The impact of a DVD based Obesity and Stress Prevention program on 3rd grade children’s psychosocial and dietary behaviors

THESIS

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Abstract

INTRODUCTION: Childhood overweight and obesity continue to escalate both domestically and worldwide. Key behaviors have been identified to prevent childhood overweight and obesity. However, avenues for implementing programs aimed at teaching these behaviors have been limited. Fuel for Learning is an eight week theory based obesity and stress prevention program on DVD that meets selected third grade Ohio educational standards. FUEL FOR LEARNING was designed for ease of use in the classroom during the school day.

AIM: The aim of this project is to evaluate the effectiveness of the nutrition component of FUEL FOR LEARNING; by examining the impact of the program on children’s dietary and psychosocial behaviors.

METHODS: A quasi experimental wait-list control design was used to conduct this pilot study. Participants included children from six third grade classrooms (n=70 treatment, n=67 control) in Columbus, Ohio. Demographic information was collected pre-intervention. Dietary and psychosocial behaviors were evaluated pre-intervention and post-intervention. The Child Modified Food Behavior Checklist was used to evaluate
changes in children’s dietary behaviors. Behavior Capabilities, Self-Efficacy and Stages of Change questionnaires were used to evaluate changes in psychosocial behaviors. Overall change scores (post-test – pre-test) for each variable were calculated and compared to evaluate the difference between the treatment and control groups. For variables deemed statistically significant further analysis was done to determine the source of variability.

RESULTS: Statistically significant changes were seen in overall dietary behavior (p=0.002) and specific dietary behaviors including: vegetable consumption (p=0.050) and use of the food label (p=0.000). Statistically significant changes were also seen in psychosocial variables including Behavioral Capabilities (p=0.000), specifically fruit (p=0.004), vegetable (p=0.000), food label reading (p=0.002) and milk (p=0.000), and Self-Efficacy (p=0.043).

DISCUSSION: FUEL FOR LEARNING, a theory based obesity and stress prevention program delivered during the school day using a DVD format, appears effective in changing psychosocial and dietary behaviors.
Dedication

Dedicated to my parents who continue to support and encourage me to follow my dreams. Thanks Mom & Dad, I love you!
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CHAPTER 1

Introduction

Childhood overweight (BMI ≥ 85th percentile based on age and gender) and obesity (BMI ≥ 95th percentile based on age and gender) continue to escalate nationally, regionally and locally. Nationally, from 1998-2008 the prevalence of overweight in children aged 2-19 increased by 3.5% (28.2% to 31.7%); the prevalence of obesity increased by 3% (13.9% to 16.9%) [1,2,3]. In children aged 6-11 there was a 4.5% increase in childhood obesity, which is greater than either of the other two age groups (2-5 years, 0.1% increase; 12-19, 3.3% increase) [1].

In Ohio the prevalence of overweight and obesity is slightly higher than what is reported nationally. From 2009-2010, 18.3% of Ohio third graders were reported as obese and 34.6% as overweight. Looking at 2009-2010 data, notable variations were found by region, ethnicity and proportion enrolled in the Free and Reduced Priced Lunch Program [4]. Locally, in Franklin County in 2009-2010, between 30-39% of third graders were reported as overweight and/or obese (BMI for age ≥ 85 percentile) [4]. During the 2007-
2008 school year in Columbus City Schools, 42% of third grade students were classified as overweight and 25% were classified as obese [5].

Many factors have been associated with the development of childhood overweight and obesity. Differences in the prevalence of obesity have been observed among different ethnic groups [6,7,8,9,10]. Rates of childhood obesity have increased across all levels of socioeconomic status. In general a lower socioeconomic status is associated with higher rates of obesity, however when examining by socioeconomic status and gender, no definitive relationship between ethnicity and obesity has been established [9]. Parental weight status, socioeconomic status and education level have also been associated with an increased risk for childhood obesity [6,9,10,11,12,13,14,15]. Dietary practices have been associated with childhood overweight and obesity. These dietary practices include: high fat intake, inadequate fruit and vegetable consumption, low breakfast consumption, low dairy consumption, higher consumption of energy dense-nutrient poor snack foods, increased consumption of energy dense foods, increase in portion sizes of foods and increased consumption of sugar sweetened beverages [16,17,18,19,20,21,22]. Low levels of physical activity are associated with an increase in childhood overweight and obesity [19,20,21,22,23].

Behaviors purported to be effective in preventing childhood obesity have been identified and programs designed to address these behaviors have been developed.
Systematic reviews and meta-analyses have identified some of these programs as successful, but not without limitations. The Expert Committee, Davis et al and The Endocrinology Society identified four similar behaviors that can be protective against childhood overweight and obesity. These behaviors include: avoiding sugar sweetened beverages, increasing the intake of fruit and vegetables, eating breakfast and limiting portion sizes. Since no prospective work has been done to identify behaviors protective against childhood overweight and obesity, recommendations from these respected groups, is the best guidance currently available [22,24,25].

Based on the analyses of Gonzalez-Suarez et al and Thomas, the Child and Adolescent Trial for Cardiovascular Health (CATCH) and Pathways are noted to be effective obesity prevention programs [26,27,28,29]. While CATCH and Pathways are considered the most successful programs, other studies have shown similar results, but are not considered in meta-analyses and systematic reviews due to having a smaller sample size, shorter term intervention (<12 weeks in length), a design other than a randomized control trial and/or lack of measurement of a clinical outcome (ex. BMI, skin folds). Examples of such nutrition education programs implemented in elementary schools with modest outcomes include: Gimme 5 Fruit, Juice and Vegetables for Fun and Health (Gimme 5), The Nutrition Detectives Program, It’s All About Kids and Smart Bodies [30,31,32,33].
Overall, obesity prevention programs have been successfully implemented during the school day and have demonstrated improvements in knowledge and skills; however, behavior change has been modest [28,29,30,31,32,33,34,35]. Statistically significant changes have not been seen in clinical outcomes (i.e. BMI) [28,29,31]. Additionally, even with teacher trainings, many teachers feel ill prepared to deliver the programs because they lack training in nutrition [27,30,33].

Schools are an important venue for teaching children how to improve their diets, make healthy food choices, and learn how to cope with stress [36]. While schools have been identified as an appropriate venue for obesity prevention programs, unfortunately there is a decreased emphasis on topics such as nutrition education in K-12 schools [26,37,38].

While teachers recognize the importance of obesity prevention, many feel ill prepared to instruct children on the necessary knowledge, skills and behaviors to achieve this goal [27,30]. A classroom based DVD program designed to educate children on these topics could help teachers address these needs without requiring excessive training. Additionally, a DVD based program would provide a standardized format for program delivery. Such a program would be especially useful if it also supported existing educational standards.
*FUEL FOR LEARNING* is a new obesity and stress prevention program that has been developed to address some of the previous program limitations. The movement and stress reduction component draws upon principles from three central areas of research: Yoga, Sensory Integration and Mindfulness Based Stress Reduction. This analysis will focus on the obesity prevention part of the program. The obesity prevention portion of *FUEL FOR LEARNING* was developed from an existing program Food Fit. Food Fit is a 6-week obesity prevention program that is based in Social Cognitive Theory [39,40,41]. Food Fit was pilot tested with 58 children at 5 YMCA after-school programs. Trained instructors delivered the program. Dietary behavior was measured pre and post-intervention and psychosocial variables were measured before and after each lesson. Extensive process evaluations were completed to monitor program fidelity. Significant changes in dietary behaviors and psychosocial variables were found [39].

*FUEL FOR LEARNING* is an 8 week DVD-based obesity and stress prevention program that supports selected 3rd grade Ohio educational standards. One day of the week, a 35 minute nutrition lesson is delivered during the school day. Five days a week a 10 minute stress prevention session is delivered during the school day. The obesity prevention component of the program was adapted from Food Fit and encourages positive food selection behaviors, aimed at improving the nutritional quality of the diet thereby facilitating the prevention of childhood obesity [42]. Food Fit is theoretically based in
Social Cognitive Theory [39,40,41]. *FUEL FOR LEARNING* was expanded to include two Transtheoretical Model constructs – stages of change and processes of change.

*FUEL FOR LEARNING* was designed to improve on limitations of past programs. To surmount challenges associated with training and program fidelity, a DVD based format is used to deliver the intervention. The DVD format provides a standardized delivery to each classroom. The program is theoretically based, to be delivered during the school day and meets selected third grade educational standards.

The purpose of this research is to evaluate the effectiveness of the nutrition component of *FUEL FOR LEARNING*. Specific research aims & hypotheses are:

1. **Determine the effect participation in the program *FUEL FOR LEARNING* has on children’s targeted dietary behaviors.**
   
   – **H₀**: There will be no statistically significant differences in targeted dietary behaviors between the treatment and control groups.
   
   – **H₁**: There will be statistically significant differences in targeted behaviors between the treatment and control groups.
2. Determine the effect participation in the program *FUEL FOR LEARNING* has on children’s targeted psychosocial variables including: behavioral capabilities, self-efficacy and stages of change.

   – Behavioral Capabilities
     - $H_0$: There will be no statistically significant differences in targeted behavioral capabilities between the treatment and control groups.
     - $H_1$: There will be statistically significant differences in targeted behavioral capabilities between the treatment and control groups.

   – Self-Efficacy
     - $H_0$: There will be no statistically significant differences in targeted self-efficacy between the treatment and control groups.
     - $H_1$: There will be statistically significant differences in targeted self-efficacy between the treatment and control groups.

   – Stages of Change
     - $H_0$: There will be no statistically significant differences in targeted stages of change between the treatment and control groups.
     - $H_1$: There will be statistically significant differences in targeted stages of change between the treatment and control groups.
Chapter 2

Review of Literature

Background and Significance

The obesity crisis continues to escalate in the United States [1,2]. The prevalence of childhood obesity (BMI ≥ 95th percentile based on age and gender) in those aged 2-19 has been on the rise since the late 1970's [1]. Recent data from NHANES surveys from 1999-2008 shows a 3% (13.9% to 16.9%) increase in childhood obesity. During this same time period, childhood overweight (BMI ≥ 85th percentile based on age and gender) has increased by 3.5% (28.2% to 31.7%) [1,2,3]. When examined by age group (2-5 years, 6-11 years, 12-19 years), the percent increase in childhood obesity for children in the 6-11 year old age bracket (4.5%) is greater than the increases seen in the other two age groups (2-5 years, 0.1% increase; 12-19 years, 3.3% increase) [1].
In Ohio, the proportion of third graders overweight and obese is slightly higher than the percentages reported nationally. In 2007-2008, 19.7% of Ohio third graders were reported as obese, while 34.6% were overweight. In 2009-2010, 18.3% of Ohio third graders were reported as obese, while 34.7% were overweight. Looking at 2009-2010 data, notable variations were found by region, ethnicity and proportion enrolled in the Free and Reduced Priced Lunch Program. The prevalence of obesity and overweight was the highest among children who resided in rural Appalachian counties (22.8% obese; 39.8% overweight) as compared to those who resided in rural (19.1% obese; 35.6% overweight), metropolitan (18.4% obese; 34.5% overweight) or suburban (14.3% obese; 30.7% overweight) counties. By ethnicity, the prevalence of overweight and obesity was highest in Hispanic third graders (30.7% obese; 53.7% overweight), followed by non-Hispanic black third graders (19.1% obese; 40.3% overweight) and non-Hispanic other (including Asian, Native Hawaiian, Other Pacific Islanders, American Indians and Alaska Native) third graders (19.1% obese; 36.5% overweight). Prevalence of overweight and obesity was lowest in non-Hispanic white children (17.2% obese, 32.4% overweight) [4]. Differences in percent obesity and overweight were also seen in Ohio third graders enrolled in the Free and Reduced-Price Meal Program (23.4% obese; 40.3% overweight) compared to those not enrolled in the program (13.8% obese; 29.7% overweight). In Franklin County in 2009-2010, between 30-39% of third graders were reported as overweight and/or obese (BMI for age ≥85 percentile) [4]. During the 2007-2008 school
year in Columbus City Schools, 42% of third grade students were classified as overweight and 25% were classified as obese [5].

