were included in the 3-year program. The point-of-purchase component was intended to educate and give the students opportunities to select and prepare fresh FV from fast food and grocery store venues. Sixteen schools participated in Gimme 5 and each of the schools were paired based on size, percentage of students receiving free or reduced lunch, and percentage of annual student turnover. The schools were then randomly assigned to intervention and control groups. Data were collected at baseline, mid-study (1.5 years), and post-intervention (3 years). Children in the intervention schools demonstrated a trend for increased weekday lunchtime FV consumption ($p=.07$) and improved social norms ($p=.06$) related to eating FV and increased self-efficacy to consume FV ($p=.05$).

Smart Bodies was a similar multi-component school-based nutrition intervention (Tuuri et al, 2008). The objective of Smart Bodies was to increase fourth and fifth grade children's

knowledge of healthy nutrition practices, FV preferences and psychosocial variables associated with FV intake. It provided an interactive wellness exhibit and classroom curriculum for a 12-week period. Sixteen schools were matched based on student standardized test scores, percentage of students eligible to receive free or reduced-price lunch and school size. Schools were randomly assigned to receive either the treatment or serve as control schools. Fourteen schools were included in the final data analysis. Results showed that nutrition knowledge gained increased significantly from baseline to post-intervention ($p<0.05$). At the same time, children expressed greater confidence that they could consume green salad, vegetables and carrot or celery sticks ($p=0.00$).

Students spend many hours each day at school and consume at least one meal per day at school. Therefore, schools offer a suitable environment where students can learn to like, prefer and consume FV. Intervention programs offered at school and promoted by teachers and staff can provide an effective way to increase children's acceptance of nutrient-rich FV and have the potential to change behavior and improve children's diets.

CHAPTER THREE

A CAFETERIA-BASED TASTING PROGRAM IMPROVED ELEMENTARY SCHOOL CHILDREN'S FRUIT PREFERENCES AND SELF-EFFICACY TO CONSUME FRUITS AND VEGETABLES

Introduction

Today's food environment in the United States can be described as "obesigenic" due to the unlimited supply of inexpensive and highly palatable foods that are high in energy density and sugar, fat and salt (Hill & Peters, 1998). This situation makes it difficult to foster a preference for foods such as fruits and vegetables (FV) in children (Bowman et al, 2004; WHO, 2003). Teaching children to like FV is important because it has been shown that children with higher preferences for FV are less likely to be categorized as overweight or obese when compared to children with lower FV preferences (Lakkakula et al, 2008).

Children's food preferences are strongly associated with their food intake (Domel et al, 1996; Drewnowski, 1997; Resnowski et al, 1997). Hence, food preferences and food intake learned during childhood have the potential to reduce obesity-related diseases later in life (Ricketts, 1997; Ludwig, Peterson & Gortmaker, 2001). Factors that impact food preferences and intake include: sensory preferences (Perez-Rodrigo et al, 2003), social environment (Addessi et al, 2005), accessibility, (Bere & Klepp, 2005) and parental behavior (Wardle & Cooke, 2008).

Repeated exposures have been shown to reduce food neophobia which is the fear of consuming new foods, and increase willingness to taste (Loewen & Pliner, 1999; Taylor & Binns, 2003), like (Wardle & Herrera et al, 2003; Lakkakula et al, 2010; Wardle & Cooke et al, 2003; Taylor & Binns, 2003), prefer (He et al, 2009, Wardle & Herrera et al, 2003; Wardle & Cooke et al, 2003) and subsequently consume unfamiliar foods such as FV (He et al, 2009; Wardle & Herrera et al, 2003; Wardle & Cooke et al, 2003). Studies suggest that eight to nine

exposures are necessary to increase liking for vegetables in pre-schoolers (Wardle & Herrera et al, 2003; Wardle & Cooke et al, 2003) while two to nine tastes are required to observe a change in FV liking in elementary school children (Lakkakula et al, 2010; Taylor & Binns, 2003; Lakkakula et al, in press). In a recent school-based cafeteria intervention, Lakkakula et al (in press) reported that children's liking for fruits increased after an average of two tastes and liking for vegetables increased after an average of five tastes. Greater liking of FV by children is thought to be associated with increased preference and intake of these items (He et al, 2009; Wardle & Herrera et al, 2003; Taylor & Binns, 2003).

Schools play an essential role in shaping the social environment and influencing children's eating habits (Pilant, 2006). School theory-based nutrition interventions have been successful at increasing knowledge of healthy nutrition practices and self-efficacy to consume FV (Tuuri et al, 2009), increasing liking for vegetables (Lakkakula et al , 2010; Taylor & Binns, 2003; Lakkakula et al, in press), and improving FV intake (He et al, 2009; Baranowski et al, 2000). A major contributing factor to the success of these behavior interventions has been the fact that they were developed using an appropriate theoretical model (Glanz, Rimer & Lewis, 2002).

One such, behavior theory, Social Cognitive Theory (SCT) explores the reciprocal interactions between personal factors, the environment around a person and human behavior (Bandura, 1997). It specifies a core set of determinants, the mechanism through which they work, and optimal ways of translating this knowledge into effective health practices (Bandura, 2004). The focus of SCT is to understand how an individual functions cognitively within his or her social experiences and how it affects future behavior and development (Bandura, 1997). A school-based FV tasting program has the potential to support the self-efficacy component of SCT

by approaching behavior change in small steps (Glanz, Rimer & Lewis, 2002). Repeated exposure to FV in a familiar setting (i.e, cafeteria) and among peers, thus increases the likelihood that children will learn to prefer FV and begin to consume them.

The primary objective of this study was to examine the impact of a one-year elementary school cafeteria-based tasting program on low-income children's preferences for FV. Additionally, the study examined whether children's FV preferences were associated with an increased risk of overweight or obesity. It was hypothesized that, after 8-weeks of tasting, third and fifth grade children would report increased preferences for a variety of FV and would maintain higher preferences 12-weeks following the intervention compared to third and fifth grade children in the control groups. In addition, it was anticipated that third and fifth grade children with higher preference scores for FV would be less likely to be categorized as overweight or obese.

Methods

A one-year quasi-experimental intervention called "Building Preferences for Fruits and Vegetables" was conducted in four low-income public elementary schools in southeastern Louisiana. Prior to the beginning of the study, permission was secured from the school system superintendent and principals and recruitment material and consent forms were sent home to parents of third and fifth grade students. Children whose parents provided consent for them to take part in food tasting and who gave personal assent to participate were included in the study. The program was approved by the Louisiana State University Agricultural Center (LSU AgCenter) Institutional Review Board.

The study began in the fall of 2009 when two schools were selected to receive the intervention and two were chosen as control schools. Children in the intervention schools

participated in a FV tasting program while children in the control group were exposed to a variety of brightly colored posters promoting FV which were hung in the school cafeteria on a weekly basis. Out of 259 eligible children, 216 students (intervention group n=171) completed questionnaires asking their preferences for 38 FV, self-efficacy, social norms and outcome expectations for FV consumption at baseline, post intervention and 12 weeks post-intervention (follow-up). The questionnaire had been previously designed and validated with a similar population (Tuuri et al, 2009; Marsh, Cullen & Baranowski, 2003). A Likert-type response scale was used to evaluate children's responses. All the surveys were administered to the participants in the classroom during the time allotted by the school principals.

Children's height and weight were measured at baseline under the supervision of the school nurses. Children removed their shoes and bulky clothing. Portable stadiometers (Shorr Productions Inc. Olney, MD) were used to measure the standing height of participants. Children stood with feet flat, together and against the wall and looked straight ahead with their line of sight parallel to the floor. A flat headpiece with a right angle was lowered until it firmly touched the crown of the head. Height was recorded by the nearest $1/8^{th}$ inch and adjusted for hair ornaments and braids. Digital scales (Seca 880, Seca Co. Hanover, MD) were used to measure body weight. Prior to each measurement session, the scales were calibrated using two 5-kg standard weights. Children were asked to stand with both feet in the center of the scale. The weight was then recorded to the nearest decimal fraction. The participant's gender-specific BMI-for-age percentile was determined from their height and weight. Children were categorized into groups according to the Centers for Disease Control and Prevention (CDC) classifications: underweight, healthy weight, overweight and obese (29). Children who were underweight (BMI-

for-age percentile < 5th percentile) (n=4) were not included in the comparison of weight status with FV preference score.

After the baseline measurements were collected, participants in the intervention schools began the 8-week FV tasting program. Children were asked to taste four vegetables (bell peppers, carrots, peas, and tomatoes) and four fruits (apricots, cantaloupes, peaches, and pears) twice a week in the school cafeteria during the lunch period. Tasting began with vegetables followed by fruits on alternating weeks. At each tasting session, participants indicated on a short survey if they tasted the fruits or vegetables offered. In order to examine a group of children with sufficient tasting exposure (Lakkakula et al, in press), only those who tasted each of the four fruits an average of two times and each of the four vegetables an average of five times were included in the analysis.

