From Root to Fruit: The Development and Evaluation of the *In Defense of Food* Curriculum.

A Nutrition Education Afterschool Curriculum for Middle School-aged Children.

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ABSTRACT

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Over the last few decades, a shift in the American diet towards more ready-to-eat, ready-to-heat foods and fewer fruits and vegetables has occurred. Simultaneously, there has also been a rise in chronic diet-related diseases disproportionately affecting underserved and minority populations. Highly processed foods are cheap and abundant, they tend to be nutritionally poor, and are disproportionately marketed to minority youth. Despite an increased public focus on health and many health promotion initiatives, health disparities continue to widen.

Michael Pollan and many others criticize the nutrition and food industries for focusing health messages on composite nutrients and bioactive components in foods (for example eat less fat or eat more fiber) rather than on dietary patterns (eat fewer highly processed, eat more whole foods). Pollan's book, *In Defense of Food (IDOF)*, was made into a documentary film, highlighting these important messages and generating solutions for what to eat to be healthy.

This study is a development project that describes the systematic development and evaluation of the *In Defense of Food* nutrition education curriculum as the companion guide to the documentary film. It was designed for a middle-school aged

audience in an afterschool setting to encourage an increased intake of fruits and vegetables and a decreased intake of highly processed foods.

In the formative stages, a project development assessment was conducted to inform the development of the curriculum for its target audience and setting. Often health promotion programs focus on ensuring the valid development of content. This study examined delivery and logistical considerations specific and important to the afterschool context. Delivery, refers to how the content is executed. Findings suggest that a curriculum with youth in an afterschool setting should include non-didactic instruction, the sharing of teacher perspectives to elicit student perspectives, address different learning needs, and help students learn through an incremental process. Logistics included the time, space, and financial constraints of the afterschool settings. Findings indicate that teachers generally only have 1-2 hours of preparation time, a lack of fixed classroom space, and small financial budgets for accompanying lesson resources and materials.

Next, the study developed the content of the IDOF curriculum using a systematic stepwise behaviorally-focused and theory-based process, the Nutrition Education DESIGN procedure. The DESIGN procedure was applied to try and enhance motivation and facilitate the achievement of the actionable behavioral outcomes of the curriculum: an increased intake of fruits and vegetables and a decreased intake of highly processed foods. The behavior-change theories applied were the Social Cognitive Theory and The Self Determination Theory. The resulting curriculum consisted of 10 sessions, 2 hours each, based on IDOF's basic message of "Eat Food; Not Too Much, and Mostly Plants."

The curriculum was activity-based, used clips from the documentary film in each session with accompanying discussions, incorporating opportunities to taste and prepare foods, and to think critically about food marketing.

The curriculum was piloted in 3 classes in 2 afterschool programs in New York City with a total of 32 youth. Professional development training was provided to the three teachers facilitating the curriculum before the start of the program and on-going as needed throughout.

A mixed methods process evaluation was conducted to examine aspects of the curriculum that were more and less likely to be delivered and variations in how they were received by students. Trained research staff conducted in-class observations in nine of the 10 lessons measuring components of program delivery (fidelity, percentage completion, teacher attitude/motivation, classroom management) and program reception (student engagement). Trained staff administered student satisfaction surveys at the end of each lesson. Descriptive statistics and intra-class correlations were calculated. Observation field notes were codified using inductive content analysis. A high proportion of the curriculum was completed across all three classrooms, however the majority of fidelity deviations occurred for those involving worksheets, performance activities, and homework assignments. Social modeling in support of behaviors and greater teacher motivation to engage with the materials was seen in high performing lessons whereas modeling that undermined the curricular messages and low motivation were observed in low performing lessons. This study revealed that for this context, activities that require students to work alone at their desks on worksheets, that require them to perform in front of their peers and return materials to subsequent lessons should

be minimized. Additionally professional development to increase teacher buy-in may be important to improve delivery of the curriculum.

Lastly, a mixed methods outcome evaluation was conducted using pre-posttest surveys measuring the targeted dietary intake of the target behaviors and psychosocial determinants (n=32), one-on-one assessments of knowledge using a quantitative rubric and accompanying notes (n=22), and semi-structured in-depth interviews (n=12). A statistically significant increase in intake of fruits and vegetables from pre to posttest, and trends towards decreases in highly processed foods were seen. Significant changes in the psychosocial determinants: self-efficacy and positive outcomes expectations were also seen; all other changes were not significant but generally in the desired direction. One-on-one knowledge assessments demonstrated that short actionable rules were easily recalled and understood. Findings also suggest that youth adopted self-regulation skills and elicited support from their family members to help them increase their intake of fruits and vegetables. However social and environmental barriers were described as difficult to overcome for highly processed foods.

Decreasing the health disparity gap starts with ensuring that nutrition education programs are developed to be responsive to the specific needs of the target audience and setting. While Pollan's messages have been successful in raising awareness about the American diet for the general public, this study showed that they can also be integrated into educational materials that, when systematically designed and well implemented, can increase the likelihood of actionable outcomes. It also demonstrates the types of considerations that are imperative for effective delivery and implementation in out-of-school time settings.

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The highest education is that which does not merely give us information but makes our life in harmony with all existence.

DEDICATION

For the hardworking New York City afterschool program teachers and staff.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

In today's food supply, it is difficult for people to select healthy foods despite the plethora of food products that line the shelves at grocery stores. Many food products bear nutrient and health claims claiming to be nutritionally superior. However, most highly processed food products tend to be nutritionally poor.

Although people eat food, not isolated nutrients, the practice of talking about food as composite nutrients and bioactive components is common amongst nutrition professionals, government, industry, and within the public.

In the book *In Defense of Food*, Michael Pollan criticizes the nutrition and food industries for transforming food to a collection of nutrients. He argues that in doing so, food is transformed from something universally understood "products of nature" to "products of food science." This practice of focusing on nutrients rather than foods is called *nutritionism* (Scrinis, 2008). Nutritionism is scientifically legitimate in that it has led to many important diet-related discoveries. However, it may not be a helpful for the dissemination of health promotion messages to the public.

This study presents, from root to fruit, the development and evaluation of the theory-driven and behaviorally-focused *In Deference of Food (IDOF)* curriculum (Bhana, Koch, Uno, & Contento, 2016). The curriculum serves as the companion guide to the *In Defense of Food* documentary film, (based on the book by Pollan with the same name) for the Public Broadcasting Service (PBS). It is designed for middle-school aged children in an afterschool setting.

The use of media in education is becoming more popular as our culture becomes more accustomed to the use of visual and interactive tools, and are often integrated into the classroom to support complex content. Documentaries in conjunction with curricula can combine a visual component with explanation, and thereby help teachers increase student understanding, but also introduce controversial topics that are not often integrated into standard school curricula. Additionally, afterschool-based initiatives are increasingly being employed as an effective means of reaching a young audience.

Curricula aimed at reaching a middle-school audience may be particularly important because they are a demographic highly targeted by the food industry, making more independent food choices, and developing food patterns within an obesogenic environment that can predispose them to diet-related illness both at present and in the future.

Although there is increasing use of documentary film as a pedagogical tool in the classroom, very few evaluations of curricula designed to accompany food-related documentary film exist.

1.1.1 The Current Food Supply: History and Implications

Throughout history, growing, cultivating, and preparing food has been an integral social and cultural element to human welfare. However agricultural practices, policies, and the economics of food have changed dramatically over the past 60 years, more so than in the preceding 10,000 (Alston, James, Andersen, & Pardey, 2010). Modern mechanisms of food acquisition have moved away from small and proximate agrarian community sources to one predominantly governed by larger, more intensive farming

operations. Additionally, a small handful of corporations (seeds producers, chemical suppliers, processors, and retailers) have become dominate forces with enormous power and control over markets and pricing, and vast influence on food and agricultural regulations (Wise, 2005). Although many proponents of the current food supply see this as a shift towards improved efficiency and choice, it may not be without consequences. Critiques of the food system believe that the current farm, energy, and information policies contribute to the lower relative prices and increased demand, of unhealthy foods by artificially making farm commodities cheaper and more abundant, and their related products easier to market and sell. A conceptual understanding of how this is possible requires firstly an understanding of current policies and economic drivers that influence the availability of highly-processed foods in the food supply by creating long-term price structures that typically make them cheaper than whole foods. Secondly, these subsidies indirectly impact short-term pricing structures, which then influence consumer demand. Lastly, the consequential shifts towards highly-processed foods, and the information policies in place create an increased opportunity for food marketers to shape information that consumers receive about their food, which further impacts how consumers use, understand, and consume food.

Food availability. A typical American supermarket is stocked with an unprecedented variety and abundance of affordable foods; carrying an average of 43,844 items in a given year (Food Marketing Institute, 2014). Foods and drinks are available at most venues, such as libraries, gas stations, office buildings, and theaters; places where they were not typically available in the past. Despite the abundance and diversity that

seemingly exists in our food supply (with products such as Gatorade, Doritos, cereal bars, and flavored yogurts); the base of national food chain can primarily be linked to a few single plant species: corn, soy, wheat, and rice which have pervaded the food supply.

In the best-seller Omnivore's Dilemma, Pollan (2006) illustrates how pervasive corn is in our food system. He highlights corn's incorporation into the chicken nugget, which he explains simply "piles corn upon corn" (p.18). The chicken contained within the nugget is raised on corn feed, the modified corn starch that is used as a binder is derived from corn, the flour in the batter that coats the nugget and the oil that it is fried in are also corn-based products (Pollan, 2006, p. 18). Additionally, and much less obvious, the leavening agents, such as lecithin, mono-, di-, and triglycerides, the coloring used to provide the artificial but attractive golden color, and the preservatives, such as citric acid meant to maintain 'freshness,' are all also derived from corn (Pollan, 2006, p. 18)

Although Pollan's messaging is targeted to the general public, academic researchers have also been heralding warnings that the cheap and abundant supply of commodity grains and their by-products are affecting the health of Americans (Alston, Sumner, & Vosti, 2008; Babic, Nesic, & Miljkovic, 2008; Balzer et al., 2008; Chouinard, Harris, & Maratsos, 2007; Fields, 2004; Golan et al., 2004; Golan & Unnevehr, 2008; Jacobson & Brownell, 2000; Miller & Coble, 2007; Poti & Popkin, 2011). U.S. farm subsidy policies include hundreds of specific provisions, but of particular interest are the commodity subsidies. These program support farm incomes which make agricultural commodities, such as corn, soy, wheat, and rice cheaper to produce, and therefore reduce the cost of producing certain highly-processed foods and other products that contain them. Essentially, the lower farm-level prices for these raw commodities result in less

expensive food products at the retail level for sale to consumers (Miller & Coble, 2007). Thus, these few highly profitable grains have become pillars of the American diet which may be contributing to the high consumption of branded processed foods, ready-to-eat foods (such as fast foods), and for meats; but while decreasing the economic access for whole fruits and vegetables.

Price. Price is selected as the primary consideration for American consumers when deciding where and what to purchase (Andreyeva, Long, & Brownell, 2010). Because the price of a calorie is substantially cheaper when obtained from unhealthy, energy-dense, highly processed foods, instead of from more healthful, often less-dense foods (Drewnowski & Darmon, 2005; Drewnowski & Specter, 2004), a shift in consumption patterns towards more unhealthful foods has been seen, particularly in those making selections within financial constraints. In turn, this has had implications on health. Some nutrition professionals believe that regardless of income, Americans have access to a nutritious diet of fresh fruits and vegetables, whole grains, and lean meats. However, food prices pose a significant barrier for many consumers who are trying to balance healthy foods and affordability (Adam Drewnowski & P. Eichelsdoerfer, 2010). As income drops, families have less disposable income to spend on food, and their food choices shift towards cheaper and more energy-dense foods that are sure to fill their stomachs (Drewnowksi & Eichelsdoerfer, 2010). Typically, healthier foods, such as whole grains, and vegetables and fruit, are the first to be discarded for cheap energy-rich starches, added sugars and vegetable fats (Andrieu, Darmon, & Drewnowski, 2006; Darmon, Briend, & Drewnowski, 2004).

In addition to the long-term price structures supported by subsidies, short-term price strategies employed by the food industry also influence how much people purchase and eventually consume. Econometric studies suggest the lowering of food prices observed over the last 50 years have led to an increased energy intake (Christian & Rashad, 2009; Finkelstein, Ruhm, & Kosa, 2005; Powell, 2009). Although the average price elasticity of food consumption is low, it can be relatively high for categories of certain foods, such as soft drinks, foods prepared away from home, and processed foods (Chandon & Wansink, 2012), which are manipulated by the food industry to encourage intake. For example, longitudinal field experiments conducted in cafeterias have revealed, price changes above 25% can significantly influence consumption of beverages and snack, but also fruit and vegetables (Block, Chandra, McManus, & Willett, 2010; French & Stables, 2003; Horgen & Brownell, 2002). Thus long-term price structures through systemic subsidies accompanied by short-term price strategies employed by the food industry have implications on contributing to the selection of highly-processed foods amongst Americans.

Marketing Influence on Consumer Food Perceptions. Presently, many of the subsidies end up in the profit margins of agribusiness because the low cost of the commodity goods compared to their final market cost makes these products very competitive. For example, Beghin and Jensen (2008) analysis of sugar price policies revealed that the cost of corn in the production of HFCS is attributable to only 1.5% of the value of the soft drink sale. Thus, food manufacturer's low input costs allow them to focus on marketing strategies, as well as to invest in advanced food engineering, research,

and development to create irresistible products. The dietary shift towards more processed foods provides greater opportunities, "as value- added" goods to influence consumer demand.

Marketing strategies contribute to the selection of processed food over whole food by creating brand loyalty, altering consumer taste and health perceptions, and by shaping the social and symbolic values associated with those foods. One of the most visible and studied actions of food marketers is the use of advertising and promotions through traditional media channels and non-traditional media channels (such as television, radio, print, and product placement, and sponsorship). However, less direct, often insidious marketing also includes branding, highlighting specific ingredients, making nutrition or health claims, or adjusting packing size and shape.

Although marketing can inform people about the product's attributes, it also increases product awareness of the brand and food. This can lead consumers, especially children, to preferentially select brands, but also to try fewer foods in search of only the brands that they already recognize (Chandon, Hutchinson, Bradlow, & Young, 2007; Hoyer & Brown, 1990).

At early ages, most children can name multiple brands by their names, packaging, logos, and often associated characters (Fischer, Schwartz, Richards, Goldstein, & Rojas, 1991); which generally translates to greater product requests for specific brands and names - labeled in the marketing sector as 'nag factor' (Bridges & Briesch, 2006). The name of the food (brand name versus a generic category name) has a strong influence on how consumer's experience a particular product by shaping their expectations of how tasty, filing, or decadent a food might be, often expectations that are uncorrelated with

reality (Oakes, 2005, 2006). For example, a recent study showed that when the same food products were named "fruit chews" instead of "candy chews," they were rated as healthier and tastier, and more of them were consumed by health-conscious individuals (Irmak, Vallen, & Robinson, 2011). Such ambiguity is often employed in the food industry to brand/label products; potato chips are marketed as "veggie chips," sugary drinks as "flavored" or "nutrient-rich" waters, and milkshakes sold as "smoothies." With the exception of a few whole fruit and vegetable "brands" such as California Cuties, Dole Pineapples, and Chiquita Bananas, these strategies are overly represented in the food product sector to increase demand.

Beyond the name or brand of a product, communication about its nutrient composition or the presence or absence of key ingredients, such as fat, sugar, soy protein, or fiber, can strongly influence the expected taste and health perceptions of a food product (Oakes, 2005; Wansink, 2003; Wansink & Park, 2002). For example, in the height of the low-fat fad, foods labeled "75% fat free" compared to "25% fat" were perceived to be leaner and of better quality (Levin & Gaeth, 1988).

Health claims, claims that indicate a "relationship exists between a food category or one of its constituents and health" such as "rich in omega 3," "supports immunity," "smart choice," or the health check mark of the American Heart Association, are increasingly being used on packaging (Mariotti, Kalonji, Huneau, & Margaritis, 2010). However, many health claims found on packaging are confusing and are often misunderstood by consumers (Mariotti et al., 2010; Nestle & Ludwig, 2010; Williams, 2005). Firstly, claims often identify a linear relationship between a nutrient and a health outcome. This often oversimplifies the relationship and or makes consumers expect a

linear relationship ("more is better") (Mariotti et al., 2010; Nestle & Ludwig, 2010; Williams, 2005). It may encourage consumers to select products thinking that they need the highlighted nutrient to achieve a certain health goal. Often the wording can be misleading, such as "provides energy" - as in a source of calories, but may be interpreted as "energizing" - invigorating. Lastly, claims may be based on flimsy science, or overstate research findings (Nestle & Ludwig, 2010). Often these health claims lead consumers to over-attribute health and taste properties to packaged foods and also categorize food as intrinsically 'good' or 'bad,' 'healthy' or 'unhealthy' regardless of its actual properties (Chandon & Wansink, 2012).

Beyond awareness and consumer expectations of the benefits of a product, food marketers work to manipulate the social and symbolic value associated with food to lead consumers to believe that eating their product is normal, fun, and socially rewarding. The eating environment, including the convenience of food, availability, and salience, can also be altered by marketers. In the same way that food is more than just nourishment, eating is much more than food intake. It can be a social activity, a cultural experience, and a form of entertainment. In this context, food marketers have subtly altered the eating environment to influence consumption of processed foods. Since highly-processed foods are often shelf stable, they can feasibly be available in many places, such as gas stations, libraries, schools, and workplaces. This increased availability is a key driver of consumption; for example, just seeing and smelling food can increase hunger and purchases. The shape and size of the serving container are external cues for how much people should eat, and since package size has grown in the past 50 years it has also become more seemingly normative to eat more (Wansink, Van

Ittersum, & Painter, 2006). Ease of preparation is a strong predictor of intake, and as such processed foods are often marketed and designed to be as convenient as possible.

The complex linkages between food policies, economics, and our relationship with food, present a variety of issues and implications. Our current food supply favors highly processed foods over whole/minimally processed foods through their availability, economic accessibility, and insidious marketing strategies which shaped consumption, understanding, and preferences for these foods. Although the relationship between energy intake, diet quality, food culture, and health is much more complex and multifaceted, it has become apparent with increasingly more visible signs of diet-related malignancies that the true cost of these cheap and abundant foods bear societal consequences.

1.1.2 A Focus on Nutrients: "Nutritionism"

In addition to the above stated regulatory and economic influences that are perpetuating the demand and consumption of highly-processed foods, Pollan and researchers argue that the emphasis of the current field of nutrition on nutrients is an additional propellant of today's food supply. This approach reduces food and health to a collection of nutrients and physiological outcomes and in doing so changes food from something that the public has conventionally understood as "products of nature" to abstract and invisible "products of science." However, applying this reductionist approach to nutrition and health has implications for consumer use and understanding of food by emphasizing constituent parts of foods, rather than dietary patterns, and shaping the diet-health relationship which may be leading to greater consumer confusion about

what to eat to be healthy. It also provides an increased opportunity for food manufacturers to manipulate food to appeal to the latest scientific information or food trend.

What is Nutritionism? Scrinis (2008) coined the term *Nutritionism (*aka *nutritional reductionism)* to describe this nutrient-focused approach which he saw as the dominant paradigm in nutrition research and practice. He defined it as the reductive way in which nutrients and foods have been studied and disseminated toward nutrient-or-food-specific biological outcomes and dietary advice. In this paradigm particular nutrients, food components, and biomarkers, (such as saturated fats, kilojoules, and body mass index (BMI)) are abstracted out of their context of foods, diets, and bodily processes. They are also removed from their cultural and ecological ambits in order to draw linear connections to health (Scrinis, 2008). In doing so, Scrinis (2008) argues that these decontextualized, isolated nutrient-specific relationships (e.g saturated fat and heart disease) are used to draw conclusions about the complex relationships between foods and bodily health which thus may not be accurate.

Since the nutritionism framework give priority to a nutrient-level understanding, as exemplified in the dietary guidelines to eat less of a particular nutrient, such as saturated fat or added sugar, it detracts from messaging to eat less of or more of particular types of foods that contain these nutrients, and thereby re-shapes the public's level of engagement with food. Comparisons between foods becomes more abstract at the nutrient level which blurs more manageable and familiar qualitative distinctions, such as whether something is highly-processed versus minimally-processed, or an animal product

versus a plant product. The nutrient facts label also exemplifies this approach. Furthermore, nutrient- level knowledge can displace and undermine food-level knowledge based on familiar cultural and historical practices with respect to food (Trichopoulos, Lagiou, & Trichopoulou, 2000).

Finally, an emphasis on nutrients renders the average consumer more vulnerable to food marketing. In doing so, this emphasis has allowed for the commodification of nutrients, and thereby also food and health (Scrinis, 2013). When nutrition and health is a commercial product, a nutritious diet ends up being something consumers buy, which pushes them towards food products marketed and positioned as products of expert, scientific discovery. The food industry has been well-placed to respond to and cultivate consumer demand for health-enhancing functional foods. Scrinis (2013) calls the food industry efforts 'nutritional facades' around food products; for advertising nutrients in products, appealing to the latest fad (e.g. gluten-free donuts), and toting health claims promising to help and heal (e.g. heart healthy Snackwell cookies).

Collectively, professional and government-endorsed dietary advice, and industry's influences and marketing strategies have moved this reductionist approach from the margins to the center of the way the public has come to view food and its relationship to the health.

We are at a crucial period in food history where critics are increasingly challenging the industrial practices and values of mass-produced and highly processed foods. Although nutritionism has become commonplace amongst nutrition professionals, government, industry, and within the public; academics and writers have been speaking out about their concerns with this paradigm, and its impact on dietary selection.

Joan Dye Gussow, has long criticized a nutricentric focus to convey dietary information. She criticized the dietary guidelines and nutrition facts panels as inappropriate and confusing for public dissemination (Gussow & Akabas, 1993). In her book *Food Politics: How the Food Industry Influences Nutrition and Health*, Nestle also (Nestle, 2013) argues that a nutrient-focused approach no longer belongs solely to the domain of nutrition science; it has been co-opted, promoted, and exploited by the food industry, with the support of government regulatory bodies and health institutions (p. 93). She examines how the food industry has lobbied the U.S. government to shape official dietary guidelines in ways that undermine the criticism of processed foods and of high meat and dairy consumption. This is exemplified, as mentioned above, in government reference nutrients and messaging to "eat less" nutrients (e.g. saturated fat) rather than actuals foods (e.g. eat less meat).

Nutritional epidemiologist, Colin Campbell, known for his popular book *The China Study,* criticized scientific reductionism within nutrition research for its attempts to explain chronic disease through single-nutrient relationships (Campbell & Campbell, 2005). His research used broad epidemiological data on large populations to capture dietary patterns among foods, nutrients, and health, and emphasized the importance of studying food and dietary patterns in a way that accounts for synergistic effects of nutrients. In recent years, nutritional epidemiologist, David Jacobs expanded on the importance of a food-synergy approach, and believes that it provides a better explanation for chronic nutrition-related disease, and how best to prevent and treat them.

It can be seen then that Pollan is recapitulating the messages of early and prolific academics, Joan Gussow, Gyorgy Scrinis, Marion Nestle, Colin Campbell, and David

Jacobs in his book *In Defense of Food*. *In Defense of Food*, upon which this study is based, shines some light on the transformation of commonly understood natural foods to esoteric food-like products as a contributor of the "American Paradox" - the notion that the more Americans "learn," and concern themselves with nutrition, the less healthy they become (Pollan, 2008, p. 9). Pollan summarizes the key criticisms of nutritionism and provides readers with the action plan to re-harness control over their food supply with 7 simple words: "Eat food, not too much, mostly plants." When telling people to E*at Food*, he is referring to whole or minimally-processed foods. *Not too Much* refers to limiting those foods and dietary patterns that are perpetuating diet- related disease, such as eating too much highly-processed foods (which he calls edible food-like substances) and meats, consuming large portions, and eating mindlessly. With M*ostly Plants*, Pollan encourages readers to adopt a mostly-plant-based diet as the true way to select healthy foods and thus to eat healthfully. Through these directions, Pollan proposes an alternative way of eating that is based on tradition and ecological principles of growing and eating whole plant-based foods.

As a leader in the social food movement, Pollan has brought the issues of nutritionism and the industrialized food system to the forefront of public attention. His criticism of a nutrient-focused approach represents one prong in the wider social food movement.

1.1.3 Building a Social Food Movement

The term 'social food movement' has become more commonly used to describe the collective burgeoning interest and change in food culture. In *Appetite for Change*,

Belasco (2014) posits that the term emerged in the late 1980s and is used to denote a wide range of political practices around anti-industrialized food production promoting organic, local, slow, and vegetarian foods, and foods that support greater social justice. Even though all these practices have been in place for a long time, collectively they contribute to the growing food movement.

Food is a means to articulate cultural, epicurean, humanitarian, and nutritional values (Kingsolver; Pollan, 2006). Metaphorically, people don't just purchase food but rather they express their values by showing allegiance or scorn for particular worldviews by "voting with their forks" (Pollan, 2006). Many different perspectives exist within the food movement, each with different agendas and interests. In the slow food movement, returning to "traditional" practices is thought to improve our food lives (Flowers & Swan, 2011). "Foodie" discourse focuses on good "taste." It uses the cultural context of gourmet food which relates to places, people, and meanings, and is associated with "food knowledge" (Baumann & Johnston, 2009, p. 3). The locavore food movement considers the origin of the food and values food grown or produced close to the an individual (Cook & Crang, 1996).