**Consequences of Childhood Overweight and Obesity**

Childhood obesity has been reported as a risk factor for many health related problems. Obese children have an increased risk for high blood pressure, high cholesterol, coronary artery disease, cardiovascular disease, impaired glucose tolerance, insulin resistance, type 2 diabetes, breathing problems including sleep apnea and asthma, joint problems, musculoskeletal discomfort/injuries, fatty liver disease, gallstones, gastroesophageal reflux disease, inflammation and early physical maturation [43,44,45,46,47,48,49,50,51,52]. In addition, psychological conditions such as poor self-esteem, depression and social discrimination are more common in overweight and obese children and can continue into adulthood [43,46,50,52,53,54,55].

Overweight and obese children are also more likely to become obese adults [11,56,57]. Obesity as an adult is more likely to be severe if the individual was overweight or obese as a child. Adult obesity is associated with an increased risk for serious health conditions including heart disease, diabetes and some cancers [58,59]. Additionally, from 1979-1981 to 1997-1999 childhood obesity related health care costs have tripled [60].
Causes of Childhood Overweight & Obesity

Many factors have been associated with the development of childhood overweight and obesity. In some individuals, there is evidence to suggest genetics, through single gene mutations may result in a greater susceptibility to obesity [61]. However, since the obesity epidemic has affected genetically stable populations, behavioral and environmental factors are implicated as playing a critical role [62].

Differences in the prevalence of obesity have been observed among different ethnic groups [43,44,45,46,47]. In a study by Wang et al using data from the Add Health Study, Asian children had the lowest prevalence of obesity. In the same study using data from NHANES, Non-Hispanic white children had the lowest prevalence of obesity when compared to non-Hispanic black and Mexican-Americans [46].

Rates of childhood obesity have increased across all levels of socioeconomic status. In general a lower socioeconomic status is associated with higher rates of obesity, however when examining by socioeconomic status and gender, no definitive relationship between ethnicity and obesity has been established. Wang et al found that, among non-Hispanic white boys age 2-9 years, socioeconomic status was inversely related to the prevalence of obesity [9]. In non-Hispanic white girls of the same age, socioeconomic status was directly related to the prevalence of obesity. Among non-
Hispanic black children and Hispanic boys age 2-9 years high socioeconomic status is associated with higher prevalence of obesity followed by low economic status, with the lowest prevalence of obesity in the medium socioeconomic status. In Hispanic girls age 2-9 years medium socioeconomic status is associated with the highest prevalence of obesity followed by low socioeconomic status, with the lowest prevalence of obesity in the high socioeconomic status. The relationship between ethnicity, socioeconomic status and the prevalence of obesity is complex and multi-dimensional [9].

Parental weight status, socioeconomic status and education level have also been associated with an increased risk for childhood obesity. The risk of childhood obesity is more than double if either of the child’s parents are obese [10,11,12]. In general, there is an inverse relationship between parental socioeconomic status and obesity; a low socioeconomic status is associated with higher weight status [6,9,12,13,14]. However, in non-Hispanic black women there is a direct relationship between socioeconomic status and obesity; a low socioeconomic status is associated with lower weight status [9]. In general, parents from a lower socioeconomic status are at an increased risk for obesity, which increases the risk of childhood obesity [9,10,11,12]. Another association observed is the relationship to parent education level. In parents, lower levels of education are associated with higher risks of obesity for their children [6,9,15].
Certain dietary practices have also been associated with childhood overweight and obesity. These dietary practices include: high fat intake, inadequate fruit and vegetable consumption, low breakfast consumption, low dairy consumption, higher consumption of energy dense-nutrient poor snack foods, increased consumption of energy dense foods, increase in portion sizes of foods and increased consumption of sugar sweetened beverages [16,17,18,19,20,21,22]. Additionally, parent dietary practices can influence child food behaviors [6,7]. Parents not only provide food for their children, but also model food behaviors that children tend to imitate [6]. If parents model undesirable food behaviors (i.e., consuming large portions, energy rich-nutrient poor foods), children may imitate these behaviors, increasing the risk for childhood overweight and obesity [6,7].

Low levels of physical activity are associated with an increase in childhood overweight and obesity. Factors associated with low levels of physical activity include an increase in television and computer screen time, a decrease in physical education in schools and obstacles that inhibit children from playing outside (i.e. limited access to a safe environment) [19,20,21,22,23]. Additionally, increased television viewing leads to greater exposure to television food advertisements for energy dense, nutrient poor foods. Viewing these advertisements can increase the desire to purchase and consume these foods thereby increasing childhood overweight and obesity [19,63].
Interventions aimed at favorably impacting behaviors associated with the prevention of obesity, could help prevent this chronic disease and spare children and their families from associated health and economic consequences. Behaviors purported to be effective in preventing childhood obesity have been identified and programs designed to address these behaviors have been developed. Systematic reviews and meta-analyses have identified some of these programs as successful, but not without limitations.

Identification of Behaviors for Obesity Prevention

In 2007 the Expert Committee released recommendations on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity [24]. The committee recommended assessment techniques for physicians and health-care providers. An annual assessment of BMI percentile and qualitative dietary assessment, including an evaluation of self-efficacy and readiness to change, are recommended. Specific dietary behaviors for evaluation include: frequency of meals outside the home (restaurant or fast food), sweetened beverage consumption, consumption of large portion sizes, consumption of 100% fruit juice, frequency and quality of breakfast consumption, consumption of high energy dense foods, fruit and vegetable consumption and eating patterns including meal and snack frequency [24].
Prevention guidelines for children between the ages of 2-18 with a BMI between the 5th-84th percentiles, include: eating 5 or more servings of fruit or vegetables per day, limiting screen time to two or less hours per day, obtaining one hour of daily physical activity, no sugar-sweetened beverages, eating breakfast daily, limiting meals outside of the home, having family meals at least 5-6 times per week and allowing children to self-regulate their meals and avoiding overly restrictive behaviors [24].

Davis et al (2007) reviewed evidence based practices for the prevention of childhood obesity and noted the following: lower intakes of dairy and calcium are associated with increased childhood obesity, increased fruit and vegetable intake has a modest effect on protecting against childhood obesity and sugar-sweetened beverage intake is positively associated with childhood obesity [22]. Limited and inconclusive evidence between childhood obesity and total energy intake, dietary fat intake and fruit juice consumption was found. Current evidence suggests: skipping breakfast, eating out – particularly fast food consumption and increased portion sizes may be associated with childhood obesity. There is limited and inconclusive evidence to report a relationship between childhood obesity and snacking [22].

In 2008, The Endocrinology Society released practice guidelines for the prevention and treatment of childhood obesity. They include 6 dietary recommendations include: avoiding calorie dense, nutrient poor foods (including: sugar-sweetened beverages,
sports drinks, fruit drinks, juices, fast food and calorie dense snacks), portion control, reducing saturated fat intake, increasing the intake of dietary fiber, fruits and vegetables and eating regular meals at set times, specifically breakfast [25]. Four of the six behaviors match those recommended by the Expert Committee [24,25].

The Expert Committee, Davis et al and The Endocrinology Society identify four similar behaviors that can be protective against childhood overweight and obesity. These behaviors include: avoiding sugar sweetened beverages, increasing the intake of fruit and vegetables, eating breakfast and limiting portion sizes. No prospective work has been done to identify behaviors protective against childhood overweight and obesity, so recommendations from these respected groups, is the best guidance currently available [22,24,25].

**Obesity Prevention & Elements of Success**

In 2011, a Cochrane Review (systematic review) of childhood obesity prevention interventions was published that examined 31,658 publications (1999-2009), 55 controlled trials were included. Interventions included were a minimum of 12 weeks in length, targeted children less than 18 years of age and reported two clinical outcomes (weight and height, percent fat content, BMI, ponderal index, skin-fold thickness and/or prevalence of overweight and obesity) at baseline and post-intervention. Results
suggest obesity prevention programs targeted at children can be effective; however reviewers could not identify which specific components are essential to decrease childhood obesity. However, six elements found in beneficial obesity prevention programs were: (1) integration of healthy eating, physical activity and body-image into the regular curriculum, (2) increased opportunities for physical activity and the development of fundamental movement skills, (3) availability of foods with improved nutritional quality, (4) an environment and culture that supports eating nutritious foods and participating in physical activity throughout the day, (5) providing resources (trainings and support) for teachers/staff to implement health promotion curricula and (6) engaging parents to support the intervention at home [64].

Gonzalez-Suarez et al (2009) examined school based childhood obesity prevention programs from 1995-2007 [26]. Studies included met the following criteria for inclusion: (1) a randomized controlled study, (2) school based intervention to increase physical activity, improve dietary behaviors or modify poor physical activity/dietary behaviors and (3) inclusion of outcome measures (BMI, percentage of body fat, waist girth, triceps skinfold or waist hip ratio) at baseline and at least 6 months after. Nineteen of the 41 papers evaluated were included in the analysis. Results demonstrated that school-based interventions for obesity prevention are effective in the short-term and programs longer than 1 year in length that combined interventions (dietary and physical activity) are
more effective. However, the meta-analysis found that school based programs did not significantly reduce BMI in treatment groups when compared to the control groups [26].

In a systematic review, Thomas (2006) examined reasons for mixed and modest results from childhood obesity prevention programs from 1985-2003 [27]. Studies included for review met the following criteria: (1) subjects were children in primary or secondary school, (2) interventions included a school component, (3) a control or reference group was used and (4) a variety of valid and reliable outcome measures were used (studies that only reported knowledge and attitudes were excluded). Of the 57 randomized controlled trials reviewed, 19 focused on nutrition, 4 aimed to decrease physical inactivity, 9 aimed to increase physical activity and 25 focused on both nutrition and physical activity. Only 4 studies resulted in statistically and clinically significant results. All 4 studies were based in social cognitive theory and had special trainings for the teachers. The analysis suggested future studies should pay particular attention to methodological issues (i.e. unit of analysis error), program design issues (i.e. not reporting theoretical framework), program implementation issues (i.e. not supervising program implementation for consistency) and use the theoretical basis to explain the results [27].
Obesity Prevention: Model Programs

Based on the analyses of Gonzalez-Suarez et al and Thomas, the Child and Adolescent Trial for Cardiovascular Health (CATCH) and Pathways were noted to be effective obesity prevention programs [26,27,28,29]. CATCH is multi-component behavioral health intervention that is based in the Health Belief Model. The study was a 2.5 year multi-site randomized controlled trial involving 3rd grade children in 96 elementary schools (56 intervention/40 control). At the school level, results showed a statistically significant decrease in total fat in lunches (p<0.001), a decrease in the percent of calories from saturated fat (p<0.01) and a statistically significant increase in potassium intake (p<0.01) when compared with the control group. At the student level, results showed statistically significant reduction in fat intake (p<0.01), including a decrease in saturate fat intake (p<0.01) and a decrease in polyunsaturated and monounsaturated fat intake (p<0.05) compared with students in the control group. Study strengths include a large sample size, use of a theoretically based intervention and use of a control group. Limitations include participation rate (baseline included 60.4%) and the amount of time available for an intervention in public elementary schools due to crowded curricula. Another limitation is that this study is that it did not involve the community [28].