Data Analysis

The data were examined using Statistical Analysis Software (SAS, Version 9.1.3; Cary, NC, 2003). Gender, grade and weight status were evaluated using descriptive statistics. The internal validity of each of the four constructs within the FV questionnaire was examined using Cronbach's alpha tests. Subsequently, factor analysis with a varimax rotation was used to identify underlying patterns in the data. Mixed-model analyses of variance (PROC MIXED) evaluated change in children's FV preferences and psychosocial variables associated with FV consumption with the three study phases (baseline, post-intervention and follow-up). Using multi-level modeling, fixed effects included treatment, test, gender, grade, race/ethnicity, school and children and the random effect was school. To examine differences between and within groups in each factor, a post hoc analysis with a Tukey-Kramer adjustment of the least square means for each factor was conducted. The level of significance was set at $p < 0.05$.

Results and Discussion

Of the 216 eligible children (who completed all three questionnaires), 75% of them (n=161) reported tasting the fruits at least eight times and vegetables at least 20 times during the 8-week tasting program. Fifty-two percent of the children (n = 83) were in the third grade and 48% (n = 78) were boys. Participants included 57% (n=91) White, 39% (n=63) Black, 2% (n=4) Hispanic, one Asian and two who identified themselves as "Other" (race-ethnicity which included bi-racial backgrounds and races not listed) children. As shown in Table 1, the participants' grades and gender were similar between the intervention and control groups.

Table 1. Participant Demographics

	Intervention (n=116)	**Control** (n=45)
Grade		
Third	58	25
Fifth	58	20
Gender		
Boy	63	15
Girl	53	30
Ethnicity		
White	66	25
Black	45	18
Hispanic	3	1
Asian	1	0
Other	1	1

A reliability score of ≥ 0.7 was considered to be acceptable (Cooper, 1983) for the survey questions describing fruit preferences, vegetable preferences, self-efficacy and positive outcome expectations to consume FV (Table 2). The four items examining negative outcome expectations and four questions about social norms were considered to be unreliable measures of behavior because the Cronbach's alpha test scores were below 0.7. Therefore, the eight questions were not included in further data analysis.

Factor analysis (PROC FACTOR) was conducted on the survey items describing fruit preferences, vegetable preferences, self-efficacy and positive outcome expectations. Fruit preferences clustered into four factors, vegetables preferences grouped into five factors, self-efficacy to consume FV clustered into three factors and positive outcome expectations grouped into two factors. Rotated factor matrix items with loading scores ≥ 0.4 were correlated with the given factor.

Fruit preferences with four factors explained 67% of the variance. Less common fruits such as apricots, avocados, cantaloupe, kiwi, mangos and papaya were included in Fruit Preference Factor 1. Preference Factor 2 included bananas, peaches, pineapple, strawberries and watermelon. Preference Factor 3 included oranges, plums and tangerines. Preference Factor 4 included common fruits like apples and grapes.

A five-factor vegetable preference explained 59% of the variance. Vegetable Preference Factor 1 included bell peppers, broccoli, celery, cabbage, lettuce, spinach and tomatoes. Baked potatoes, green beans and potato salad were included in Preference Factor 2. Carrots, corn and peas were included in Preference Factor 3. Preference Factor 4 included garlic and onion. Preference Factor 5 included greens and sweet potatoes.

The three factors describing self-efficacy to consume FV explained 63% of the variance. Factor 1 for self-efficacy included the following responses : (1) I think I can drink a glass of my favorite juice for breakfast, (2) I think I can eat a fruit that's served for lunch at school, (3) I think I can eat my favorite fruit instead of my usual dessert, (4) I think I can choose my favorite fruit instead of my favorite cookie and candy bar for a snack, (5) I think I can eat my favorite fruit instead of my usual dessert for dinner, (6) I think I can eat two or more servings of fruit or juice each day. Factor 2 included the following responses: I think I can eat a carrot or celery stick

instead of chips for lunch at home, and choose my favorite raw vegetable with dip instead of my favorite cookies, candy bar and chips for snacks. Lastly, Self-Efficacy Factor 3 responses consisted of: (1) I think I can add fruit to my cereal for breakfast, (2) eat a vegetable that's served and a green salad for lunch at school, (3) eat a big serving of vegetables and (4) a green salad for dinner, (5) eat 3 or more servings of vegetables each day, and (6) 5 or more servings of fruits and vegetables each day.

Table 2. Sample questionnaire items and standardized alpha reliability scores.

Measure	# of items	Response scale	Sample item	Alpha reliability		
				Pre	Post	Follow-up
Fruit preferences	17	a	How much do you like an apple?	0.94	0.91	0.91
Vegetable preferences	21	a	How much do you like a bell pepper?	0.88	0.91	0.90
Self-efficacy	18	b	For dinner, I think I can eat a green salad	0.92	0.94	0.93
Outcome expectations	13	c				
Positive	9	c	If I eat fruits and vegetables every day, I will be healthier	0.84	0.80	0.83
Negative	4	c	If I eat fruits and vegetables every day, my friends will make fun of me	0.52	0.36	0.53
Social norms	4	d	Most kids my age think that eating 2 or more servings of fruit juice each day is a good thing	0.66	0.66	0.67

The possible response scales included the following:

a 1 = I do not like it, 2 = I like it a little, 3 = I like it a lot, 4 = I have never tasted it.

b 1 = I am sure I cannot, 2 = I don't think so, 3 = I am not sure, 4 = I think so, 5 = I am sure I can.

c 1 = I disagree very much 2 = I disagree a little 3 = I am not sure 4 = I agree a little 5 = I agree very much.

d 1 = A very good thing, 2 = A good thing, 3 = Not important, 4 = I don't know.

A two-factor positive outcome expectation explained 54% of the variance. Factor 1 of Positive Outcome Expectations included: if I eat FV every day, I will have a prettier smile and stronger eyes, my friends will start eating them too, I will become stronger and think better in class. Eating FV every day will keep me from getting fat, my family will be proud of me and I will have more energy were included in Factor 2 for Positive Outcome Expectations.

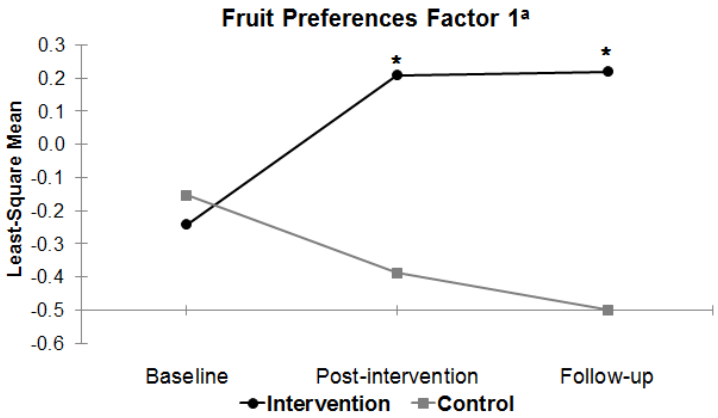


Figure 3. Least square means for Fruit Preferences Factor 1 for intervention and control groups at three time points.
All statistical tests used SAS PROC MIXED with a Tukey–Kramer adjustment.
a Fruit Preferences Factor 1 = Apricots, Avocado, Cantaloupe, Kiwi, Mangos & Papaya (p=0.03)
* Significant difference from baseline to post test (P = 0.04) and baseline to booster (P =0.01).

The school-based cafeteria FV tasting program impacted children's fruit preferences and self-efficacy associated with FV consumption. Significant differences were observed between the intervention and control groups toward preferences for less common (p=0.03) and common fruit items (p=0.02). In the intervention group, preference for less common fruits such as apricots, avocados, cantaloupe, kiwi, mangos and papaya increased from baseline to post-intervention (p=0.04) and from baseline to follow-up (p=0.01) (Figure 3). Fruit preferences for common fruits such as apples and grapes increased among children in the control group (Figure 4). In addition, children in the intervention group reported greater confidence that they could consume fruits, vegetables and salad (Self-Efficacy Factor 3) from baseline to follow-up (p=0.01) (Figure 5).

In this study, 35% of children (n=55) were categorized as overweight/obese (BMI-for-age percentile > 85th percentile) and 65% of children (n=102) were considered to be at a healthy weight (BMI-for-age percentile: 5th to < 85th). No relationship was found between weight status and race, gender or grade at baseline. Participants were categorized into one of two FV preference groups using the individual's mean score of the 38 FV reported in the baseline survey.