As with other social movements, the food social movement goes beyond rhetoric and includes initiatives such as local farmer's markets, community supported agriculture (CSA), urban land trusts and rural organic farms, educational programs, and food-related media (social media, documentaries, films, and podcasts). The extent to which interested parties are acting together, forming coalitions and speaking out is a testament to the power and accessibility of food-related issues for critical analysis. We are seeing much more of such analyses in the media, amongst educators and researchers, chefs, policy

makers, and other advocates.

Today's food producers have also been criticized for concealing aspects of food production and thus part of the emerging food movement has also been to call for transparency between the producer and the consumer, and all steps in the process. *Food Inc.*, a critically acclaimed documentary film, traced the contours of the current global capitalist food system, exposing viewers to major injustices in factory farming practices. Michael Pollan and Eric Schlosser play narrative roles within the film's three segments examining the industrial production of meat, then looking at the industrial production of grains and vegetables (primarily corn and soy), and lastly the economic and social inequalities and implications on human health of an increasingly complex food system. The film was so well and widely received that it provoked the formation of an alliance of American food industries to launch a website – SafeFoodInc.com -- to counter the claims, that they deemed "myths propagated by the film."

1.1.4 The Food Documentary Context

Indeed, the past decade has seen an overwhelming emergence and growth in the number of documentary films, which has generated attention on how documentaries can provoke debate over social issues. Documentaries have conventionally been perceived as a passive experience, intended primarily for informal learning or entertainment (Nisbet & Aufderheide, 2009). However, recent films such as *Bowling for Columbine, Fahrenheit 911, Super Size Me, An Inconvenient Truth,* and *Food Inc*. have changed the landscape for how documentary films are perceived and used as part of an effort to elicit emotion, shift education, spark debate, shape public opinion, build activist networks, and change

policy (Nisbet & Aufderheide, 2009). A large proportion of these films have been dedicated to discussions about food and the environment.

Some films critique the current food system and offer solutions for alternative foodways, others draw connections from food production and consumption to the mounting diet-related diseases, and others examine the global implications of our food system with respect to the environment or inequalities and power.

Super Size Me (dir. Spurlock, 2004) was a pivotal documentary in the genre of food- related documentaries because it was the first to gain much critical acclaim and put the food industry under scrutiny. Spurlock clearly connects the food industry to the rising rates of obesity in the United States (Pelman v. McDonalds Corp, 2003).

Food Fight (dir. Chris Taylor, 2008), *Food Inc.* (dir. Robert Kenner, 2008), and *King Corn* (dir. Aaron Woolf, 2007) critique the broader food industry and food system and frame their discussions around the environmental impact of the industry and on human health.

The Future of Food (dir. Deborah Koons, 2004), and *GMO-roulette* (dir. Jeffrey M. Smith, 2012) explore the implications of the ever growing influences of biotechnology on the food system, and *Food Stamped* (dirs. Shira and Yoav Potash, 2010), *The Garden* (dir. Scott Hamilton Kennedy, 2008), and *The Price of Sugar* (dir. Bill Haney, 2007) explore the resulting issues of inequality, power, and or health disparity.

Although this list is not exhaustive, it provides an overview of the range of films that have been circulating the United States over the last 10 years. The majority of these films focus specifically on the state of the American food system with a common theme

to engage people as active citizens and political agents of change. Many films have websites with calls for action that allow visitors to enroll in listservs, sign petitions, and find additional relevant food-related materials.

Additionally, as documentaries become increasingly more popular they are also recognized as important teaching voices in media, thus many documentary sites also generate teaching tools to be used concurrently with the films.

1.1.5 Documentary as a Pedagogical Tool

The use of media in education is becoming increasingly more popular as our culture becomes more accustomed to the use of visual and interactive tools (Purcell, Heaps, Buchanan, & Friedrich, 2013). The annual Grunwald Associates (2009) survey for PBS reported that educators are integrating more digital media into their instructional practices Grunwald Associates (2009). Hobbs (2011) revealed that the most frequently used forms of media in the classroom was television, video, and film, and that teachers report ease of access and use of film-viewing equipment (Marcus & Stoddard, 2007; Purcell et al., 2013).

Additionally, PBS programming was the single most popular source of video content used by teachers (Grunwald Associates, 2009). Surveys asking history teachers about their use of documentary film found that over 82% of teachers reported using documentary films on average at least once a week; less than 9% reporting using documentary film only once a month or less; and 0% of the teachers surveyed reported no use of documentary film in their classrooms (Marcus & Stoddard, 2007).

Additionally, the use of documentary film with curricula provides extensive

utility for educators. Teachers often rely on documentaries for classroom management, to resolve inadequacies in planning, and to provide support for difficult and complex content (Golden & Costanzo, 2006). Documentaries used in conjunction with curricula combine a visual component with explanation, and thereby can help teachers render abstract notions more intelligible, increase subject matter in a topic, and help increase student knowledge (Turker & Aslan, 2008). Oztas (2007) found that the use of films increased student comprehension in history education; and Marcus (2005), found an increase in motivation to learn through film use.

In the documentary film, In Defense of Food, Pollan visits other countries and cultures which demonstrate or have returned to simpler ways of eating. He shows how nutritional science and deceptive marketing practices have contributed to the poor dietary health that Americans face. The film also spotlights families as they struggle to eat healthy within a complex food supply and presents hope for change and solutions to our dietary woes. The study reported here describes the development and evaluation of a behavior-focused, theory-driven curriculum that integrates clips from the documentary *In Defense of Food* and is an example of such an approach.

1.2 RATIONALE FOR THE STUDY

1.2.1 Nutrition Education for Young Adolescents

A middle school audience was selected for the IDOF curriculum as a group that consumes too many unhealthy foods that have contributed to the increased prevalence of emerging diet-related diseases in this group (White House Task Force on Childhood Obesity, 2010). This age group is able to grasp the concepts and skills related to improving diet quality and health and to understand their long-term impacts are concepts.

Dietary Patterns Among American Youth. Adolescents are gaining greater autonomy over their foods choices. However, given the "obesogenic" environment in which many are making choices, most youth have adopted dietary patterns that are likely leading to poor health outcomes.

It is generally understood that a diet high in fresh fruits and vegetables and low in highly processed foods, in conjunction with adequate physical activity can promote healthy weights in children and adolescents (Hill, Wyatt, & Peters, 2012). However, most American youth do not meet the recommendations for eating 2 ½ to 6 ½ cups of fruits and vegetables daily; and discretionary calories from soda, fruit drinks, dairy desserts, and grain desserts/snacks contribute to approximately 40% of the daily calories for children and adolescents aged 2-18 years with implications on poor diet quality (Reedy & Krebs-Smith, 2010). Addressing the issues of eating too few fruits and vegetables, and consuming too many discretionary calories from highly processed foods is important for maintaining a healthy weight and decreasing risk of diet-related diseases and point to the need for efforts to be directed towards improving dietary patterns away from highly processed foods and towards a greater intake of whole fruits and vegetables.

Life-stage Considerations. Middle school-aged children are at an age when they are capable of understanding the concepts and skills related to improving diet quality and health, as well as its long-term impacts. Adolescents at this age are gaining autonomy over their food choices and increasing their purchasing power, but are still highly impressionable to the powerful marketing levers used by food industry to sell highly processed junk foods (Folta, Goldberg, Economos, Bell, & Meltzer, 2006; J. Harris, Schwartz, & Brownell, 2010). Often these products claim to be healthy with images and vernacular aligned with government guidelines (e.g. low-fat, high fiber, % daily recommendation) or the latest dietary fad (e.g. gluten-free) however tend to be nutritionally poor (Poti, Mendez, Ng, & Popkin, 2015). By this age, youth are able to integrate motivation for and cognitive processes of self-regulation towards food choice, thereby making decisions not solely on taste and convenience but also based on health and weight implications (Contento, 2011; Contento, Michela, & Goldberg, 1998). However, calling attention to the processing of food products is often passed over, understated, or ignored.

Approaches to Reach Adolescents. A review of the qualitative literature about food and health has shown that adolescents dichotomize foods into "healthful foods" and "junk foods" for which they attributed contrasting characteristics (Bisogni, Jastran, Seligson, & Thompson, 2012; Chapman & Maclean, 1993; Contento, Williams, Michela, & Franklin, 2006). Some dichotomized foods based on their impacts on the body, attributing fruits and vegetables to helping the body perform, and those that don't as "junk food." Others, associated "junk foods," with pleasure, being with friends,

independence, guilt, affordability, and convenience versus "health foods," for which they attributed family, being at home, and meals.

Giving up eating "junk food" for teens may require giving up more than the food itself, as it is inextricably intertwined with issues of identity, self-concept, friendship, security, independence and authority (Story, Neumark-Sztainer, & French, 2002).

Changing social norms around healthful eating might be one effective approach. Findings from systematic reviews of peer influence indicate that patterns related to food intake may be partially due to peer influence; and that dyadic affiliations which are characterized by stability, reciprocity, closeness, and frequent interactions promote greater conformity (Badaly, Kelly, Schwartz, & Dabney-Lieras, 2013).

Addressing food preferences through increased exposure to healthful foods, might be another element to successfully reaching adolescents to increase their intake of whole/minimally processed foods, like fruits and vegetables. A review by Klepp et al (2005) concluded that interventions should be aimed at improving preferences for fruits and vegetables, such as through taste testing games or fruit and vegetables schemes in social settings which make trying foods fun (Klepp et al., 2005). A systematic review conducted by McClain et al (2009) revealed that preferences were positively associated with fruit and vegetable intake among adolescents (McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009). Attitudes, social desirability, and social support were also positively associated with fruit and vegetable consumption (McClain et al., 2009). Nutrition education targeted at this cohort may help to increase their preferences for whole plant-based foods, specifically fruits and vegetables, and decrease their intake of highly processed foods.

Targeting Efforts to Minority and at-risk Populations. Minority and underserved youth have higher rates of diet-related chronic diseases, consume a substantial proportion of nutrient-poor, energy-dense highly processed foods, and are disproportionately targeted by food marketers.

Among underserved minority youth, the prevalence of obesity can be as high as 50% (Kaufman et al., 2009). Rates of type II diabetes are significantly higher in Hispanic (0.22 cases/1,000 youth) and black (1.05 cases/1,000 youth) adolescents than national averages (Pettitt et al., 2006). These racial and ethnic minority groups also experience diet-related disparities related to low fruit and vegetable intake and diets high in fast foods and sugar sweetened beverages (Adam Drewnowski & Petra Eichelsdoerfer, 2010; Satia, 2009).

American youth can easily access and select highly processed foods, which are cheap and abundant in the food supply and heavily marketed to them. Each year billions of dollars are spent by the food industry marketing highly processed junk food to young people; a vulnerable population who are unable to fully understand the persuasive intent of marketing strategies. Furthermore, Black and Hispanic youth, are disproportionately targeted by industry which has direct impacts on their selection and consumption of these foods (Cairns, Angus, Hastings, & Caraher, 2013; J. Harris et al., 2013; J. L. Harris et al., 2015).

Reaching Adolescents in Afterschool Settings. Schools are typically selected as a setting for implementation of various betterment programs because they often provide continuous and intensive contact with children and adolescents during their formative years (Katz, O'Connell, Njike, Yeh, & Nawaz, 2008; Kelishadi & Azizi-Soleiman, 2014).

Despite these advantages, the most prominent limitation to day school-based interventions tends to be time constraints in executing programs especially given the demands for schools to improve the academic achievement of children. Although nutrition education interventions during the school day hold potential and remain important, afterschool programs are emerging as useful and feasible settings for positive youth development (PYD) programs because they do not detract from the school day, can offer a safe environments for youth to spend time with peers, and facilitate the development of positive life skills that are not generally taught in day-school programs (Smith, 2007).

It is estimated that 8.4 million American children attend some form of afterschool programming (ASP) (Afterschool Alliance, 2014; Kelder et al., 2005) with anticipated increases as the number of dual income families continue to increase (Sarampote, Bassett, & Winsler, 2004). Afterschool programs disproportionally serve minority and underserved youth, with African American and Latino parents much more likely to enroll their children compared to the general population (Afterschool Alliance, 2014), and a greater percentage of non-participating African American (61%) and Hispanic (50%) parents expressing interest in enrollment if programs were made available to them than the general population (38%) (Afterschool Alliance, 2014).

Compared to day-school based interventions, few implementation and evaluation studies have been conducted for nutrition education programs in afterschool settings, despite the apparent need for and interest in ASP. Expanding efforts to provide quality nutrition education in afterschool hours is a logical next step.

Meta-analyses and systematic reviews collectively demonstrate that school and

afterschool settings in general have the greatest relative impacts in diet-related health promotion programs; however overall effects tend to be small with a great deal of heterogeneity across studies (Branscum & Sharma, 2012; Katz et al., 2008; Kelishadi & Azizi-Soleiman, 2014; Silveira, Taddei, Guerra, & Nobre, 2013; Waters et al., 2011). Heterogeneity of outcome measures is compounded by heterogeneity found in study designs, educational philosophies, the application (or lack thereof) of theoretical frameworks, and the nature, quality, and duration of interventions, making it difficult to extrapolate generalizations (Katz et al., 2008). Thus, it has been argued that in order to more effectively and efficiently respond to the dietary failings of American youth, research in community settings needs to be more carefully planned, and built upon the science of behavior change and evidence-based practices to better elicit desired outcomes and inform the direction of future interventions (Baranowski, Cerin, & Baranowski, 2009b).

1.2.2 Developing Effective Nutrition Education Programs

Developing effective nutrition education programs can be challenging and involve major program planning, however this can be made easier by following a specific procedure.

Attributes of Successful Programs. Existing evidence suggests that while many factors impact outcomes, strong educational materials that are behaviorally-focused and rooted in theory, and systematically apply effective design elements linking theory, research, and practice are more likely to facilitate individual level dietary change

(Baranowski et al., 2009b; Contento, 2008; Contento et al., 1995; Katz et al., 2008; Michie, Prestwich, & de Bruin, 2010; Waters Elizabeth, 2011)

Behavioral Focus. Knowledge-based nutrition education programs have been developed in school setting with the goal of changing food-related knowledge, skills and attitudes (Contento, 2008). Although some have been effective in changing knowledge, they have not been particularly effective in changing behavior (Contento et al., 1995; Lytle, 1994). People's food choices are complex and determined by a myriad of factors, which are constantly interacting with each other and therefore knowledge-based programs form only one narrow category of influence on diet-related behaviors and practices. The recognition that food choice is incredibly complex and dynamic has lead nutrition educators and researchers to argue that nutrition education should go beyond disseminating nutrition information and be designed to facilitate personal dietary changes in more comprehensive ways (Contento, 2008). Taking a behavioral focus implies selecting a behavioral goal that is substantially or causally related to the primary health outcome of concern (Baranowski, Cerin, & Baranowski, 2009a), is actionable (Contento, 2008, 2012), and meets the needs of the specific target group (Baranowski et al., 2009a; Contento, 2008, 2012).

Application of Theory. There is a growing recognition that the development and implementation of effective behavior change interventions are enhanced by the application of theory (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003; Contento et al., 1995; Michie & Prestwich, 2010). Theory can be used to improve the efficiency of intervention development by identifying theoretical constructs hypothesized to provide the strongest causal links to the desired behavioral outcome. Thus changing

the constructs with the greatest predictive power can lead to behavior change (Baranowski et al., 2009a). Secondly, recognizing how constructs within a theory interact, can allow for intervention techniques to be refined or tailored to provide stronger effects (Michie & Prestwich, 2010). Thirdly, applying and evaluating theory-based interventions appropriately can help elucidate why interventions are effective or ineffective thereby facilitate a better understanding of mechanisms which can provide guidance for the development of future interventions and build on existing knowledge (Michie et al., 2010).

Applying a Systematic Framework. Developing effective nutrition education programs can be challenging and involve major program planning, however this can be made easier by following a specific procedure. Although many existing frameworks have been developed for designing and evaluating interventions, few provide detailed guidance on how to apply theory to the design of nutrition education programs specifically. DESIGN, a 6-step Procedure (Contento, 2006, 2016), was developed specifically to guide the systematic development of behaviorally-focused and theory-driven nutrition education programs, and is applied in this case study in the development of the In Defense of Food afterschool program for middle school-aged children.

Given the inherent complexity of health promotion programs, many researchers in the field recognize the importance of not-only developing theory-based and behaviorally focused nutrition education, but also taking a systematic approach to program development (Baranowski et al., 2009b; Bartholomew, Parcel, Kok, & Gottlieb, 2011; Contento, 2016; Michie & Abraham, 2004). Applying a systematic approach can

strengthen programs by maximizing their potential for success and by conserving resources.

Approaches such as Intervention mapping (IM) (Bartholomew et al., 2011), Re-AIM (Glasgow, Vogt, & Boles, 1999), the PRECEDE-PROCEED model (Green & Kreuter, 2005), and the U.K, Medical Research Council's framework (Craig et al., 2008) use a stepwise approach the design, development, and analysis of, however these frameworks tend to be used in large complex interventions. For example, IM has been used to plan health education programs such as Long Live Love (an HIV-prevention program targeted at Dutch adolescents) (van Empelen, Kok, Schaalma, & Bartholomew, 2003); Re-AIM was used to evaluate an integrative medicine program for underserved women with chronic pelvic pain (Chao, Abercrombie, Santana, & Duncan, 2015).

The Mediating Variable model (Cerin, Barnett, & Baranowski, 2009) and the Nutrition Education DESIGN Procedure (abbreviated as the DESIGN Procedure) have been developed to more strictly be applied to nutrition and physical-activity-related programs. The Mediating Variable Model emphasizes that selecting the most highly predictive mediators of behavior change for the target audience, and focusing on stages which can have moderator effects can direct resources and the development and evaluation on the most impactful and probable antecedents of behavior change (Baranowski et al., 2009b). Although the Mediating Variable Model has been designed with setting-approach nutrition and physical activity education in mind, it does very little to guidance on the actual development of educational programs.

The DESIGN Procedure specifically guides nutrition educators through a straightforward stepwise process to develop effective nutrition education (Contento,

2016). The steps and process allow for an audience-specific approach, the development of educational resources and an evaluation plan using behavior-focused and theory driven strategies. DESIGN has been used in previous studies in the development of educational curricula, such as with Food Health and Choices (FHC), a childhood obesity-prevention intervention for elementary school children in a day-school setting, and for the culturally-focused nutrition education curriculum for Hispanic cancer survivors, Cocinar Para Su Salud! (Cook for your Health!) (Greenlee et al., 2015).

1.2.3 Designing Appropriate Program Evaluations

In an effort to ensure funding is allocated effectively and efficiency, development studies are often conducted (MacDonald & Rudduck, 1971; Walker, 1971; Wallace, 2002). With brand new curricula, an evaluation approach which is aligned to the developmental stage of the program is also critical (Bowen et al., 2009; Scheirer et al., 2012; Urban, Hargraves, & Trochim, 2014). Additionally, including an evaluation of how a program is implemented and received can shed light on aspects of success and failure of a new curriculum and suggest ways for its improved implementation and lasting uptake in the community for which it is being designed.

Curriculum Development Projects. In developing a curriculum (or modifying an existing one), McKimm (2007) and Craig et al. (2011) describe a number of stages that must be completed within a curricular cycle: assessment, design, implementation, and evaluation. Assessment, refers to the preliminary stage when one determines the educational message and context for which the program is meant to be developed and delivered. Key elements specific to meeting the needs of the learners and that which

match the context are outlined, including those that pose constraints. In the design phase, the curriculum is outlined (delineating key objectives and benchmarks for achievement) and developed (considering content, methods of delivery, and resources needed to deliver the curriculum). Implementation includes implementing professional development plans and creating a comprehensive assessment model. Lastly, evaluation refers to the structured process of assessing outcomes in order to gain feedback used to address factors determined in the assessment phase and so completing the cycle (Drake, 1998; Glatthorn, 2004; McKimm, 2007).

Evaluation Lifecycle. Outcome evaluations typically include pre and posttests surveys in randomized control trials or quasi-experimental settings, however implementation efforts can be relatively messy and complex at these initial stages of program development and these traditional study designs may inadequately obtain evaluative information (Urban et al., 2014). Stead et al. suggests, that these traditional intervention trials at their early stages fail to "capture the detail and complexity of inputs and tactics" (Stead, Hastings, & Eadie, 2002; Zapka, Goins, Pbert, & Ockene, 2004) p, 354) thereby missing the true nature of the outcomes as well as telling organizational factors important for replication (Urban et al., 2014).

It has been suggested that the evaluation of a program should match the "lifecycle" of the program (Figure 1.1) to ensure more effective and efficient use of resource (Bowen et al., 2009; Urban et al., 2014; Zapka et al., 2004).

Programs at their initial stages of development and implementation are undergoing rapid and often substantial changes and therefore the emphasis should be on building internal consistency and measuring implementation factors and selected

outcomes within intervention groups rather than between groups. Secondly, the challenge of evaluating complex interventions lies in the inability to control for all factors that may produce variable results. Using qualitative research methods to accompany quantitative efforts provides greater opportunities to translate outcomes of a new program (Urban et al., 2014).

Lastly, at the early stages of development and evaluation of a health promotion program modifications and adjustments based on a new program's application to a new setting and population may be apparent. Thus, a range of evaluation levels (e.g. process and outcome) are often suggested in order to strengthen the ability to accurately measure outcomes (Kozica, 2015). The process component enables researches to explicitly understand the complexity of programs at their early stages and suggests ways to answer questions about context, adoption, and responses to change (Stetler et al., 2006). The outcome evaluation collects data on the impact, outputs, or other hypothesized outcomes of the study providing information on the degree of success of a new program. Often outcome evaluations are necessary to determine whether or not to scale up by providing the baseline effects upon which to generate power analyses for larger/full evaluation trials (Bowen et al., 2009; Prescott & Soeken, 1989).

A shift in evaluation research for health promotion programs points to the need for mixed methods approaches that understand the contexts of behavior change through qualitative exploration in addition to standard quantitative approaches needed to generate effect sizes, especially early on in the lifecycle of the program.

Table 1.1 Program Evaluation Lifecycle

	Program Evolution	Phase	Evaluation Evolution	
Initiation	Program is in initial implementation(s) – brand new program or adaptation of existing program Program undergoing rapid or substantial change/adaptation or revision after initial trials	I-A I-B	- Implementation, participant and facilitator satisfaction; process and participant assessment (post evaluation). - Implementation & selected outcomes; post; outcome measures – internal consistency	*Process & response*
Development	Scale & Scope revisions or changes/adaptations are smaller; most program elements still evolving Most program elements implemented consistently; minor changes; some elements still evolving	II-A II-B	- Program's association with change in group outcomes in this context; unmatched pre- and post-test outcomes, quant/qual assess. of change, assess. of measure validity and reliability	*Change*
Stability	Program implemented consistently; participant experience stable Program has formal written procedures/protocol and implemented consistently with well-trained facilitators	III-A III-B	- Effectiveness using design and statistical control and comparisons - Assess effectiveness using control experiments or quasi-experiments	Comparison & Control
Dissemination	Program implemented at multiple sites Program is fully protocolized and is being widely distributed	IV-A IV-B	- Examine outcome effectiveness across wider range of contexts - Formal assessment across multiple program implementation to enable general assertions (e.g meta-analysis)	Generalizability

Importance of Process Evaluations in Settings-based Interventions. Process evaluations generate information that describes the implementation of the program. They can help shed light on the aspects of the program that may be contributing to the outcome effects, reveal whether the program has viable validity in the "real world," and can guide resource allocation.

Windsor, Baronowski, Clark, and Cutter (1994) explain the purpose of process evaluation as follows:

> Process produces documentation on what is going on in a program and confirms the existence and availability of physical structural elements of the program… Process evaluation involves documentation and description of specific program activities – how much of what, for whom, when, and by whom. It includes monitoring the frequency of participation by the target population and is used to confirm the frequency and extent of implementation of selected programs or program elements. Process evaluation derives evidence from staff, consumer, or outside evaluators on the quality of the implementation plan and on the appropriateness of content, methods, materials, media, and instruments [p.3].

A seminal study, "Avoiding type III errors in health education program evaluations: a case study," from 1985 laid the foundation for modern-day health promotion 'process' or 'implementation' evaluations (Basch, Sliepcevich, Gold, Duncan, & Kolbe, 1985). The article suggested that Type III error (drawing incorrect conclusions about the effectiveness of an intervention) can occur when "evaluating a program that has not been adequately implemented" (p.316). In addition to investigating whether the program worked or not, evaluators must first investigate whether the program was carried out as planned, and if not, how it veered from the original plan (Linnan & Steckler, 2002).

Data from process evaluations can be used in part to determine how the program's elements impact the mediating variables hypothesized in the theoretical model for the intervention and or the behavioral outcomes. For example, in the school-based obesity prevention program, *Choice, Control, Change*, targeted at middle-school aged children, Gray et al (2015) demonstrated that changes in student behavioral outcomes were the result of changes in their mediating variables, which in turn were induced by implementation factors of the program (Gray, Contento, & Koch, 2015). Burgermaster

(2015) in a multisite process evaluation of *Food Health & Choices*, an obesity prevention program targeted at elementary school-aged children in New York City public schools found significant relationships between process measures, related to student reception of the program and behavioral outcomes.

When developing a program for "real-world" settings, it becomes critical to understand the perspectives of different stakeholders who may affect and be affected by the revised intervention, which ultimately leads to whether the end-product is taken up and integrated into practice (Bowen et al., 2009; Chen, 2010). That is, irrespective of a program's efficacy or effectiveness, the program must also be practical, suitable to the intended audience's capacity for implementation, and acceptable to the implementers, otherwise it has little chance of survival in a community setting (Chen, 2010).