Pathways is a culturally tailored program to promote healthful eating and physical activity. The program is based in Social Learning Theory. The study was a 3 year multi-
site randomized controlled trial involving third through fifth graders from 41 schools (21 intervention/20 controls) in seven American Indian communities. The intervention had four components: classroom, food service, physical activity and family modules. The intervention was designed to promote healthy eating and increase physical activity – ultimately to prevent childhood obesity. Statistically significant findings included increases (treatment vs. control) in student knowledge in third grade (p=0.0001), fourth grade (p=0.0001) and fifth grade (p=0.0003). Knowledge retention of third grade curriculum was statistically significantly greater in the treatment group (p=0.0001), however retention of fourth grade curriculum was not (p=0.0132). Pathways demonstrated that a culturally tailored program can impact knowledge. The strengths of this study include: a large sample size, a theoretically based curriculum, a randomized treatment design, a culturally tailored program and inclusion of the family and school community in the program. A limitation was variable program implementation. While teachers were trained to implement the program, notable differences in program delivery were found. Other limitations included: no changes in percent body fat were observed over the three years and there was a decrease in participation in family events and take home activities each successive year [29].

While CATCH and Pathways are considered the most successful programs, other studies have shown similar results, but are not considered in meta-analyses and systematic reviews due to having a smaller sample size, shorter term intervention (<12 weeks in
length), a design other than a randomized control trial and/or lack of measurement of a clinical outcome (ex. BMI, skin folds). Examples of such nutrition education programs implemented in elementary schools with modest outcomes include: Gimme 5 Fruit, Juice and Vegetables for Fun and Health (Gimme 5), The Nutrition Detectives Program, It’s All About Kids and Smart Bodies [30,31,32,33].

Gimme 5 is a theoretically based program designed to increase consumption of fruit, juice and vegetables and to impact related psychosocial variables. The theoretical model used for Gimme 5 is social cognitive theory. This study was a 3 year multi-site randomized controlled trial involving elementary school children in 32 elementary schools (16 intervention/16 control). Results showed statistically significant increases in fruit, juice and vegetable consumption (p=0.038), vegetable consumption (p=0.017) and knowledge (p=0.038). No statistically significant differences were seen in fruit consumption or the other psychosocial variables. Improvements, while not statistically significant, were seen in (1) fruit, juice and vegetable consumption during weekday lunch (p=0.074), (2) self-efficacy (p=0.054) and (3) social norms (p=0.056). Strengths of the study include a large sample size and a theoretically based in-school program. Study limitations include, observation of modest increases in fruit, juice and vegetable intake (0.2 servings), the reliance on self-report by students and teachers were uncomfortable presenting the curriculum [30].
The Nutrition Detectives Program focused on teaching children (grades 2-4) to read nutrition food labels, detect deceptive marketing and choose healthy foods. The intervention was taught by physical education teachers during the school day. The intervention included 5 mini lessons that totaled less than 2 hours in length. In comparison to the control group, statistically significant increases were found in nutrition label literacy ($p<0.01$). No statistically significant improvements were seen in self-reported dietary behaviors or BMI [31].

It’s All About Kids focused on nutrition knowledge, attitudes and behaviors with 30 minute classroom lessons delivered once a week over six weeks to fourth grade students. There were 71 in the treatment group and 69 in the control group. In comparison to the control group, statistically significant improvements were seen in knowledge of foods that are higher in fat ($p<0.043$) and behavioral intent related too food choices ($p<0.014$). Significant decreases in saturated fat intake ($p<0.019$) and sodium intake ($p<0.041$) were also found [32].

Smart Bodies focuses on (1) increasing nutrition knowledge, (2) improving psychosocial variables related to fruit and vegetable consumption and (3) developing preferences for these foods. This study used a randomized control design. The 12-week intervention was delivered to fourth and fifth grade students at 7 public elementary schools and included taste testing of fruits and vegetables. Eight of the 40 intervention classrooms
were not compliant in delivery of the program (delivered <3 Smart Bodies activities per week) and were not included in the analysis. Statistically significant improvements were seen in nutrition knowledge (p=0.00) and self-efficacy related to fruit consumption and eating the recommended number of fruits and vegetables each day (p=0.00). No changes were seen in self-efficacy related to vegetable consumption or adding fruit to cereal. Smart Bodies relied on teachers for implementation and reliance on self-report by students [33].

Overall, obesity prevention programs have been successfully implemented during the school day and have demonstrated improvements in knowledge and skills; however, behavior change has been modest [28,29,30,31,32,33,34,35]. Statistically significant changes have not been seen in primary outcomes (i.e. BMI) [28,29,31]. Additionally, even with teacher trainings, many teachers feel ill prepared to deliver the programs [27,30,33].

**DVD Based Obesity Prevention Intervention in School**

An estimated 55 million students were enrolled in public and private elementary and secondary schools in the United States in 2008, making schools an ideal location to reach children [37,65]. Schools are an important venue for teaching children how to improve their diets, make healthy food choices, and learn how to cope with stress [36].
While schools have been identified as an appropriate venue for obesity prevention programs; unfortunately there is a decreased emphasis on topics such as nutrition education and stress management in K-12 schools [26,37,38].

While teachers recognize the importance of obesity prevention, many feel ill prepared to instruct children on the necessary knowledge, skills and behaviors to achieve these goals [27,30]. A classroom based DVD program designed to educate children on these topics could help teachers address these needs without requiring excessive training. Additionally, a DVD based program would provide a standardized format for program delivery. Such a program would be especially useful if it also supported existing educational standards. In a search of MEDLINE, ERIC and PubMed databases, no studies have been reported that examine the use of a DVD for delivery of a nutrition education/obesity prevention program to school aged children in the classroom.

**Obesity Prevention Intervention Programs**

*FUEL FOR LEARNING* is a new obesity/stress prevention program that has been developed to address some of the previous program limitations. The obesity prevention portion of *FUEL FOR LEARNING* was developed from an existing program Food Fit. The stress management portion of the program was developed from an existing program Move into Learning. This section will discuss the obesity prevention portion of the
program. Since the nutrition component of FUEL FOR LEARNING is based on Food Fit, Food Fit will be described first, followed by FUEL FOR LEARNING.

**Food Fit**

Food Fit is a 6-week obesity prevention program that was developed by faculty at the Ohio State University in the department of Human Nutrition [39]. Food Fit is based in Social Cognitive Theory [39,40,41]. Social Cognitive Theory provides a framework for understanding, predicting and changing targeted behaviors. The theory focuses on the interaction between personal factors, behavior and the environment, emphasizing an individual’s ability to change the personal factors and the environment, ultimately resulting in behavior change. The construct of self-efficacy, an individual’s level of confidence in performing the behavior, is central to the model [40,41].

Food Fit was designed to impact three of the psychosocial variables within Social Cognitive Theory that are thought to mediate behavior change: behavior capabilities (knowledge and skill), self-efficacy (confidence in using the skill) and outcome expectancies (value placed on skill usage). Lessons are designed to improve behavioral capabilities through knowledge and skills training and participation in demonstrations, role-playing, taste testing and role modeling. Positive and vicarious reinforcement, taste testing, role playing and observational learning are used throughout each lesson, to
enhance self-efficacy and encourage achievement of target behaviors. The focus of each lesson is the ‘target’ behavior to be achieved. Detailed task analyses were conducted during the development of Food Fit to identify sub-skills needed to execute target behaviors. Each lesson is designed to teach children the critical skills needed to perform the target behaviors and to foster self-efficacy [39,40,41]. The lesson topics include:

1. Choosing Lower Calorie Snack Foods
2. Choosing 1 Serving of a Snack Food when Eating from a Large Container
3. Choosing Beverages without Added Sugar
4. Choosing Cereals with a Low Amount of Added Sugar
5. Eating Whole Fruit and Choosing Fruit for Breakfast and Snacks
6. Eating Vegetables and Choosing Raw Vegetables for a Snack

Food Fit was pilot tested with 58 children at 5 YMCA after-school programs. Trained instructors delivered the program. Dietary behavior was measured pre and post-intervention and psychosocial variables were measured before and after each lesson. Extensive process evaluations were completed to monitor program fidelity [39].

Statistically significant improvements were found in dietary behavior (p<0.001), specifically in increased consumption of fruits and vegetables as snacks (p=0.0014), increased consumption of citrus fruits and juice (p=0.0209), increased consumption of raw vegetables (p=0.0006) and increased use of the food label for food selection.
Statistically significant improvements in behavioral capabilities were found for choosing one serving of a packaged snack food (p=0.001), eating fruit and choosing whole fruit for breakfast and snacks (p=0.001) and eating vegetables and choosing raw vegetables for a snack (p=0.001). Self-efficacy scores showed statistically significant improvements for choosing lower calorie alternatives for snack foods (p=0.006), choosing one serving of a packaged snack food (p=0.001), choosing beverages without added sugar (p=0.006) and eating fruit and choosing whole fruit for breakfast and snacks (p=0.015). Statistically significant improvements in outcome expectancies were found for choosing beverages without added sugar (p=0.001) and eating vegetables and choosing raw vegetables for a snack (p=0.001) [39].

Limitations of the program include the need for trained instructors and extensive training for these instructors. Study limitations include a small sample size, the lack of a control group for comparison and post-testing only included dietary assessment and not psychosocial variables targeted in each lesson. Since implemented at an after school program, participation rates varied and children were at various levels of cognitive development (grades 3-5) [39].
Fuel for Learning

**FUEL FOR LEARNING** is an 8 week DVD-based obesity and stress prevention program that supports selected 3rd grade Ohio educational standards. One day of the week, a 35 minute nutrition lesson is delivered during the school day. Five days a week a 10 minute stress prevention session is delivered during the school day.

The obesity prevention component of the program was adapted from Food Fit and encourages positive food selection behaviors, aimed at improving the nutritional quality of the diet facilitating the prevention of childhood obesity [39]. Four of the eight behaviors recommended by the American Medical Association Expert Committee (eating 5 or more servings of fruit or vegetables per day, no sugar-sweetened beverages, eating breakfast daily and allowing children to self-regulate their meals and avoiding overly restrictive behaviors – portion control) and five of the six behaviors recommended by The Endocrinology Society (avoiding calorie dense, nutrient poor foods – including: sugar-sweetened beverages, sports drinks, fruit drinks, juices, fast food and calorie dense snacks, portion control, increasing the intake of dietary fiber, fruits and vegetables and eating regular meals at set times, specifically breakfast) [24,63]. **FUEL FOR LEARNING** targets all four of the similar behaviors (avoiding sugar sweetened beverages, increasing the intake of fruit and vegetables, eating breakfast and limiting portion sizes) identified by the Expert Committee, Davis et al and The
Endocrinology Society as protective against childhood overweight and obesity [22,24,63].