Group 1 (mean score 1.0 to 1.9; n = 13) consisted of children who indicated that they did not like most of the FV while Group 2 (mean score 2.0 to 3.0; n=144) included children who reported that they "liked it a little" or "liked it a lot". No associations were observed between preference scores for FV and risk of being categorized as overweight or obese (p=0.9) between these two groups.

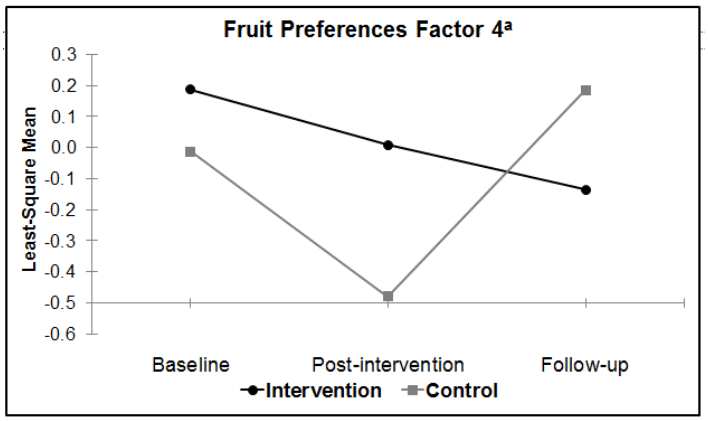


Figure 4. Least square means for Fruit Preferences Factor 4 for intervention and control groups at three time points.
All statistical tests used SAS PROC MIXED with a Tukey–Kramer adjustment.
a Fruit Preferences Factor 4 = Apple and Grapes (p=0.02)

Children's food preferences reflect food items that they will select when given a choice (Birch, 1999) and liking is one of the factors that affects food selection (Drewnowki, 1997; Nestle et al, 1998). Lakkakula et al (in press) found that an average of two tastes of fruits and five tastes of vegetables were necessary to increase liking. Therefore to be included in further analysis, children in the intervention group had to taste at least 28 times. Sixty-eight percent of children in the intervention groups (79% of 3rd graders (n=58) and 70% of 5th graders (n=58)) were included in the study. Similar to findings reported from other studies, preferences for some fruit items increased while preferences for vegetables did not change (Lakkakula et al, 2008; Cooke & Wardle, 2005; Edwards & Hartwell, 2002; Zeinstra et al, 2007; Thomson et al, 2010). This may be due to the innate human tendency to like sweet and salty foods, and reject bitter or

sour foods such as vegetables (Desor, Maller & Andrews, 1975; Nisbett & Gurwitz, 1970). Children in the intervention group, however, when exposed to unfamiliar fruits such as apricots and peaches experienced a shift in preferences and began to prefer the flavor and textures of these less commonly available items. Children in the intervention group reported a small but consistent decrease in preference scores for common fruits such as apples and grapes while children in the control group had a highly variable response toward these items.

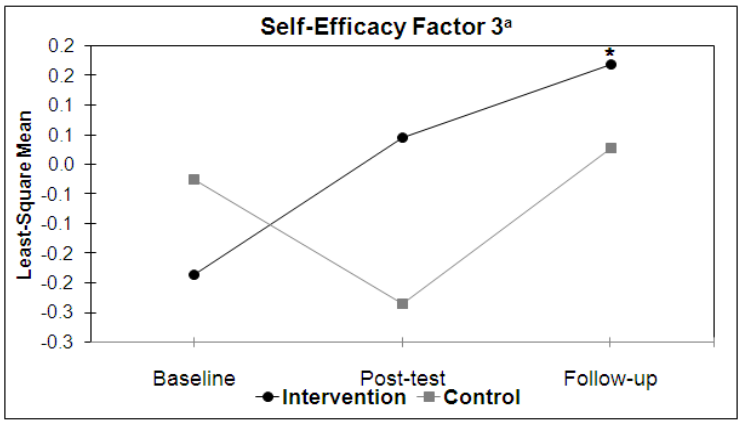


Figure 5. Least square means for Self-Efficacy Factor 3 for intervention and control groups at three time points.
All statistical tests used SAS PROC MIXED with a Tukey–Kramer adjustment.
a Self-efficacy Factor 3 = For breakfast, I think I can add fruit to my cereal; for lunch at school, I think I can eat a vegetable that's served & eat a green salad; for dinner, I think I can eat a big servings of vegetables and eat a green salad; I think I can eat 3 or more servings of vegetables each day and eat 5 or more servings of fruits and vegetables each day (p=0.07)
* Significant difference from baseline to booster (P =0.01)

In contrast to a previous study with a group of black children (Lakkakula et al, 2008), no association was observed between the child's FV preferences and risk of being overweight or obese. The racial/ethnic representation in the present study included primarily white students (57%). In addition, only 8% (n=12) of children had an average FV preference score below 2.0 indicating that they did not prefer those 38 FV items in the questionnaires at baseline. Ninety-two percent of the children (n=145) indicated they preferred the 38 FV items in the survey.

Therefore, the lack of association between weight status and FV preferences in this group of children may have been due to different racial representation or the fact that the FV preference comparison groups were not equally represented.

The present study had several limitations. The lack of random assignment of schools does not support a claim of causal effects. Furthermore, the results of this study conducted with low-income public elementary students in the southern United States should not be generalized to other regions and socio-economic groups in the United States. Finally, this study is limited by the fact that data were self-reported and are dependent upon the honesty of the children when responding to the questionnaire items.

Conclusion

The "Building Preferences for Fruits and Vegetables" program demonstrated that a cafeteria-based intervention with repeated taste exposures to FV increased and maintained children's preferences for less common fruits and self-efficacy to consume FV. This program can be adopted by teachers and parents as a way to increase children's acceptance of a variety of nutrient-rich foods and has the potential to change behavior and improve the diet. Future research should focus on ways to incorporate FV tasting programs into practice in the school setting and increase the participation rate of children by involving parents and teachers as role models. Furthermore, additional research is needed to determine if the observed increases in preference and self-efficacy result in an increase in children's FV consumption.

CHAPTER FOUR

SUMMARY

The quasi-experimental "Building Preferences for Fruits and Vegetables" program was designed to increase and maintain preferences for a variety of FV among third and fifth grade children attending low-income public elementary schools in southeastern Louisiana. Another goal was to examine the association between a child's FV preferences and his/her being overweight or obese. Students in the intervention schools participated in a FV tasting program where they tasted four fruits (apricots, cantaloupe, peaches and pears) and four vegetables (bell peppers, carrots, peas and tomatoes) twice a week on a rotating schedule for eight weeks followed by two weeks of tasting four months post- intervention (follow-up). Children in the control schools received brightly colored posters which were posted in the school cafeteria each week. Students who participated in the intervention demonstrated a significant increase in preferences for less common fruits such as apricots, avocados, cantaloupe, kiwi, mangos and papaya and greater self-efficacy to consume more fruits, salad and vegetables compared to control group students. Preference for fruits such as apples and grapes decreased among the children in the intervention group, whereas, children in the control group showed an increased preference for these items. This suggests that children in the intervention group experienced a shift from preferring more common fruits to preferring less common items. No association was observed between FV preference scores and risk of being overweight or obese in this group of children. This lack of relationship between FV preferences and weight status was in contrast with the findings from a previous study with a group of Black elementary school children living in the same geographical location (Lakkakula et al, 2008).

The lack of random assignment of the schools to an intervention or control group was a study limitation. Therefore, data from this study should not be used to draw causal inferences.

Furthermore, the information was self-reported and relied on the truthfulness of the children when answering the survey questions. Lastly, the results of the present study should not be generalized to the other regions and socio-economic groups in the United States.

The "Building Preferences for Fruits and Vegetables" program positively impacted third and fifth grade children's preferences for less common fruits and self-efficacy to consume FV. The decreased preferences for common fruits observed among children who participated in the intervention suggest that they experienced a shift in preferences from common fruits to less common fruits. Previous studies have shown that food preferences are strongly related to food intake (Loewen & Pliner, 1999; Perez-Rodgrido et al, 2003) suggesting that the improved fruit preferences for a variety of less common fruits observed in this group of children may lead to a greater variety of fruit consumption. Furthermore, children expressed greater confidence to consume fruits with cereal for breakfast, and vegetables and salads for lunch and dinner to meet the recommended servings of FV for their age. This could lead to positive dietary behavior changes (Strethcer et al, 1986). The results from this school-based cafeteria FV tasting program are promising; however, additional research is needed to determine if greater FV preferences lead to increased FV consumption by children.

LITERATURE CITED

Addessi E, Galloway AT, Visalberghi E & Birch LL. (2005). Specific social influences on the acceptance of novel foods in 2-5 year-old children. *Appetite* 45, 264 - 271.