Lastly, data about the implementation can be used to improve the program by identifying elements that need to be strengthened or eliminated while it is ongoing and before it is more widely disseminated or more rigorously tested (e.g. in controlled trials). Implementation data can also be used to develop benchmarks to monitor progress towards specified goals, to provide accountability to funding sources or stakeholders, and to explain program effects.

Nutrition education initiatives can achieve mixed or moderate behavioral changes or health impacts for many reasons including the failure to pilot test intervention methods, use methods appropriate for the lifecyle of the program, failure to deliver programs as intended, and/or failure to assess the delivery of the intervention, and/or standardize evaluations (Windsor, Baranowski, Clark, & Cutter, 1994). When process evaluations are conducted in systematic and meaningful ways, they can provide meaning

to the outcome effects generated and allow for greater comparative power across studies (Baranowski & Jago, 2005; Gray et al., 2015; Windsor et al., 1994).

Components of Process Evaluations. As increasingly more process evaluations for community-based health promotion studies were being published in the 80's and 90's (e.g. COMMIT study (Corbett, Thompson, White, Taylor, & Group, 1990), the Working Well Trial (Heimendinger et al., 1995), Child and Adolescent Trail for Cardiovascular Health (CATCH) study (Perry et al., 1997), The Stanford Five-City Program (Flora et al., 1993), and the Minnesota Heart Health Program (Finnegan, Murray, Kurth, & McCarthy, 1989)), components of process evaluation were developed and refined. These early studies made important contributes to the development of process evaluation theory and methods and demonstrated the complexity of the design and implementation of process evaluation efforts. For example, the school-based CATCH intervention included measurements of dose (whether the prescribed components of the CATCH program were implemented), fidelity (whether the prescribed components were implemented as planned), program content, and other factors mediating impact on the study outcomes (Perry et al., 1997). They included the measurement of student characteristics, intervention activities, and school characteristics.

Across studies, researchers chose to define, operationalize, and measure the constructs of process evaluations in various ways. Baranowski and Stable (2000) derived a comprehensive explanation of 11 components of process evaluations, how to operationalize measures, and considerations to make in conducting research. The

framework (Table 1.2) serves as the foundation for this study with further adaptations based on the work of Lee, Contento & Koch (2013) and Burgermaster (2015).

Table 1.2 Components of process evaluations

(Baranowski and Stable (2000, p.160-161)

Components of Process Evaluation	Qualitative Aspect(s)	Quantitative Aspect(s)	Composite Score(s)	Significance for Conduct of Research
Recruitment: attracting agencies, implementers, or potential participants for corresponding parts of the program.	Types of resources (messages or incentives) employed to attain participation.	Number of potential participants. Differences between recruited sample and population on selected characteristics.	Participant rate (percentage of potential participants agreeing to participate). Participation resource rate (number or costs of resources employed per participant).	Low statistical power. External validity of experiment (sample recruitment bias).
Maintenance: keeping participants involved in the programmatic and data collection.	Types of resources (messages or incentives) employed to attain participation maintenance	Numbers of participants who continue to a point in time Differences among maintained sample, recruited sample, and population on selected characteristics	Maintenance rate (percentage of participants who maintain participation to a point in time) Maintenance resource rate (numbers or costs of resources employed to achieve participation maintenance to a point in time)	Low statistical power External validity of experiment (sample maintenance bias)
Context: aspects of the environment of an intervention.	Types of contextual factors	Levels on contextual factors		Moderation of effects Generalizability Potential targets for intervention
Resources: the materials or characteristics of agencies, implementers, or participants necessary to attain project	Types of resources	Numbers or levels of resources	Resource adequacy	Screening criteria Moderation of effects Potential targets for intervention

goals.				
Implementation: the extent to which the program is implemented as designed	Fidelity (quality of delivery on one or more scales)	Extent (number or amount of units delivered or provided)	Dose (Fidelity × Extent)	Internal validity of experiment Ineffective interventions due to low implementation
Reach: the extent to which the program contacts or is received by the targeted group.	Depth (aspects or components of the intervention received)	Spread (number or percentage of participants receiving a component)	Penetration	Participation bias due to reach Inefficient intervention
Barriers: problems encountered in reaching participants.	Types of barriers	Difficulty per type	Obstruction	Explains low values in other components of process Identifies targets for change efforts
Exposure: the extent to which participants view or read the materials that reach them.	Component preference (how much each activity was liked)	Extent of Exposure	Receptiveness	Moderation of effect.
Initial Use: the extent to which a participant conducts activities specified in the materials.	Types of activities specified	Amount of use (number of activities conducted)	Activity	Moderation of effect.
Continued Use: the extent to which a participant continues to do any of the activities.	Types of activities continued (to a point in time).	Amount of activities continued (to a point in time).	Habituation.	Moderation of effect.
Contamination: the extent to which participants receive interventions from outside the program and the extent to which the control group receives the treatment.	Types of components of competing programs reaching participants. Types of components of treatment programs reaching control group participants.	Number of competing programs reaching participants. Number of control participants learning about treatment program.	External contamination rate (average numbers of competing program components). Internal contamination rate (average numbers of treatment components reaching control group participants).	Internal validity of experiment.

1.3 PURPOSE

The purpose of this dissertation is to develop, implement, and evaluate the *In Defense of Food* film curriculum, a multi-component curriculum comprised of 10 sequential, 2-hour lessons developed for afterschool programming with a middle school audience (Bhana et al., 2016). The curriculum integrates film clips with theory-driven and behaviorally focused activities to increase intake of whole/minimally processed foods and decrease intake of highly processed foods among middle school-aged students. As such, this study also attempts to illustrate how curricula can help students to think cogently and critically about their co-opted food supply and its resulting implications on their choice autonomy and health.

1.4 RESEARCH QUESTIONS

1.4.1 Article 1: Needs Assessment

1. What are the specific needs, with respect to nutrition education curricula, of after school programs?
2. What components of an educational curriculum are important for the afterschool setting?

1.4.2 Article 2: Using the DESIGN Procedure

1. How can the nutrition education DESIGN procedure be used to develop a theory-based behavioral nutrition education curricula intended to emphasize consumption

of whole minimally-processed foods and decreased intake of highly processed foods?

1.4.3 Article 3: Process Evaluation

1. How was the curriculum implemented and what were the facilitators and challenges?
2. Was the curriculum implemented as planned?
    a. To what extent was the curriculum delivered as planned?
    b. To what extent were students engaged in the curriculum?
    c. To what extent were teacher practices supportive of implementation?
3. Did participants receive the IDOF program as planned?
    a. To what extent were students satisfied with the curriculum? (student satisfaction & student engagement)
4. What recommendations for intervention improvement were generated by this process evaluation?

1.4.4 Article 4: Outcome Evaluation

1. What was the outcome of the IDOF curriculum on targeted behaviors of increasing intake of whole/minimally processed plant-based foods and decreasing intake of highly processed foods?
2. What was the impact of the IDOF curriculum on targeted potential determinants of behavior change?

1.5 SIGNIFICANCE

Films such as *Super Size Me*, *Food Inc.*, *King Corn*, and *A Place at the Table*, embody the growing genre of pedagogy about the food supply that can be used in classroom. Many of these recent food-related documentaries are accompanied by educational materials (in the form of discussion guides, and activities, to full accompanying curricula), however, none of the existing accompanying material explored to date provide evidence of validation or the use of behavioral theory in their development. Furthermore, although promising approaches of health promotion in middle-school children have been developed, less is known about the impact of potential strategies that integrate media and messaging that move the focus from nutrition reductionism to encourage youth to follow dietary patterns that promote health.

1.6 DEFINITION OF TERMS

Table 1.3 Definitions of Terms

Term	Definition
Nutritionism	A health paradigm that assumes that the nutritional value of food is the sum of all of its constituent parts.
Documentary	*Theatrically released nonfiction motion picture dealing creatively with cultural, artistic, historical, social, scientific, economic or other subjects. It may be photographed in actual occurrence, or may employ partial re-enactment, stock footage, stills, animation, stop- motion or other techniques, as long as the emphasis is on fact and not on fiction"* (Academy of Motion Picture Arts and Sciences, 2014).
Nutrition Education	*"The learning experience designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well-being"* (Contento, 2011).
Student-centered Learning	*Learning experiences that shift the focus of instruction from the teacher to the student and where the emphasis is placed on the learner's critical role in constructing meaning from new information and prior experience(Hannafin & Hannafin, 2010) .*

Scaffolding	*A variety of instructional techniques applied to allow for student progression towards a better understanding of a concept, and ultimately more independence in the learning process (Pea, 2004)*
Differentiation	*A teaching framework for effective teaching that employs strategies for learning to ensure students of all abilities and learning styles are engaged. It often includes the use of visual, tactile, auditory, and kinesthetic components (McTighe & Tomlinson, 2006; Vygotsky, 1978).*

CHAPTER 2 (ARTICLE 1): PEDAGOGICAL AND PRAGMATIC CONSIDERATIONS FOR THE *IN DEFENSE OF FOOD* CURRICULUM: A QUALITATIVE PROJECT ASSESSMENT STUDY

2.1 INTRODUCTION

Diet-related diseases, such as obesity, type II diabetes, and hypertension are emerging in the American population at younger ages than ever before (Flynn et al., 2006; Rosenbloom, Joe, Young, & Winter, 1999). These emerging health problems are disproportionately impacting minority and poor subgroups suggesting the need for targeted nutrition education efforts (Calzada & Anderson-Worts, 2009).

Adolescents are a particularly vulnerable group; they are making more autonomous food-related decisions in a food environment that promotes chronic diet-related disease and are developing behavioral patterns that not only determine their current health status, but also their risks for developing chronic diseases moving forward (Lawrence, Gootman, & Sim, 2008).

Schools have been identified as a suitable environment to reach adolescents because they provide extensive and continuous contact with the target population (Katz, O'Connell, Njike, Yeh, & Nawaz, 2008). With increasing competition for valuable classroom time, some researchers are beginning to explore the out-of-school space as a forum for health promotion programs with youth (Wang et al., 2015). The number of afterschool programs offered across the country has rapidly increased in recent years (Afterschool Alliance, 2014); a growing number of these focused on improving dietary intake (LeCroy, 2004; Story et al., 2003).

However, bringing about behavior change can be difficult, especially without larger systemic changes or policy-wide supports (Briggs, 2010). While comprehensive

reviews have found that school-based interventions overall are effective, the behavior changes have been minimal (Diep, Chen, Davies, Baranowski, & Baranowski, 2014; Evans, Christian, Cleghorn, Greenwood, & Cade, 2012). This could be because even when nutrition education programs are able to equip youth with the motivations, knowledge, and skills to take healthy actions, youth must still constantly resist the temptations of an obesogenic environment. Other contributing factors might be that programs are developed without adequate acceptance or buy-in of teachers or implementers of the intervention and use ineffective pedagogical approaches (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2002). There has been considerable recent interest in the importance of using appropriate *behavior change strategies* or *techniques* to implement theory-based interventions (Abraham & Michie, 2008; Contento, 2016) and an emphasis on context-specific pedagogical approaches.

Lessons learned from successful school-based nutrition education programs (such as CATCH and Planet Health) point to the importance of involving stakeholders (e.g. teachers, site personnel, students, and parents) in the initial developmental stages (Franks et al., 2015). Stakeholder involvement is essential to ensure that programs are practical and acceptable to site implementers (Chen, 2010), made available to youth, and garner greater environmental/policy supports to help youth continuously make healthy choices (Briggs, 2010; Franks et al., 2015). However, even when stakeholders' input was sought, there is little in the nutrition education literature about stakeholders' input on classroom delivery and pedagogical issues. Yet, this is where "the rubber hits the road." That is, there is a gap in knowledge about how teachers and other implementers believe that nutrition education can be effectively delivered using pedagogically sound approaches.

This is especially true for after-school programs, which have rarely involved nutrition education.

Thus, conducting a curriculum development assessment is an important first step in the development of any new curriculum, usually involving a systematic examination of the state of interest, ability, knowledge, or capacity of stakeholders and the target group involved in the program (Brown, 1995). In the preliminary stages, an assessment phase can help to identify aspects of program development that are important for its viability in the setting that it is being designed for and to ensure greater effectiveness of the program through its tailored development (Contento, 2016).

The purpose of this study was to examine the perspectives of day-school teachers and afterschool program staff on the positive aspects and challenges of afterschool nutrition education for middle school-aged children in an afterschool setting and pedagogical approaches that they would recommend. In-depth interviews were identified as a suitable means of explorative research to garner in-depth information based on participants' experiences, feelings, and opinions (Creswell & Clark, 2007).

This study was the first step in the curriculum develop project (described elsewhere), that applied the Nutrition Education DESIGN procedure (Contento, 2016) to guide the development of the *In Defense of Food* (*IDOF*) afterschool curriculum. IDOF is a 10-week nutrition education curriculum based on the work of Michael Pollan intended to be distributed nationally by the Public Broadcasting Service (PBS). DESIGN is a six-step procedure used to develop behaviorally-focused and theory driven nutrition education programs. In the early stages, DESIGN focuses the developer on thoroughly understanding the context for which the nutrition education program is being designed.

2.2 METHODS

2.2.1 Recruitment and Enrollment

A convenient sample of participants with a range of experience working in afterschool programs was recruited by the lead investigator through direct outreach via e-mail or telephone from a list initially generated and provided by the New York City Department of Youth and Community Development (DYCD). The DYCD is the largest funders of school and center-based organizations that serve middle-school aged children in afterschool programming in New York City (American Institutes of Research, 2016). Of the 21 sites that expressed interest in participating in the study, the first eight eligible sites were included in the study. Snowball sampling was used to capture day-school teachers of middle school-aged children as another source of experts in working with youth. The lead researcher had no established relationship with the participants of this study. Participants were screened for eligibility and invited to participate in the study if they 1) were currently working as a day-school teacher and/or in an afterschool program setting and had at least one year's experience teaching middle-school aged children and/or working in an afterschool program setting; 2) were over 18 years of age; 3) were native English speakers. The selection of day-school teachers considered sector (public, private for-profit, and private non-profit) and teaching experience in order to ensure a heterogeneous distribution of the sample. All afterschool program staff were selected from the non-profit sector, and were DYCD funded programs, to reflect the majority of urban afterschool programs in New York City (Office of the Mayor, 2014). A total of 12 participants (n=4 day-school teachers) and (n=8 afterschool program staff) participated in this study. Ethical approval for the study was provided by Teacher College, Columbia

University Institutional Review Board (Protocol # 15-221). The participants gave written informed consent to participate before entering the study.

2.2.2 In-depth interview protocol and data collection

The lead investigator created an interview script that was informed by standard interview techniques and included 6-open ended questions and probes and follow-up questions. Table 2.1 presents the core questions and probes of the interview protocol (Appendix A.1 provides the entire Interview Protocol).

Interviews were held from March to June 2015 in person when possible, otherwise over the telephone by the lead researcher (female, MHSc.) with experience conducting interviews. Each interview lasted for 30 to 45 minutes. Each interview began with a short demographic survey (to collect data on age, gender, current position, public or private-sector position, and years of experience in field). This was followed by a clarification of the definition of 'nutrition education programs,' and a brief introduction about the interviewer, and finally an explanation of her reasons for undertaking this research – which was described to the participants as "to inform the development of a nutrition education program for an afterschool setting with middle school-aged children." The complete interview protocol is provided in Appendix A.1.

Table 2.1 Interview protocol: Core Questions and Probes

Core Questions	Probes
1. What are the positive aspects of afterschool programs? Nutrition-related programs? What are challenges for after school programs?	What are strengths of afterschool programs? What do you think are weaknesses of afterschool programs? What types of considerations do you make when deciding to adopt a new curriculum? When would you reject an afterschool curriculum? What are the most common issues you have with curricula?
2. What are the resources (time, money, manpower) that influence an afterschool program?	What resource considerations do you feel are important in using a curriculum for afterschool programs? Which resource requirements would preclude you from adoption a curriculum? Describe a typical afterschool program.
3. What aspects are important to you in a good quality curriculum?	What suggestions would you give a curriculum developer for afterschool programs? For middle-school aged children? Describe an activity that has been/would be successful for afterschool programs with middle-school age children? In which ways was this successful? In which ways could it be improved?

2.2.3 Analysis

Interviews were audio recorded and transcribed verbatim by an outside source. All transcriptions were reviewed along with their audio recording a minimum of two times to ensure accuracy. Pseudonyms were given to each participant and replaced any mention of the participants' real names in the transcript and used thereafter in data analysis.

The lead researcher developed an initial codebook using line-by-line coding to identify themes, patterns of words, perceptions, ideas, and curriculum suggestions and then classified them into categories. Two independent coders (including the lead investigator and a trained research assistant) met to come to consensus on their codes after coding each transcript. After establishing reliability between coders, each coder (the lead investigator and a research assistant) received 4 to 6 randomly assigned transcripts.

Discrepancies between coding pairs were resolved through discussion. SPSS 24 (IBM, 2016) was used to calculate a chance-corrected agreement (Krippendorff's Alpha Reliability Estimate) across coding pairs of 0.825 (substantial agreement) (Krippendorff, 2004). Each interview transcript was imported into the qualitative software NVivo 11 (QSR International, Melbourne Australia, 2015). Themes were extracted from the imported text files using an inductive analysis based on frequency of the responses across interviews. Given that a theme could be referenced multiple times by a single staff member, both the overall frequency for which a theme was referenced, and the number of participants who referenced the theme were considered in developing the inclusion criteria. Themes were defined as topics, issues, or program suggestions that met the following criteria: they had to be discussed at least 3 times (frequency), and by at least two sources.

2.3 RESULTS

Interviews with teachers and afterschool program staff were conducted to learn about the positive aspects and challenges of afterschool nutrition education curricula for middle-school aged children. Teachers had an average of 12.6 years of teaching experience (4-16 years of experience) and taught a range of subjects including English, history, science, and math; none of the teachers had explicitly taught a health class. Three of the four teachers had experience working in low-income schools.

All afterschool program participants worked in the non-profit sector in New York City and had experience serving at-risk youth. Most sites, at which program staff were working, offered a range of classes and activities (n=5). The remaining were focused on a single type of programming (e.g. academic support (n=2) or sports (n=1)). Three sites

had experience hosting nutrition/food-related courses (n=1 nutrition/cooking class; n=2 food justice classes); one site was developing a gardening program; one site integrated health and nutrition lessons and activities into their existing sports curriculum; and the remaining sites had either external organizations come in to facilitate a health/nutrition class or did not have any experience to date with health or nutrition programming.

Table 2.2 Participant Characteristics

Variable	All Participants (n=12)	Teachers (n=4)	Afterschool Program Staff (n=8)
Mean age [years (sd); range]	34.91 (7.29); 26-51	37.75 (1.5); 36-39	33.5 (8.7); 26-51
Gender female (%)	7 (58.3%)	1 (25%)	6 (75%)
Mean years of professional experience [years (sd); range]	10.33 (5.74)	12.75 (2.75)	9.12 (6.60)
Sector			
Public (%)	--	2 (50%)	--
Private (%)	--	1 (25%)	--
Non-Profit (%)	--	1 (25%)	8 (100%)
Composition of afterschool programming	--	--	
Offers a range of classes			5 (62.5%)
Offers primarily academic support			2 (25%)
Offer a sports program			1 (12.5%)

Individual themes that emerged from participants were organized into two meta-themes: (1) pedagogical elements for successful learning with this age group; and (2) pragmatic considerations for hosting Nutrition Education (NE) programs in the afterschool context. These meta-themes consisted of 7 individual themes: 5 pedagogical elements and 2 pragmatic considerations.

The pedagogical elements that were derived as specific and essential for afterschool programing were: (a) the importance of student-centered learning, such as "voice and choice" activities; (b) use of scaffolding strategies; (c) differentiation

strategies to engage different learning styles; (d) tailoring activity duration to be developmentally appropriate; and (e) building social connection between peers and with teachers.

Pragmatic considerations included: (a) essential elements, such as ensuring cultural competence in relevant educational materials, and incorporating activities that were fun and engaging; and (b) logistics, such as working within the financial, time, and space constraints of community-based afterschool programs. Table 2.3 provides all the individual themes classified under the 2 meta-themes that were included in the analysis, the frequency in which each of the themes that met the inclusion criteria were mentioned, and the number of sources (interviewed participants) who referenced each theme. Results are discussed below by meta-theme and theme with illustrative quotes from participants.

Table 2.3 Frequency of themes by source

Themes	Number of sources, n=12 (% of all sources)	Frequency across sources
(1) Pedagogical Elements for Successful Learning		
a) Student-centered learning	11 (91.6%)	44
b) Scaffolding Strategies	6 (50%)	15
c) Differentiation Strategies	11 (91.6%)	18
d) Duration to be Developmentally Appropriate	9 (75%)	24
e) Teaching through Relationships	10 (83%)	24
(2) Pragmatic Considerations for Hosting NE programs in the Afterschool Context		
a) Essential Elements	10 (83%)	33
Ensuring Cultural Competence	6 (50%)	9
Fun and Engaging	9 (75%)	21
Evaluation Benchmarks	3 (25%)	3
b) Logistics (financial, time, space constraints)	9 (75%)	48

Source refers to the number of participants that discussed the theme. *Frequency* refers to the total number of instances that the theme was referenced.

(1) Pedagogical elements for successful learning – a number of themes emerged when teachers and afterschool program staff were asked about both the positive aspects and challenges of afterschool programs and the aspects of good quality curricula that are

important to them. Of them, 11/12 (91.6%) of the sources indicated that student-centered learning and applying differentiation strategies, and 10/12 (83%) indicated that teaching through relationships were integral elements for successful learning environments.

a) Student-centered learning - Teachers and afterschool program staff alike highlighted the importance of student-centered learning, although afterschool program staff commonly referred to this concept as 'voice and choice.' Student-centered learning shifts the focus of instruction from the teacher to the student, where the emphasis is placed on the learner's critical role in constructing meaning from new information and prior experience (Hannafin & Hannafin, 2010; Pedersen & Liu, 2003). Educational programs, learning experiences, instructional approaches, and academic-support strategies take a student-centered approach when they address the distinct learning needs, interests, or aspirations of individual students and groups of students. That is the teacher moves from "sage on the stage" to "guide by the side."

They do the reading, they respond, they come up with the big questions that we get to talk about and I help to guide them, but have them teach each other […] which is very powerful too. Like, sometimes we chunk lessons so you take each group, you know, make them responsible for this section […] and then they will teach their peers. And those discussions are the most powerful they have. Because I can say something ten times, when your peer says it in a different way or just coming from a different source, it speaks to them in a different way. So, I think making the kids responsible for the learning and making them responsible for the discovery, and then making them responsible for the production, like sharing a poster, or just turning and talking to the person next to you […] but having them have a more active role. – Tina, Teacher

"Afterschool programs should not be about didactic delivery. It's about voice and choice, giving kids the mic and letting them come to the stage." – Edith, Program Director

So it's not just content that they [the students] are supposed to kind of receive, passively, but rather they are more active participants in the learning." – Peter, Teacher

A lot of times, I just tell my students: okay, this is my objective, what do you think would be the most interesting way to do this and sometimes they just leave it open like that and sometimes they say, here are 4 ideas that I have. – Jen, Youth Developer

b) Scaffolding strategies - Scaffolding instructional techniques were discussed as a way to move students progressively toward a stronger understanding, and ultimately, greater independence in the learning process (Berk & Winsler, 1995; Pea, 2004).

Typically, the first part of the lesson, it's the teacher doing it [a new skill] first, to guide the process. It is a scaffold, from the teacher starting it out and then the teacher kind of guides you [the student] to some degree. So you are doing some of that, but the teacher is helping you. And then it becomes more independent in the small group, where the teacher is more facilitating or monitoring. And then by the end, it typically comes back to a whole group share. – Peter, Teacher

You start from the very beginning in terms of say, how the food is grown. What is this? What are the nutrients in that? Very basic things and scaffold it up, building… all the way to how we are going to procure these things, then is how you cook them, then is how you grow them. – Dina, Afterschool Program Director

[Referring to successful lessons] Something where you start individually with kids, or working together perhaps, in small groups to discuss something, then even giving the kids some presentation opportunities to share with a small group or with the whole class. – Kim, Youth Developer

So a lot of times, they [teachers] dwell on the reading part, but there can always be a discussion component that could be in a small group then brought to the larger groups, and that could be lots of things like that. And then there's the production component. And at the production it could be something that they are used to for writing, it could be again designing a poster or a project. – Leo, Teacher

c) Differentiation strategies - Differentiation strategies were discussed as integral in the building of lessons and development of teaching materials to ensure that regardless of where students begin, they can learn content effectively and according to their needs. These are strategies are employed to ensure students of all abilities and learning styles are engaged and often includes using visual, tactile, auditory, and kinesthetic components in the lessons (Kolb, 1984; McTighe & Tomlinson, 2006; Vygotsky, 1978).

The research does support that the more you have kids engaged using their senses, get them working with their hands on that matter, like whether that would be cooking and gardening… then listening to a story, that you know… it's better. – Ali, Assistant Program Director

I would not create lessons in a way that they just sit and get, kind of lecture style, instead having certain games, certain activities where they use their hands, or even kind of exploration, the kind of things where students are using the internet, to do some of the searching themselves […] and perhaps there is a video that they could watch. And then they are engaging in that video content through some question-answer type of things, through a discussion and the teacher facilitates. – Peter, Teacher

d) Tailoring activity duration – reference was often made to considering the attention spans of the middle-school aged children, with respect to curriculum length, lesson length, and activities length.