The obesity prevention component of FUEL FOR LEARNING is based on Food Fit. Food Fit is theoretically based in Social Cognitive Theory [39,40,41]. FUEL FOR LEARNING was expanded to include two Transtheoretical Model constructs – stages of change and processes of change. The Transtheoretical Model matches behavior change processes with various stages of readiness to change. Stages of readiness to change include: precontemplation (no desire to change), contemplation (plans to change in next 6 months), preparation (plans to make changes in next 30 days), action (has made the changes) and maintenance (changes are integrated into lifestyle). The processes of change mediate individual’s progression from one stage to the next and serve as an important guide for interventions targeting behavior change. According to the Transtheoretical Model, it is important to match the appropriate ‘processes of change’ with a given ‘stage of change.’ The nutrition lessons were designed assuming that children were in either the precontemplation or contemplation stage. The processes of change constructs used in each lesson to encourage movement from precontemplation to contemplation include: consciousness raising, dramatic relief, environmental re-evaluation. The processes of change constructs used in each lesson to encourage movement from contemplation to preparation include: self re-evaluation process [41].
The obesity prevention portion of the program targets development of simple, discrete skills in each lesson. The program was designed using specific pedagogical techniques to facilitate changes in each of the constructs. The lesson topics include:

1. Choosing Lower Calorie Snack Foods
2. Choosing 1 Serving of a Packaged Snack Food
3. Choosing Beverages without Added Sugars
4. Choosing Breakfast Cereals Low in Sugar
5. Choosing 3 Different Fruits Everyday
6. Choosing 3 Different Vegetables Everyday
7. Choosing 3 Servings of Skim Milk or Dairy Alternatives Everyday
8. Choosing Healthier Foods for Breakfast Everyday

Each of the eight obesity prevention lesson are broken down into five components including: Introduction, Benefits & Consequences, Modeling & Taste Testing, Role Play and Goal Setting. During the Introduction the lesson topic was introduced using practical scenarios to introduce lesson topics and the “rationale” for learning targeted behaviors. The Benefits & Consequences section features a hands-on activity for the children to demonstrate concrete examples of abstract concepts (calories) and the positive benefits and negative consequences associated with the particular behavior being promoted. During Modeling & Taste Testing, the positive behavior is promoted and modeled by the leader and positive and vicarious reinforcement are used to engage children and
encourage them to taste the healthy food being promoted through the lesson. During the Role-Play, children practice imitating and advocating for the desired behavior through two real-world situations – one with an adult and one with a peer. Finally, the Goal Setting section includes a review of key lesson objectives and an activity for the students to demonstrate knowledge and understanding of the target behavior. The activities within each component were designed to target specific constructs within Social Cognitive Theory and Transtheoretical Model. Table 1 outlines the constructs targeted through the specific activities in each component.
<table>
<thead>
<tr>
<th>Component</th>
<th>Pedagogical Technique</th>
<th>Construct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>Did you know...</td>
<td>TTM: conscious raising</td>
</tr>
<tr>
<td></td>
<td>And if you...</td>
<td>TTM: dramatic relief, negative</td>
</tr>
<tr>
<td></td>
<td>But, if you...</td>
<td>TTM: dramatic relief, positive</td>
</tr>
<tr>
<td></td>
<td>Since (dramatic relief, positive), let’s learn</td>
<td>TTM: dramatic relief, positive</td>
</tr>
<tr>
<td></td>
<td>How to (target behavior – name of lesson)</td>
<td>SCT: outcome expectations/expectancies</td>
</tr>
<tr>
<td><strong>Benefits &amp; Consequences</strong> (Game)</td>
<td>Knowledge, facts</td>
<td>SCT: behavioral capabilities</td>
</tr>
<tr>
<td></td>
<td>Activity</td>
<td>SCT: outcome expectations/expectancies</td>
</tr>
<tr>
<td><strong>Modeling &amp; Taste Testing</strong></td>
<td>Modeling – Knowledge, facts</td>
<td>SCT: behavioral capabilities</td>
</tr>
<tr>
<td></td>
<td>Modeling – Demo, all repeat</td>
<td>SCT: self-efficacy, personal mastery</td>
</tr>
<tr>
<td></td>
<td>Modeling – Demo, all repeat</td>
<td>SCT: self-efficacy, social modeling</td>
</tr>
<tr>
<td></td>
<td>Tasting healthy options – self as role model of healthy eating behavior</td>
<td>TTM: self re-evaluation</td>
</tr>
<tr>
<td></td>
<td>Tasting healthy options – self as role model of healthy eating behavior can help others in family learn healthy eating too</td>
<td>TTM: environmental re-evaluation</td>
</tr>
<tr>
<td><strong>Role Play</strong></td>
<td>Verbalize knowledge learned</td>
<td>SCT: behavioral capabilities</td>
</tr>
<tr>
<td></td>
<td>Demonstrate sills learned</td>
<td>SCT: self-efficacy, personal mastery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SCT: self-efficacy, social persuasion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TTM: self re-evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TTM: social persuasion</td>
</tr>
<tr>
<td><strong>Goal Setting</strong></td>
<td>Picture of self doing behavior</td>
<td>SCT: self-efficacy, vicarious rehearsal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TTM: self-re-evaluation</td>
</tr>
</tbody>
</table>

Parent newsletters have been created for each lesson. The newsletters are designed to reinforce the targeted obesity and stress prevention behaviors in *FUEL FOR LEARNING* by providing tips for practical application of these behaviors while at home.
FUEL FOR LEARNING was designed to improve on limitations of past programs. To surmount challenges associated with training and program fidelity, a DVD based format is used to deliver the intervention. The DVD format provides a standardized delivery to each classroom. The program is theoretically based, to be delivered during the school day and meets selected third grade academic content standards.
CHAPTER 3

Methods

Design

A quasi-experimental non-equivalent wait list control group design was used to execute this study. The treatment – implementation of FUEL FOR LEARNING, was assigned to 3 participating classrooms due to administrative requests. The remaining 3 classrooms served as the control group. Pre-tests were administered to both the treatment and control classrooms prior to implementation of the treatment during a field trip to the Center of Science and Industry (COSI).

Pre-tests were completed at COSI by Immaculate Conception School on January 12, 2011 and by Hilliard Beacon Elementary School on January 13, 2011. The treatment classroom at Immaculate Conception School started the 8-week treatment on January 11, 2011 and concluded on March 10, 2011. The two treatment classrooms at Hilliard Beacon started the 8-week treatment on January 14, 2011 and concluded on March 11,
2011. The control classrooms continued with normal classroom activities during this time.

Post-tests were administered to both treatment and control classrooms after implementation of the treatment. On March 11, 2011 at Immaculate Conception School and March 17, 2011 at Hilliard Beacon Elementary School, the children who provided verbal assent and whose parents provided parental permission completed post-test assessments. The assessments took place in the classrooms at the schools. On March 21, 2011 the treatment classrooms resumed normal classroom activities and the control classrooms began the 8-week program. The control group concluded the 8-week program on May 20, 2011. Approval from the Behavioral and Social Sciences Institutional Review Board at The Ohio State University was obtained on December 6, 2010.

Sample

Recruitment for the study occurred between December 10, 2010 and January 12, 2011. During recruitment, Ohio State University staff obtained permission from parents to allow their child to participate in the program and verbal assent from the children. Parent permission forms were sent home to parents on December 10, 2010 in a sealed envelope that includes a parent letter describing the program along with “The Ohio
State University Parental Permission For Child’s Participation in Research” form (appendix A). The parent permission forms were returned in pre-paid postage envelope provided via US Mail. All children also had to give verbal assent to participate using “The Ohio State University Assent to Participation” form (appendix B). Ohio State University staff obtained verbal assent during the weeks of December 13, 2010 and January 3, 2011 in the classrooms. Participation in the program was strictly voluntary. Children who had parental permission and provided verbal assent, were eligible to participate and were assigned subject identification numbers.

Third grade children from six classrooms in two Columbus, Ohio elementary schools (Hilliard Beacon Elementary School – public school and Immaculate Conception School – parochial/private school) were eligible for participation. Participation was strictly voluntary. The sample included children who gave verbal assent and whose parents completed and signed an informed consent form.

**Intervention**

*FUEL FOR LEARNING* is an 8 week DVD-based obesity and stress prevention program that supports selected 3rd grade Ohio educational standards. A 45 minute session was delivered one day each week and 10 minute sessions were delivered the remaining four days of the week. The 45 minute session includes 35 minutes of obesity prevention and
10 minutes of stress prevention. The 10 minute sessions on the remaining 4 days focused on stress prevention. The eight nutrition education segments are theoretically based in Social Cognitive Theory and Transtheoretical Model. The lessons were designed to stand alone, so any absence from one lesson would not affect the ability to participate in the others. The movement and stress reduction component draws upon principles from three central areas of research: Yoga, Sensory Integration and Mindfulness Based Stress Reduction. This analysis will focus on the obesity prevention part of the program.

Measurement/Instrumentation

The following evaluation tools were administered before (pre test) and after (post test) to children who had given verbal assent and whose parent or legal guardian had given informed consent.

1. **Child-Modified Food Behavior Checklist (CM-FBC):** A child-modified version of the Food Behavior Checklist is a 19-item self-report instrument. The Child Modified Food Behavior Checklist is designed to measure fruit and vegetables consumption, milk consumption, fat and cholesterol consumption, sugar sweetened beverage consumption and dietary behaviors such as use of the food label and frequency of eating at fast food restaurants. Responses are either
dichotomous (Yes/No) or frequency based (0-5). This instrument has been shown to have suitable reliability and validity [66]. See Appendix C.

2. **Behavioral Capabilities**: The Behavioral Capabilities questionnaire is a 16-item self-report instrument based on social cognitive theory. This instrument evaluates if individuals have the necessary knowledge and skills to perform each of the 8 target dietary behaviors (choosing lower calorie snack foods, choosing 1 serving from a packaged snack food, choosing beverages without added sugar, choosing breakfast cereals low in sugar, choosing 3 different fruits every day, choosing 3 different vegetables everyday, choosing 3 servings of skim milk or dairy alternatives everyday and choosing healthier foods for breakfast everyday). Face and content validity was established by a 6 member expert committee. The table (TABLE 2) below details which items evaluate which target dietary behaviors and the manner in which they do so. See Appendix D.
### TABLE 2: Behavioral Capabilities Targeted Dietary Behaviors

<table>
<thead>
<tr>
<th>Item</th>
<th>Target Dietary Behavior</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Choosing Lower Calorie Snack Foods</td>
<td>Skill - comparing food labels; multiple choice</td>
</tr>
<tr>
<td>2</td>
<td>Choosing 1 Serving of a Packaged Snack Food</td>
<td>Skill - comparing food labels; multiple choice</td>
</tr>
<tr>
<td>3</td>
<td>Choosing Beverages without Added Sugars</td>
<td>Skill - comparing food labels; multiple choice</td>
</tr>
<tr>
<td>4</td>
<td>Choosing 3 Different Fruits Everyday</td>
<td>Knowledge - fruit servings needed daily; multiple choice</td>
</tr>
<tr>
<td>5</td>
<td>Choosing 3 Different Fruits Everyday</td>
<td>Knowledge - what is a fruit; multiple choice</td>
</tr>
<tr>
<td>6</td>
<td>Choosing 3 Different Fruits Everyday</td>
<td>Knowledge - what beverages count as a fruit; multiple choice</td>
</tr>
<tr>
<td>7</td>
<td>Choosing 3 Different Vegetables Everyday</td>
<td>Knowledge - vegetable servings needed daily; multiple choice</td>
</tr>
<tr>
<td>8</td>
<td>Choosing 3 Different Vegetables Everyday</td>
<td>Knowledge - what is a vegetable; multiple choice</td>
</tr>
<tr>
<td>9</td>
<td>Choosing 3 Servings of Skim Milk or Dairy Alternatives Everyday</td>
<td>Knowledge - milk servings needed daily; multiple choice</td>
</tr>
<tr>
<td>10</td>
<td>Choosing 3 Servings of Skim Milk or Dairy Alternatives Everyday</td>
<td>Knowledge - milk alternatives; true/false/I don’t know</td>
</tr>
<tr>
<td>11</td>
<td>Choosing 3 Servings of Skim Milk or Dairy Alternatives Everyday</td>
<td>Knowledge - milk alternatives; true/false/I don’t know</td>
</tr>
<tr>
<td>12</td>
<td>Choosing 3 Servings of Skim Milk or Dairy Alternatives Everyday</td>
<td>Knowledge - milk alternatives; true/false/I don’t know</td>
</tr>
<tr>
<td>13</td>
<td>Choosing Breakfast Cereals Low in Sugar</td>
<td>Skill - comparing food labels; multiple choice</td>
</tr>
<tr>
<td>14</td>
<td>Choosing Healthier Foods for Breakfast Everyday</td>
<td>Knowledge - frequency of breakfast consumption; multiple choice</td>
</tr>
<tr>
<td>15</td>
<td>Choosing Healthier Foods for Breakfast Everyday</td>
<td>Knowledge - healthiest breakfast foods; multiple choice</td>
</tr>
<tr>
<td>16</td>
<td>Choosing Healthier Foods for Breakfast Everyday</td>
<td>Knowledge - healthiest breakfast beverages; multiple choice</td>
</tr>
</tbody>
</table>

3. **Stages of Change**: The Stages of Change questionnaire is a 10-item self-report instrument based on the Transtheoretical Model. Respondents are asked to identify which statement best describes their readiness to change for 10 behaviors targeted through **FUEL FOR LEARNING**. These 10 behaviors include: the 8 target dietary behaviors (choosing lower calorie snack foods, choosing 1
serving from a packaged snack food, choosing beverages without added sugar, choosing breakfast cereals low in sugar, choosing 3 different fruits every day, choosing 3 different vegetables everyday, choosing 3 servings of skim milk or dairy alternatives everyday and choosing healthier foods for breakfast everyday) and 2 stress prevention behaviors, which will not be examined in this evaluation. Responses, which correspond to the 5 stages of change, include: “I don’t and don’t plan to anytime soon” (Pre-contemplation), “I don’t, but think I should” (Contemplation), “I don’t usually, but I’m going to start soon” (Preparation), “I just started to” (Action) and “I usually do” (Maintenance). See Appendix E.