Bandura, A. (1986). *Social Foundations of Thoughts and Action: A social Cognitive Theory*. Prentice Hall, Englewood Cliffs, NJ.

Bandura A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Bandura A. (2004). Health promotion by social cognitive means. *Health Education and Behavior* 31, 143 – 164.

Baronowski, T. (1990). Reciprocal determinism at stages of behavior change: an integration of community, personal, and behavior perspectives. *International Quarterly of Community Health Education* 10, 297-327.

Baranowski T, Davis M, Resnicow K, Baranowski J, Doyle C, Lin LS, Smith M & Wang DT. (2000). Gimme 5 fruit, juice, and vegetables for fun and health: outcome evaluation. *Health Education & Behavior* 27(1), 96-111.

Beauchamp GK & Moran M. (1985) Acceptance of sweet and salty taste in 2-year-old children. *Appetite* 5, 291-305.

Bere E & Klepp K. (2005). Changes in accessibility and preferences predict children's future fruit and vegetable intake. *International Journal of Behavioral Nutrition and Physical Activity* 2, 15-22.

Birch LL. (1999). Development of food preferences. *Annual Review of Nutrition* 19, 41-62.

Bowman SA, Gortmaker SL, Ebbeling CB, Pereira MA & Ludwig, DS. (2004). Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics* 113, 112-118.

Centers for Disease Control and Prevention (CDC). Childhood overweight and obesity. Centers for Disease Control and Prevention Website. Retrieved April 9, 2010, from http://www.cdc.gov/obesity/childhood/index.html

The Child and Adolescent Health Measurement Initiative (CAHMI). Data Resource Center for Child and Adolescent Health: 2007 Childhood Obesity State Report Cards. Retrieved February 20, 2011, from http://nschdata.org/Viewdocument.aspx?item=540

Cooke LJ & Wardle J. (2005). Age and gender differences in children's food preferences. *British Journal of Nutrition* 93, 741 - 746.

Cooper, JCB. (1983). Factor analysis: an overview. *The American Statistician* 37, 141 – 147.

Cornwell TB & McAlister AR. (2011). Alternative thinking about starting points of obesity. Development of child taste preferences. *Appetite* 56, 428-439.

Desor JA, Maller O & Andrews K. (1975). Ingestive responses of human newborns to salty, sour, and bitter stimuli. *Journal of Comparative Physiology and Psychology* 89, 966-970.

Domel SB, Thompson WO, Davis HC, Baronowski T, Leonard SB & Baronowski J. (1996). Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Education Research, Theory & Practice* 11(3), 299-308.

Drewnowki A. (1997). Taste preferences and food intake. *Annual Review of Nutrition* 17, 237-253.

Drewnowski, A. (2007). The real contribution of added sugars and fats to obesity. *Epidemiologic Review* 29, 160-171.

Edwards JSA & Hartwell HH. (2002). Fruits and vegetables – attitudes and knowledge of primary school children. *Journal of Human Nutrition and Dietetics* 15(5), 365-374.

Epstein LH, Gordy CC, Rayner HA, Beddome M, Kilanowski CK, Paluch R. (2001). Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for children obesity. *Obesity Research* 9, 171-178.

Glanz K, Rimer BK & Lewis FM. (2002). Health behavior and health education: Theory, research, and practice. San Francisco: Wiley & Sons.

He M, Beynon C, Bouck MS, Onge RS, Stewart S, Khoshaba L, Horbul BA, Chircoski B. (2009). Impact evaluation of the Northern Fruit and Vegetable Pilot Programme – a cluster-randomised controlled trial. *Public Health Nutrition* 12(11), 2199 – 2208.

Hill JO & Peters JC. (1998). Environmental Contributions to the Obesity Epidemic. *Science* 280, 1371-1374.

Koivisto UK & Sjodén PO. (1996). Food and general neophobia in Swedish families: parent-child comparisons and relationships with serving specific foods. *Appetite* 26, 107-118.

Lakkakula AP, Zanovec M, Silverman L, Murphy E, Tuuri G. (2008). Black children with high preferences for fruits and vegetables are at less risk of being at risk of overweight or overweight. *Journal of American Dietetic Association* 108, 1912-1915.

Lakkakula A, Geaghan J, Zanovec M, Pierce S & Tuuri G. (2010). Repeated taste exposure increases liking for vegetables by low-income elementary school children. *Appetite* 55, 226-231.

Lakkakula A, Geaghan JP, Wong WP, Zanovec M, Pierce SH & Tuuri G. (2011). A cafeteria-based tasting program increased liking of fruits and vegetables by lower, middle and upper elementary school-age children. *Appetite* In press.

Larson N, Story M & Nelson M. (2009). Neighbourhood environments. Disparities in access to healthy foods in the U.S.. *American Journal of Preventive Medicine* 36, 74-81.

Loewen R & Pliner P. (1999). Effects of prior exposure to palatable and unpalatable novel foods on children's willingness to taste other novel food. *Appetite* 32, 351 – 366.

Ludwig DS, Peterson KE, Gortmaker SL. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity. *Lancet* 357, 505-508.

Nicklaus S, Boggio V, Chabanet C, Issanchou S (2004). A prospective study of food preferences in childhood. *Food Qual Pref* 15 (7-8), 805-818.

Marsh T, Cullen KW & Baranowski T. (2003). Validation of a fruit, juice, and vegetables availability questionnaire. *Journal of Nutrition Education and Behavior* 35, 93-96.

Nestle M, Wing R, Birch LL, Disogra L & Drewnowki A. (1998). Behavioral and social influences on food choice. *Annual Review of Nutrition.* 56, S50-74.

Nisbett RE & Gurwitz SB. (1970). Weight, sex, and the eating behavior of human newborns. *Journal of Comparative Physiology and Psychology* 73, 245-253.

Pajares, F. (2002). Overview of Social Cognitive Theory and of Self-Efficacy. Retrieved March 25, 2011, from http://des.emory.edu/mfp/eff.html

Perez-Rodrigo C, Ribas L, Serra-Majem Ll & Aranceta J. (2003). Food preferences of Spanish children and young people: the enKid study. *European Journal of Clinical Nutrition* 57, Suppl 1, S45-S48.

Perry CL, Bishop D, Taylor GL, Davis M, Story M, Gray C, Bishop SC, Mays RA, Lytle LA & Harnack L. (2004). A randomized school trial of environmental strategies to encourage fruit and vegetable consumption among children. *Health Education and Behavior* 31(1), 65-76.

Pilant, VB. (2006). Position of the American Dietetic Association: local support for nutrition integrity in schools. *Journal of the American Dietetic Association* 106, 122-133.

Resnowski K, Hearn M, Smith M, Baranowski T, Lin LS, Baranowski J, Doyle C & Wang DT. (1997). Social-cognitive predictors of fruit and vegetable intake in children. *Health Sychology* 16(3), 272-276.

Riboli E & Norat T. (2003). Epidemiologic evidence of the protective effect of fruit and vegetables on cancer risk. *The American Journal of Clinical Nutrition* 78(3), 559S-569S.

Ricketts CD. Fat preferences, dietary fat intake and body composition in children. (1997). *European Journal of Clinical Nutrition* 51, 778-781.

Skinner JD, Caruth BR, Wendy B & Ziegler PJ. (2002). Children's food preferences: a longitudinal analysis. *Journal of American Dietetic Association* 102, 1638 –1647.

Strecher VJ, McEvoy De Vellis B, Becker MH & Rosenstock IM. (1986). The role of self-efficacy in achieving health behavior change. *Health Education Quarterly* 13, 73-91.

Taylor J & Binns D. (2003). Evaluation of a fruit & vegetable pilot program for elementary school children in Prince Edward Island. Prince Edward Island: Prince Edward Island healthy Eating Alliance 2003.

Thomson JL, McCabe-Sellers BJ, Strickland E, Lovera D, Nuss HJ, Yadrick K, Duke S & Bogle ML. (2010). Development and evaluation of WillTry. An instrucment for measuring children's willingness to try fruits and vegetables. *Appetite* 54, 465-472.

Tuuri G, Zanovec M, Silverman L, Geaghan J, Solmon M, Holston D, Guarino A, Roy H, & Murphy E. (2009). "Smart Bodies" school wellness program increased children's knowledge of healthy nutrition practices and self-efficacy to consume fruit and vegetables. *Appetite* 52, 445-451.

United States Department of Agriculture (USDA). Food and Nutrition Service. (2011). National School Lunch Program: Program Fact Sheet. Retrieved March 1, 2011, from http://www.fns.usda.gov/cnd/Lunch/AboutLunch/NSLPFactSheet.pdf

United States Department of Health and Human Services (USDHHS). (2000). *Healthy People 2010: understanding and improving health*. Washington, DC: US Government Printing Office.