I would say that with any of the activities, I would keep them to 15 to 20 minutes […] but the goal I would say is 15 minutes is a nice target and 20 is kind of not bad. – Max, Youth Developer

I would say activities like have to run for 20 minutes, no more than 30. I would definitely say if you are dealing with middle school kids, you want to shoot for 20 minutes. For 1 hour lessons, you want to have 3 different segments of things. – Don, Program Director

Middle school students, after maybe doing a particular project for three months, they want to do something else, they're not impressed and they want to try and examine it in a different way; then the other piece would be making sure that you change things up maybe every 2 or 3 months. – Diana, Program Director

e) Teaching through relationships – refers to the complex social environment in which students and teachers converse, share experiences, and participate in activities that together can make for engaging learning (Biggs, 1996). While maintaining a formal relationship between students and teachers, teachers and afterschool program staff indicated that teaching through relationships was an integral part of a healthy classroom environment, as one which recognizes the human stories of the learners themselves, as well as the teachers (Biggs, 1996).

Well, part of it [increasing student engagement] is through your own personal relationships with the kids. […] I tell them about my own personal stories or stories of people I know and that really connects them to the topic. And then I ask them to share, you know, their own experiences, whether it is something they experienced or something they heard about. – Tina, Teacher

That [developing meaningful relationships] for me, in my life and any of my roles I've had in education, is probably a starting point for anything, and what I've found is that kids work harder to do the right thing, to stay with you if they know you care about them, if they know you are working hard for them, if they have a vast interest in you as an individual. – Zula, Afterschool Assistant Program Director

A major point of emphasis, you know, try to get to know people, be personal, share ideas, without being unprofessional, but you know you can include some parts of yourself and share some of those kinds of things with kids so that they see you as a human being. So that kind of human connection is huge and then often will help students to develop some set of, doesn't have to be strong as rules, but some sort of expectations regarding protocols, for how you are going to operate together group. – Peter, Teacher

I believe that the most important aspect of an after school program are the relationships that are built with the middle school students. I believe that the middle school students just in terms of their development, they really really are interested in how they relate to other people and I think that the relationships that they establish not only with their peers like within the program allowing them to develop relationships with their peers but then also these relationships, with some of the facilitators or instructors that can then turn into a mentoring relationship but I think for the most important part is relationships because middle schoolers, it is voluntary, they don't have to come. – Kim, Afterschool Program Director

(2) Pragmatic Considerations for Hosting Nutrition Education Programs in the Afterschool Context – two main themes emerged when teachers and afterschool program staff were asked about aspects that are important to a good quality program and the

resources constraints that they had to work within. Most teachers and afterschool program staff 10/12 (83%) indicated that there were key elements that were absolutely integral to a successful program (such as cultural competence, a fun and engaging program, and embedded evaluation benchmarks). Nine out of 12 of them (75%) listed financial, space, and time constraints as a persisting logistical challenge that most afterschool programs face. Table 3 provides an analysis of themes by source and frequency.

a) Essential elements – Essential elements refers to the components that teachers and staff felt absolutely necessary to a successful program. Most teachers and staff drew attention to the need for fun and engaging curricula, especially given the voluntary nature of afterschool programs and that kids are typically exhausted after a long day of school. Cultural competence refers to a true and genuine reflection of the diverse demographic that afterschool programs serve in the program activities. Also mentioned was the importance of embedded objectives, benchmarks, or evaluation pieces for which teachers/facilitators and program directors could use to assess that the program was doing what it was intended to do.

Like those kinds of active, hands-on activities, really are essential. Games and things like that, because they've been lectured at all day. – Kim, Afterschool Program Director

It has to be fun. For afterschool, these are kids that just had an entire day of school, so tons of information and there's some stress and pressure associated with that. – Edith, Afterschool Program Director

What I mean, is that, by the time children get to the after school, they're spent, like they are done. I mean they have been at school all day long so it has to be fun, it has to be engaging, it has to be interactive. – Max, Youth Developer

I think something that relates to their own culture, it's that almost like they don't want to try out other foods so they are actually complain about what's offered at school lunch, they complain about how there's never rice and beans, and there's never things from their culture. – Jill, Youth Developer

Yeah, I think that's so important to ensure that there are some kind of reflection of the students' own culture, I definitely think that's so important. – Ned, Teacher

What are the outcomes? What are the outcomes? What are the benchmarks along the way that are able to demonstrate that the program is actually achieving […]. – Diana, Afterschool Program Director

b) Logistics (financial, time, and space constraints) – Common logistical problems that met the criteria for inclusion as a theme were: working within the financial constraints of afterschool programming and available funding. Space was also an issue mainly due to the lack of a permanent space, having to share space with other programs, and limited resources within the accessible spaces available to afterschool programs for food preparation, for example. Lastly, some participants commented that a high degree of facilitator burden made offering quality curriculum difficult.

It's hard right now, because they share space with the public school right now, so we are borrowing teachers' classroom. – Max, Youth Developer

If there's kind of like materials that need to be kept in a particular space, in the same room, that kind of poses a problem. – Edith, Afterschool Program Director

I mean, I wouldn't assume that any place has access to like computers, TVs and things like that. – Ali, Assistant Program Director

Laptops and internet access, we can use hotspots but we can only support a certain amount of computers and connections that time, so we really are restricted. We have 108 kids in the middle school program, we can have about safely, 50 of them on the internet at the same time due to our resource problem. – Jill, Youth Developer

You cannot necessarily assume that there will be kitchen supplies or you know, stoves and things like this to cook. And if, you know, if anything, maybe thinking about cold preparation recipes, so things you could just cut up. And you know, wash, sort of mix together, make sort of salad. – Don, Afterschool Program Director

You are going to go with the thing that is gonna be the least amount of effort because you're [program facilitators] being asked to do 500 million things. – Zula, Assistant Program Director

2.4 DISCUSSION

2.4.1 Main Findings.

This study solicited the viewpoint of key stakeholders in developing a new curriculum, focusing on practical design considerations and pedagogical approaches that

they would recommend for an afterschool setting, thus filling a gap in the nutrition education literature.

Findings from this study demonstrate that there are particular pedagogical approaches (e.g. student-centered learning, scaffolding, differentiation, and teaching through relationships) that teachers and staff considered to be important for developing a successful learning environment in the afterschool context. In addition, and what they felt differentiates afterschool from day-school, are that activities are fun and engaging, hands-on, and culturally-relevant to an ethnically diverse audience. They highlighted the importance of ensuring that the afterschool space was not simply an extension of day school. Finally, participants raised logistical considerations: limited funding, with budgets around $25 or less per lesson; time constraints, limiting lesson preparation time to about 2 hours per lesson; and space constraints, requiring curricula to accommodate a lack of fixed classroom space.

Very little research exists that describes the practical aspects of this important initial development phase for a nutrition education curriculum, for any setting, but particularly for afterschool settings. Outside of after-school nutrition education, similar findings are seen in development projects for other extra-curricular programs. For example, teachers interviewed in the development of an afterschool dance program noted the importance of balancing student-led and facilitator-led instruction and developing teacher-student rapport through the sharing of experiences (Sebire et al., 2013). Similar sentiments have also been echoed by Noam, Biancarosa, and Dechausay (2003) who explain that afterschool curricula should address different learning styles (differentiation), provide opportunities for more hands-on and experiential learning, and foster

relationships between peers and between the teacher and student. Interviews with afterschool program staff implementing a physical activity program similarly mentioned logistical issues related to space and resources, the importance of positive teacher-child relationships, and engaging activities. They also raised the issue of difficulty of maintaining attendance and unmotivated and unengaged staff members that were not mentioned in our study (Zarrett, Skiles, Wilson, & McClintock, 2012).

The Health Education Curriculum Analysis Tool (HECAT), a tool developed by the Centers for Disease Control, highlights 15 characteristics integral to effective health education curriculum executed in day-school settings. These include the use of "strategies designed to personalize information and engage students;" "age-appropriate and developmentally-appropriate information, learning strategies, teaching methods, and materials;" "teaching methods and materials that are culturally inclusive;" and "opportunities to make positive connections with influential others" (Centers for Disease Control, 2013). Afterschool and day school are considered different realms of learning (Noam et al., 2003, p. 3) and therefore this demonstrates crossover in pedagogical approaches for day-school health promotion and those highlighted by participants in this study for afterschool programs which may be of particular relevance when bridging developing, bridging or adapting health promotion programs or professional development trainings.

Nutrition education is often delivered using the didactic model, in which information and direction is imparted from the teacher to the student. However, insights gained from participants in this study related to a voluntary learning space emphasize the importance of learner-centered delivery. A shift in nutrition education delivery

approaches in other voluntary learning spaces, such the Woman, Infant, and Children (WIC) and SNAP ED programs, seem to also highlight the importance of paying attention not only to *what* the message is, but also *how* it is delivered (Cason, Scholl, & Kassab, 2002; Cena et al., 2008; Deehy et al., 2010; Gerstein et al., 2010; Norris, 2003). A recent study indicated that the student/learner-centered delivery mechanisms were received favorably by WIC site staff at the local and state level (Deehy et al., 2010). Multiple studies in adults have demonstrated that the student/learner-centered delivery mechanisms are favorably received by learners (Gerstein et al., 2010), have generated positive food-related behavior change (Cena et al., 2008), and greater changes than when compared to didactic instruction of the same content (Cason et al., 2002; Cena et al., 2008).

2.4.2 Strengths and Limitations.

A strength of the study is that it involved participants who come from the pool of teachers and other school-related personnel who have experience teaching middle-school aged children and work in afterschool settings. The use of snowball sampling to capture teachers may be considered a limitation, yet it is widely used in studies such as this. The small sample size may also be considered a limitation, but participants' comments reached saturation and hence we can rely on the interview results. This study did not specifically seek out those participants with experience teaching or in providing afterschool nutrition education programs, which may be considered to be a limitation. However, nutrition education afterschool programs are rare and the participants'

comments provide a fresh look at the practical and pedagogical issues that are rarely discussed in nutrition education curriculum development reports.

2.4.3 Conclusions.

While the study was conducted to provide information for developing a specific curriculum, the interview questions, and the participants' responses were for afterschool programs in general and so are applicable to the development of other programs. Thus, the pedagogical elements for successful learning and the logistical concerns raised can be used to inform the development of afterschool nutrition education curricula more generally.

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CHAPTER 3 (ARTICLE 2): APPLYING THE NUTRITION EDUCATION DESIGN PROCEDURE IN THE DEVELOPMENT OF THE *IN DEFENSE OF FOOD* AFTERSCHOOL CURRICULUM

3.1 INTRODUCTION

3.1.1 Background

Adolescence marks a period of change where individuals develop more responsibility for health-related behaviors that can affect their future (Neumark-Sztainer, Story, Perry, & Casey, 1999). Food-related behaviors are particularly important during these pivotal years (Story, Neumark-Sztainer, & French, 2002) because not only do they have direct consequence for health and well-being, but they shape choices later in life (Videon & Manning, 2003). Adolescents are failing to meet dietary recommendations resulting patterns of poor diet quality mirroring trends in obesity and chronic disease rates in youth across the country (Hurley et al., 2009; Moreno et al., 2010). Obesity and diet-related chronic diseases are linked to diets high in highly processed foods (J. M. Poti, Mendez, & Ng, 2015). Discretionary calories from soda, fruit drinks, dairy desserts, and grain desserts/snacks contribute to approximately 40% of the daily calories for children and adolescents aged 2-18 years (Reedy & Krebs-Smith, 2010) when the Dietary Guidelines recommends that discretionary calories be no more than 14-17% (Dietary Guidelines Advisory Committee, 2015). Furthermore, most American youth also do not meet the recommendations for eating 2 ½ to 6 ½ cups of fruits and vegetables daily.

The issues of consuming too many discretionary calories from highly processed foods and eating too few fruits and vegetables are important for maintaining a healthy weight and decreasing risk of diet-related diseases; and point to the need for efforts to be directed at improving dietary patterns away from highly processed foods and towards a greater intake of whole foods, particularly fruits and vegetables. However very few

nutrition education programs to date targeting middle school-aged children specifically emphasize decreasing intake of highly processed foods as a behavioral change goal. Furthermore, despite the many nutrition education initiatives that have burgeoned across the country, reviews indicate mixed success (Waters et al., 2011). In order to effectively and efficiently design nutrition education programs, researchers have called for better quality interventions to be developed that are behaviorally-focused, theory-driven, and follow systematic approaches to program design (Baranowski, Cerin, & Baranowski, 2009; Contento, 2012).

The objective of this study is to demonstrate how the Nutrition Education DESIGN Procedure (DESIGN procedure), a 6-step process, can be applied to generate a behaviorally-focused, theory driven, nutrition education curriculum for a middle school afterschool audience with the primary behavioral goals of decreasing intake of highly processed foods and increasing intake of whole/minimally processed foods, particularly fruits and vegetables.

3.1.2 Key Attributes for Successful Nutrition Education Programs

Existing evidence suggests that while many factors impact outcomes, strong educational materials that are behaviorally-focused, rooted in theory, and systematically apply effective design elements that link theory, research, and practice are more likely to facilitate individual level dietary change (Abraham & Michie, 2008; Baranowski et al., 2009; Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003; Centers for Disease Control, 2013; Contento, 2008; Contento et al., 1995; Katz, O'Connell, Njike, Yeh, & Nawaz, 2008; Michie, Prestwich, & de Bruin, 2010; Waters et al., 2011).

I. Behavioral Focus. Knowledge-based nutrition education programs have been developed in school settings with the assumption that a change in food-related knowledge will lead to a change in attitudes and a change in behavior (Baranowski et al., 2009; Contento, 2008). However, while they are often effective in changing knowledge, they have not been particularly effective in changing behavior (Baranowski et al., 2003; Contento et al., 1995). People's food choices are complex and determined by a myriad of factors, which are constantly interacting with each other and therefore knowledge-based programs form only one narrow category of influence on diet-related behaviors and practices. The recognition that food choice is very complex and dynamic has lead nutrition educators and researchers to argue that nutrition education should go beyond disseminating nutrition information and be designed to facilitate personal dietary changes (Contento, 2006). Taking a behavioral focus implies selecting a behavioral goal that is substantially or causally related to the primary health outcome of concern (Baranowski et al., 2009), is actionable and observable (Contento, 2006), and meets the needs of the specific target group (Baranowski et al., 2009; Contento, 2006). They can be general, such as eating more fruits and vegetables, or specific, such as drinking no more than 1 soda per week (Contento, 2016).

II. Application of Theory. There is a growing recognition that the development and implementation of effective behavior change interventions are enhanced by the application of behavior change theory (Baranowski et al., 2003; Contento et al., 1995; Michie & Prestwich, 2010; Michie, van Stralen, & West, 2011). Theory can be used to improve the efficiency of intervention development by identifying psychosocial theory-based determinants of behavior (also known as mediators or constructs) hypothesized to

provide the strongest causal links to the desired behavioral outcome. Changing the determinants with the greatest predictive power thereby can lead to behavior change (Baranowski et al., 2009). Recognizing how determinants within a theory interact can allow for intervention techniques, strategies, and activities to be refined or tailored to provide stronger effects (Contento, 2008; Michie & Prestwich, 2010). Furthermore, applying and evaluating theory-based interventions appropriately can help elucidate why interventions are effective or ineffective and thereby facilitate a better understanding of mechanisms that can provide guidance for the development of future interventions and build on existing knowledge (Contento, 2016; Michie et al., 2010).

III. Applying a Systematic Design Framework: The DESIGN Procedure.

Given the inherent complexity of health promotion programs, many researchers in the field recognize the importance of developing theory-based and behaviorally-focused nutrition education programs using a systematic approach (Baranowski et al., 2009; Bartholomew, Parcel, Kok, & Gottlieb, 2011; Contento, 2016; Michie & Abraham, 2004).

Applying a systematic approach can strengthen programs by maximizing their potential for success and by conserving resources. This can be done through thorough assessments of the target audience to determine the most effective allocation of resources, learning from past applications of the framework in similar situations, and by streamlining the documentation of the planning, development, and evaluation processes (Contento, 2006; Michie & Abraham, 2004). It also allows for a cumulative and comparable science to be generated to better understand overall effects and aspects of successful and unsuccessful programs.

Approaches such as Intervention mapping (IM) (Bartholomew et al., 2011), Re-AIM (Glasgow, Vogt, & Boles, 1999), the PRECEDE-PROCEED model (Green & Kreuter, 2005), and the U.K, Medical Research Council's framework (Craig et al., 2008) use a stepwise approach the design, development, and analysis of health promotion programs and are designed to be applicable to a variety of health issues. For example, IM has been used to plan health education programs such as Long Live Love (an HIV-prevention program targeted at Dutch adolescents) (van Empelen, Kok, Schaalma, & Bartholomew, 2003); Re-AIM was used to evaluate an integrative medicine program for underserved women with chronic pelvic pain (Chao, Abercrombie, Santana, & Duncan, 2015). These models are usually directed at large scale interventions and are complex to use, consequently they are most often only used in research studies.

The Mediating Variable Model and the Nutrition Education DESIGN Procedure have been developed to more specifically be applied to nutrition and physical-activity-related educational programs (Baranowski et al., 2009; Contento, 2016). The Mediating Variable Model emphasizes that selecting the most highly predictive mediators of behavior change for the target audience, and focusing on procedures most likely to change them can direct the use of resources on the most impactful and probable antecedents of behavior change (Baranowski et al., 2009). Although the Mediating Variable Model proposes a series of general steps for developing nutrition and physical activity education interventions, it does very little to direct the actual development of appropriate educational activities that address the behaviors targeted by the program and the mediators of change.

The DESIGN Procedure specifically guides nutrition educators through a straightforward stepwise process to develop effective nutrition education for real-world settings (Contento, 2016). DESIGN is an acronym for '**D**ecide the behavior;' '**E**xplore determinants;' '**S**elect theory;' '**I**ndicate objectives;' '**G**enerate educational plans;' and '**N**ail down the evaluation.' The steps and process allow for an audience-specific approach, the development of group sessions and educational resources, and an evaluation plan using behavior-focused and theory driven Behavior Change Strategies and Evaluation plan (Contento, 2016). DESIGN has been used in previous studies in the development of educational curricula, such as with Food Health and Choices (FHC), a childhood obesity-prevention intervention for elementary school children in a day-school setting (Abrams, 2014), and for a culturally-relevant dietary intervention for cancer survivors (Greenlee et al., 2015).

3.1.3 Purpose

The purpose of this study is to describe the development of the *In Defense of Food* (IDOF) afterschool curriculum for middle school-aged children using the Nutrition Education DESIGN Procedure, a systematic stepwise approach for translating evidence-based nutrition education theory into behavioral outcomes. Such a description provides useful guidance for the design of interventions and curricula for research and practice settings.

3.2 METHODS

3.2.1 The In Defense of Food Afterschool Curriculum

The PBS documentary film *In Defense of Food,* based on the book with the same name by Michael Pollan, aims to provide viewers with the answer to the question: What should I eat to be healthy? The film shows a simple way of eating that can help consumers rediscover the pleasures of eating whole plant-based foods and avoid the chronic diseases often associated with a diet of highly processed foods.

The purpose of the IDOF curriculum was to translate the book and film into an afterschool curriculum for middle school students that would encourage the consumption of more fruits and vegetables and less highly processed foods.

The Teachers College (TC) Institutional Review Board (IRB) approved the methods for in this study. Funding was provided by the National Science Foundation (NSF) and Public Broadcasting Service (PBS) for this project.

3.2.2 Nutrition Education DESIGN Procedure.

Step 1. Decide on program behavior change goals for the target audience by assessing issues and behaviors of concern. *The first step of DESIGN involves defining the audience, examining the issues of concern relevant to this audience, and selecting both empirically-identified and audience-derived behaviors for change related to the issues of concern (Contento, 2016). Based on this assessment the main behavioral change goal(s) is/are derived and stated as the change or action the program intends for the audience to achieve.*

Issues and Behaviors of Concern. Middle school afterschool students, primarily of African American and Hispanic ethnic backgrounds, are the intended audience for this

curriculum. Students attending Department of Youth and Community Development (DYCD)-governed afterschool programs will receive the curriculum.

Minority disadvantaged youth in the United States have higher rates of obesity are at higher risk for diet-related chronic diseases than their White counterparts (*CDC Health Disparities & Inequalities Report (CHDIR)*, 2011). These are thus issues of concern. They tend to have suboptimal diet quality (Hurley et al., 2009), with the most prominent dietary patterns being increased snacking occasions, increased consumption of fast food and sugar-sweetened beverages (Moreno et al., 2010), and an inadequate intake of fruits and vegetables (Briefel & Johnson, 2004). Lower overall diet quality, as measured by the Youth Healthy Eating Index (YHEI) is significantly associated with higher percent body fat in this population (Hurley et al., 2009) and emerging diet-related diseases (Connolly, Unwin, Sherriff, Bilous, & Kelly, 2000; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008).

Not only are these high-fat, high-sugar foods readily available, cheap and abundant in these disadvantaged communities (Drewnowski & Eichelsdoerfer, 2010; Drewnowski & Specter, 2004), but minority youth are disproportionately targeted by the food industry who use sophisticated marketing to ensure continued consumption of highly-processed junk foods (Harris et al., 2015). Adolescents are rarely conscious of the persuasive intent of junk food marketing, leaving them more vulnerable to the marketing strategies (Keller et al., 2012). This may lead them to make connections or derive meaning from a product without even realizing it. For example, marketers exploit most adolescents' desires to fit in and be cool by selling an image to them, one that says that if you buy this product you will be happy, popular, cool, sporty, healthy, and/or attractive.

Studies are emerging to suggest that the degree of brand recognition that children have, often to those foods highest in salt, sugar, and fat, is a significant predictor of child BMI, after controlling for age, gender, and screen time (Cornwell, McAlister, & Polmear-Swendris, 2014).

The behaviors of eating too few fruits and vegetables, and consuming too many discretionary calories from highly processed foods (such as sugar-sweetened beverages, fast food, and processed packaged snacks) are important dietary behaviors that need to be addressed in this target population in order to maintain a healthy weight and improve diet quality. Consequently, the targeted behavior change goal of the IDOF nutrition education curriculum is to increase intake of fruits and vegetables and to decrease intake of highly processed foods in order to help address the deficits in the diets of our target audience.

Step 2. Explore Determinants of Change for Targeted Behaviors. *Step 2 of the DESIGN procedure entails exploring potential determinants with greatest impact to bring about change on the target behavior. The literature suggests a framework for understanding behavior change as involving three components:* ***motivational factors*** *(simplified as factors for "why-to" change behavior,* ***facilitating or capability factors*** *(simplified as "how-to" change behavior) and* ***environmental supports*** *for change* (Contento, 2016).

A needs assessment of the target audience is conducted at this stage along with a thorough review of the literature to understand specific determinants predictive of change with the target audience. In addition, an assessment can be made about practical

ways to deliver the curriculum to ensure that the determinants are addressed appropriately.

Exploring determinants motivating and facilitating behavior change.

Motivational (or *why-to*) factors that are potentially impactful in encouraging positive behavior change in the target audience were identified as positive and negative outcome expectations (including social norms and preferences), expectancies (attitudes); goal intention. Facilitating (or *how-to*) factors that enable the audience to act on their motivations were identified as behavioral capability (factual and procedural knowledge, critical thinking skills, and affective skills), self-efficacy, and self-regulation skills. Interviews with middle-school aged children and a review of the literature were conducted to explore these potential determinants specifically in terms of fruit and vegetable and highly processed foods intakes amongst the selected target audience. Table 3.1 lists each determinant and provides supporting literature and data retrieved from the interviews).

Interviews. From May to July 2015, semi-structured interviews were conducted with a convenient sample of 6^{th}-8^{th} grade students (n=6, 50% female; mean age=13.2±1.6 years; 11-15years old) were conducted. The lead researcher contacted a list of six parents of middle-school aged children, generated through word of mouth. Verbal consent from parents was provided and students were read assent scripts. Interviews lasted 15 minutes, were conducted over the phone using a semi-structured interview protocol (Appendix B.1), and audio-recorded. Audio-recordings were reviewed by the lead investigator and

extensive notes were taken for codes related to motivational and facilitating determinants of behavior change.