4. **Self-Efficacy:** The Self-Efficacy Questionnaire is a 24 item self-report questionnaire designed to evaluate an individual’s perceived self-efficacy (confidence) in executing each of the 8 target dietary behaviors (choosing lower calorie snack foods, choosing 1 serving from a packaged snack food, choosing beverages without added sugar, choosing breakfast cereals low in sugar, choosing 3 different fruits every day, choosing 3 different vegetables everyday, choosing 3 servings of skim milk or dairy alternatives everyday and choosing healthier foods for breakfast everyday) that are addressed in *FUEL FOR LEARNING*. There are three self-efficacy questions for each of the 8 target dietary behaviors. The first question evaluates an individual’s perception of their self-efficacy about the target behavior without ‘competing influences.’ The second
question evaluates an individual’s perception of their self-efficacy of the target behavior given the ‘competing influence’ of a better tasting alternative. The third question evaluates an individual’s perception of their self-efficacy of the target behavior given the ‘competing influence’ of peers who do not execute the target behavior. Response categories for each question are: very low, low, medium, high, very high. This instrument was deemed to have suitable content and face validity by a 6 member expert committee. See Appendix F.

5. **Anthropometric Assessment:** Height and weight were measured and used to calculate body mass index (BMI) percentiles.

**Height:** All participants were be measured using a standard stadiometer. Height was recorded in inches to the nearest eighth of an inch. Participants were measured alone, with 2 supervising adults, to safeguard confidentiality. Participants were asked to remove shoes for measurements. Height was recorded on the “Student Information Form.” See Appendix G.

**Weight:** All participants were weighed using an electronic scale. Weight was recorded in pounds, to the nearest tenth of a pound. Participants were asked to stand upright with their weight evenly distributed on both feet. Participants were weighed alone, with 2 supervising adults, to safeguard confidentiality. Participants were weighed wearing their normal clothing and were asked to take
off shoes, coats and jackets. Weight was recorded on “Student Information Form.” See Appendix G.

BMI Percentile: BMI was calculated using body mass index for age using the Center for Disease Control (CDC) Child and Teen BMI Calculator [67]. BMI percentile was used as opposed to BMI z-scores, because BMI percentile is more widely used in clinical practice [68].

6. **Demographic Characteristics**: Birth date, age, gender and ethnicity were collected for each child. Data was recorded on the “Student Information Form.” See Appendix G.

7. **Attendance**: The nutrition coloring activity was collected after each nutrition lesson. Completion of the nutrition coloring activity was used as a surrogate for attendance. See Appendix H.

**Statistical Analysis**

To evaluate changes in dietary behavior (Child Modified Food Behavior Checklist) and psychosocial variables (Behavioral Capabilities, Self-Efficacy and Stages of Change) a total composite score for each instrument was calculated for both pre and post tests. For the Child Modified Food Behavior the applicable dicotomous questions (numbers 1,
2, 3, 5, 6, 8, 9, 10, 16, 17, 18) were scored, assigning one point was for desirable behaviors and zero points for undesirable behaviors with a maximum of 11 points. For Behavioral Capabilities one point was given for the correct response and zero points were given for incorrect responses with a maximum of 16 points. For Self-Efficacy only the first question, evaluating the individuals perception of his/her self-efficacy, for each targeted behavior was used in the statistical analysis. For Self-Efficacy and Stages of Change the score for each item ranged from 1-5 and an average of the 8 items was calculated, resulting in a 1-5 score.

Change scores (post-test score – pre-test score) were calculated for each instrument (Child Modified Food Behavior Checklist, Behavioral Capabilities, Self Efficacy, Stages of Change). An analysis of variance, using a univariate general linear model, was conducted to evaluate differences between the treatment and control groups. For each analysis, potential covariates (gender, school and BMI Percentile) were analyzed for statistical significance. Variables found to be significant were included as factors in the statistical model. Statistical significance was set at p ≤0.05. To determine the impact of attendance on change scores for dietary behaviors and psychosocial variables, a univariate general linear model was conducted.
For results deemed statistically significant, further analysis was conducted on the lessons specific data to determine the source of variability. Wald’s test, using a logistic generalized linear model (multinomial) was conducted.

To determine the effect of shared food behavior at the school level, an intraclass correlation between school and pre test score on the Child Modified Food Behavior Checklist (dietary behavior) was calculated.

SAS (9.2, Cary, NC) was used to perform an intraclass correlation. SPSS (19.0, Chicago, IL) was used to perform statistical analysis of all other outcome measures. Statistical significance was determined using a p value of ≤0.05.

In summary, the univariate general linear model was used to analyze continuous data (pre-age and BMI percentile) and categorical data approximated to the normal curve (composite change scores). Binary data (gender) and categorical data (BMI Classification, lesson specific change scores) were analyzed using the logistic generalized linear model (multinomial) (TABLE 3).
<table>
<thead>
<tr>
<th>Variables</th>
<th>Univariate General Linear Model</th>
<th>Logistic Generalized Linear Model (multinomial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic Information</td>
<td>Pre-Age BMI Percentile</td>
<td>Gender BMI Classification</td>
</tr>
<tr>
<td>Child Modified Food Behavior Checklist</td>
<td>Composite Change Scores</td>
<td>Fruit Change Scores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetable Change Scores</td>
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<tr>
<td></td>
<td></td>
<td>Milk Change Scores</td>
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<tr>
<td></td>
<td></td>
<td>Label Change Scores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sugar Sweetened Beverages</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change Scores</td>
</tr>
<tr>
<td>Behavioral Capabilities</td>
<td>Composite Change Scores</td>
<td>Fruit Change Scores</td>
</tr>
<tr>
<td></td>
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<td>Vegetable Change Scores</td>
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<td>Milk Change Scores</td>
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<td>Label Change Scores</td>
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<td></td>
<td></td>
<td>Breakfast Change Scores</td>
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<tr>
<td>Self-Efficacy</td>
<td>Composite Change Scores</td>
<td>Fruit Change Scores</td>
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<td>Breakfast Change Scores</td>
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<td>Stages of Change</td>
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<td>Milk Change Scores</td>
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<td>Label Change Scores</td>
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<tr>
<td></td>
<td></td>
<td>Breakfast Change Scores</td>
</tr>
</tbody>
</table>
Chapter 4

Results

The study sample included 137 third grade children overall, 70 males (51.1%) and 67 females (48.9%). The mean age was 9.05 years. The mean BMI Percentile was 58% (TABLE 4.1). There were n=67 in the treatment group and n=70 in the control group. No statistically significant differences were found in baseline characteristics between the treatment vs. control groups (TABLE 4).
### TABLE 4: Demographic Information

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Treatment Group</th>
<th></th>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class 1</td>
<td>Class 2</td>
<td>Class 3</td>
<td>Total</td>
<td>Class 1</td>
<td>Class 2</td>
<td>Class 3</td>
<td>Total</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n (%); x̄ ± SD</td>
<td>n (%); x̄ ± SD</td>
<td>n (%);  x̄ ± SD</td>
<td>n (%); x̄ ± SD</td>
<td>n (%);  x̄ ± SD</td>
<td>n (%);  x̄ ± SD</td>
<td>n (%);  x̄ ± SD</td>
<td>n (%); x̄ ± SD</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=</td>
<td>20 (29.9)</td>
<td>23 (34.3)</td>
<td>24 (35.8)</td>
<td>67 (48.9)</td>
<td>24 (34.1)</td>
<td>22 (31.4)</td>
<td>24 (34.3)</td>
<td>70 (51.1)</td>
<td>0.761</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Test Age (mean years)</td>
<td>8.85 ± 0.39</td>
<td>8.91 ± 0.40</td>
<td>8.90 ± 0.34</td>
<td>8.89 ± 0.37</td>
<td>9.01 ± 0.35</td>
<td>9.00 ± 0.41</td>
<td>9.15 ± 0.35</td>
<td>9.05 ± 0.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
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<td></td>
<td>0.936</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11 (55.0)</td>
<td>11 (47.8)</td>
<td>12 (50.0)</td>
<td>34 (50.7)</td>
<td>11 (45.8)</td>
<td>12 (54.5)</td>
<td>13 (54.2)</td>
<td>36 (51.4)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Female</td>
<td>9 (45.0)</td>
<td>12 (52.2)</td>
<td>12 (50.0)</td>
<td>33 (49.3)</td>
<td>13 (54.2)</td>
<td>10 (45.5)</td>
<td>11 (45.8)</td>
<td>34 (48.6)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BMI Percentile (mean %)</td>
<td>61 ± 28</td>
<td>68 ± 28</td>
<td>63 ± 33</td>
<td>64 ± 29</td>
<td>51 ± 31</td>
<td>67 ± 33</td>
<td>55 ± 33</td>
<td>58 ± 32</td>
<td>0.680</td>
<td></td>
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<td>BMI Classification</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.908</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (4.2)</td>
<td>1 (1.5)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (4.2)</td>
<td>1 (1.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy Weight</td>
<td>15 (75.0)</td>
<td>15 (65.2)</td>
<td>14 (58.3)</td>
<td>44 (65.7)</td>
<td>19 (79.2)</td>
<td>10 (45.4)</td>
<td>17 (70.8)</td>
<td>46 (65.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>3 (15.0)</td>
<td>4 (17.4)</td>
<td>5 (20.8)</td>
<td>12 (17.9)</td>
<td>2 (8.3)</td>
<td>6 (27.3)</td>
<td>2 (8.3)</td>
<td>10 (14.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May be Obese</td>
<td>2 (10.0)</td>
<td>4 (17.4)</td>
<td>4 (16.7)</td>
<td>10 (14.9)</td>
<td>3 (12.5)</td>
<td>6 (27.3)</td>
<td>4 (16.7)</td>
<td>13 (18.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Intraclass Correlation**

The intraclass correlation between school and pre-score on the Child Modified Food Behavior Checklist was quantified to determine if shared food behavior at the school
level had an impact on dietary behavior. This value was quantified at 0.000000162.
Since this value is relatively close to 0, there is no evidence to suggest a significant
relationship between school and pre-score on the Child Modified Food Behavior
Checklist. However, to be conservative and account for any differences at the school
level, school was included as a factor in the statistical model.