Wang Y, Monteiro C & Popkin BM. (2002). Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *The American Journal of Clinical Nutrition* 75, 971 – 977.

Wardle J & Cooke L. (2008). Genetic and environmental determinants of children's food preferences. *British Journal of Nutrition* 99, S15-S21.

Wardle J, Cooke LJ, Gibson EL, Sapochnik M, Sheiham A & Lawson M. (2003). Increasing children's acceptance of vegetables; a randomized trial of parent-led exposure. *Appetite* 40, 155 – 162.

Wardle J, Herrera M-L, Cooke L & Gibson EL. (2003). Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable. *European Journal of Clinical Nutrition* 57, 341 – 348.

Wardle J, Sanderson S, Gibson EL & Rapoport L. (2001). Factor-analytic structure of food preferences in four-year-old children in the UK. *Appetite* 37, 217 – 223.

World Health Organization. (2003). *Diet, nutrition, and the prevention of chronic diseases (WHO Technical Report Series No.916).* Geneva: World Health Organization.

Zeinstra G, Koelen MA, Kok FJ & de Graaf C. (2007). Cognitive development and children's perceptions of fruit and vegetables : a qualitative study. *International Journal of Behavioral Nutrition and Physical Activity* 4, 30.

APPENDIX A

PARENT/GUARDIAN CONSENT FORM

LSU
LOUISIANA STATE UNIVERSITY

College of Agriculture
School of Human Ecology

Dear Parent or Caregiver,

Will you let your child help us?
We want children to learn to like and eat more fruits and vegetables.
If you agree to let your child help us we will ask them how much they like fruits and vegetables.
We will also help the school nurse measure your child's height and weight.
Your child may be asked to taste small pieces of fruit and vegetables during their lunches at school.
We will encourage them to taste the food, but we won't make them if they don't want to.
We will also ask them how much they like the fruits or vegetables that they tasted.

The school principal and your child's teacher have agreed to help us, but we need your help too.

You can read more about our project on the back of the page.

Georgianna Tuuri

Georgianna Tuuri, PhD, LDN, RD
Associate Professor of Nutrition
School of Human Ecology
Phone 578-1722

Sarah Pierce

Sarah Pierce, PhD
Associate Professor of Child Development
School of Human Ecology
Phone 578-1725

I will allow my child to participate in the study described on the back of this page.

Your Signature: _____ Date: _____

Information about your child:

Name: _____(please print) Gender: _____ Grade: _____

Date of Birth: _____ Age: _____ Race/Ethnicity: _____

Please give us your address and telephone number in case we need to contact you:

Address: _____ Telephone number: _____

☐ My child is eligible for free school lunch
☐ My child is eligible for reduced-price school lunch
☐ My child is not eligible for free or reduced-price school lunch

Please check if your child is allergic to any of these foods:

☐ Bell peppers ☐ Carrots ☐ Peas ☐ Tomatoes
☐ Apricots ☐ Cantaloupe ☐ Peaches ☐ Pears ☐ Raisins

APPENDIX B

PARENT/GUARDIAN COVER LETTER

Description of the Study

Project Title: Building Preferences for Fruits and Vegetables by Elementary School Students

Investigators: The following investigators are available for questions, M-F, 8:00 a.m.-4:30 p.m.

Georgianna Tuuri, PhD, LDN, RD
Associate Professor of Nutrition
School of Human Ecology, LSU
(225) 578-1722

Sarah Pierce, PhD
Associate Professor of Child Development
School of Human Ecology, LSU
(225) 578-1725

Purpose of the Study: The purpose of the study is to improve children's liking for fruits and vegetables and to encourage them to eat more fruits and vegetables.

Inclusion Criteria: First-, third-, and fifth-grade children who are enrolled in selected schools in West Baton Rouge Parish, Louisiana.

Exclusion Criteria: Children who are not enrolled in the first, third, or fifth grades in selected schools in West Baton Parish, Louisiana.

Description of the Study: The study will take place at your child's school. Before the program begins, your child will answer questions about how much they like fruits and vegetables and will have their height and weight measured under the supervision of the school nurse. Some of the children will be asked to taste a few raisins and small pieces of fruits (apricots, cantaloupe, peaches, pears) or vegetables (bell peppers, carrots, peas, tomatoes) during several lunch periods. After being offered the food, the children will tell us if they swallowed the food or spit it into their napkin. They will also give us their opinion of the tasted food. At the end of the school year and one year following the program, the children will again tell us how much they like fruits and vegetables. The children who began the program as first- or third-graders will have their height and weight measured again at this time. Selected parents may be asked to participate in a group discussion about ways to teach children to like fruits and vegetables.

Benefits: Children will learn about the benefits of eating healthy foods such as fruits and vegetables and children in selected schools will have the opportunity to taste different fruits and vegetables.

Risks: There are no known risks.

Right to Refuse: Participation is voluntary. A child will become part of the study only if both the child and the parent agree to the child's participation. A child may be withdrawn at the request of the parent or may withdraw himself from the study.

Privacy: Results of the study may be published, but no names or identifying information will be included for publication. Participants' identities will remain confidential unless disclosure is required by law.

Financial Information: There is no cost for participating in the study. Parents who participate in a group discussion will receive a fruit basket worth $25.

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact David Morrison, Associate Vice Chancellor & Associate Director, LSU AgCenter, (225) 578-4182. I will allow my child to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Approved LSU AgCenter IRB 11-26-08 H08-2
Michael Keenan

APPENDIX C

CHILDREN SURVEY

BUILDING PREFERENCES FOR FRUITS AND VEGETABLES
FRUIT AND VEGETABLE PREFERENCE SURVEY

Name: _____ **Age:** _____

Birth month: **Day:** __ __ **Year:** _____

January	J	01	01	1994	0	Caucasian (White)	1
February	F	02	02	1995	1	Black	2
March	M	03	03	1996	2	Hispanic/Latino	3
April	A	04	04	1997	3	Asian	4
May	M	05	05	1998	4	Other	5
June	J	06	06	1999	5		
July	J	07	07	2000	6		
August	A	08	08	2001	7		
September	S	09	09	2002	8		
October	O	10	10	2003	9		
November	N						
December	D						

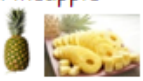
Boy	B
Girl	G

3rd grade	3
5th grade	5

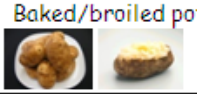
Directions: Circle the face that best describes you for each question below.

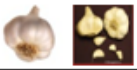
How much do you like these fruits?

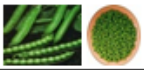
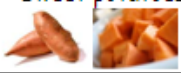
FRUITS	I like it a lot	I like it a little	I do not like it	I have never tasted it
1. Apple 				
2. Apricots 				
3. Avocado 				
4. Bananas 				
5. Cantaloupe 				
6. Grapes 				
7. Kiwi 				

FRUITS	I like it a lot	I like it a little	I do not like it	I have never tasted it
8. Oranges 				
9. Mangos 				
10. Papaya 				
11. Peaches 				
12. Pears 				
13. Pineapple 				
14. Plums 				
15. Strawberries 				
16. Tangerines 				
17. Watermelon 				

How much do you like these vegetables?

VEGETABLES	I like it a lot	I like it a little	I do not like it	I have never tasted it
18. Baked/broiled potato 				
19. Bell peppers 				

VEGETABLES	I like it a lot	I like it a little	I do not like it	I have never tasted it
20. Broccoli 				
21. Carrots 				
22. Cauliflower 				
23. Celery 				
24. Coleslaw 				
25. Cabbage 				
26. Corn 				
27. Cucumber 				
28. French fries 				
29. Garlic 				
30. Greens 				
31. Green beans 				
32. Lettuce/salad 				
33. Onion 				

VEGETABLES	I like it a lot	I like it a little	I do not like it	I have never tasted it
34. Peas 				
35. Potato salad 				
36. Sweet potatoes 				
37. Spinach 				
38. Tomatoes 				

Directions: Bubble in the correct answer for each question below. Make sure to fill in each bubble carefully.

What do you think about eating fruits and vegetables?