Table 3. 1 Motivational and Facilitating Determinants of Behavior Change for Middle School-aged Children

Determinant Category	Potential Determinant	Interviews and Supporting Literature
Motivational "Why-to" Determinants	***Outcome Expectations*** are "beliefs about positive outcomes of performing the behavior and the negative outcomes of not performing a behavior [which] can be physical (e.g food preferences), social (e.g. perceived social norms), or self-evaluative (e.g. attitudes) (Contento, 2016)." ***Social Norms*** are "beliefs that people who are important to use either approve or disapprove of us performing a behavior (Contento, 2016)." ***Preferences*** are "our sensory-affective responses to food (taste, smell, impact on how full we feel) (Contento, 2016)."	**Interviews.** Adolescents expressed benefits to eating fruits and vegetables, including enhanced physical performance, psychological factors (such as mood), physical sensations (such as "feeling energized"), and ability to control weight. Although students recognized that fruits and vegetables are healthy, they perceive their peers to find them undesirable, which in turn acted as a determinant of their own reported preferences and intake of fruits and vegetables. They also revealed that the undesirable hedonic qualities of fruits and vegetables (e.g. taste, smell, sight) as reasons for their limited intake. **Literature.** Adolescents believe eating fruits and vegetables will enhance cognitive function and benefit their appearance, immunity, longevity, and future health (O'Dea J, 2003). Research with low-income youth similarly show that perceived social norms, perceived peer attitudes (Di Noia & Cullen, 2015; McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009) and preferences were positively associated with fruit and vegetable intake (McClain et al., 2009). Research corroborates our assessment findings that adolescents are highly influenced by the perceived hedonic qualities of fruits and vegetables as reasons for their limited intake (Bauer, Yang, & Austin, 2004; O'Dea J, 2003; Spear, 2002).
	Expectancies/Attitudes are "our favorable and unfavorable judgments or values about a given behavior (Contento, 2016)."	**Interviews.** Adolescents indicated that being good at sports is important to them and that remaining a healthy weight is important to them so that they could continue to participate in sports.
Facilitating Action "How-to" Determinants	***Functional/Procedural knowledge*** is "food and nutrition-related knowledge and cognitive, affective, and behavioral skills needed to enact the behavior (Contento, 2016)."	**Interviews.** Most students recognize that eating fruits and vegetables is an essential part of a healthy diet, however, they had limited knowledge about how to select and prepare healthy foods, and what to do to integrate healthy eating into their lives on a regular basis. Many thought eating healthy meant adding or removing key nutrients (specifically protein; and sugar, carbohydrates, and fat respectively). **Literature.** Recent reviews have indicated that improving knowledge in adolescents is positively associated with fruit and vegetable consumption (McClain et al., 2009; Rasmussen et al., 2006).
	Self-efficacy/perceived barriers	**Interviews.** Adolescents indicated that limited availability and variety of fruits and vegetables at home and school,

is “the confidence people have that they can carry out the intended behavior successfully (Contento, 2016).”	their inconvenience, and to a lesser extent price and tempting advertising of junk food acted as barriers to eating fruits and vegetables. Students believed their parents played a large role in their ability to select healthful foods and expressed low self-efficacy for doing so unguided. **Literature.** The literature reveals that adolescents indicate that time is a perceived barrier to eating fruits and vegetables (e.g. with shorter lunch breaks) and that the vending machines at school which provide access to highly processed foods is perceived as convenient and time-saving; namely because adolescents prefer to focus their time and energy on fun activities rather than meal planning (Spear, 2002). Barriers associated with decreasing intake of highly processed foods included a reported inability to “resist temptations” of highly processed junk foods, namely when hunger and food cravings strike (Neumark-Sztainer et al., 1999). Research also indicates that helping adolescents to overcome perceived barriers along with increasing self-efficacy is a significant determinant of fruit and vegetable consumption in middle school students (Young, Fors, & Hayes, 2004).
Self- regulation (goal-setting) skills includes “creating specific, measurable, attainable, realistic, and time-sensitive goals that […create a] sense of fulfillment from having achieved the goals (Contento, 2016).”	**Interviews.** *Many students had not learned about goal setting specifically for food-related behaviors. However, a basic understanding of the purpose of setting goals exists. Students indicated the importance of setting achievable goals and then building on them once they are achieved.* Research indicates that guided goal setting is appropriate for this age group (Contento, Michela, & Goldberg, 1998; Contento, Michela, & Williams, 1995; Contento et al., 2016).

Step 3. Select a theory or create a model to guide program development and clarify a philosophy. *Select the theory or educational philosophy that will provide the framework for the program based on the determinants that were revealed in the needs assessment and in the empirical literature. Theories can provide a map to guide program development by helping to frame and focus lesson materials around specific determinants understood to motivate and facilitate behavior change (Contento, 2016). The philosophical approach refers to how nutrition educators and program developers*

approach nutrition science and their particular roles as educators, and can also help to focus educational efforts within a unified message.

Theory Model. Analyses from the needs assessment and empirical literature support the reliance on the Social Cognitive Theory (SCT) (Bandura, 1986) and the Self-Determination Theory (SDT) (Deci & Ryan, 1985) as the theoretical foundation for the curriculum. Figure 1 illustrates the theoretical model associated with the design and evaluation of the curriculum.

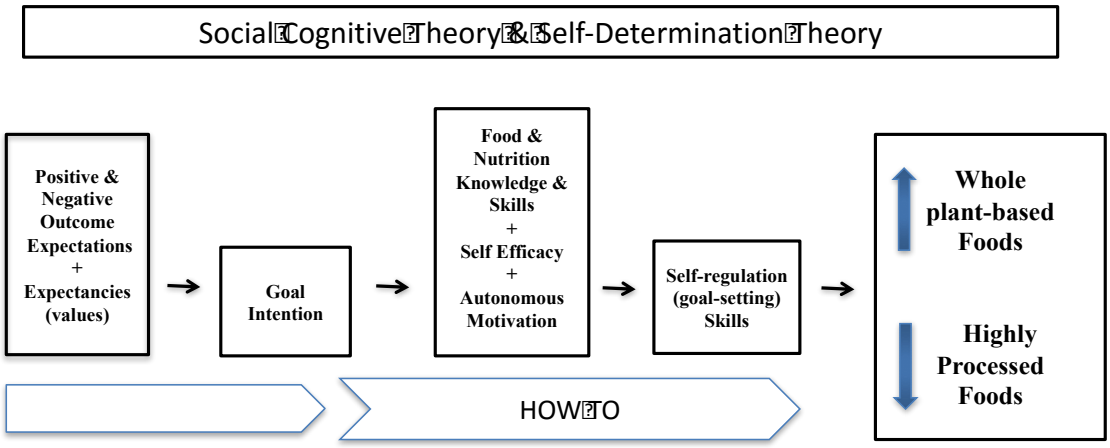
Social Cognitive Theory (SCT). Social Cognitive Theory proposes that behavior change results from the reciprocal and dynamic exchange of relevant personal, behavioral, and environmental factors (Bandura, 1986). Personal factors refer to individual thoughts and feelings, and include outcome expectations, the beliefs about the likelihood of various outcomes resulting in engaging in a particular behavior, and self-efficacy, referring to the confidence that a person feels to carry out an intended behavior successfully (Contento, 2016). Behavioral factors consist of the diet-related knowledge and skills that people have to take charge over their own behaviors. These include self-regulatory mechanisms, such as self-monitoring (e.g. goal setting), and enlisting social support. Successful self-regulation translates to an ability to endure or bypass immediate negative outcomes for long-term gains (McAlister, Perry, & Parcel, 2008).

Self-determination Theory (SDT). Self-determination theory is a general theory of human motivation (Deci & Ryan, 1985). It proposes that individuals have an innate psychological need for autonomy, competence, and relatedness, which when satisfied leads to self-derived motivation to be well (Deci & Ryan, 1985). SDT can be helpful in assisting people to take action by supporting autonomy (by initiating and regulating one's

own actions), enhancing their competence (building understanding of how to, and self-efficacy to achieve outcomes), and by fostering the relatedness of the message (developing connections to others also motivated to change) (Contento, 2016). Adolescents at this stage are increasing their cognitive abilities and developing their sense of identity. A sense of autonomy directed towards healthy behaviors may be particularly important, especially as students at this age indicate that they want to be included in decision making and have control over the activities that they engage in.

The use of these two theories in an integrated approach with middle school students was effective in improving eating patterns (Contento, Koch, Lee, & Calabrese-Barton, 2010).

Figure 3. 1 Theoretical Model for the In Defense of Food Curriculum.



IDOF Nutrition and Educational Philosophy. The philosophy of the IDOF curriculum related to nutrition is based on the belief that in order to improve the diets and health outcomes of youth, an emphasis should be placed on dietary patterns, rather than individual nutrients or foods. Dietary patterns, such as whether a person consumes a large

proportion of highly processed foods compared to whole plant-based foods, impacts diet quality and health (Moubarac et al., 2013; Mozaffarian, Hao, Rimm, Willett, & Hu, 2011; J. Poti, Duffey, & Popkin, 2014; J. Poti, Mendez, Ng, & Popkin, 2015; Rosenheck, 2008). Taking a whole diet approach, such as focusing on the types of foods that are typically healthy (e.g. whole plant-based foods) compared to those that are typically not provides qualitative distinctions that are often more important than which nutrients to eat more or less of (Scrinis, 2008, 2013).

In terms of educational philosophy, the curriculum is based on the belief that adolescents need the motivation and skills to contend with a difficult food environment. Afterschool programs provide a social and supportive environment and can facilitate capacity building in culturally, developmentally, and engaging ways.

Step 4. Indicate general educational objectives for key determinants of behavior change or action. *In Step 4 of DESIGN general educational objectives (statements of intended learning outcomes) are generated for the motivational determinants and facilitating determinants outlined in the theoretical model. This preliminary step is used to translate the determinants into activities. They are not statements of what the educator will do, but rather what the participants will know, feel, or do differently with respect to the determinant in order to achieve behavior change.*

Table 3.2 General Motivational and Facilitating Objectives Selected to Guide the IDOF Program.

Determinant Category	Determinants from Theory Model	General Educational Objectives Participants will be able to:	
		Increase consumption of whole plant-based foods	**Decrease consumption of highly processed foods**
Motivational or "Why-to" Determinants	**Negative outcome expectations**		Demonstrate an increased awareness of the negative consequences related to eating highly processed foods.
	Positive outcome expectations	Articulate the benefits of eating fruits and vegetables. Describe the benefits of eating a variety of whole plant-based foods.	
	Outcome expectations: Preferences	Demonstrate an appreciation of the taste of various whole plant-based foods.	
	Outcome expectations: Social Norms	Express a recognition in the influence their peers and family members have on their dietary choices surrounding whole plant-based foods.	Express a recognition in the influence their peers and family members have on their dietary choices surrounding highly processed foods.
	Outcome expectations: Attitudes	Express positive attitudes towards eating whole plant-based foods.	Express negative attitudes towards eating highly processed foods.
Facilitating Action or "How to" Determinants	**Food and Nutrition Skills**	Demonstrate the ability to identify whole plant-based foods. Describe how to increase their consumption of whole plant-based foods and how to increase the variety of these foods in their diets.	Demonstrate the ability to identify highly processed foods. Describe how to decrease their consumption of highly processed foods.
	Behavioral Skills	Prepare and select appealing whole plant-based foods for snacks and meals.	
	Self-efficacy	Demonstrate increased confidence in eating more whole plant-based foods. Identify strategies to overcome barriers to eating whole plant-based foods.	Demonstrate increased confidence in consuming fewer highly processed foods. Identify strategies to overcome barriers to resisting highly processed foods.

Goal intention	State intention to increase F&V intake.	State intention to decrease consumption of highly processed foods.
Self-regulation skills	Set and monitor goals to eat more and/or a greater variety of whole plant-based foods.	Set and monitor goals to eat fewer highly processed foods.

Step 5. Generate Educational Plans. *Step 5 of DESIGN involves translating theory-based general educational objectives into theory-based strategies and then activities for motivating and facilitating behavior change, which are then sequenced in the following order based on instructional theory: Excite students – gain their attention; Explain – present stimulus and new material; Expand – provide guidance and practice for how-to take action; and Exit – provide ways to apply and close (Contento, 2016).”*

Curriculum and behavior change experts, middle school-aged children, experienced teachers, and afterschool program staff were consulted in the translation of determinants to learning objectives and activities. Brainstorming sessions were held to identify unique ways to operationalize the determinants from SCT and SDT into engaging and interesting activities for students. The curriculum was frontloaded to focus on motivational determinants by emphasizing “*why-to”* knowledge and other motivators and transitioned into facilitating determinants by emphasizing “*how-to”* knowledge and skills.

The process of translating theory-based objectives into activities involved first selecting one or more appropriate specific theory-based *behavior change strategies* – which are categories of procedures -- that can be used to operationalize the determinants. These behavior change strategies are similar to what are called behavior change techniques (Michie, Johnston, Francis, Hardeman & Eccles, 2008). These *strategies* were then converted to practical educational activities. Within each lesson the activities

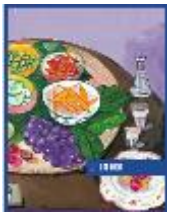
were sequenced based on learning theory and instructional design theory (Gagne, Wager, Golas, Keller, & Russell, 2005; Kinzie, 2005; Merrill, 2009). Each lesson thus follows the recommended sequence of "instructional events," here labeled as the 4Es: *Excite* students, *Explain* new material to increase understanding of why-to take action, *Expand* students' experience by providing guidance and practice for how-to take action, and Exit the lesson through application and action planning. Finally, the activities were designed to involve appropriate communication principles for engaging the students (Brookfield, 2015; Cacioppo, Petty, Kao, & Rodriguez, 1986)

Table 3.4 provides the planning matrix for each lesson, showing the connection between the instructional sequence, each determinant, the related behavior change strategy employed, the specific educational objectives to be achieved, and the activities or content (educational material) provided to achieve the educational objective.

Curriculum Overview. This process resulted in a 10-lesson 2-hour afterschool curriculum for middle school students, designed to accompany the PBS documentary film based on Michael Pollan's book, *In Defense of Food*. It incorporates 2-to-5 minute-film clips from the documentary in each lesson. The curriculum is designed to answer the question "What should I eat to be healthy" by organizing the lessons into three major sections related to the themes in Pollan's axiom: *Eat Food. Not too Much. Mostly Plants*. Each theme explores a different aspect of food. *Eat Food* (lessons 1-3) helps students to define highly processed foods and learn to differentiate them from minimally or unprocessed (healthy) alternatives. *Not too Much* (lessons 4-6) explores the factors that lead to overconsumption of highly processed foods and their health implications, especially for those living within financial constraints. *Mostly Plants* (lesson 7-9)

provides positive experiences and skills on how to select, prepare, and enjoy a mostly plant-based diet. The last lesson is a celebration. An overview of the curriculum is shown in Table 3.3.

Table 3.3 An Overview of the In Defense of Food Curriculum

Theme	Overview
Eat Food (Lessons 1-3) 	Students are introduced to the terms: *foods* (whole, minimally-processed plant-based foods) and *phuds* (highly processed foods). They learn to differentiate commonly consumed food and phuds, why it is important to try and eat more foods and fewer phuds, and how persuasive marketing can make it difficult to maintain this balance.
Not Too Much (Lessons 4-6) 	Students draw connections between their food environment, as one that encourages the consumption of many highly processed foods, and poor health and heath disparities. They further explore advertising strategies which shape what, when, and how much we eat, and begin to build capacity to voice their concerns and to make changes in their lives.
Mostly Plants (Lessons 7-9) 	Students build an appreciation for eating whole/minimally processed plant-based foods and learn practical skills for preparing them while exploring how other cultures and groups of people eat.
Celebrate (Lesson 10) 	Students look back and celebrate on all that they have done and learned in a final show case and celebration of their work.

Food Rules. Each lesson provides students with a "Food Rule," taken from Michael Pollans' book *Food Rules* and described in the film, to operationalize the lesson's theme in clear and actionable ways. For example, the theme *Eat Food*, a food rule is *Eat food you can picture growing in nature;* for the theme *Not too* much, a food rule is: *Avoid foods you see advertised on television;* and for the theme *Mostly Plants,* a food rule is: *Eat your Colors.* Table 4 shows each Food Rule and its corresponding lesson. A tailored take-home sheet is provided to the students with the lesson's food rules and a tip sheet for the family, stressing the fun and ease of the program while also providing information that the family could use at home.

Delivering IDOF Components. Although lessons were designed to be two hours, a one-hour mark was provided within the lesson plan in order to allow for adaptability to the specific needs of afterschool programs. All lessons included an opening (Excite) and closing (Exit) activity designed to introduce the lesson's theme and allow students to leave the program excited as well. Throughout each lesson, hands-on activities, opportunities for peer-led facilitation, discussions which let students generate meaning from the educational material, "food rules," and film clips were also used to elaborate on the themes. Many lessons also included reflection pieces allowing students to either come up with a food ad, poem, or skit, reflect on their food environments through photography, drawing, and writing exercises called *Capture it* pieces. Lessons helped students make changes in their individual behavior by creating contracts for weekly behavior change, called *Action Plan Activities.* Students were given the opportunity to derive conclusions from the material and select the types of changes that they wanted to make accordingly (student-centered learning) (Hannafin & Hannafin,

2010; Pedersen & Liu, 2003); work individually, then discuss in small groups, and then engage in large group sharing (scaffolding) (Berk & Winsler, 1995; Pea, 2004); opportunities to learn by seeing, reading, doing, and hearing (addressing different learning styles, differentiation) (McTighe & Tomlinson, 2006; Vygotsky, 1978); and to share their own and hear teacher-generated stories (teaching through relationships) (Biggs, 1996).

Tasting. Most lessons provide a tasting opportunity to introduce, familiarize, and build self-efficacy for the selection and preparation of whole plant-based foods. Nutrition experts reviewed the recipes and tastings to ensure that they were healthy, culturally diverse, and accessible for students and their families. To address site-specific variations in access and preferences, at least two tasting options and ingredient substitutions were provided for tasting and recipes where appropriate. Tastings included trying seeds and foods derived from seeds (e.g. sunflower seeds, hummus, edamame, and pepitas) as whole plant-based alternatives to highly processed snack foods. Recipes, such as a plant-part salad and a melon-mint parfait dessert, were introduced to students and were primarily plant-based foods assembled from whole and minimally-processed foods. Take-home recipes were provided designed to also facilitate family engagement in the program's messaging.

Organization. Components of the lessons were clearly and consistently explained and identified. The materials were well-organized and self-contained (within each lesson and within each theme).

Visual Design. The lesson plans addressing each of the three themes (*Eat Food, Not too Much, Mostly Plants*) was color-coded in blue, red, and green respectively. The

materials were designed to be attractive and inviting, providing adequate white space, colorful diagrams, large and varied typefaces, brief discrete phrases, sidebars, clear headings, and graphics.

Table 3.4 Planning Matrices for Lessons

Whole / Minimally-processed (W/MP); Highly Processed Foods (HPF); Educational sequence (ES)

THEME 1: Eat Food
Lesson 1: Where are the Soda Trees?
Food Rule: Eat Foods You can Picture Growing in Nature

Instructional event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Positive outcome expectations**	Provide personal information about positive outcomes of eating whole/minimally-processed (W/MP) foods.	Students will be able to express increased beliefs that healthy eating will help them reach personal goals.	• Provide information related to diet-food and goal achievement relationships; involving personal assessment and groups discussions.
Excite	**Negative outcome expectations**	Provide opportunity for personalized self-assessment of consuming highly processed foods (HPF); and the impact of their ubiquity in the food environment.	Students will be able to identify HP foods as those that hinder them from being good at things important to them, and as being everywhere around them.	• Provide information related to diet-food and goal achievement relationships; involving personal assessment and groups discussions
Explain	**Behavioral capability/ Competence** **(Procedural knowledge)**	Provide instruction on how to perform the behavior; and active mastery experience ("learning by doing.")	Students will be able to apply a food rule to identify and differentiate W/MP foods from HP foods.	• Instruction on how to perform the behavior to create an interactive learning experience involving the presentation of picture cards and psychomotor opportunities to respond to them.
Expand	**Outcome expectation: Social Norms**	Shift perceptions of social norms about W/MP foods and HP foods.		• Watch media clip from IDOF film. • Group discussion.

Expand	**Outcome expectation: Food preferences**	Provide direct experiences with W/MP foods.	Students will express positive attitudes towards eating plant-based snacks.	• Food tasting.
Exit	**Self-efficacy**	Model/demonstrate the behavior	Students will demonstrate increased confidence in ability to choose a healthful snack (W/MP food) instead of a HP food.	• Food tasting. • Group Discussion.

Lesson 2: Chemical Cuisine
Food Rule: Eat Foods with Ingredients that a Third Grader Could Pronounce.

Instructional event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Behavioral capability** **(Functional / Procedural knowledge)**	Provide instruction on how to perform the behavior.	Students will be able to define ingredients and identify the ingredient listings on packaged foods; state and understand the food rule;	• Provide instruction and create interactive learning experiences on how to perform the behavior involving applying what is learned, using role play activities, hand outs and group discussion. • Provide worksheets to develop affective skills.
Explain	**Behavioral capability/Competence** **(Critical thinking skills)**	Provide opportunity for active mastery experiences (learning by doing).	Students will be able to recognize that HP foods tend to have long and hard-to-pronounce ingredient lists.	• Hand-on activities to develop skills, such as identifying food products by reviewing their ingredient lists.
Expand	**Negative outcome expectations**	Provide information about negative outcomes of consuming HP foods.	Students will be able to recognize HP foods are highly engineered to taste appealing and mask undesirable flavors.	• Food Tasting. • Group discussion.
Exit	**Outcome expectations: Attitudes**	Build on personal meanings.	Students will be able to express negative attitudes towards HP foods.	• Watch media clip from IDOF film and have a group discussion involving an exploration of feelings related to HP foods.

Lesson 3: The Claim Game
Food Rule: Avoid products that make health claims.

Instructional Event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Negative outcome expectations**	Provide information about negative outcomes of behavior.	Students will recognize that food marketing influences their food choices.	• Demonstrations using personalized statistics.
Explain	**Behavioral capability/Competence**	Provide guided practice.	Students will be able to identify food marketing techniques used on	• Demonstration of marketing

	(Critical thinking skills)		packages.	strategies on food packages, followed by guided practice with feedback.
Expand	**Behavioral capability/competence** **(Critical thinking skills)**	Provide guided practice	Students will be able to identify food marketing techniques used on packages.	• Active application of higher order learning, involving analysis, evaluation, and synthesis of marketing used on food packages.
Expand	**Behavioral capability** **(Affective skills)**	Build effective communication skills.	Students will be able to discuss how marketing of HP foods influences preferences, selection, and consumption; and apply the food rule as they make choices.	• Watch media clip from IDOF film, use handouts and have a discussion. • Provide worksheets to develop affective skills.
Expand	**Outcome expectations: Food preferences**	Provide positive experiences with W/MP foods.	Students will express pleasure in trying W/MP foods.	• Food tasting.
Exit	**Negative outcome expectations**	Personalized self-assessment compared to ideal (healthful) scenarios.	Students will be able to recognize that their personal food environment consists of mostly HP foods.	• Students complete a self-assessment of the W/MP and HP foods around them and consider the impact that that has on their food choices.
Exit	Goal Intention	Stimulate action goal setting.	Students will be able to create a personal action plan to eat a W/MP food instead HP food.	• Teach goal setting skills and provide action planning forms.
THEME 2: Not too Much Lesson 4: Don't be Phoooled. Food Rule: Avoid foods you see advertised on television.				
Instructional event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Negative outcome expectations**	Provide information about negative outcomes of behavior.	Students will be able to explain how most people can instantly recognize logos of HP foods and discuss how this impacts what we think about them.	• Provide factual information related to the behavior change involving remembering and understanding, using handouts and group discussions.
Explain	**Functional / Procedural knowledge/Co**	Guided practice	Students will be able to identify persuasive techniques used in food	• Learn and identify

	mpetence		marketing.	persuasive techniques used by food marketer in various food advertisements.
Expand	**Self-efficacy / Perceived barriers**	Prompt identification of perceived barriers and reframe perceptions of barriers.	Students will be able to demonstrate increased confidence in their ability to identify marketing strategies for HP foods.	Provide activities regarding diet-food supply relationships involving presentation of visuals, role play, and group discussions.
Expand	**Behavioral capability** **(Affective skills)**	Build effective communication skills	Students will be able to state opinions about the lesson's Food Rule.	• Watch media clip from IDOF film and have a discussion. • Provide worksheets to develop affective skills.
Expand	**Self-efficacy**	Prompt identification of perceived barriers and reframe perceptions of barriers.	Students will be able to generate arguments to convince their peers to avoid HP foods advertised on television and other media sources.	• Provide opportunities for role play and group discussions
Exit	**Self-efficacy**	Reframe perceptions of barriers.	Students will be able to demonstrate increased confidence in their ability to defend W/MP foods.	• Provide opportunities for role play.
Lesson 5: Supersized Food Rule: Choose smaller plates and glasses.				
Instructional event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Negative outcome expectations**	Provide information about negative outcomes of behavior through consciousness-raising about risks and self-assessments to personalize risks.	Students will be able to recognize that large packages and portions make us eat more.	• Interactive demonstrations, using handouts, and group discussions. • Self-assessment activity and discussions about outcomes of eating larger portions.
Explain	**Self-efficacy**	Prompt identification of perceived barriers and reframe perceptions of barriers.	Students will be able to identify foods that come in large packages.	• Watch media clip from IDOF film and have a discussion.
Expand	**Behavioral capability** **(Affective skills)**	Build effective communication skills	Students will be able to state opinions about the lesson's Food Rule.	• Provide worksheets to develop affective skills.
Expand	**Negative outcome**	Self-assessments to personalize risks.	Students will be able to identify foods that they commonly consume in large	• Self-assessment of commonly consumed portion

	expectation		packages.	sizes at fast food restaurants.
Expand	**Self-efficacy**	Prompt identification of perceived barriers and reframe perceptions of barriers.	Students will be able to strategize ways to eat less HP foods, despite it being everywhere; and demonstrate increased confidence in choosing small portions of HP foods.	• Make desired actions easy to understand and do through demonstrations, and provided practice/direct experience related to behavior change (by preparing foods and following a recipe).
Expand	**Outcome expectations: Food preferences**	Provide direct experiences with healthful foods	Students will express pleasure in trying W/MP foods.	• Taste popcorn, which students prepare, with culturally-diverse flavoring added to it.
Exit	**Self-regulation skills**	Stimulate action goal setting.	Students will be able to create a personal action plan to eat W/MP food instead of HP food.	• Review goal setting skills and provide action planning forms.

Lesson 6: Dia-beat it!
Food Rule: Make water your beverage of choice. Sweeten and salt your food yourself.