Dietary Behavior

The Child Modified Food Behavior Checklist was completed by 124 children, 60 in the
treatment group and 64 in the control group. Statistically significant differences in
change scores were found in overall dietary behavior between the treatment and
control group (p=0.002). There was a $0.966 \pm 0.310$ unit increase in desirable food
behaviors in the treatment group (TABLE 5). Statistically significant improvements were
found in vegetable change scores (p=0.050) and food label change scores (p=0.000). The
vegetable change scores increased $0.666 \pm 0.340$ units, indicating increased desirable
vegetable behaviors in the treatment group. The food label change scores increased
$2.169 \pm 0.443$ units, indicating an increase in desirable food label behaviors in the
treatment group.
### TABLE 5: Statistical Analyses by Group

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Control</th>
<th>Treatment</th>
<th>Parameter Estimate</th>
<th>p value</th>
<th>Effect Size (n²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Modified Food Behavior Checklist</td>
<td>0.11 ± 1.40 64</td>
<td>1.05 ± 1.97 60</td>
<td>0.960 (0.310)</td>
<td>0.002*</td>
<td>0.075¹</td>
</tr>
<tr>
<td>Behavior Capabilities</td>
<td>0.82 ± 3.16 55</td>
<td>4.32 ± 2.81 63</td>
<td>3.469 (0.541)</td>
<td>0.000*</td>
<td>0.267²</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>-0.01 ± 0.76 63</td>
<td>0.31 ± 0.90 66</td>
<td>0.341 (0.145)</td>
<td>0.020*</td>
<td>0.043¹</td>
</tr>
<tr>
<td>Stages of Change</td>
<td>0.08 ± 0.72 67</td>
<td>0.20 ± 0.68 70</td>
<td>0.127 (0.121)</td>
<td>0.293</td>
<td>0.008³</td>
</tr>
</tbody>
</table>

Statistical model accounts for Gender, School and BMI Percentile

* p value ≤ 0.05, statistically significant

¹ medium effect size (0.0588)

² large effect size (0.1379)

³ small effect size (0.0099)

### Psychosocial Outcomes

The Behavioral Capabilities questionnaire was completed by 188 children, 63 in the treatment group and 55 in the control group. The change scores were statistically significantly different between the treatment and control group (p=0.000). There was a 3.469 ± 0.3541 unit increase in correct responses in the treatment group (TABLE 5). Statistically significant improvements were found in fruit change scores (p=0.004), vegetable change scores (p=0.000), food label change scores (p=0.002) and milk change.
scores (p=0.000). Looking further at these increases, fruit change scores increased $0.964 \pm 0.331$ units in correct responses in the treatment group. Vegetable change scores increased $1.938 \pm 0.369$ units in correct responses in the treatment group. Food label change scores increased $1.241 \pm 0.375$ units in correct responses in the treatment group. Finally, milk change increased $1.407 \pm 0.337$ units in correct responses in the treatment group.

The Self-Efficacy questionnaire, was completed by 129 children, 66 in the treatment group and 63 in the control group. The change scores were statistically significantly different between the treatment and control group (p=0.043). There was a $0.341 \pm 0.145$ unit increase in confidence in ability to perform behaviors in the treatment group (TABLE 5). Statistically significant improvements were not seen in any of the individual targeted behaviors.

The Stages of Change questionnaire was completed by 137 children, 70 in the treatment group and 67 in the control group. The change scores were not statistically significant between the treatment and control groups (p=0.293). There was a $0.127 \pm 0.121$ unit increase in the treatment groups stage of change (TABLE 5).
Lesson Attendance

Lesson attendance was 0 lessons for the control group (n=67) and ranged from 3 to 8 lessons for the treatment group (n=70). Lesson attendance was examined to determine if the number of lessons attended impacted changes scores for the outcome measures. The mean number of lessons attended by children in the treatment group was 7.1 (TABLE 6).

### TABLE 6: Lesson Attendance Treatment vs. Control Groups

<table>
<thead>
<tr>
<th>Students</th>
<th>Control</th>
<th>Treatment Group Total Lesson Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 n (%)</td>
<td>1 n (%)</td>
</tr>
<tr>
<td>Students</td>
<td>67 (48.9)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

The mean number of students attending each lesson in the treatment group is presented in TABLE 7. The mean number of students attending each of the 8 lessons in the treatment group was 61.9 (88.4%).
TABLE 7: Attendance by Lesson

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Lesson Number</th>
<th>1 n (%)</th>
<th>2 n (%)</th>
<th>3 n (%)</th>
<th>4 n (%)</th>
<th>5 n (%)</th>
<th>6 n (%)</th>
<th>7 n (%)</th>
<th>8 n (%)</th>
<th>Mean x (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>1</td>
<td>20</td>
<td>22</td>
<td>18</td>
<td>22</td>
<td>20</td>
<td>17</td>
<td>23</td>
<td>21</td>
<td>20.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(83.3)</td>
<td>(91.7)</td>
<td>(75.0)</td>
<td>(91.7)</td>
<td>(83.3)</td>
<td>(70.8)</td>
<td>(95.8)</td>
<td>(87.5)</td>
<td>(84.9)</td>
</tr>
<tr>
<td>Class 2</td>
<td>2</td>
<td>16</td>
<td>21</td>
<td>19</td>
<td>22</td>
<td>20</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(72.7)</td>
<td>(95.5)</td>
<td>(86.4)</td>
<td>(100.0)</td>
<td>(90.9)</td>
<td>(81.8)</td>
<td>(72.7)</td>
<td>(72.7)</td>
<td>(84.1)</td>
</tr>
<tr>
<td>Class 3</td>
<td>3</td>
<td>23</td>
<td>22</td>
<td>24</td>
<td>20</td>
<td>24</td>
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<td>24</td>
<td>23.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(95.8)</td>
<td>(91.7)</td>
<td>(100.0)</td>
<td>(83.3)</td>
<td>(100)</td>
<td>(95.8)</td>
<td>(100)</td>
<td>(100)</td>
<td>(95.8)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>59</td>
<td>65</td>
<td>61</td>
<td>64</td>
<td>64</td>
<td>58</td>
<td>63</td>
<td>61</td>
<td>61.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(84.3)</td>
<td>(92.9)</td>
<td>(87.1)</td>
<td>(91.4)</td>
<td>(91.4)</td>
<td>(82.9)</td>
<td>(90.0)</td>
<td>(87.1)</td>
<td>(88.4)</td>
</tr>
</tbody>
</table>

For the Child Modified Food Behavior Checklist, lesson attendance data showed statistically significant change scores were found at 8 lessons (p=0.007). For Behavioral Capabilities statistically significant scores were found at 7 lessons (p=0.001) and 8 lessons (p=0.000). For Self-Efficacy lesson attendance showed statistically significant scores were found at 5 lessons (p=0.008) (TABLE 8).
### TABLE 8: Statistical Analyses by Lesson Attendance

<table>
<thead>
<tr>
<th>Number of Lessons Attended</th>
<th>0  x̄ (n)</th>
<th>3  x̄ (n)</th>
<th>4  x̄ (n)</th>
<th>5  x̄ (n)</th>
<th>6  x̄ (n)</th>
<th>7  x̄ (n)</th>
<th>8  x̄ (n)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Modified Food</td>
<td>0.11 (64)</td>
<td>-2.00 (2)</td>
<td>0.00 (1)</td>
<td>1.67 (2)</td>
<td>0.88 (8)</td>
<td>0.71 (17)</td>
<td>1.48 (29)</td>
<td>0.007*</td>
</tr>
<tr>
<td>Behavior Checklist</td>
<td>0.00 (1)</td>
<td>4.29 (17)</td>
<td>0.001*</td>
<td>0.39 (31)</td>
<td>0.000*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavior Capabilities</td>
<td>0.82 (55)</td>
<td>6.50 (2)</td>
<td>0.00 (0)</td>
<td>5.33 (3)</td>
<td>3.40 (10)</td>
<td>0.000*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>-0.01 (63)</td>
<td>-1.00 (1)</td>
<td>0.75 (1)</td>
<td>2.25 (3)</td>
<td>0.008*</td>
<td>0.000*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stages of Change</td>
<td>0.08 (67)</td>
<td>-0.44 (2)</td>
<td>-0.75 (1)</td>
<td>0.13 (3)</td>
<td>0.30 (11)</td>
<td>0.13 (20)</td>
<td>0.29 (33)</td>
<td>0.494</td>
</tr>
</tbody>
</table>
CHAPTER 5

Discussion

The DVD based nutrition component of *FUEL FOR LEARNING* positively impacted dietary behaviors and behavioral capabilities in third graders. Significant improvements were seen in overall dietary behavior, specifically increases in consumption of vegetables and use of the food label. In terms of psychosocial variables, significant improvements were seen in overall behavioral capabilities, specifically increases in knowledge and skills related to fruits, vegetables, use of the food label and milk.

As purported through Social Cognitive Theory, improvements in behavioral capabilities, self-efficacy and stages of change mediate changes in dietary behavior. Significant changes were seen in behavioral capabilities corresponding to changes in dietary behavior, specifically vegetable consumption and use of the food label. This is consistent with Social Cognitive Theory. Theoretically, similar changes should also be seen in self-efficacy and stages of change; however changes were not detected in these variables.
Significant changes in using the food label for food selection were seen in both dietary behavior and behavioral capabilities. Using the food label for food selection was the focus of four lessons (lessons 1, 2, 3 and 4) whereas other targeted behaviors were only addressed in only one lesson. Significant changes in using the food label for food selection may have been impacted due to increased exposure to this topic.

The other dietary behaviors examined including fruit, milk and sugar sweetened beverages change scores were not statistically significant. Each of these topics was addressed in only one lesson and only had 2 items on the Child Modified Food Behavior Checklist measuring intake. Food labels were discussed in 4 lessons and there were 3 items on the Child Modified Food Behavior Checklist measuring vegetable intake. Two questions measuring food intake may not have been sufficient to capture changes in these dietary behaviors. Looking closer at where the children started it is interesting to note that 49.3% of students were practicing both of the desirable fruit dietary practices, 71.7% were practicing both of the desirable milk behaviors and 52.2% were practicing both of the desirable sugar-sweetened beverages behaviors. In comparison, 40.6% were practicing the desirable food label reading behavior and 11.6% were practicing the desirable vegetable dietary practice. This left individuals practicing both desirable dietary behaviors with no room for improvement on the post-test with 0 as the highest possible change score. In comparison, there was more room for improvement in
desirable food label reading and vegetable intake than there was in fruit, milk and decreased sugar-sweetened beverage intake.

For behavioral capabilities, all items except the breakfast change scores showed statistically significant improvements. Similar to what was found in terms of dietary behavior, 52.2% of students correctly answered all 3 questions on breakfast on the pre-test. This left these individuals no room for improvement on the post-test with 0 as the highest possible change score. In comparison, 34.1% correctly answered the 3 questions on fruit, 23.2% correctly answered the 2 questions on vegetables, 5.1% correctly answered the 4 questions on the food label and 9.4% correctly answered the 4 questions on milk. Since breakfast approached statistical significance (p=0.069) the high percentage of students correctly answering all 3 questions on the pre-test, likely influenced this result.

Despite using prescribed methods to promote self-efficacy and stages of change, no changes were seen in these variables. This may be due to problems with instrumentation. The instruments used to measure self-efficacy and stages of change were limited to 1 question about each behavior, which may be insufficient to evaluate changes in these constructs. Test fatigue may also be a problem as these were the last two questionnaires completed by the students during both pre and post testing.
Furthermore, self-efficacy and stages of change are more abstract concepts and may be beyond the cognitive development of 8-10 year olds [70].

Overall, statistically significant improvements were seen in dietary behavior and behavioral capabilities. Changes in behavioral capabilities, knowledge and skills, were larger (3.469 ± 0.541 unit increase with 16 items measured) than changes in dietary behavior (0.960 ± 0.310 unit increase with 11 items measured). Larger changes were seen in knowledge and skills than in dietary behavior.

Similar to other programs, FUEL FOR LEARNING showed greater improvements in knowledge and skills than in dietary behavior [28,29,30,31,32,33,34,35,39]. Social Cognitive Theory purports that constructs, including behavioral capabilities, are mediators of behavior change. Thus, impacting behavioral capabilities through increases in knowledge and skills should mediate changes in behavior [41]. Behavioral capabilities mediating behavior change, would suggest that improvements would be greater in behavioral capabilities, which is consistent with the findings of FUEL FOR LEARNING.

Results from Gimme 5 are similar to those found in this study. Gimme 5 showed statistically significant increases in (1) fruit, juice & vegetable consumption, (2) vegetable consumption and (3) knowledge. No changes were found in fruit consumption.
or other psychosocial variables [30]. Similarly, FUEL FOR LEARNING found increases in overall dietary behavior, specifically vegetable consumption and knowledge.