	A very good thing	A good thing	Not Important	I don't know
39. Most people in my family think that eating 2 or more servings of **fruit or juice** each day is___	①	②	③	④
40. Most people in my family think that eating 3 or more servings of **vegetables** each day is___	①	②	③	④
41. Most kids my age think that eating 2 or more servings of **fruit or juice** each day is___	①	②	③	④
42. Most kids my age think that eating 3 or more servings of **vegetables** each day is___	①	②	③	④

If I eat fruits and vegetables every day…

	I disagree Very much	I disagree a little	I am not sure	I agree a little	I agree very much
43. my friends will make fun of me	①	②	③	④	⑤
44. it will keep me from getting fat	①	②	③	④	⑤
45. my family will be proud of me	①	②	③	④	⑤

If I eat fruits and vegetables every day…

	I disagree Very much	I disagree a little	I am not sure	I agree a little	I agree very much
46. I will have a prettier smile	①	②	③	④	⑤
47. my friends will not come to my house to eat	①	②	③	④	⑤
48. my friends will start eating them too	①	②	③	④	⑤
49. I will be healthier	①	②	③	④	⑤
50. I will have more energy	①	②	③	④	⑤

If I eat fruits and vegetables every day…

51. I will have stronger eyes	①	②	③	④	⑤
52. I will become stronger	①	②	③	④	⑤

If I eat fruits and vegetables every day…

53. I will have less energy than if I eat a candy bar	①	②	③	④	⑤
54. I will think better in class	①	②	③	④	⑤
55. I will not enjoy eating that meal or snack	①	②	③	④	⑤

How sure are you that you can:

	I am sure I cannot	I don't think so	I am not sure	I think so	I am sure I can
For breakfast, I think I can…					
56. drink a glass of my favorite juice	①	②	③	④	⑤
57. add fruit to my cereal	①	②	③	④	⑤
For lunch at school, I think I can...					
58. eat a vegetable that's served	①	②	③	④	⑤
59. eat a fruit that's served	①	②	③	④	⑤
60. eat a green salad	①	②	③	④	⑤

How sure are you that you can:

	I am sure I cannot	I don't think so	I am not sure	I think so	I am sure I can
For lunch at home, I think I can…					
61. eat a carrot or celery stick instead of chips	①	②	③	④	⑤
62. eat my favorite fruit instead of my usual dessert	①	②	③	④	⑤
For a snack I think I can choose…					
63. my favorite fruit instead of my favorite cookie	①	②	③	④	⑤
64. my favorite fruit instead of my favorite candy bar	①	②	③	④	⑤
65. my favorite raw vegetable with dip instead of my favorite cookie	①	②	③	④	⑤
66. my favorite raw vegetable with dip instead of my favorite candy bar	①	②	③	④	⑤
67. my favorite raw vegetable with dip instead of my favorite chips	①	②	③	④	⑤
For dinner, I think I can…					
68. eat a big serving of vegetables	①	②	③	④	⑤
69. eat my favorite fruit instead of my usual dessert	①	②	③	④	⑤
70. eat a green salad	①	②	③	④	⑤
I think I can…					
71. eat **2** or more servings of **fruit** or juice each day	①	②	③	④	⑤
72. eat **3** or more servings of **vegetables** each day	①	②	③	④	⑤
73. eat **5** or more servings of **fruits and vegetables** each day	①	②	③	④	⑤

APPENDIX D

FACTOR LOADINGS FOR FRUIT PREFERENCES

Rotated Factor Pattern				
	Factor1	**Factor2**	**Factor3**	**Factor4**
apple	0.18671	0.07612	0.14056	**0.85118**
apricots	**0.77344**	0.25355	0.17651	0.15979
bananas	0.33078	**0.41413**	-0.17985	0.40885
cantaloupe	**0.78992**	0.32333	-0.07433	0.17366
grapes	0.07776	0.29565	0.21704	**0.76999**
kiwi	**0.69281**	0.36316	0.08071	0.04222
oranges	0.05031	0.05513	**0.81125**	0.25380
mangos	**0.77111**	0.27963	0.23745	0.08863
papaya	**0.79496**	0.14030	0.28953	0.02969
peaches	0.37444	**0.63990**	0.36618	0.08069
pears	0.47888	**0.58961**	0.18843	0.17767
pineapple	0.23912	**0.65035**	0.22137	0.15473
plums	0.45498	0.38841	**0.52276**	0.10845
strawberries	0.26880	**0.61959**	0.44972	0.06981
tangerine	0.41831	0.31950	**0.60686**	-0.01104
watermelon	0.10737	**0.80160**	-0.01209	0.20727
avocado	**0.73977**	0.02989	0.13532	0.21021

APPENDIX E

FACTOR LOADINGS FOR VEGETABLE PREFERENCES

Rotated Factor Pattern					
	Factor1	**Factor2**	**Factor3**	**Factor4**	**Factor5**
Baked potato	0.06974	**0.81282**	-0.02291	0.21460	0.02528
Bell pepper	**0.66455**	0.11923	-0.03497	0.37651	-0.03795
Broccoli	**0.66018**	0.19521	0.21027	0.05824	0.16425
Carrots	0.45787	-0.07785	**0.56545**	0.17734	-0.08778
Cauliflower	**0.46544**	-0.03330	0.31934	0.41187	0.23603
Celery	**0.71158**	0.09388	0.10603	0.24613	0.02772
Coleslaw	0.32916	0.10994	0.21231	0.37711	0.06125
Cabbage	**0.55293**	0.20819	0.15323	0.01120	0.48849
Corn	-0.05296	0.09705	**0.78836**	0.20476	-0.16356
French fries	0.14429	0.11496	**0.15309**	-0.10606	-0.70279
Garlic	0.14562	0.23726	0.15189	**0.78599**	0.10389
Greens	0.43365	0.31002	0.37800	0.16031	**0.52485**
Green bean	0.16898	**0.71055**	0.40157	0.06848	0.00945
Lettuce	**0.49782**	0.49329	0.24256	0.06471	-0.07274
Onion	0.29187	0.15563	0.07438	**0.70953**	0.17130
Peas	0.15507	0.19437	**0.68399**	0.00041	0.35507
Potato salad	0.27746	**0.60048**	-0.04097	0.16150	0.20299
Sweet potato	0.24879	0.27616	0.08488	0.21969	**0.47455**
Spinach	**0.60921**	0.32142	0.22487	0.08091	0.31584
Tomatoes	**0.63841**	0.23219	-0.12728	0.27888	-0.04444

APPENDIX F

FACTOR LOADINGS FOR SELF-EFFICACY TO CONSUME FRUITS AND VEGETABLES

Rotated Factor Pattern for Self-Efficacy to Consume FV			
How sure are you that you can:	**Factor1**	**Factor2**	**Factor3**
For breakfast, I think I can drink a glass of my favorite juice	**0.56374**	0.03413	0.14864
For breakfast, I think I can add fruit to my cereal	0.34645	0.16686	**0.39416**
For lunch at school, I think I can eat a vegetable that's served	0.47985	0.28000	**0.48758**
For lunch at school, I think I can eat a fruit that's served	**0.67277**	0.12128	0.31744
For lunch at school, I think I can eat a green salad	0.10549	0.20708	**0.77440**
For lunch at home, I think I can eat a carrot or celery stick instead of chips	0.44089	**0.48864**	0.30258
For lunch at home, I think I can eat my favorite fruit instead of my usual dessert	**0.73127**	0.31473	0.12364
For a snack, I think I can choose my favorite fruit instead of my favorite cookie	**0.67681**	0.50402	0.13300
For a snack, I think I can choose my favorite fruit instead of my favorite candy bar	**0.64241**	0.54328	0.07977
For a snack, I think I can choose my favorite raw vegetable with dip instead of my favorite cookie	0.17151	**0.85332**	0.24747
For a snack, I think I can choose my favorite raw vegetable with dip instead of my favorite candy bar	0.18295	**0.85951**	0.24008
For a snack, I think I can choose my favorite raw vegetable with dip instead of my favorite chips	0.14128	**0.85919**	0.27356
For dinner, I think I can eat a big serving of vegetables	0.37734	0.39817	**0.54069**
For dinner, I think I can eat my favorite fruit instead of my usual dessert	**0.59482**	0.47955	0.22784
For dinner, I think I can eat a green salad	0.08225	0.28803	**0.77526**
I think I can eat 2 or more servings of fruits and juice each day	**0.67222**	0.08090	0.32552
I think I can eat 3 or more servings of vegetables each day	0.46014	0.19027	**0.67967**
I think I can eat 5 or more servings of fruits and vegetables each day	0.46790	0.08436	**0.59174**

APPENDIX G

FACTOR LOADINGS FOR POSITIVE OUTCOME EXPECATIONS

Positive Outcome Expectations **If I eat fruits and vegetables every day**	**Factor 1**	**Factor 2**
It will keep me from getting fat	-0.04821	**0.77809**
My family will be proud of me	0.26039	**0.69912**
I will have a prettier smile	**0.72468**	-0.06659
My friends will start eating them too	**0.53176**	0.15209
I will be healthier	**0.61698**	0.53751
I will have more energy	0.44619	**0.54975**
I will have stronger eyes	**0.75304**	0.18282
I will become stronger	**0.67614**	0.41314
I will think better in class	**0.63190**	0.23534