Instructional event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Negative outcome expectations**	Provide information about negative outcomes of behavior.	Students will be able to describe how rates of type 2 diabetes are rising and how type 2 diabetes develops.	• Provide factual information related to the behavior change involving demonstrations, national statistics, and personal stories. • Provide a clear image of threat using demonstrations of body function with sugar load.
Excite	**Negative outcome expectations**	Provide information about negative outcomes of behavior.	Students will be able to discuss disparity in type 2 diabetes rates in the U.S.	• Watch media clip from IDOF film and have a discussion.
Expand	**Functional / Procedural knowledge/Competence**	Provide factual knowledge related to behavior and instruction on how to perform the behavior.	Students will be able to calculate teaspoons of sugar in snacks and beverages and recognize various names for sugar.	• Provide instruction and create an interactive learning experience on how to perform the behavior, involving applying what is learned.

Expand	**Functional / Procedural knowledge**	Build effective communication skills.	Students will be able to state opinions about the lesson's Food Rule.	• Provide worksheets to develop affective skills.
Expand	**Outcome expectations: Food Preferences**	Provide positive experiences with W/MP foods.	Students will express pleasure in trying W/MP foods.	• Food tasting.
Exit	**Self-regulation skills / Autonomy support**	Stimulate action goal setting.	Students will be able to create a personal action plan to eat W/MP food instead of HP food.	• Review goal setting skills and provide action planning forms.

THEME 3: Mostly Plants
Lesson 7: Rooting for Plants
Food Rule: If it came from a plant, eat it. If it was made in a plant, don't.

Instructional event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Positive outcome expectations**	Provide information about positive outcomes of behavior.	Students will explain why it is important to eat mostly plants.	• Provide factual information related to the behavior change involving visuals, activities, and handouts.
Excite	**Outcome expectations: Social Norms**	Reframe perceived norms	Students will be able to list two motivations they share with their peers for eating W/MP foods.	• Watch media clip from IDOF film and have a discussion.
Explain	**Functional / Procedural knowledge**	Provide factual knowledge related to behavior and instruction on how to perform the behavior.	Students will be able to identify W/MP foods that they can eat.	• Provide instruction and create an interactive learning experience on how to perform the behavior, involving visuals and handouts.
Expand	**Functional / Procedural knowledge**	Build effective communication skills.	Students will be able to state opinions about the lesson's Food Rule.	• Provide worksheets to develop affective skills.
Expand	**Outcome expectations: Preferences**	Provide positive experiences with W/MP foods.	Students will express pleasure in trying W/MP foods.	• Food tasting.
Expand	**Self efficacy**	Provide guided practice.	Students will be able to express increased confidence in their ability to prepare a W/MP food.	• Food tasting.
Exit	**Self regulation skills**	Stimulate action goal setting.	Students will be able to create a personal action plan to eat W/MP food instead of HP food.	• Review goal setting skills and provide action planning forms.

Lesson 8: Color your World
Food Rule: Eat your colors.

Instructional Event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Positive outcome expectations**	Provide information about positive outcomes of behavior.	Students will explain a positive experience they had with W/MP foods.	• Discussion of positive experiences and benefits related to behavior change.
Excite	**Outcome expectations: Social Norms**	Reframe perceived norms	Students will be able to list two motivations they share with their peers for eating W/MP foods.	• Watch media clip from IDOF film and have a discussion.
Explain	**Functional / Procedural knowledge**	Build effective communication skills.	Students will be able to state and understand the lesson's Food Rule, and identify a variety of different colored W/MP foods that they could eat.	• Provide instruction and create an interactive learning experience on how to perform the behavior, involving visuals and handouts. • Provide worksheets to develop affective skills.
Expand	**Outcome expectations: Food Preferences**	Provide positive experiences with W/MP foods.	Students will express pleasure in trying W/MP foods.	• Food tasting.
Expand	**Self-efficacy/Competence**	Provide guided practice.	Students will be able to express increased confidence in their ability to prepare a W/MP food.	• Food tasting.
Exit	**Self-regulation skills / Autonomy support**	Stimulate action goal setting.	Students will be able to create a personal action plan to eat W/MP food instead of HP food.	• Review goal setting skills and provide action planning forms.
Lesson 9: Lettuce turnip the beet Food Rule: Eat more like the French.				
Instrumental event	Determinant	Behavior Change Strategy	Specific Objective	Educational Material(s)
Excite	**Positive outcome expectations**	Provide information about positive outcomes of behavior.	Students will explain a positive experience they had with W/MP foods.	• Discussion of positive experiences and benefits related to behavior.
Explain	**Functional / Procedural knowledge**	Provide factual knowledge related to behavior and instruction on how to perform the behavior.	Students will be able to state and understand the lesson's Food Rule.	• Provide factual information related to the behavior involving understanding using a media clip

				from IDOF film.
Expand	**Self-efficacy**	Reframe perception of confidence to carry out behavior.	Students will be able to strategize solutions to barriers to eating W/MP foods by providing advice to others.	• Brainstorming; discussions of barriers and ways to overcome them.
Expand	**Outcome expectations: Food Preferences**	Provide positive experiences with W/MP foods.	Students will express pleasure in trying W/MP foods.	• Food tasting.
Expand	**Self efficacy**	Provide guided practice.	Students will be able to express increased confidence in their ability to prepare a W/MP food.	• Food tasting.
Exit	**Self regulation skills/ Autonomy support**	Stimulate action goal setting.	Students will be able to create a personal action plan to eat W/MP food instead of HP food.	• Review goal setting skills and provide action planning forms.

Lesson 10: Eat Food. Not too Much. Mostly Plants.
Food Rule: Break the Rules once in a While.

Instructional event	**Determinant**	**Behavior Change Strategy**	**Specific Objective**	**Educational Material(s)**
Excite	**Positive outcome expectations**	Provide information about positive outcomes of behavior.	Students will explain a positive experience they had with W/MP foods.	• Students complete self-assessment activity involving handouts. • Discussion of positive experiences and benefits related to behavior.
Excite	**Outcome expectations: Attitudes**	Build personal meanings.	Students will be able to express an increased desired to follow the Food Rules in order to eat W/MP foods.	• Visuals, reflection questions related to media clip from IDOF film.
Expand	**Outcome expectations: Food Preferences**	Provide positive experiences with W/MP foods.	Students will express pleasure in trying W/MP foods.	• Food tasting.
Expand	**Self-efficacy/Competence**	Provide guided practice.	Students will be able to express increased confidence in their ability to prepare a W/MP food.	• Food tasting.
Exit	**Self-regulation skills** **Autonomy support**	Stimulate action goal setting.	Students will be able to create a personal action plan to eat W/MP food instead of HP food.	• Review goal setting skills and provide action planning forms.

Step 6: Nail down the Evaluation Plan for the Sessions. *Step 6 of DESIGN involves constructing an evaluation plan in order to determine whether the educational sessions, indirect educational activities, and supportive activities created were effective in meeting the general objectives and the behavior change goals of the program.*

The program sought out to address two behavior change goals: increasing intake of whole plant-based foods (operationalized as an increase in fruits and vegetables) and decreasing intake of highly processed foods (operationalized as a decrease in sugar-sweetened beverages, processed packaged snacks, and fast food).

An evaluation plan was generated (including a process and outcome evaluation) in order to determine whether the intervention whether the program was implemented as planned and had the intended impacts on the targeted behaviors and determinants, and The evaluation of IDOF was based on information derived from empirical literature, theoretical literature, program objectives, and the demographics of our sample. Evaluation procedures were determined during the planning and development of the educational intervention to allow evaluation procedures to be incorporated into the activities of the program.

Process Evaluation. The process evaluation assessed whether the program was implemented as planned. It included in-class observations using observation checklists and field notes conducted by trained research assistants, and student feedback forms for each activity and lesson collected with student exit surveys.

Outcome Evaluation. Student outcomes were measured in terms of improvements in the determinants of change and behavioral outcomes through pre- and post-intervention surveys with all participating students. One-on-one assessments of student understanding using lesson artifacts and in-depth interviews with a purposeful sample of students were also conducted. Table 3.5 and 3.6 provides the evaluation plan in detail for the process and outcome components of the evaluation.

Table 3.5 Evaluation Plan for the Process Evaluation

Process Evaluation Component	Quantitative/ Qualitative Aspects	Methods	Sample Question (s)
	Fidelity (degree to which the curriculum was implemented as planned).	Classroom observation form (1-5 pt. scale)	Were lesson materials altered, omitted, inserted, delayed?
	Extent (degree of completion of the lesson as designed).	Classroom observation form (% completion)	How much of the lesson was completed?
Implementation of Curriculum – extent to which the curriculum was implemented as designed (Baranowski & Stables, 2000; Burgermaster, 2015; Contento, 2016; Lee, Contento, & Koch, 2013).	**Teaching Practices** (Teacher Attitude/Motivation & Classroom Management) (Contento, 2016; Lee et al., 2013)		
	Teacher Attitude/Motivation (the extent to which the teacher is motivated and enthusiastic about the teaching material;	Classroom observation form (3-point scale + field notes)	To what extent does the teacher exhibit motivation and enthusiasm towards the teaching material? (3-point scale: negative; neutral; positive.)
	Classroom Management (the extent to which the teacher executes the lesson without behavioral disruptions).	Classroom observation form (3-point scale + field notes)	To what extent is the lesson executed with behavioral disruptions? (3-point scale: major problems; minor problems; no problems.)
Reception (Reach, Student Satisfaction, and Student Engagement) – the extent to which participants received the materials that reached them **(Baranowski & Stables, 2000; Contento, 2016; Lee et al., 2013)**.	Reach (student attendance)	Student exit ticket (% of curriculum students are present for)	What percentage of all the lessons were students present for?
	Student Satisfaction/Component preference (how much was each lesson/activity was liked).	IDOF student exit ticket	Tell us how much you liked or didn't like each activity (5-point Likert: didn't like it at all; didn't like it; neutral; liked it; liked it very much). Tell us how much you liked or

			didn't the lesson overall (5-point Likert: didn't like it at all; didn't like it; neutral; liked it; liked it very much).
	Classroom Engagement (the extent to which students are engaged in the lesson/activity).	Classroom observation form (3-point scale + field notes)	How engaged are the students in the material? (3-point scale: uninterested; few/some involved; most/all actively involved)

Table 3.6 Evaluation Plan for the Outcome Evaluation

Behavior	General Educational Objective (Theoretical Determinant)	Method	Sample Question(s) to Evaluate Outcome
Increase intake of whole plant-based foods.	Describe why selecting whole plant-based foods is important (Positive outcome expectations). Describe the importance of eating a variety of whole plant-based foods (Positive outcome expectations).	Pre-post survey	"Eating fruits and vegetables helps me do well in school." (Response options include: not at all true for me; not true for me; neither true or not true; somewhat true for me; very true for me.)
	Express positive attitudes towards eating whole plant-based foods (Expectancies/Attitudes).	Interview	
	Appreciate the taste of various whole plant-based foods (Outcome expectations: Preferences).	Interview	
	Recognize the influence of their peers and family members have on their dietary choices surrounding whole plant-based foods (Outcome expectations: Social norms).	Interview	
	Demonstrate an ability to identify whole plant-based foods (Functional / Procedural knowledge). Prepare and select appealing whole plant-based foods for snacks and meals (Functional / Procedural knowledge). Describe how to increase their consumption of whole plant-based foods and how to increase the variety of these foods in their diets. (Functional / Procedural knowledge)	One-on-one mixed methods assessment with subset	Please describe what you think this [Food Rule] means? How would you apply it to your life?
	Demonstrate increased confidence in eating more whole plant-based foods. (Self-efficacy) Identify strategies to overcome barriers to eating	Pre-post survey	I am sure I can eat fruits at school lunch (Response options include: Not at all sure; a little sure; neutral; sure; very sure)

	whole plant-based foods. (Self-efficacy)		
	State intention to increase FV intake. (Goal intention)	Pre-post survey	I would like to eat more fruits and vegetables (Response options include: Not at all true for me, not true for me, neither true or not true, somewhat true for me, very true for me).
	Set and monitor goals to eat more and/or a greater variety of whole plant-based foods. (Self-regulation skills)	Pre-post survey	I believe that I can set a goal for healthy eating (Response options include) Not at all sure; a little sure; neutral; sure; very sure).
	Demonstrate an increased awareness of the negative consequences related to eating highly processed foods. (Negative outcome expectations)	Pre-post survey	Drinking lots of sweetened beverages such as fruit drinks, ice-teas, sodas, and sports drinks contributes to our developing diabetes. (Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me)
Decrease intake of highly processed foods.	Express negative attitudes towards eating highly processed foods. (Outcome expectations: Attitudes)	Pre-post survey	Drinking lots of sweetened beverages such as fruit drinks, ice-teas, sodas, and sports drinks is cool. (Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me)
	Recognize the influence of their peers and family members have on their dietary choices surrounding highly processed foods. (Outcome expectations: Social norms)	Interview	
	Demonstrate an ability to identify highly processed foods. (Functional / Procedural knowledge) Describe how to decrease their consumption of highly processed foods. (Functional / Procedural knowledge)	One-on-one mixed methods assessment	Please describe what you think this [Food Rule] means? How would you apply it to your life?
	Demonstrate increased confidence in consuming fewer highly processed foods. (Self-efficacy) Identify strategies to overcome barriers to resisting highly processed foods. (Self-efficacy)	Pre-post survey	I am sure I can drink fewer sweetened beverages after school. (Response options: Not at all sure, a little sure, neutral, sure, very sure)
	State intention to decrease consumption of highly processed foods (Goal intention).	Pre-post survey	I would like to drink fewer sweetened beverages. (Response options: Not at all true for me; not true for me; neither true or not true; somewhat true for me; very true for me)

3.3 DISCUSSION

This study illustrates the application of the Nutrition Education DESIGN Procedure using the development of the *In Defense of Food* curriculum as a case study. The DESIGN Procedure is a systematic approach to nutrition education planning which takes an important health issue for a particular population as the starting point and links program development, implementation and delivery, and evaluation to a behaviorally-focused outcome. In doing so, the DESIGN procedure provides a detailed framework for this problem-oriented approach and ensures that theory, determinants or mediators of behavior change, program objectives, and delivery strategies are the focal point for achievement of the desired behavioral changes.

In this case study, the DESIGN Procedure allowed for a curriculum to be developed to operationalize the messages of an extant book (Pollan, 2008) and its derived documentary film (Schwarz, 2015): Eat Food, Mostly Plants, and Not Too Much. The curriculum uses a variety of media for instruction: group discussions, excerpts from the documentary film, food related activities, worksheets for students, take home messages for families, and so forth. This is one of the few studies to describe in detail the theoretical basis and systematic application of intervention techniques and strategies in the development of a nutrition education curriculum focused on highly processed food intake. In another study the DESIGN procedure was used to develop a nine-session intervention for Hispanic women who were breast cancer survivors and that focused on cooking (Greenlee et al.2015). Thus, the procedure can be applied for other contexts and audiences.

The procedure is also unique in that though it is comprehensive, it can be used for practice as well as research settings and it provides guidance on exactly how to design group sessions and curricula ready for delivery. Other frameworks are useful primarily for large scale and complex interventions, or provide no details on exactly how to design theory-based individual sessions or curricula and materials (Bartholomew et al., 2011, Glasgow et al., 1999, Green and Kreuter, 2005, Baranowski et al., 2009, Michie and Prestwich, 2010).

3.3.1 Strengths and Limitations

Strengths of DESIGN are illustrated in its ability to provide a guided and comprehensive approach for development and evaluation of intervention and curricula of relevance to researchers, teachers, program planners, and funders. Additionally, the emphasis on thorough early assessment processes are particularly appropriate for public health and population-based applications, where viability is reliant on the on-going adoption and favorability of education materials in the setting for which they are designed. The methods employed to operationalize theoretical determinants (linked to educational activities and program objectives) are seldom explicitly reported in nutrition education research. While the procedure is comprehensive, it is parsimonious and easy to use in both research and practice settings. The procedure can be used not only for designing group sessions, curricula and educational materials, but also for designing environmental supports for action. Lastly, DESIGN takes an integrative approach to program development and evaluation; this allows for benchmarks of success or

shortcoming to be made apparent and therefore course corrected during the initial development phase.

The precise nature of the relationships between each DESIGN step and how they combine to determine overall health impact is unknown, as is the case for the other planning frameworks currently in use for health-related interventions. DESIGN considers all steps as interacting multiplicatively. Future research may be necessary to determine the precise mathematical functions that characterize the interplay of each procedural step in effective nutrition education development. Another potential drawback to any planning model is the inherent tendency of applying it as a cookbook, rather than as a spring board for innovative approaches, which may stifle creativity and thinking outside the box.

3.3.2. Future Directions

The DESIGN Procedure provides a framework for designing health promoting interventions by ensuring that theory, determinants or mediators of behavior change, program objectives, delivery strategies, and activities are systematically addressed towards achieving the desired behavioral changes. It nurtures a deeper understanding of the processes involved in improving our ability to design, deliver, and evaluate interventions consistently. Wider use and dissemination of DESIGN can connect these often neglected aspects of program development and allow for best practices and effective strategies to be made more transparent.

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CHAPTER 4 (ARTICLE 3): A DEVELOPMENT PROJECT OF THE *IN DEFENSE OF FOOD* AFTER SCHOOL CURRICULUM: A MIXED METHODS PROCESS EVALUATION FOR IMPROVING THE PROGRAM

4.1 INTRODUCTION

4.1.1 Afterschool is a Viable Setting for Health Promotion Programs

Visible minorities and underserved populations are disproportionately affected by chronic diet-related diseases (Calzada & Anderson-Worts, 2009). This has important implications for policy makers and program developers to focus initiatives at the most at-risk subgroups. Currently, many resources are allocated to health promotion in day-school environments. Focusing initiatives on afterschool, however, also has a great many benefits in reaching children and targeting those most at-risk.

Afterschool settings can offer a critical, yet underused and understudied, setting for nutrition-related programs that can effectively reach the most underserved populations and supplement existing day-school programming with the potential to have positive impacts on dietary behaviors of middle-school aged children. An estimated 8.4 million youth presently attend afterschool programming (ASP) in the United States (Afterschool Alliance, 2014; Kelder et al., 2005) with anticipated increases as the number of dual income families continue to increase (Sarampote, Bassett, & Winsler, 2004). Afterschool programs disproportionally serve minority and underserved youth; African American and Latino parents are much more likely to enroll their children compared to the general population (Afterschool Alliance, 2014), and a greater percentage of non-participating African American (61%) and Hispanic (50%) parents express an interest in enrollment if programs were made available to them than the general population (38%) (Afterschool

Alliance, 2014). Afterschool settings do not detract from the school day, can be used to supplement existing nutrition and health education, and also offer a safe environment for youth to develop lifelong dietary habits. ASP can also have positive impacts on dietary habits and preferences of adolescents, who may otherwise engage in unhealthy dietary behaviors when left at home, unsupervised. Often ASP have designated snack times with the ability to limit the types of foods and the portions of snacks that adolescents are exposed to in the time preceding dinner (Kenney et al., 2014). ASPs also have the opportunity to introduce students to and provide repeated exposure to healthier alternatives to commonly consumed snacks.

Compared to day-school based interventions, few process evaluation studies have been conducted for nutrition education programs in afterschool settings. A recent systematic review of health promotion programs with children and adolescents revealed variable findings and a major limitation cited among the afterschool interventions reviewed was the inadequate use of process evaluations which were thus recommended to enhance the effectiveness of afterschool-based health promotion interventions (Branscum & Sharma, 2012). Expanding efforts to improve the quality of nutrition education programs in setting which reach the most at-risk youth is a timely and important step in responsible program development.

4.1.2 Components of Process Evaluations in Settings-based Interventions

Setting-based interventions can be complex and resource intensive. When developing a program for "real-world" settings, it becomes critical to understand the perspectives of different stakeholders who may affect and be affected by the revised intervention, which ultimately leads to whether the end-product is taken up and integrated

into practice (Bowen et al., 2009; Chen, 2010). That is, irrespective of a program's efficacy or effectiveness, the program must also be practical, matched with the intended audience's ability to implementation it, and acceptable to the implementers, otherwise it has little chance of enduring in a community setting (Chen, 2010)".

Additionally, in order to accurately measure outcomes, it is important that the implementation plan and outcome measurements fit the design and stage of development of the program (Scheirer et al., 2012; Urban, Hargraves, & Trochim, 2014). For example, during the initial development of a new program or with its inaugural launch, modifications and adjustments based on its application to a new setting and new population may be apparent. Many research evaluators therefore emphasize the importance of taking mixed methods approaches to understand process components in depth and in doing so, aligning with the early lifecycle of the program (Bowen et al., 2009; Scheirer et al., 2012; Urban et al., 2014).

Process evaluations consistently include variables related to intervention delivery and intervention reception (Durlak & DuPre, 2008). Intervention delivery (Implementation of the Program) refers to the facilitator-oriented variables describing how an intervention is presented, often operationalized as fidelity, completion, and adaptation (Durlak & DuPre, 2008). Intervention reception (Program Reception) refers to participant-oriented variables describing what the participants received from the curriculum and are often operationalized as reach (attendance), satisfaction, and engagement (Baranowski & Stables, 2000; Durlak & DuPre, 2008). However recently, evaluation researchers have expanded the constructs that they measure, especially for setting-based health or education programs seeking to generate complex behavioral

outcomes to include: an examination of the teachers' role in program implementation (Lee, Contento, & Koch, 2013), the classroom context (Burgermaster, Gray, Tipton, Contento, & Koch, 2016) , and implementation integrity and adaption to its specific context (Richards, Kostadinov, Jones, Richard, & Cargo, 2014). In doing so, process evaluations can help shed light on the aspects of the program that may be contributing to the outcome effects, reveal whether the program has viable validity in the "real world," and can guide resource allocation (Bowen et al., 2009).

4.1.3 Research Questions

This study reports on the process evaluation of the *In Defense of Food (IDOF)* curriculum for middle school-aged children in an afterschool setting (Bhana, Koch, Uno, & Contento, 2016). The objectives are to determine how the *In Defense of Food* curriculum was implemented and to identify facilitators and challenges in the implementation process.

Specifically, this study examines the following research questions:

1. Was the curriculum implemented as planned?
    a. To what extent was the curriculum delivered as planned?
    b. To what extent were teaching practices supportive of implementation?
2. Did students receive the *In Defense of Food* curriculum as planned?
    a. To what extent were students satisfied with the curriculum?
    b. To what extent were students engaged in the curriculum?
3. What recommendations for intervention improvement were generated by this process evaluation?

4.2 METHODS

4.2.1 Study Design, Sample, Intervention

Design. This study used an explanatory mixed methods approach to evaluate whether the invention could be deployed in a community context.

Recruitment and Participation. Recruitment flyers were distributed to the New York City Department of Youth & Community Development (DYCD) at their quarterly meetings reaching 70 afterschool site manager of whom 15 expressed interest. Sites that didn't offer programming to middle-school aged students, held mixed-level classes (e.g. older elementary with younger middle), or were not able to accommodate a weekly 2-hour lesson during a continuous 14-week period were excluded. Four sites were suitable. However, two dropped out at the last minute due to a change in funding structure and low enrollment.

The remaining two afterschool program sites, in low-income neighborhoods in New York City, were enrolled; one within a New York Community Affordable Housing (NYCAH) center (Site 1) and the other within in a public middle school-high school in Astoria, Queens (Site 2). Both sites were DYCD-funding programs. Informed written consent was given by parents. All middle-school aged children enrolled in the afterschool program at the two respective sites received the IDOF curriculum, but only those parents providing informed written consent for their children to participate in the study were included in the evaluation. All participating children and teachers received a gift valued at approximately $20 for their time. The Teachers College Columbia University (TC) Institutional Review Board (IRB) (Protocol # 15-386) approved all procedures, surveys, and protocols.

Sample. Site 1 offered the program in one classroom to middle-school aged children in grades six through eight (class 1). Site 2 offered the program in two classrooms to middle-school aged children in grades six (class 2) and seventh and eighth grade (class 3). The mean age of students was 12.1 (±0.6) and 50% were male. The majority of students were African American (56.3%) or Hispanic (34.4%) and the remaining were of mixed race (6.3%) or White (3.1%).

4.2.2 Curriculum Overview

The IDOF curriculum is a behaviorally-focused, theory-driven curriculum for afterschool middle school-aged children. Its educational message, based on *In Defense of Food* by Michael Pollan, is that optimal dietary health can be achieved by eating whole plant-based foods and minimizing intake of highly processed foods. Each lesson uses short film clips from the *In Defense of Food* documentary, along with practical guidance in food preparation and activities to promote consumption of whole plant-based foods, primarily fruits and vegetables, and to decrease intake of highly processed foods, primarily fast foods, sugar-sweetened beverages, and processed packaged snacks. The curriculum was developed using a systematic step-wise process guided by the Nutrition Education DESIGN process, described elsewhere. The outcome results from this curriculum are also provided elsewhere. This study presents the process evaluation of the IDOF curriculum as part of the development project for the curriculum. The curriculum was taught by afterschool program teachers one day per week from 4-6pm, between September and December 2015.

4.2.3 Professional Development.

Site-specific professional development consisted of a workshop and on-going support. Afterschool program staff received a training workshop prior to the start of the curriculum in one 2-hour session; and in one 1-hour session before the start of lesson two. The first training session was dynamic and interactive; designed to provide the knowledge and skills required to successfully implement the program. It included background information about the program, how to use curriculum components and materials, and how to facilitate food preparation and tasting demonstrations. The second one-hour session provided basic group management techniques and tips focused on classroom management in relation to the program's activities. On-going support was also made available in the hour before each lesson began to ensure teachers understood and could successfully deliver the lesson.