Similarities were also seen between the Nutrition Detectives program and FUEL FOR LEARNING. Both programs were about 2 hours in length and showed statistically significant improvements in food label literacy [31].

The obesity prevention portion of FUEL FOR LEARNING was based on Food Fit and found results similar to Food Fit. Both programs demonstrated significant improvements in overall dietary behavior, vegetable intake and the use of the food label. Similarly, both programs produced significant changes in behavioral capabilities. FUEL FOR LEARNING impacted 4 of the 5 targeted behavioral capabilities, whereas Food Fit impacted 3 of the 6. Food Fit found increases in Self-Efficacy in four of the lessons, which this program did not. Differences in the measurement of Self-Efficacy may have contributed to this difference. Food Fit measured Self-Efficacy after each lesson and had an entire questionnaire devoted to Self-Efficacy for each lesson. FUEL FOR LEARNING measured Self-Efficacy at pre- and post-testing and only had 1 questionnaire devoted to Self-Efficacy with only 1 question for each lesson. The delay in measurement and fewer questions may have impacted measurement of self-efficacy in FUEL FOR LEARNING [39].
One important difference in programming between Food Fit and *FUEL FOR LEARNING*, is the type of props used. Food Fit used brand name products and targeted specific brands that were commonly available and purchased in the area where the intervention was delivered. Since *FUEL FOR LEARNING* was filmed on DVD, brand named products could not be used. Instead props that were designed specifically for the DVD and whole food items were used. Based on the results, the use props and whole food items instead of brand name food products, does not appear to have an impact on the intervention [39].

The *FUEL FOR LEARNING* study improves on limitations of Food Fit study through inclusion of a control group for comparison and implementation during the school day to children of the same grade level. Another improvement is the evaluation of psychosocial variables at pre- and post-testing in *FUEL FOR LEARNING*, rather than pre- and post-lesson in Food Fit [39].

*FUEL FOR LEARNING*, overcomes the limitation of program fidelity and teachers feeling ill prepared to deliver the program through the DVD based format [27,30,33]. *FUEL FOR LEARNING* also overcomes is the standardization of delivery. Previous research noted variations in program delivery and teachers feeling ill prepared to implement behavior change curricula [27,30,33]. To ensure program fidelity, Food Fit, completed detailed process evaluations [39]. The DVD delivery format is also a cost effective method for delivery as it requires less study personnel and fewer teacher trainings.
Overall, results from *FUEL FOR LEARNING* are similar to those from previous programs. One major difference is the mode of delivery via DVD. The delivery via DVD helps to overcome the limitations of program fidelity and teachers feeling ill prepared to deliver behavior change curricula [27,30,33]. However, further research is needed to allow for generalization of results to the population.

**Limitations**

Several limitations should be noted in interpreting the results from this study. This was designed as a pilot study and included a small sample size. The small sample size lacked statistical power for analysis at the class level, so analysis was done at the individual level. While the intervention is standardized through the DVD based format and each student receives the same content, delivery is at the classroom level, so data analysis should be done by classroom.

Due to study limitations, a convenience sample was used in this study. The convenience sample was not representative of third graders throughout the state of Ohio. A larger sample of classrooms throughout the state of Ohio would have also provided a more diverse and representative sample.
Due to administrative requests, classrooms within each school were assigned to the treatment and control groups. This is of concern as contamination may have occurred. However, if contamination occurred, it should lessen the differences between the treatment and control groups, meaning differences in terms of dietary behavior and psychosocial variables between the treatment and control groups may be greater than what was found in this study.

Another limitation of the study is the instruments used for data collection. The Child Modified Food Behavior Checklist was statistically validated; however it has not been compared to a validated method such as direct observation or 24-hour recall with assisted food records [20,66]. The instruments measuring psychosocial variables were validated by an expert committee for face and content validity. Further reliability and validity testing of these instruments should be done to evaluate reliability and validity at the 3rd grade level.

Time for data collection was limited. The time constraints, limited the number of items that could be included in each questionnaire. The Self-Efficacy and Stages of Change questionnaires included only 8 questions. The time constraints, limiting the number of questions asked on Self-Efficacy and Stages of Change may have hindered the measurement of these variables.
Aside from height and weight, this study relied on self-reported data from third grade children. The cognitive ability of 3rd grades is another limitation. Third graders are 8-10 years old and have varying abilities to recall and self-report information. The ability of an 8-10 year old to report self-efficacy and stages of change accurately is unknown [70].

Despite limitations, results from this study add to the existing research that nutrition interventions can be effective when delivered during the school day to third grade students. Further, this study demonstrates that a DVD based format can be an effective method of delivery.

Recommendations for Future Research

A follow-up study should be done to determine if these changes impact long-term dietary behavior behaviors, psychosocial variables and BMI percentile in this sample. While changes in BMI percentile were not examined during the short duration of the study, it would be interesting to see if any changes occurred.

To confirm the results of this study, a similar yet larger study with randomization at the school level ought to be conducted. The larger study should include schools from different settings (i.e. urban, rural, suburban) and different socioeconomic levels (i.e. low, medium, high). Data on ethnicity, socioeconomic status and participation in free
and reduced priced lunches should be collected. Analysis of data should be done by classroom, rather than at the individual level. To analyze by classroom a minimum of 8 schools need to be enrolled in the study [71].

In terms of instrumentation, further analysis and development of all instruments should be done. There is a need for validated instruments that are tailored for the various age groups in nutrition education research. The child modified food behavior checklist was validated statistically; however validation should be confirmed with direct observation or 24 hour recall using assisted food records in 3rd graders [42,69]. The instruments measuring psychosocial variables should be further developed and tested for reliability and validity with third grade students.

The FUEL FOR LEARNING DVD based curriculum could be further developed into a web based format and utilized by third classrooms throughout the state of Ohio. A series of nutrition education lessons could be developed for each grade level that address specific academic content standards. Along with the nutrition education videos, the web based content could include brief teacher trainings, sample lessons plans and assignments.

FUEL FOR LEARNING is an 8-week intervention, however to increase effectiveness, longer interventions have been recommended [64]. With the growing obesity problem,
ideally nutrition education would be integrated into the curriculum at all grade levels during the school day. Students would be exposed to nutrition throughout elementary, middle and high school and similar to *FUEL FOR LEARNING* the nutrition curriculum would meet academic content standards. Making nutrition part of the curriculum would serve as a continuous reminder to students of the importance of proper nutrition and continuously reinforce the national nutrition policy. *FUEL FOR LEARNING* demonstrates a DVD based format can be an effective method of delivery. To help with integration of nutrition education into the curriculum nutrition educators could develop a web based program that includes short teacher trainings, sample lesson plans, implementation strategies and videos, similar to the lessons delivered through *FUEL FOR LEARNING*. 
References


61. Farooqu S, O’Rahilly S. Recent advances in the genetics of severe childhood obesity. *Arch Dis Child.* 2003;83:31-34.


Appendix A: Parental Permission Form
The Ohio State University Parental Permission For Child’s Participation in Research

Study Title: The State of OHIO gets FUEL FOR LEARNING
Researcher: Dr. Gail Kaye and Dr. Maryanna Klatt
Sponsor: OSU Outreach and Engagement

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.
Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this project is to provide your child with a classroom based wellness program, The State of OHIO gets FUEL FOR LEARNING. This project includes lessons on nutrition, exercise that includes yoga movement and meditation and breathing techniques and will assess effects of his or her ability to learn new skills, attend to school work and sit quietly in the classroom.

Procedures/Tasks:
This program is a combination of nutrition education, yoga, movement and meditation. With your permission, your child will participate in the program every school day for 8 weeks. Four days a week, the sessions will last 10 minutes and then once a week a 45 minute program will be provided.

Before starting the program we would like to measure your child’s height and weight. To assure your child feels comfortable, they will be measured in privacy with two of our staff members.
We would also like your child to fill out a simple survey asking them about the types of foods they eat regularly, their behavior capabilities, self-efficacy and outcome expectancies related to food and their stress level.

Duration:
The State of OHIO gets FUEL FOR LEARNING is an 8 week program. The program will last 18 weeks, with a COSI day the first week that will include having your child complete a survey. This will be followed by 8-weeks of the program or 8-weeks of normal classroom activity. During the 10th week all participants will complete the same survey they completed at COSI in the classroom. Then the last 8 weeks the groups switch and the group that participated in normal classroom activity will receive 8-weeks of The State of OHIO gets FUEL FOR LEARNING.

Your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
The children will perform the program in their classrooms, at their desks or standing behind their desks. The movements are simple and are of minimal risk. Information about your child will be kept strictly confidential. The assessments will be kept protected in locked files.

The benefits of the program are that it may improve your child’s attention, ability to concentrate and provide your child with strategies and skills to choose healthy foods. The program may also improve classroom behavior. If successful, the program will be provided to other classrooms to improve children’s attention and behavior.

Confidentiality:
Efforts will be made to keep your child’s study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.
Incentives:
There are no incentives other than the potential benefits of the program listed above.

Participant Rights:
You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:
For questions, concerns, or complaints about the study you may contact Gail Kaye: 614-292-8880 or GKaye@hec.ohio-state.edu or Maryanna Klatt, 614-292-0065 or Maryanna.Klatt@osumc.edu.

For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If your child is injured as a result of participating in this study or for questions about a study-related injury, you may contact Gail Kaye: 614-292-8880 or GKaye@hec.ohio-state.edu or Maryanna Klatt, 614-292-0065 or Maryanna.Klatt@osumc.edu.
Signing the parental permission form
I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to permit my child to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

---

Printed name of subject

Printed name of person authorized to provide permission for subject

Signature of person authorized to provide permission for subject

Relationship to the subject

Date and time

AM/PM

---

Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

---

Printed name of person obtaining consent

Signature of person obtaining consent

Date and time

AM/PM
Appendix B: Child Assent Form
The Ohio State University Assent to Participate in Research

Study Title: The State of OHIO gets FUEL FOR LEARNING

Researcher: Dr. Gail Kaye and Dr. Maryanna Klatt

Sponsor: OSU Outreach and Engagement

• You are being asked to be in a research study. Studies are done to find better ways to treat people or to understand things better.
• This form will tell you about the study to help you decide whether or not you want to participate.
• You should ask any questions you have before making up your mind. You can think about it and discuss it with your family or friends before you decide.
• It is okay to say “No” if you don’t want to be in the study. If you say “Yes” you can change your mind and quit being in the study at any time without getting in trouble.
• If you decide you want to be in the study, an adult (usually a parent) will also need to give permission for you to be in the study.

1. What is this study about?
The study is a nutrition education, movement and yoga program that also includes quiet and thinking time. The program will be on DVD and in school for 8 weeks.

2. What will I need to do if I am in this study?
We ask that you pay attention to the DVD, follow along by answering questions, doing the activities, doing the movements and participating in the quiet time. We ask that you follow what the leader on the DVD says and do everything with your best effort. During the first week and the tenth week, we will ask you to complete a survey about the program.
3. **How long will I be in the study?**
   The State of OHIO gets FUEL FOR LEARNING is an 8 week program. The program will last 18 weeks, with a COSI day the first week that will include completing a survey. This will be followed by 8-weeks of the program or 8-weeks of normal classroom activities. During the 10th week you will complete the same survey they completed at COSI, but this time you will complete it at school. Then the last 8 weeks the groups switch and the group that participated in normal classroom activities will receive 8-weeks of The State of OHIO gets FUEL FOR LEARNING.

4. **Can I stop being in the study?**
   You may stop being in the study at any time.

5. **What bad things might happen to me if I am in the study?**
   We do not think any bad things will happen to you.

6. **What good things might happen to me if I am in the study?**
   We think that the program will be fun for you. It might make you feel relaxed, calm and happy. It might also give you strategies and skills to choose healthier foods.

7. **Will I be given anything for being in this study?**
   We think the program is fun, but you will not be given special treats other than a time to learn about and try food each week and the opportunity to move, stretch and think about happy things.