APPENDIX H

SOURCE TABLES FOR EACH FACTOR

Fruit Preferences Factor 1 Model Information	
Data Set	WORK.FACTOR1
Dependent Variable	Factor1
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	135
Number of Observations Not Used	348

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	375.48746471	
1	2	314.10268050	16.89167227
2	2	309.54600743	0.00295543
3	1	309.42793781	0.00036080
4	1	309.41517390	0.00000233
5	1	309.41509020	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		0.04285	0.2317	0.18	0.4266	0.05	0.003777	1.776E44
School*ID		0.6285	0.2706	2.32	0.0101	0.05	0.3137	1.8358
AR(1)	**ID(trt*School)**	0.3828	0.5659	0.68	0.4988	0.05	-0.7263	1.4919
Residual		0.2676	0.2359	1.13	0.1283	0.05	0.08067	5.2527

Fit Statistics	
-2 Res Log Likelihood	309.4
AIC (smaller is better)	317.4
AICC (smaller is better)	317.7
BIC (smaller is better)	313.8

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	1.23	0.4669
Test	2	54	0.22	0.8016
Test*trt	2	54	3.91	0.0259

Fruit Preferences Factor 2 Model Information	
Data Set	WORK.FACTOR1
Dependent Variable	Factor2
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	135
Number of Observations Not Used	348

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	386.00028903	
1	2	478.57937011	61918.827978
2	1	432.49140344	16289.766020
3	3	394.17311968	0.19375206
4	2	374.89415262	0.17081578
5	1	358.98027590	0.14571114
6	1	347.16530997	0.10305271
7	1	339.76818530	0.05973990
8	1	335.82060181	0.02674717
9	1	334.18781523	0.00655710
10	2	333.82391390	0.00043734
11	1	333.80185905	0.00000197
12	1	333.80176348	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		0	.	.	.	.	.	.
School*ID		0.6694	0.1611	4.16	<.0001	0.05	0.4392	1.1436

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
AR(1)	**ID(trt*School)**	0.1360	0.3645	0.37	0.7091	0.05	-0.5785	0.8505
Residual		0.2924	0.1089	2.69	0.0036	0.05	0.1580	0.7152

Fit Statistics	
-2 Res Log Likelihood	333.8
AIC (smaller is better)	339.8
AICC (smaller is better)	340.0
BIC (smaller is better)	337.1

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.10	0.8085
Test	2	54	2.87	0.0655
Test*trt	2	54	0.77	0.4667

Fruit Preferences Factor 3 Model Information	
Data Set	WORK.FACTOR1
Dependent Variable	Factor3
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL

Class Level Information		
Class	**Levels**	**Values**
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	135
Number of Observations Not Used	348

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	380.03586882	
1	2	355.12347142	392.23894346
2	3	345.48318777	0.10524580
3	1	337.94727232	0.07233764
4	1	333.22427209	0.03829993
5	1	330.87671179	0.01469761
6	1	330.03934121	0.00288007
7	1	329.88859392	0.00014411
8	1	329.88167569	0.00000042
9	1	329.88165597	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		1.27E-19	.	.	.	.	.	.
School*ID		0.6838	0.1374	4.98	<.0001	0.05	0.4779	1.0591
AR(1)	**ID(trt*School)**	-0.03091	0.3550	-0.09	0.9306	0.05	-0.7267	0.6649
Residual		0.2465	0.06697	3.68	0.0001	0.05	0.1542	0.4561

Fit Statistics	
-2 Res Log Likelihood	329.9
AIC (smaller is better)	335.9
AICC (smaller is better)	336.1
BIC (smaller is better)	333.2

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	3.84	0.3006
Test	2	54	0.43	0.6534
Test*trt	2	54	0.21	0.8089

Fruit Preferences Factor 4 Model Information	
Data Set	WORK.FACTOR1
Dependent Variable	Factor4
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test

Class Level Information		
Class	**Levels**	**Values**
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	135
Number of Observations Not Used	348

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	380.08657520	
1	2	339.41783546	4.02052020
2	1	333.59963913	4.45975303
3	1	328.52499376	0.00726758
4	1	328.48467304	0.00453312
5	1	328.09121228	0.00511162

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
6	1	326.13363997	0.00076855
7	1	326.09728910	0.00003509
8	1	326.09563040	0.00000037
9	1	326.09561374	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		0.3183	0.6527	0.49	0.3129	0.05	0.04535	617605
School*ID		0.8996	0.1698	5.30	<.0001	0.05	0.6414	1.3532
AR(1)	**ID(trt*School)**	-0.2461	0.3458	-0.71	0.4766	0.05	-0.9240	0.4317
Residual		0.1574	0.04011	3.92	<.0001	0.05	0.1010	0.2788

Fit Statistics	
-2 Res Log Likelihood	326.1
AIC (smaller is better)	334.1
AICC (smaller is better)	334.4
BIC (smaller is better)	330.5

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.03	0.8970
Test	2	54	3.24	0.0471
Test*trt	2	54	4.43	0.0166

Vegetable Preferences Factor 1 Model Information	
Data Set	WORK.FACTOR4
Dependent Variable	Factor1
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1

Dimensions	
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	173
Number of Observations Not Used	310

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	494.94967476	
1	2	430.04705076	0.00949820
2	2	429.91213945	0.00529444
3	1	429.56258759	0.00123122
4	1	429.49402380	0.00005228
5	1	429.49080266	0.00000005
6	1	429.49079936	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		0.02032	0.1386	0.15	0.4417	0.05	0.002033	2.943E71
School*ID		0.6724	0.2527	2.66	0.0039	0.05	0.3615	1.6622
AR(1)	**ID(trt*School)**	0.4021	0.3857	1.04	0.2973	0.05	-0.3540	1.1581
Residual		0.3537	0.2177	1.62	0.0521	0.05	0.1405	1.9877

Fit Statistics	
-2 Res Log Likelihood	429.5
AIC (smaller is better)	437.5
AICC (smaller is better)	437.7
BIC (smaller is better)	433.9

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.93	0.5108
Test	2	69	0.40	0.6748
Test*trt	2	69	0.27	0.7632

Vegetable Preferences Factor 2 Model Information	
Data Set	WORK.FACTOR4
Dependent Variable	Factor2
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464

Class Level Information		
Class	**Levels**	**Values**
		465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	173
Number of Observations Not Used	310

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	491.16494880	
1	4	451.83974937	0.00139589
2	1	451.73258963	0.00002115
3	1	451.73105659	0.00000001

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		1.15E-19	.	.	.	.	.	.
School*ID		0.6803	0.1517	4.49	<.0001	0.05	0.4591	1.1119
AR(1)	**ID(trt*School)**	-0.1062	0.3315	-0.32	0.7486	0.05	-0.7560	0.5436
Residual		0.3226	0.08672	3.72	<.0001	0.05	0.2027	0.5925

Fit Statistics	
-2 Res Log Likelihood	451.7
AIC (smaller is better)	457.7
AICC (smaller is better)	457.9
BIC (smaller is better)	455.0

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	3.23	0.3231
Test	2	69	0.92	0.4030
Test*trt	2	69	0.17	0.8430

Vegetable Preferences Factor 3 Model Information	
Data Set	WORK.FACTOR4
Dependent Variable	Factor3
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323

Class Level Information		
Class	**Levels**	**Values**
		325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	173
Number of Observations Not Used	310

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	486.20887941	
1	2	398.33723671	0.11338413
2	2	397.77065189	0.04977084
3	2	396.56611689	0.00995331
4	1	396.30876496	0.00229620
5	1	396.19484371	0.00010488
6	1	396.19004910	0.00000019

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
7	1	396.19004056	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		0.3005	0.5200	0.58	0.2817	0.05	0.04979	8828.22
School*ID		0.6177	0.1763	3.50	0.0002	0.05	0.3784	1.1852
AR(1)	**ID(trt*School)**	0.4075	0.3314	1.23	0.2188	0.05	-0.2419	1.0570
Residual		0.2636	0.1402	1.88	0.0300	0.05	0.1156	1.0817

Fit Statistics	
-2 Res Log Likelihood	396.2
AIC (smaller is better)	404.2
AICC (smaller is better)	404.4
BIC (smaller is better)	400.6

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.39	0.6450
Test	2	69	3.38	0.0396
Test*trt	2	69	1.38	0.2597

Vegetable Preferences Factor 4 Model Information	
Data Set	WORK.FACTOR4
Dependent Variable	Factor4
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile

Vegetable Preferences Factor 4 Model Information	
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	173
Number of Observations Not Used	310

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	491.91590123	
1	2	467.12540080	0.00002860

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
2	1	467.12308000	0.00000001
3	1	467.12307895	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)		0	.	.	.	.	.	.
School*ID		0.4377	0.2498	1.75	0.0399	0.05	0.1832	2.0699
AR(1)	**ID(trt*School)**	0.1897	0.3572	0.53	0.5954	0.05	-0.5104	0.8897
Residual		0.5561	0.2304	2.41	0.0079	0.05	0.2836	1.5439

Fit Statistics	
-2 Res Log Likelihood	467.1
AIC (smaller is better)	473.1
AICC (smaller is better)	473.3
BIC (smaller is better)	470.4

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.83	0.5302
Test	2	69	0.74	0.4801
Test*trt	2	69	0.69	0.5058

Vegetable Preferences Factor 5 Model Information	
Data Set	WORK.FACTOR4
Dependent Variable	Factor5
Covariance Structures	Variance Components, Autoregressive
Subject Effect	ID(trt*School)
Estimation Method	REML
Residual Variance Method	Profile

Vegetable Preferences Factor 5 Model Information	
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	4
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	173

Number of Observations	
Number of Observations Not Used	310

Iteration History			
Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	494.79303557	
1	2	444.48243218	0.00509972
2	1	444.09887002	0.00016015
3	1	444.08768763	0.00000018
4	1	444.08767520	0.00000000

Convergence criteria met.