4.2.4 Process Evaluations Constructs and Variables

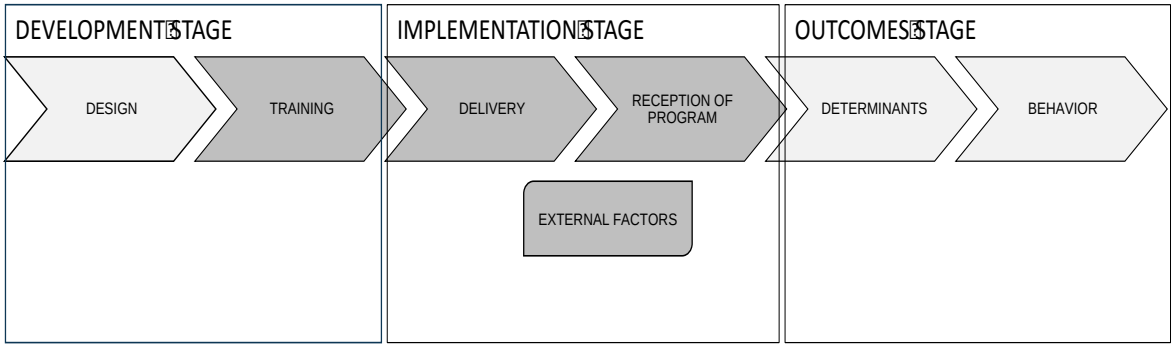
This study applies a framework for process evaluations first developed by Baronowski & Stable (2000), and later adapted for settings-based nutrition education by Lee et al. (2013) and Burgermaster (2015). A modified version of the framework was used to guide this process evaluation. Definitions of each component measured is presented in Figure 4.1 as part of a larger framework that links development to implementation to outcomes.

In this model, the Development stage includes the design of the curriculum (e.g. behaviorally-focused, theory driven curriculum; with the use of behavior change strategies) (Burgermaster, 2015); and 'Training' involving site-specific supports, such as

professional development and ongoing support (Burgermaster, 2015). The outcome stage refers to resulting behavioral and health outcomes of the program (mediated through determinants) (Gray, Contento, & Koch, 2015; Lee et al., 2013). This study focuses on the Implementation (process) stage, constructed of 'Implementation of Program,' (Baranowski & Stables, 2000) 'Reception of Program,' (Baranowski & Stables, 2000; Gray et al., 2015) and 'External Factors'(Gray et al., 2015; Lee et al., 2013). Delivery of the program has been operationalized as **fidelity** (the quality of delivery) (Baranowski & Stables, 2000), **extent** (the percentage of the curriculum completed), and **teaching practices** (teacher attitude/motivation and classroom management). 'Reception of Program,' has been operationalized as **reach** of curriculum (attendance) (Baranowski & Stables, 2000) and **exposure** (student satisfaction, and student engagement) (Baranowski & Stables, 2000; Lee et al., 2013); and 'External Factors' has been operationalized as operational **site-specific logistics/resources** required outside of the teacher's control and **barriers to implementation** (Lee et al., 2013).

Figure 4. 1 Conceptual Model for the IDOF Process Evaluation.

(Conceptual Model Adapted from Baronowski & Stable, 2000; Burgermaster, 2015; Lee et al., 2013.)



DESIGN: use of behavior theory and behavior change strategies in curriculum development • NE DESIGN Procedure **TRAINING:** Professional Development Ongoing Support	**DELIVERY:** facilitator-oriented description of how the curriculum was presented. • Fidelity (1-5pt. fidelity score) • Extent (% completion) • Teacher Practices (1-3 pt. classroom management; 1-3 pt. teacher attitude/motivation) **RECEPTION OF PROGRAM:** participant-oriented description of what the audience received from the curriculum. • Reach (student attendance) • Exposure (1-3 pt. student engagement; 1-5pt. student satisfaction) **EXTERNAL FACTORS:** • Operational Logistics/Resources (field notes) • Barriers to implementation (field notes)	**DETERMINANTS:** • Outcome expectations • Expectancies/Attitudes • Goal Intention • Autonomous Motivation • Self efficacy • Knowledge & Skills • Self-regulation skills **BEHAVIOR:** Measurable outcome of curriculum • Intake of FV • Intake of HPF

Fidelity – the extent of actual delivery of the curriculum as compared to its prescribed delivery.

Extent (% completion) - the number of activities delivered as compared to the prescribed number of activities in each lesson of the curriculum.

Teacher Practices (Classroom management & Teacher Attitude/Motivation) – the extent to which the class was managed to create a suitable learning environment by teachers and the extent to which the teacher was motivated to support the IDOF messages.

Reach (attendance) – the extent to which the program was received by the target group.

Exposure (Student satisfaction & Student engagement) – the extent to which the target group received the materials that reached them as a component of preference (how much they liked each activity) and reception (how receptive they were during the execution of the lesson).

External Factors (Operational Logistics/Resources & Barriers to Implementation) – aspects of the environment of the intervention required to execute the curriculum and problems encountered in reaching participants.

4.2.5 Measures and Data Collection

Measure: Classroom Observation Forms. Classroom observation forms were used to measure: 'Fidelity,' 'Extent,' 'Teaching Practices' (classroom management and teacher attitude/motivation), and 'Student Engagement.' Observations forms were one to two pages and were completed for nine out of the ten lessons. They were adapted from a previously validated measure (Contento, Koch, Lee, & Calabrese-Barton, 2010) (Appendix C.1.1). Observations were completed by trained classroom observers (female, graduate students) who remained in the classroom for the duration of the lesson (1.5 to 2 hours) and completed the forms for the respective lesson within 24 hours of the observation. Each classroom observer was also provided with a copy of each lesson plan to review in advance of the observation, and which they were encouraged to refer to as needed during observations.

Space was reserved for observers to take notes for each of the components listed on the observation forms to provide context for why a particular score was given and to make general observations about the execution and reception of the curriculum. Chance-corrected Cohen's Kappa was calculated across coding pairs (the lead investigator with each trained classroom observers) revealing moderate agreement or perfect/almost perfect inter-observer agreement ($\kappa_1 = 0.690$; $\kappa_2 = 0.636$; $\kappa_3 = 0.845$; $p<0.0010$) (Hallgren, 2012).

Measure: Student Exit Tickets. The student exit ticket was a one-page questionnaire administered to students across each of the ten lessons at the end of (or before students left the classroom) each lesson by classroom observers (Appendix C.1.2). They were used to measure student satisfaction and reach. All exit tickets were reviewed

for completeness and accuracy by a trained classroom observers after submission by the student and marked with the student's unique identification code.

Scoring Procedure: Implementation of Program. For 'Fidelity' an initial score of 5 was assigned with a one-point deduction for every occurrence within the lesson when an activity was altered, omitted, inserted, or delayed, providing a final possible range of zero to five for the lesson. The sum of scores across lessons was averaged and scaled up to generate score out of 100 points. Based on the literature, an a priori fidelity score of < 33, 33 to 67, >67 was determined as values of low, moderate, and high fidelity respectively (Forgatch, Patterson, & DeGarmo, 2006).

Within each class, the number of times curricular materials were implemented as planned, altered, omitted, inserted, or delayed was counted and divided by the total number of activities observed per class in order to compare the proportion of the curricular materials across each count.

'Extent' was calculated as a percentage score based on the proportion of lesson activities completed by the teacher of the total activities in the lesson.

'Classroom Management' and 'Teacher Motivation/Attitude' were used to measure 'Teacher Practices' using a quantitative three-point scale. Response options for 'Classroom Management' were: 1 = major problems (where extensive disciplinary actions were taken hindering delivery of the lesson for > 2/3 of the session); 2 = minor problems (where the class was disturbed by students' behavioral problems but for <2/3 of the time to >1/3 of the time); and 3 = no problems (when the lesson was completed without management issues or with student disruption lasting for <1/3 of the time).

Response options for 'Teacher Motivation/Attitude' were 1 = negative (where the teacher presents attitudes or behaviors that undermine the IDOF material and/or messaging); 2 = neutral (where the teacher is neutrally motivated or unenthusiastic towards the IDOF material and messaging), and 3 = positive (where the teacher expresses motivation by expressing positive attitudes and reinforcing target behaviors, and/or an enthusiasm for stimulating the students to understand the material).

Scoring Procedure: Reception of Program. 'Student Satisfaction' with the curriculum was measured using a 5-point Likert scale asking the students to rate how much they liked each activity and then how much they liked each lesson overall. The sum of scores within lessons was averaged and scaled up to generate score out of 100 points.

'Reach' was calculated from the student exit ticket as a percentage score based on the proportion of the lesson that a student was present for. This was done to help distinguish students that arrived or exited part way through the lesson to give a more acute account of reach. Mean reach values were calculated based on a per lesson and per class basis and across 9 of the 10 lessons so as to align with observation data. Attendance counts were also generated based on the number of students that were present for each lesson.

'Student Engagement' was measured by classroom observers. The response options for 'Student Engagement' were: 1 = uninterested (overall, <1/3 of the students were engaged throughout the lesson); 2 = few/some involved (overall, between 1/3 and 2/3 of the participants were engaged throughout the lesson); and 3 = most involved (overall, >2/3 of the students were involved throughout the lesson).

Table 4.1 presents a summary of the measures and methods of data collection used in this study.

4.2.6 Data Analysis

A total of 23 complete observation forms were collected over the course of the intervention (76% response rate) generating field notes on 68-82 different activities across the three classes.

Descriptive analyses for Implementation of Program (i.e. extent, curriculum fidelity, and teaching practices) and Reception of Program (i.e. reach, student satisfaction, and student engagement) were conducted using SPSS 24 (IBM, 2016). Mean scores, standard deviations, ranges, and frequencies were calculated for each variable for each class and overall. Bivariate correlations were used to examine associations between all measures. Intra-class correlations (ICC) range from 0 to 1.0 and describes the ratio of the between group variance to the total variance (Woltman, Feldstain, MacKay, & Rocchi, 2012). ICCs are commonly used to determine whether HLM is warranted, however were applied descriptively in this study to explore which process outcomes were related to lesson-to-lesson variation and which could be explained at the program level. Intra-class correlations (ICC) were accompanied by one-way Anova tests for between group means and a post-hoc Tukey test when significant differences were seen.

Content analysis was used to analyze qualitative field notes. All field notes were transcribed into a spreadsheet and imported for analysis into NVivo 11 (QSR International, Melbourne Australia, 2015). The lead researcher identified themes,

patterns of words, perceptions, ideas, and suggestions and then classified them into categories based on the components of the process evaluation. Themes were extracted from the imported text files using inductive analysis based on frequency of appearance across field notes. Themes were defined as topics, issues, or action that met the following criteria: they had to be discussed at least 2 times (frequency), and by at least two sources (observers).

Table 4.1 Summary of Study Measures and Data Collection Methods.

Implementation Stage	Process Evaluation Components	Measures	Type of Data Collected	Analysis
Delivery of Program	**Fidelity** The actual delivery of the curriculum as compared to its prescribed delivery	Classroom Observation Forms	5-point scale (implemented as planned (5); less 1 point for every activity alteration, omission, insertion, or delay.	Descriptive; ICC, one-way Anova
			Field notes	Content analysis
	Extent (% completion) The number of activities delivered as compared to the prescribed number of activities in each lesson of the curriculum.	Classroom Observation Forms	Proportion score (activities completed/total activities)	Descriptive; ICC, one-way Anova
	Teacher Practices:			
	Classroom management The extent to which the class was managed to create a suitable learning environment by teachers.	Classroom Observation Forms	3-point scale	Descriptive; ICC, one-way Anova
			Field notes	Content Analysis
	Teacher Attitude/Motivation The extent to which the teacher was motivated to support the IDOF messages.	Classroom Observation Forms	3-point scale	Descriptive; ICC, one-way Anova
			Field notes	Content Analysis
Reception of Program	**Reach (attendance)** The extent to which the program was received by the target group.	Student Exit Tickets	Proportion score (activities present for/total activities per lesson)	Descriptive; ICC, one-way Anova
	Exposure:			
	Student Satisfaction The extent to which the materials that reached the target group were liked.	Student Exit Tickets	5-point Likert scale	Descriptive; ICC, one-way Anova
	Student Engagement The extent to which the target group was receptive to the materials that reached them during the execution of the lessons.	Classroom Observation Forms	3-point scale	Descriptive; ICC, one-way Anova
			Field notes	Content analysis

Table 4.2 Descriptive Statistics of Process Evaluation Components by Class

Process Components		Class 1 Mean (SE) Range*	Class 2 Mean (SE) Range*	Class 3 Mean (SE) Range*
PROGRAM DELIVERY				
FIDELITY SCORE		75.6 (±5.6) 20-100[d]/60-100[e]	62.9 (±10.2) 20-100 [d]/20-100 [e]	65.7 (±5.7) 20-100[d]/40-80[e]
ICC = 0.15				
EXTENT[a] (% COMPLETION)		93.0 (±2.6) 0-100[d]/77.4-100[e]	70.1 (±7.1) 0-100[d]/44-100[e]	79.3 (±6.4) 0-100[d]/60-100[e]
ICC = 0.22				
Teacher Practices	CLASSROOM MANAGEMENT[b]	2.78 (± 0.15) 1-3[d]/2-3[e]	2.0 (±0.21) 1-3[d]/1-3[e]	1.86 (±0.10) 1-3[d]/1-2[e]
	ICC = 0.15			
	TEACHER ATTITUDE/MOTIVATION	2.89 (± 0.11) 1-3[d]/2-3[e]	2.57 (±0.20) 1-3[d]/2-3[e]	2.29 (±0.29) 1-3[d]/1-3[e]
	ICC = 0.19			
RECEPTION OF PROGRAM				
REACH		57.0 (±0.7) 0-100[d]/11.9 -100[e]	44.1 (±0.04) 0-100[d]/11.9-67.2[e]	58.1 (±0.05) 0-100[d]/34.3-89.6[e]
ICC = 0.95				
STUDENT SATISFACTION[c]		95.8 (±1.4) 20-100[d]/90.0-100[e]	94.2 (±2.3) 20-100[d]/80-100[e]	76.2 (±2.1) 20-100[d] /68-100[e]
ICC = 0.45				
STUDENT ENGAGEMENT		2.78 (±0.15) 1-3[d]/2-3[e]	2.14 (±0.34) 1-3[d]/1-3[e]	1.71 (±0.29) 1-3[d]/1-3[e]
ICC = 0.09				

Note. Intra-class correlation (ICC) reports the proportion of variance between lessons and within the curriculum;

[a] Significant differences in variances F(2)=4.90; p=0.019); difference between class 1 and class 2 (p=0.016)

[b] Significant differences in variances (F(2)=8.92; p=0.002); difference between class 1 and class 3 (p=0.003)

[c] Significant differences in variances (F(2)=29.0; p<0.001); difference between class 1, class 2, and class 3 (p<0.001)

d The theoretical range of scores

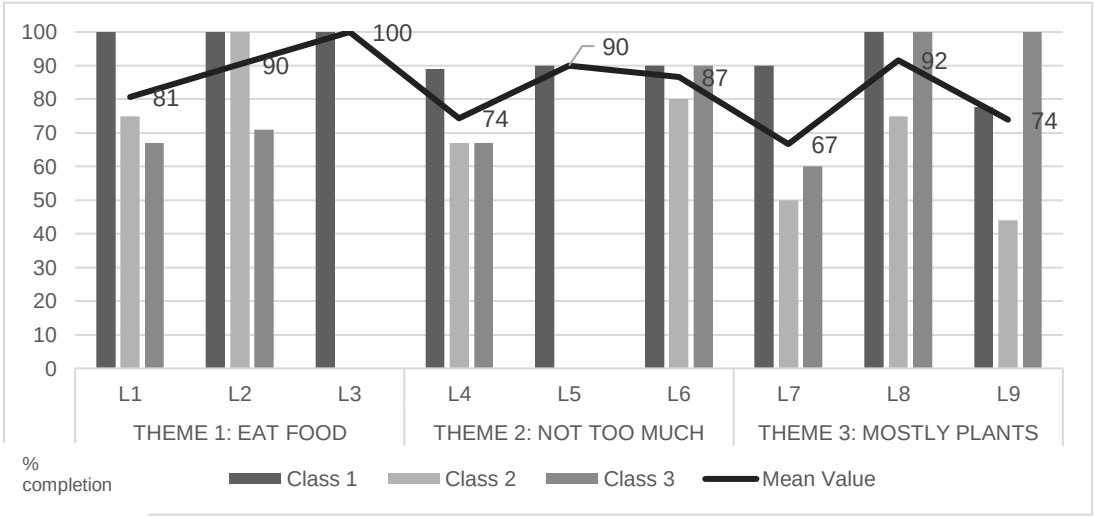
e The actual range of scores

4.3.1 Delivery of Program

Extent. Results from program Extent indicate that a high proportion of the curriculum was generally completed. Class 1 completed the greatest proportion of the curriculum (93%±7.7) and Class 2 (70%±18.7) the least. Percent completion ranged from 44% to 100% across lessons; with a mean completion score of 80.8%. A dip in percent completion is seen with the start of each new curricular theme, and which

increases by the end of the theme, possibly reflecting a learning curve as teachers adjust to the teaching demands of a new theme. Lowest percent completion scores were seen across the last theme (Mostly Plants) which dedicated a greater proportion of the lesson to food preparation and small group work towards a culminating project. Figure 4. 2 shows the distribution of Extent (% completion) across the lessons by class and with a trend line of mean values.

Figure 4. 2 Extent of Delivery of Program by Class and IDOF Theme Across the Curriculum.

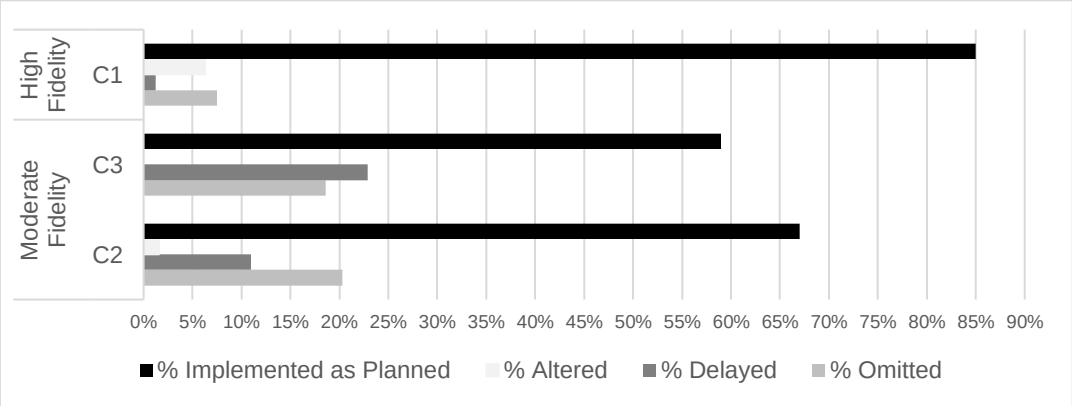


Note: Distribution of Extent (% completion) by class and lesson. The trend line represents mean Extent of all three classes. L=Lesson

Fidelity. Two of the three classes executed the curriculum with moderate implementation fidelity (with scores of 63 and 66) and one implemented with high fidelity (with a score of 76). The quantitative fidelity measure and content analysis of field notes indicated that omitting, delaying activities, and altering the sequence of activities were the most common deviations from the outlined curriculum across classrooms. None of the teachers inserted any of their own materials. The moderate fidelity classrooms commonly were more likely to omit (20% and 19% of activities) and delay (11% and 23% of activities), compared to the high implementation fidelity class

which omitted and delayed only 8% and 1% of the observed activities. However, the 'high fidelity' class was more likely to alter the sequence of activities (6%) compared to the 'moderate fidelity' classes (2% and 0%). Figure 4.3 presents the proportion of the total curricular activities that were implemented as planned, omitted, sequentially altered, or delayed to subsequent lessons by fidelity categorization.

Figure 4.3 Proportion of Curricular Material Delivered as Planned: Altered, Delayed, or Omitted in High and Moderate Fidelity Groups.



Note: C1, C2, C3 = Class 1, Class 2, and Class 3 respectively.

The majority of omitted and delayed material consisted of worksheet sheets that required students to sit and write independently at their desks (25%), culminating group performance activities (such skits, creating a food advertisement, and creating a poster to present) that required the formation or re-formation of small groups and were typically sequenced at the end of a lesson (30%), and individual "homework" projects that required students to return material to share with the group (e.g. photo reflections of the student food environment, or returning individual action plans for class discussions in subsequent lessons) (13%).

Content analysis of field notes related to the omission, altered sequence, and delay of curricular activities revealed four major themes to explain deviations from the

prescribed curriculum: Time Management, Maintaining Classroom Order, Missing Material, and Poor Attendance and are presented in Table 4.3.

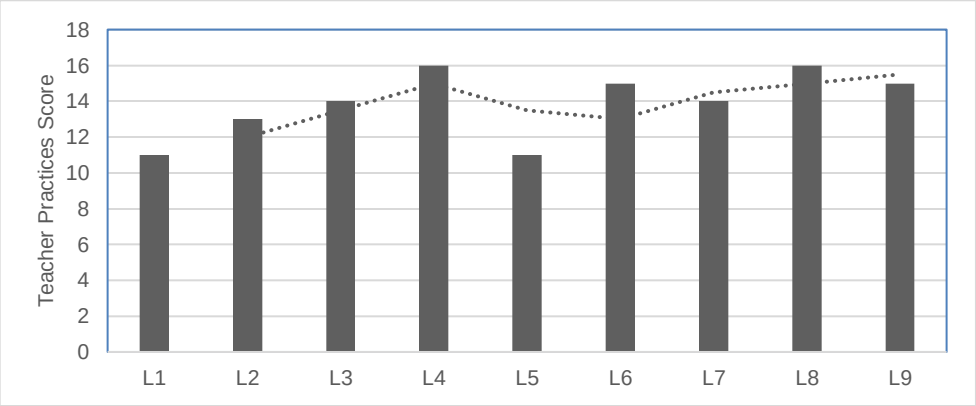
Table 4.3 Fidelity Deviations.

Theme	Illustrative Text
Time Management – an inability to execute activities within the prescribed time allocated in the curriculum.	*Slow execution. Teacher was unable to finish.* – Observer 1 *Ran out of time after the film, didn't finish other activities.* – Observer 3 *Nervous to begin, took 40 min to complete first activity; kept the activity going too long.* – Observer 1
Maintaining Classroom Order – making adaptations to the curriculum in response to students in order to maintain order in the classroom.	*Kids were disengaged and chatting, teacher replaced this activity [student worksheet] with film clip to return to it later.* – Observer 4 *Skipped this worksheet. Students were upset with amount of paperwork. They worked on their HW instead and weren't very engaged.* – Observer 2 Complained about too many worksheets but were willing to talk about it + say their [answers] rather than write them down. – Observer 3 *Couldn't get group back together after tasting, omitted culminating project.* – Observer 3
Missing Materials – missing materials precluded an activity from being executed as planned.	*Will do next week, copies of activity sheets [handouts from previous lesson] for the class were missing"* – Observer 1 *Teacher didn't check in because it seemed that nobody had their action plan sheets.* – Observer 4 *Students hadn't completed HW* – Observer 2
Low Attendance – attendance issues precluding certain activities from being executed as planned.	*Only 4 students left; no one organized into groups* – Observer 2 Only a few kids left at this point, essentially stopped paying attention, were not directly facing the board where the food rule was written on the sheet; did not fill in food rule on sheet. – Observer 2

Teacher Practices. ICC values for Teacher Attitude/Motivation (ICC = 0.19) and Classroom Management (ICC = 0.15) indicate that a greater proportion of their variance was driven by lesson-to-lesson variation compared to classroom level variation.

Positive moderate correlations between Teacher Attitude/Motivation and Classroom Management were found ($r=0.552$, $p<0.01$). A per lesson composite score of Teacher Attitude/Motivation and Classroom Management for Class 1, 2, and 3 was generated as a Teacher Practices Score (actual range = 11-16; theoretical range = 6-18). The distribution of the Teacher Practices Score is plotted for each of the nine observed lessons and represented in Figure 4.4. With the exception of lesson 5, a general upward trend in the Teacher Practices Score is seen through the course of the curriculum.

Figure 4.4 Distribution of Teacher Practices by Lesson.



Note: Teacher Practices = Sum of Classroom Management and Teacher Attitude/Motivation for Class 1, 2, & 3; L=Lesson. Range of values = 11 to 16).

Content analysis of field notes related to Teacher Practices revealed two themes that emerged in relation to high and low scoring lessons: modeling and teacher engagement (Table 4.4).

Table 4.4 Teacher Practices coded by High and Low Ranking Lessons

Theme	Illustrative Text
Modeling – descriptions of the teacher modeling or reinforcing the target behaviors in front of the students. Positive modeling (e.g. the teacher is eating fruits and vegetables); Negative modeling (e.g. the teacher is consuming HPF).	*Teacher ate salad and called in another teacher to try it as well. She took a second bowl.* *Staff* [Afterschool program staff] *delivered a box of food at the end of the lesson and ____* [teacher] *grabbed an apple and ate it in an animated way to show students how tasty it is.* *Teacher wouldn't eat the plant-part salad.*

	Teacher was drinking a Pepsi during the lesson.
Teacher engagement – descriptions of the teacher either engaged in activities alongside the student (immersive) or choosing to disengage during the lesson (e.g. removing him/herself form the activity, using cell phone, leaving classroom during activity).	*[Teacher's name] generated her own spoken-word Poem [*an activity assigned to students] *about heart disease and diabetes and shared it with the class. Animated and expressive instruction. […] was really into it.* *Teacher joined a group and played the Color Columns game with them.* *[Teacher's name] didn't make popcorn flavors with students and sat at another table playing on […] phone.* *[Teacher's name] left the classroom during the activity.*

4.3.2 Reception of Program

Reach. Reach varied from as low as 44% in Lesson 1 to as high as 63% in Lesson 7. By class, students were present for 57%, 44% and 58% of the curriculum in Class 1, 2, and 3 respectively. Extremely high intra-class correlations (ICC=0.95) indicate reach is strongly homogenous across the classrooms and driven by factors external to lesson-to-lesson variation. Generally, reach increased across the curriculum indicating that a greater proportion of students were present for a greater proportion of the lesson as the curriculum progressed (Table 4.5).