8. **Who can I talk to about the study?**
   For questions about the study you may contact Gail Kaye: 614-292-8880 or GKaye@hec.ohio-state.edu or Maryanna Klatt, 614-292-0065 or Maryanna.Klatt@osumc.edu.

   To discuss other study-related questions with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.
Signing the assent form

I have read (or someone has read to me) this form. I have had a chance to ask questions before making up my mind. I want to be in this research study.

Signature or printed name of subject ______________________________ AM/PM
Date and time ______________________________

Investigator/Research Staff

I have explained the research to the participant before requesting the signature above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining assent ______________________________
Signature of person obtaining assent ______________________________ AM/PM
Date and time ______________________________

This form must be accompanied by an IRB approved parental permission form signed by a parent/guardian.
Appendix C: Child Modified Food Behavior Checklist
Child-Modified Food Behavior Checklist

Answer the following items by checking yes or no. Note that some answers are related to serving portions.

1. Do you eat more that 1 kind of fruit daily?
   Yes   No

2. During the past week, did you have citrus fruit or citrus juice?
   Yes   No

3. Do you eat more that 1 kind of vegetable a day?
   Yes   No

4. How many servings of vegetables do you eat each day?
   None  1 Serving  2 Servings  3 Servings  4 Servings  5 Servings

5. Do you eat 2 or more servings of vegetables at your main meal?
   Yes   No

6. Do you eat fruit or vegetables as snacks?
   Yes   No

7. How many servings of fruit do you eat each day?
   None  1 Serving  2 Servings  3 Servings  4 Servings  5 Servings

8. During the past week, did you have raw vegetables?
   Yes   No

9. Do you drink milk daily?
   Yes   No
10. During the past week, did you have milk as a beverage or on cereal?
   Yes   No

11. During the past week, did you have fish?
   Yes   No

12. How many times a week do you usually eat food from a fast food restaurant?
   None    1 Serving    2 Servings    3 Servings    4 Servings    5 Servings

13. During the past week did you have eggs?
   Yes   No

14. If you eat eggs, about how many eggs do you usually eat in a week?
   None    1 Serving    2 Servings    3 Servings    4 Servings    5 Servings

15. Do you eat low-fat instead of high fat foods?
   Yes   No

16. When choosing a food to eat, do you use the Nutrition facts on the food label?
   Yes   No

17. Do you drink regular soft drinks?
   Yes   No

18. Do you drink kool-aid, Gatorade, sunny delight, or other fruit drink/punch?
   Yes   No

19. Would you describe your diet as
   Excellent          Very Good          Good          Fair          Poor
Appendix D: Behavioral Capabilities Questionnaire
Subject ID: __________________________

Directions: Read each question below and circle or check the box next to the best answer.

1. If you were hungry, which snack below would be a healthier choice?
   - Pretzels [ ]
   - Cheese Crackers [ ]
   - Potato Chips [ ]

<table>
<thead>
<tr>
<th>Snack</th>
<th>Serving Size</th>
<th>Calories</th>
<th>Calories from Fat</th>
<th>% Daily Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretzels</td>
<td>1 package</td>
<td>110</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheese Crackers</td>
<td>1 package</td>
<td>150</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potato Chips</td>
<td>1 package</td>
<td>170</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. If you wanted to eat 1-serving of potato chips, how many would you eat?
   - 150 chips [ ]
   - 10 chips [ ]
   - 17 chips [ ]
   - I don't know [ ]

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>Calories</th>
<th>Calories from Fat</th>
<th>% Daily Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 oz (17 chips)</td>
<td>150</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. If you were thirsty, which drink below would be a healthier choice?  

<table>
<thead>
<tr>
<th>Drink</th>
<th>Nutritional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soda Pop</td>
<td></td>
</tr>
<tr>
<td>Power-Drink</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
</tbody>
</table>

4. How many servings of fruit should kids like me eat everyday?  

1 serving  
2 servings  
3 servings  
I don't know

5. Which would be the healthier choice if you were going to eat some fruit?  

<table>
<thead>
<tr>
<th>Fruit</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strawberry Pop Tart</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
</tr>
<tr>
<td>Fruit Roll Up</td>
<td></td>
</tr>
</tbody>
</table>

6. Which would be the healthier choice if you were going to drink some juice?  

<table>
<thead>
<tr>
<th>Juice</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Apple Juice</td>
<td></td>
</tr>
<tr>
<td>Grape Drink</td>
<td></td>
</tr>
<tr>
<td>Orange Soda</td>
<td></td>
</tr>
</tbody>
</table>

7. How many servings of vegetables should kids like me eat everyday?  

1 serving  
2 servings  
3 servings  
I don't know

8. Which would be the healthiest choice if you were going to eat some vegetables?  

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>I don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Carrots</td>
<td></td>
</tr>
<tr>
<td>Breaded Onion Rings</td>
<td></td>
</tr>
<tr>
<td>Tater Tots</td>
<td></td>
</tr>
</tbody>
</table>
9. How many servings from the milk/dairy group should kids like me eat or drink everyday?
   1 serving  2 servings  3 servings  I don't know

10. If you can't or don't drink milk, you could have unsweetened soy milk instead.
    True    False    I don't know

11. If you can't or don't drink milk, you could have soda instead.
    True    False    I don't know

12. If you can't or don't drink milk, you could have calcium fortified orange juice instead.
    True    False    I don't know

13. If you were going to have cereal, which cereal below would be a healthier choice?

    Cereal 1  Cereal 2  Cereal 3

    [Nutrition Facts]
    Serving Size: 1 cup
    Amount per serving:
    Calories: 110
    Calories from Fat: 0
    Total Fat: 1.5g 1%  Saturated Fat: 0.5g 3%
    Trans Fat: 0g 0%  Cholesterol: 0mg 0%
    Sodium: 110mg 5%  Total Carbohydrate: 22g 7%
    Dietary Fiber: 2g 8%  Sugars: 3g 1%
    Protein: 4g

    [Nutrition Facts]
    Serving Size: 1 cup
    Amount per serving:
    Calories: 90
    Calories from Fat: 0
    Total Fat: 1g 2%  Saturated Fat: 0g 0%
    Trans Fat: 0g 0%  Cholesterol: 0mg 0%
    Sodium: 20mg 1%  Total Carbohydrate: 17g 5%
    Dietary Fiber: 1g 4%  Sugars: 1g 3%
    Protein: 0g

    [Nutrition Facts]
    Serving Size: 1 cup
    Amount per serving:
    Calories: 60
    Calories from Fat: 0
    Total Fat: 0g 0%
    Saturated Fat: 0g 0%
    Trans Fat: 0g 0%  Cholesterol: 0mg 0%
    Sodium: 0mg 0%  Total Carbohydrate: 15g 5%
    Dietary Fiber: 1g 2%  Sugars: 1g 1%
    Protein: 2g

14. How many days every week should you eat breakfast?
    4 days  5 days  7 days  I don't know

15. Which would be a healthier choice to have for breakfast?
    Toasted Cereal & Banana  Frosted Cereal & Marshmallows  Strawberry Filled Doughnut  I don't know

16. Which would be a healthier choice to have for breakfast?
    Apple Drink  100% Orange Juice  Grape Soda  I don't know
Appendix E: Stages of Change Questionnaire
Read each statement below. Circle or color in the box that describes what you do.

1. **I eat lower calorie snack foods:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

2. **I eat only 1-serving from a large bag or box of a packaged snack food:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

3. **I drink drinks without added sugar:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

4. **I eat 3-servings of fruit everyday:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

5. **I eat 3-servings of vegetables everyday:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

6. **I eat 3-Servings from the dairy group everyday:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

7. **I eat cereals low in sugar:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

8. **I eat breakfast everyday:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

9. **I roll with life as it happens, not getting too stressed with stuff that happens at school or home:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>

10. **I can see the things and people in my life that help keep me healthy and happy:**

<table>
<thead>
<tr>
<th>now</th>
<th>want to anytime soon.</th>
<th>usually, but I’m going to start soon.</th>
<th>just started to.</th>
<th>usually do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>don’t</td>
<td>don’t</td>
<td>should.</td>
<td>want to</td>
<td>anytime</td>
</tr>
</tbody>
</table>
Appendix F: Self-Efficacy Questionnaire
1. If you had the choice, how sure are you that you can □
   - Very Sure
   - Very Unsure
   - Very Sure
   - Very Unsure

   □ eat a lower calorie snack food, instead of a higher calorie snack food.
   □ eat a lower calorie snack food, instead of a higher calorie snack food even if the higher calorie snack food tastes better.
   □ eat a lower calorie snack food, instead of a higher calorie snack food even if your friends eat the higher calorie snack food.

2. If you had the choice, how sure are you that you can □
   - Very Sure
   - Very Unsure
   - Very Sure
   - Very Unsure

   □...eat only 1-serving of a snack food from a larger bag or box.
   □ eat only 1-serving of a snack food from a larger bag or box even if you were really hungry.
   □ eat only 1-serving of a snack food from a larger bag or box even if your friends eat more.

3. If you had the choice, how sure are you that you can □
   - Very Sure
   - Very Unsure
   - Very Sure
   - Very Unsure

   □ choose a drink without added sugar.
   □ choose a drink without added sugar even if the drinks with added sugar taste better.
   □ choose a drink without added sugar even if your friends do not drink them.
<table>
<thead>
<tr>
<th>4. If you had the choice, how sure are you that you can □</th>
<th>Very Unsure</th>
<th>Very Sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ eat 3 servings of fruit everyday.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ eat 3 servings of fruit everyday even if other foods taste better.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ eat 3 servings of fruit everyday even if your friends do not eat them.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. If you had the choice, how sure are you that you can □</td>
<td>Very Unsure</td>
<td>Very Sure</td>
</tr>
<tr>
<td>□ eat 3 servings of vegetables everyday.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ eat 3 servings of vegetables everyday even if other foods taste better.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ eat 3 servings of vegetables everyday even if your friends do not eat them.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. If you had the choice, how sure are you that you can □</td>
<td>Very Unsure</td>
<td>Very Sure</td>
</tr>
<tr>
<td>□ eat or drink 3 servings from the milk/dairy group everyday.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ eat or drink 3 servings from the milk/dairy group everyday even if other foods or drinks taste better.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ eat or drink 3 servings from the milk/dairy group everyday even if your friends do not eat or drink them.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. If you had the choice, how sure are you that you can…

<table>
<thead>
<tr>
<th></th>
<th>Very Sure</th>
<th>Very Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. eat cereals low in sugar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. eat cereals low in sugar even if other cereals taste better.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. eat cereals low in sugar even if your friends do not eat them.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. If you had the choice, how sure are you that you can…

<table>
<thead>
<tr>
<th></th>
<th>Very Sure</th>
<th>Very Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. eat breakfast everyday.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. eat breakfast everyday even if you don’t like to eat breakfast.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. eat breakfast everyday even if your friends do not eat breakfast everyday.</td>
<td></td>
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</tbody>
</table>
Appendix G: Student Information Form
Student Name: ________________________________

Student Information Form

Subject ID: ______________________

Are you a: BOY  GIRL

What is your ethnicity (circle all that apply):

- White
- Black or African American
- Asian
- Hispanic
- American Indian
- Hawaiian/Pacific Islander

Other (please list): _________________________________

Height (inches): ________________  Weight (pounds): ______________
Appendix H: Nutrition Coloring Activities
The next time I have a snack, I’m going to choose a lower calorie snack food.
Name:_______________________________________________________

The next time I have a snack, I’m going to choose 1-serving of a packaged snack food.
The next time I have a drink, I’m going to choose a drink without added sugar.
The next time I have cereal, I’m going to choose a cereal low in sugar.
I will eat 3 different fruits everyday.
Name:_______________________________________________________

I will eat 3 different vegetables everyday.
I will have 3 servings from the milk group or milk alternatives everyday.
I will eat a healthy breakfast everyday.