Covariance Parameter Estimates								
Cov Parm	Subject	Estimate	Standard Error	Z Value	Pr Z	Alpha	Lower	Upper
School(trt)		0	.	.	.	.	.	.
School*ID		0.6162	0.1123	5.49	<.0001	0.05	0.4441	0.9126
AR(1)	ID(trt*School)	-0.2831	0.2064	-1.37	0.1701	0.05	-0.6875	0.1214
Residual		0.3060	0.05333	5.74	<.0001	0.05	0.2235	0.4448

Fit Statistics	
-2 Res Log Likelihood	444.1
AIC (smaller is better)	450.1
AICC (smaller is better)	450.2
BIC (smaller is better)	447.4

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.66	0.5665
Test	2	69	0.84	0.4349
Test*trt	2	69	0.83	0.4392

Positive Outcome Expectations Factor 1 Model Information	
Data Set	WORK.FACTOR2
Dependent Variable	Factor1
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426

Class Level Information		
Class	**Levels**	**Values**
		427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	3
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	431
Number of Observations Not Used	52

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	1229.13112331	
1	3	1197.49520809	0.00005099
2	1	1197.48442131	0.00000003
3	1	1197.48441485	0.00000000

Convergence criteria met.

Covariance Parameter Estimates							
Cov Parm	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)	0.06642	0.1313	0.51	0.3065	0.05	0.009772	45858
School*ID	0.3056	0.07113	4.30	<.0001	0.05	0.2030	0.5118
Residual	0.6903	0.06074	11.37	<.0001	0.05	0.5852	0.8267

Fit Statistics	
-2 Res Log Likelihood	1197.5
AIC (smaller is better)	1203.5
AICC (smaller is better)	1203.5
BIC (smaller is better)	1200.8

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.47	0.6176
Test	2	268	1.13	0.3252
Test*trt	2	268	0.88	0.4164

Positive Outcome Expectations Factor 2 Model Information	
Data Set	WORK.FACTOR2
Dependent Variable	Factor2
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323

Class Level Information		
Class	**Levels**	**Values**
		325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	3
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	431
Number of Observations Not Used	52

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	1233.55601769	
1	2	1209.15149653	0.00001287
2	1	1209.14871878	0.00000000

Convergence criteria met.

Covariance Parameter Estimates							
Cov Parm	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**

Covariance Parameter Estimates							
Cov Parm	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)	0	.	.	.	.	.	.
School*ID	0.2815	0.06940	4.06	<.0001	0.05	0.1830	0.4881
Residual	0.7310	0.06396	11.43	<.0001	0.05	0.6202	0.8746

Fit Statistics	
-2 Res Log Likelihood	1209.1
AIC (smaller is better)	1213.1
AICC (smaller is better)	1213.2
BIC (smaller is better)	1211.3

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.35	0.6602
Test	2	268	1.00	0.3695
Test*trt	2	268	0.50	0.6062

Self-Efficacy to Consume FV Factor 1 Model Information	
Data Set	WORK.FACTOR3
Dependent Variable	Factor1
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3

Class Level Information		
Class	**Levels**	**Values**
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	3
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	425
Number of Observations Not Used	58

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	1217.65085839	
1	2	1176.92558773	0.00035843
2	1	1176.84969240	0.00000149
3	1	1176.84938839	0.00000000

Convergence criteria met.

Covariance Parameter Estimates							
Cov Parm	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)	0	.	.	.	.	.	.
School*ID	0.3958	0.08092	4.89	<.0001	0.05	0.2751	0.6182
Residual	0.6359	0.05743	11.07	<.0001	0.05	0.5368	0.7654

Fit Statistics	
-2 Res Log Likelihood	1176.8
AIC (smaller is better)	1180.8
AICC (smaller is better)	1180.9
BIC (smaller is better)	1179.0

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.43	0.6302
Test	2	260	0.07	0.9307
Test*trt	2	260	0.63	0.5314

Self-Efficacy to Consume FV Factor 2 Model Information	
Data Set	WORK.FACTOR3
Dependent Variable	Factor2
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2

Class Level Information		
Class	**Levels**	**Values**
School	3	1 2 3
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	3
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	425
Number of Observations Not Used	58

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	1213.94337408	
1	3	1161.99987228	0.00000161
2	1	1161.99955164	0.00000000

Convergence criteria met.

Covariance Parameter Estimates							
Cov Parm	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)	0.1227	0.2115	0.58	0.2809	0.05	0.02040	3330.99
School*ID	0.3544	0.06964	5.09	<.0001	0.05	0.2495	0.5430
Residual	0.6242	0.05430	11.49	<.0001	0.05	0.5300	0.7459

Fit Statistics	
-2 Res Log Likelihood	1162.0
AIC (smaller is better)	1168.0
AICC (smaller is better)	1168.1
BIC (smaller is better)	1165.3

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.01	0.9462
Test	2	260	0.00	0.9965
Test*trt	2	260	2.92	0.0555

Self-Efficacy to Consume FV Factor 3 Model Information	
Data Set	WORK.FACTOR3
Dependent Variable	Factor3
Covariance Structure	Variance Components
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
Test	3	Baseline booster post test
trt	2	1 2
School	3	1 2 3

Class Level Information		
Class	**Levels**	**Values**
Gender	2	BOY GIRL
Grade	2	1 2
ID	161	158 159 160 162 163 164 167 168 170 172 173 174 176 183 184 186 188 189 195 197 201 208 210 211 212 215 216 217 218 219 221 222 227 228 232 233 239 241 243 247 248 249 254 255 258 259 261 263 264 265 266 268 273 275 277 280 281 283 287 288 289 290 291 292 294 295 296 299 300 303 304 305 306 307 308 309 311 312 313 314 315 316 318 319 320 321 322 323 325 328 329 330 333 334 338 341 342 343 344 347 350 351 352 353 355 357 361 362 363 364 369 372 373 384 386 388 389 394 396 398 399 405 409 410 413 414 416 417 418 419 425 426 427 433 434 437 440 441 442 446 448 449 450 451 454 455 456 457 458 459 460 461 462 464 465 467 471 472 473 475 477

Dimensions	
Covariance Parameters	3
Columns in X	12
Columns in Z	164
Subjects	1
Max Obs Per Subject	483

Number of Observations	
Number of Observations Read	483
Number of Observations Used	425
Number of Observations Not Used	58

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	1210.54374318	
1	2	1131.18955232	0.00000942
2	1	1131.18783983	0.00000000

Convergence criteria met.

Covariance Parameter Estimates							
Cov Parm	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**	**Alpha**	**Lower**	**Upper**
School(trt)	0	.	.	.	.	.	.
School*ID	0.4640	0.07652	6.06	<.0001	0.05	0.3441	0.6597
Residual	0.5222	0.04553	11.47	<.0001	0.05	0.4433	0.6243

Fit Statistics	
-2 Res Log Likelihood	1131.2
AIC (smaller is better)	1135.2
AICC (smaller is better)	1135.2
BIC (smaller is better)	1133.4

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	1	1	0.37	0.6535
Test	2	260	2.83	0.0607
Test*trt	2	260	2.66	0.0716

VITA

Wei-Ping Wong was born in Tenom, Sabah, Malaysia. Wei-Ping, daughter of Sew Kiong Wong and Choi Lan Lo, is the second child of four children. She received her Bachelor of Science Degree in Dietetics in May 2008 from Iowa State University, Ames, Iowa. Wei-Ping began a master's program in the fall of 2009 at Louisiana State University in the School of Human Ecology with a concentration in human nutrition. She is a registered dietitian and a member of American Society for Nutrition and American Dietetic Association.