Table 4.5 Attendance by Lesson (n=32)

	In attendance n (%reach)
Lesson 1	16 (44%)
Lesson 2	20 (52%)
Lesson 3	18 (49%)
Lesson 4	20 (59%)
Lesson 5	20 (41%)
Lesson 6	20 (60%)
Lesson 7	22 (63%)
Lesson 8	20 (60%)
Lesson 9	21 (60%)

Note: Attendance is based on present bodies in the class during the course of the lesson; Reach is based on the proportion of the lesson that reached the students and account for whether students arrived or exited partway through the lesson.

Exposure: Student Satisfaction. An ICC coefficient of 0.466 was computed revealing high variance between classes rather than within lessons and indicating that student satisfaction is primarily driven by factors related to the classroom as a whole rather than those related to the execution of each lesson. An analysis of variance and post-hoc Tukey Test with class as a fixed factor and student satisfaction as the dependent variable revealed statistically significant differences between student satisfaction across all three classes ($F(2)=29.0$; $p<0.001$).

Exposure: Student Engagement. Conversely, an ICC coefficient of 0.096 for student engagement was computed demonstrating that student engagement is primarily driven by lesson-to-lesson factors rather than those related to the classroom.

Content analysis of field notes demonstrated that the greatest frequency of positive experiences occurred with the food tasting activities (activities in which students prepared and/or tasted foods), film clips and film clip discussions (the presentation of the IDOF film clips based on the theme of the lesson), and marketing activities (in which students directly engaged with highly processed food product packages and ads).

Some kids were so excited about the Logo cut-outs [marketing game] that they wanted to keep them (to take home) and to reveal them to other students at the site. – Observer 1

All students were interested in answering the film questions. They asked if the clip could be played again – Observer 1

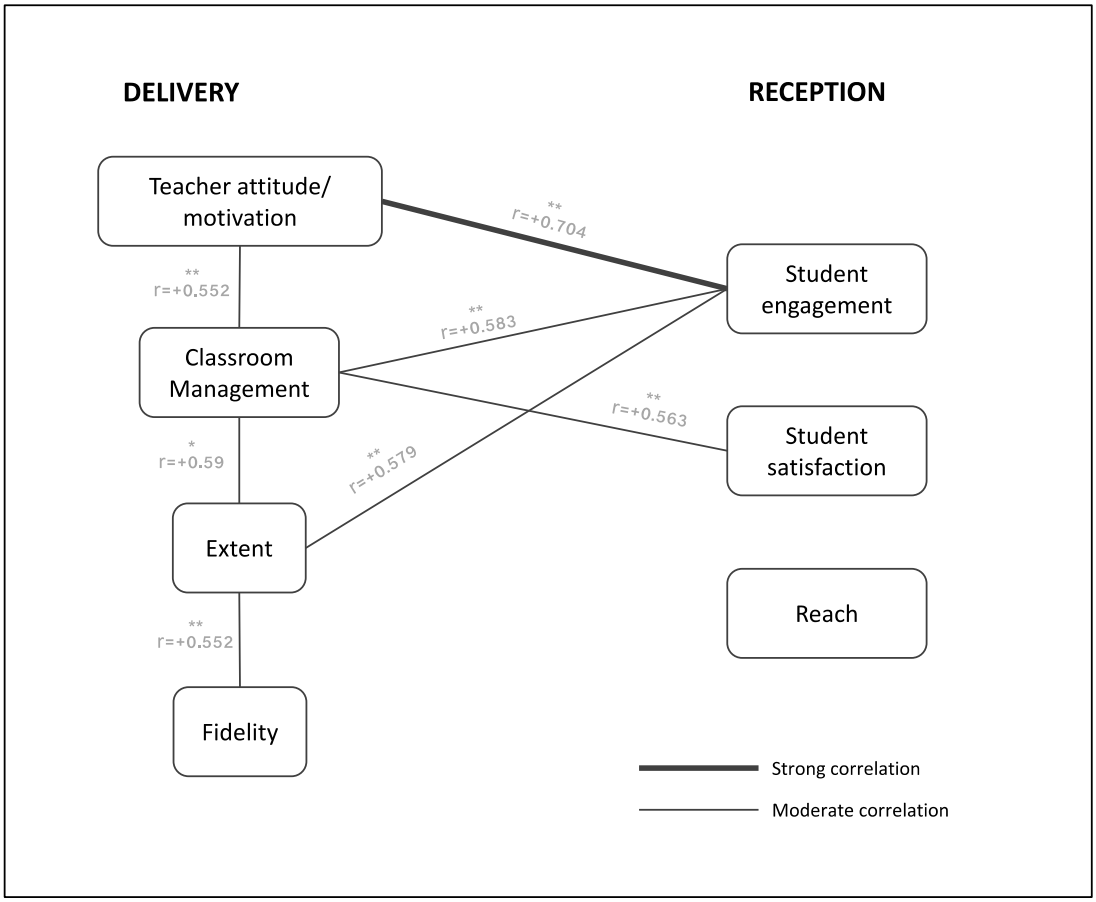
Too exited! The teacher omitted the last activity and let the kids to continue making flavor shakers. – Observer 1

All excited to make and try foods. – Observer 4

Couldn't get the group back together after tasting. Two kids made their parents wait until after the tasting because they didn't want to leave. – Observer 1

Correlations between Process Evaluation Components. A correlation analysis revealed moderate significant correlations within the Implementation of Program components and between Delivery of Program and Reception of Program components. No correlations were seen within Reception of Program components. High significant correlations were seen between Teacher Attitude/Motivation and Student Engagement ($r=0.704$, $p<0.01$) (Figure 4.4).

Figure 4. 5 Correlations between Process Evaluation Components.



Note: ** Correlation is significant at the 0.01 level (two-tailed); * Correlation is significant at the 0.05 level (two tailed).

4.3.3 External Factors

Field notes revealed that class disturbances related to students and site staff entering and exiting the classroom often disrupted the lessons, making it difficult for students to regain attention and teachers their teaching flow. Students often dropped in and left whenever their parents had arrived to pick them up. Site specific factors related to limited resources and maintenance issues may have also posed a barrier to adequate implementation. These included technical difficulties with audio-visual equipment occurring across all classrooms, a regular shifting of classrooms, and maintenance issues related to building disrepair, the latter being primarily a problem for Site 1. Additional external factors that might have influenced process measures, related to social modeling, included the different policy approaches associated with food provision at each site. Site 1 offered students a snack, and fresh fruit was generally a part of the offering. At Site 2, a staff-operated tuck shop offered students a variety of HPF for sale.

4.4 DISCUSSION

4.4.1 Main Findings.

This study sought to explain how a brand-new nutrition education curriculum was implemented by afterschool program staff and received by middle-school aged youth. The evaluation applied a comprehensive framework, adapted from Baranowski and Stables (2000); Burgermaster (2015); Lee et al. (2013), to measure facilitator-oriented (fidelity, extent, teacher practices) and participant-oriented (reach and exposure) outcomes. The intention of a process evaluation is to be explanatory and exploratory in nature and therefore a mixed methods approach was undertaken to concurrently

triangulate quantitative and qualitative findings and generate a rich description of the target outcomes (Creswell & Clark, 2007).

Program Delivery. Findings from this study indicate that the curriculum was generally implemented according to plan. A high proportion of the curriculum was completed (97%, 79%, 73%) and with high to moderate Implementation Fidelity (76/100, 63/100, and 66/100) in Classes 1, 2, and 3 respectively. These findings are comparable to other school and afterschool-based nutrition education programs. Caballero et al. (2003) found observer measured completion rates of 90% for the Pathways program, and in the TEENS study, observers reported completion rates of approximately 80% (Lytle et al., 2004).

Quantitative measures of Implementation Fidelity are much more variable and difficult to compare; however, some crossover exists with qualitative accounts of lesson disruptions. Similar to the culminating projects associated with the IDOF curriculum, the TEENS study also required in-class presentations of culminating nutrition projects that were poorly implemented, not well received by students, and often unsupervised or unmonitored by teachers (Lytle et al., 2004). These findings and related research suggest that perhaps group-based activities that require continued and collaborative effort and/or in-class presentations may not be suitable for the afterschool context or for this age cohort. This may be partly related to the voluntary nature of afterschool programs making it difficult for continued and sustained group work, and due to the particular developmental stage of adolescents, who are more attuned to peer perceptions and reluctant to present in front of others (Afterschool Alliance, 2014).

This study found that worksheets, requiring students to work independently at their desks were also commonly omitted or delayed, as were homework assignments that required students to return materials back to the program the following week. Aside from the reliance on students' memory to bring materials back the following week, the use of these type of worksheets likely misaligns with afterschool tenants of active learning and building personal and social skills with engaging activities (Durlak, Weissberg, & Pachan, 2010; Pierce, Auger, & Vandell, 2013; Shernoff, 2010). Field notes triangulate these findings indicating that teachers often delayed or omitted worksheets in an effort to regain classroom order and in response to student exasperation with the amount of written work being asked of them. Findings from the process evaluation of the Gimme 5 program similarly found that worksheets related to goal setting activities were amongst the lowest proportion of activities to be completed (Davis et al., 2000). However, it should be noted that it is important not to throw the baby out with the bath water, as goal setting/self-regulations skills are an important theoretical and practical predictor of diet-related behavior change (Kreausukon, Gellert, Lippke, & Schwarzer, 2012; Nystrom, Schmitz, Perry, Lytle, & Neumark-Sztainer, 2005). However, these findings may encourage nutrition education program developers to consider alternative ways of operationalizing goal-setting skills/self-regulation skills, especially for greater suitability with an afterschool context. For example, Moeller, Theiler, and Wu (2012) successfully used a digital learning software to help Spanish-speaking students set language-acquisition goals. Similarly, many mobile and web applications that are free and easy to use have also been suggested (Turkay, 2014). Other studies have incorporated group goal setting and monitoring in the afterschool setting (Annesi, Westcott, Faigenbaum, and

Unruh (2005), which have also been suggested for other settings-based health promotion programs to increase accountability and social cohesion (Ory, Jordan, & Bazzarre, 2002).

Progression trends may have demonstrated an approximate learning curve of teachers as they master skills necessary to delivery the curriculum and which may be reflected in the slower facilitation of activities and greater classroom management issues at the onset of the curriculum and each curricular theme but that improve over the course of the curriculum and within each theme. Field notes further support this finding, suggesting a general delay in activity completion related to slow facilitation (e.g. the teacher taking a long time to deliver instructions, allowing activities to go on longer than allotted for in the curriculum, pausing often to review the lesson plan). Furthermore, field notes also attributed these findings a general excitement associated with preparing and tasting foods that delayed the facilitation of subsequent activities in the lesson and hampered the ability of teachers to regain order in the classroom. These findings may point to the need to provide greater professional development, especially as it relates to food preparation and tasting in order to improve process measures and allow teachers to practice skills in a training settings. Wilson et al. (2009) demonstrated that theory-driven professional development that allow staff to practice intervention skills and correct problem areas generated improvements in process outcomes related to implementation fidelity, dose, and reach. In addition, it may also point to the importance of considering the sequential order of activities, such that those that are generally stimulating to the students (such as tasting and food preparation activities) should be the final activity of the lesson.

Lastly, social modelling that either supported or undermined IDOF behaviors was observed in high and low scoring lessons for Teacher Practices. Teacher attitude/motivation to engage with the IDOF message by modeling positive food behavior, demonstrating enthusiasm for tasting, and reinforcing positive behavior outside of the curriculum (e.g. snack time) occurred in high scoring lessons. Whereas in low scoring lessons, teachers were observed on their cell phone during activities, refusing to try foods prepared during the lesson, or remaining disengaged during food preparation activities. Strong positive correlations found between teacher attitude/motivation and student engagement additionally suggest a connection between delivery and reception that has also been demonstrated in other studies (Burgermaster, 2015; Gray et al., 2015). Findings from a nutrition education process evaluation have demonstrated that students within "low buy-in" classrooms (where teachers demonstrated low engagement and motivation towards the health promotion message) tended to also eat poorly (Burgermaster et al., 2016). Some health promotion interventions have demonstrated that a greater effect on target behaviors can be achieved when the intervention also targets the educators themselves (Campbell et al., 2008; Harden, Oakley, & Weston, 1999) Collectively, these findings suggest that more focus needs to be placed on the teachers of nutrition education curricula.

Program Reception. A common afterschool program issue is inconsistent attendance; student's leave when their parents come to pick them up, participation is voluntary, and conflicting obligations can take priority over participation in these types of extra-curricular activities (Afterschool Alliance, 2014). On average, students in this

study were present for 53.1% (±21.4) of the curriculum; comparable to other afterschool nutrition education programs (Branscum & Kaye, 2012; Branscum & Sharma, 2012). Intra-class correlations indicate that attendance and student satisfaction are primarily driven by factors at the class level, therefore due to the context of the program rather than in response to individual lessons. These findings may be relevant in considering how best to improve program Reach and Student Satisfaction by also focusing efforts on building favorable class-level environments such as through activities that generate positive social relationships in an effort to improve attendance (Durlak et al., 2010).

4.4.2 Strengths and Limitations.

This study measured reach in a way that was sensitive to the drop-in/drop-out nature of afterschool programming and therefore generated more detailed findings on reach than often derived from interventions using less stringent binary measures for attendance (e.g. present in class – yes/no). Other strengths of this study include the use of a comprehensive assessment model employing both quantitative and qualitative assessments to generate a detailed account of the implementation outcomes. Further, this study was not based on teacher self-report of events and rather employed trained observers to collect data, which likely reduced bias in relation to social desirability and overestimation of implementation (Resnicow et al., 1998). Furthermore, a validated observation instrument (Contento et al., 2010) was used to assess process outcomes and training measures were taken to ensure suitable inter-rater reliability between observers was attained.

Although, the intention of this study was to implement the program across four sites, difficulties in the recruitment phase (related to a last-minute dropout and low enrollment) precluded reaching the desired sample size. This challenge, echoed by other researchers working in afterschool settings, (Singh, Chinapaw, Brug, & Van Mechelen, 2009) highlights the precarious nature of setting-based research and reinforces the importance of these preliminary phases of explanatory and exploratory research. However, it may also draw attention to a low general interest in or capacity for these types of nutrition education programs in the afterschool context. Sites participating in this study consist of a selected sample, with staff who may be inherently more motivated for health promotion or from sites that are better equipped to facilitate a NE program. Although this would generally be considered a limitation, when the viable uptake of a settings-based health promotion program is the long-term goal, self-section can be a strength (Chen, 2010). Such that, the sample with whom this research is being conducted may more closely represent the true population of host sites for a program because those with an inherent motivation and capacity for NE programs would be more likely to seek out and adopt these types of programs.

Additionally, in this study deviations from fidelity were not differentiated from adaptions – changes to the curriculum by the teachers in response to the local conditions (Mowbray, Holter, Teague, & Bybee, 2003). This may not be considered a limitation when evaluating programs in the "real world" where substantial adaptation to program materials is likely (Hill, Maucione, & Hood, 2007). However, other schools of thought argue that it is important to measure absolute fidelity to the original model, especially in

early stages of evaluation, if the objective is to determine which components of the program are essential (Mowbray et al., 2003).

Materials for the curriculum were provided by the researchers, and therefore it is unclear how implementation would have been impacted if sites were responsible for generating their own materials. This is especially important when considering a NE curriculum that involves food preparation.

4.4.3 Implications for Future Research.

Lesson-to-lesson variability in program delivery and Student Engagement was made apparent in this study. These finding may indicate that the performance of teachers leading a new curriculum can be highly variable. Additionally, student Satisfaction and Reach appeared to be highly contingent on class-level factors. These outcomes may have implications for future approaches to process evaluations of new curricula and highlight the importance of delineating assessment plans that account for these varying configurations. For example, in evaluating the performance of a novice teacher, frequent observations have been identified as important to acutely capture fluctuations in their performance (Pallas, 2010) and which may also be relevant here. Or in investigating class-level mechanisms, such as student satisfaction, process evaluators may be able to rely on data from a subset of students, rather than the entire class, in an effort to conserve resources while still generating similar findings. Secondly, if scaling up, ensuring that teachers are also asked to complete pre-post surveys to measure and control for their mediator or behavior change may also be important. Lastly, other comprehensive process evaluations have demonstrated that process components can influence student behavior

(Burgermaster et al., 2016; Gray et al., 2015), and therefore continued research is needed to see if a link between process evaluation data and outcome data can further explain the effects of the IDOF curriculum.

4.4.4. Implications for Future Practice.

Although the IDOF curriculum was designed as a ready to use tool, this curriculum would benefit from a training manual or protocol that directly addresses ways to enhance teacher motivation/attitude towards the curricular materials, to encourage positive teacher modeling of target behaviors, and provide an opportunity for skill development and trouble shooting in advance of delivering the curriculum. This might include the development of a companion professional development module that is also theory-driven and behaviorally focused with the aim of improving the target behaviors in teachers themselves.

Professional development should also provide greater supportive training and opportunities to practice for food preparation and tasting activities and demonstrations. It could focus on building teacher self-efficacy to teach the content, but should also draw attention to the delivery strategies embedded in the curriculum all of which might help improve flow and student engagement. Lastly, a constraint of urban afterschool programs is that they are often taught by teachers with little formal training, therefore the professional development should also include strategies to improve classroom management, such as manage transitions between activities and dealing with teaching environments with a great deal of external disruptions (e.g. other teachers and students entering and exiting the class).

Other adjustments might include converting written worksheets into active learning activities, removing in-class presentations and culminating activities, and ensuring that the lesson is completed with high excitement activities such as the food preparation and tasting activities.

Since afterschool programs are often beholden to funders, internal evaluation reports are also often required. Therefore, the generation and provision of evaluation materials that sites could use might also be helpful in the adoption and sustainability of the curriculum.

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CHAPTER 5 (ARTICLE 4): A DEVELOPMENT PROJECT OF THE *IN DEFENSE OF FOOD* AFTERSCHOOL CURRICULUM: THE MIXED METHODS OUTCOME EVALUATION

5.1 INTRODUCTION

It is now commonly accepted that the current "Western" lifestyle is contributing to the pandemic of chronic diet-related diseases in the United States (Amine et al., 2002; Gootman, McGinnis, & Kraak, 2006; Marmot et al., 2007). Overweight and obesity has become one of the most important public health issues facing American youth today. In recent years, there has also been a rise in obesity-related diseases such as type II diabetes and cardiovascular diseases in Americans (Yang et al., 2012) striking at younger and younger ages (May, Kuklina, & Yoon, 2012).

Disparity in Diet-related Diseases. Although overweight and obesity rates seem to be leveling off in some population subgroups, poor minority groups in the United States remain disproportionately affected (Ogden, Carroll, Kit, & Flegal, 2012). Overweight tends to be the first overt manifestation of a problem which can lead to a cascade of other health complications related to metabolic and cardiovascular health (Cruz & Goran, 2004). The prevalence of cardiovascular disease risk factors among American children increased from 1999 to 2008, with a three-fold increase in pre and type-II diabetes, disproportionally seen in those who are overweight and obese (May et al., 2012). These chronic diet-related disease are significantly more likely to occur in Hispanics and African Americans (Kwagyan et al., 2015; Ogden, Carroll, Curtin, Lamb,

& Flegal, 2010) indicating that more focused efforts may be necessary for these subgroups.

Shifts in Diet Quality. A shift in diet quality and increased rates of obesity and other diet-related diseases, corresponds with the rapid increases in and availability of 'fast' or 'convenience' ready-to-eat, and ready-to-heat highly processed foods and drink products (Popkin, 2006; Poti, Mendez, Ng, & Popkin, 2015).

"Processed foods" are defined as foods (other than raw agricultural commodities) that are classified based on the extent to which they have been altered from their natural state (USDA, 2011; Dietary Guidelines Advisory Committee, 2010). All foods exist on a spectrum of processing from unprocessed or minimally-processed, like fresh fruits, whole eggs, or milk, to those that are highly processed (containing multi-ingredient, industrially-formulated mixtures), as found in most fast foods and packaged convenience foods (Poti et al., 2015). On average, highly processed foods have a higher proportion of fat, sugar, and salt compared to less-processed versions(Poti et al., 2015); they are substantially cheaper than more healthful options (Drewnowski & Darmon, 2005; Drewnowski & Specter, 2004); and tend to lead to a greater consumption of overall calories (Chandon & Wansink, 2012; Poti et al., 2015). Emerging research is showing that diets predominated by highly processed foods tend to be nutritionally poor compared to those comprised of mostly whole foods (Moubarac et al., 2013; Poti et al., 2015).

American youth can easily access and select highly processed foods, which are cheap and abundant in the food supply and heavily marketed to them. Each year billions of dollars are spent by the food industry marketing highly processed junk food to young people; a vulnerable population who are unable to fully understand the persuasive intent

of marketing strategies. Furthermore, Black and Hispanic youth, are disproportionately targeted by industry which has direct impacts on their selection and consumption of these foods (Cairns, Angus, Hastings, & Caraher, 2013; J Harris et al., 2013; J Harris et al., 2015).

Secular trends from 1999 to 2004 have shown significant increases in the frequent consumption of fast food (Bauer, Larson, Nelson, Story, & Neumark-Sztainer, 2009) and sweetened beverages (Nelson, Neumark-Sztainer, Hannan, & Story, 2009). National survey data indicate that snacking occasions have also increased among American youth (Moreno et al., 2010) with 40% of their total intake coming from discretionary calories (from soda, fruit drinks, snacks - such as cakes, cookies, chips, donuts, and pies, and ready-to-eat pizza) (Reedy & Krebs-Smith, 2010), rather than the recommended maximum of 14-17% (Dietary Guidelines Advisory Committee, 2015)

Rather than pinpointing a particular nutrient or an individual food as the culprit of the health complications that adolescents are facing, it is becoming increasingly clear that a number of behaviors that define a dietary pattern, such as whether a person consumes a large amount of various processed foods (sugar-sweetened beverages, processed packaged snacks, and fast food) compared to whole foods (fruits and vegetables), may influence whether a person can maintain energy balance and optimal health over the long term (Baranowski, Cerin, & Baranowski, 2009; Moreno et al., 2010; Popkin, 2006; Poti, Duffey, & Popkin, 2014).

Although processed foods have come to dominate the American diet, few nutrition initiatives aim to specifically and explicitly provide the message to eat less highly processed foods.

Among those who have brought to the attention of the American public the importance of healthy eating patterns, as opposed to a focus on individual nutrients, is Michael Pollan. His book, *In Defense of Food*, highlights the dietary approach of eating less highly processed foods and more whole and minimally-processed plant-based foods. This study examines the use of this message with middle school youth.

5.1.1 Reaching American Youth.

Middle School-aged Children. Targeting health promotion prevention programs to middle school students versus grade school students has been hypothesized by researchers to be more effective (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2002). This is because this older age group is better able to grasp the long-term impacts of diet and health and understand the concepts and skills related to improving diet quality and health. Secondly, adolescents are gaining autonomy over their food choices and increasing their purchasing power, but are still highly impressionable to the powerful marketing leavers used by food industry to sell highly processed junk foods (Folta, Goldberg, Economos, Bell, & Meltzer, 2006; J Harris, Schwartz, & Brownell, 2010). Finally, adolescents may be more likely to influence the food purchases made by adults (both for at home foods and with away from home purchases) as well as shift their own towards healthier options.

Afterschool Programs to Reach Youth. The afterschool setting can be an influential environment for health promotion with poor minority youth (Whitehouse Task Force on Childhood Obesity, 2010). It is a learning environment that does not detract from school day activities, can be used to supplement existing nutrition and health education, and also offer a safe space for youth to develop lifelong dietary habits.

Additionally, many existing afterschool programs operate in low-income communities where access to healthful foods may be limited. Youth from low-income and minority households are more likely than their higher income and white peers to participate in an afterschool program (Afterschool Alliance, 2014).

Given the future implications of prevailing diet-related chronic diseases in the United States, initiatives targeted to the most at-risk and suitable cohorts and those that provide messaging away from single-nutrient approaches towards dietary patterns approaches are important. However, whole-diet initiatives which target at-risk minority youth in afterschool settings are not common. This study provides an outcome evaluation for the *In Defense of Food* (IDOF) afterschool curriculum, based on Pollan's book *In Defense of Food* and aimed at decreasing intake of highly processed foods and increasing intake of whole/minimally processed plant-based foods.

5.1.2 Purpose

This study examined the following research questions:

1. What was the outcome of the IDOF curriculum on targeted behaviors of increasing intake of whole plant-based foods and decreasing intake of highly processed foods?
2. What was the impact of the IDOF curriculum on targeted potential determinants of behavior change?

5.2 METHODS

5.2.1 Study Design

The outcome evaluation utilized an explanatory mixed methods approach (Creswell & Clark, 2007) in which quantitative pre-posttest survey data were collected, followed by qualitative open-ended one-on-one assessments, and semi-structured in-depth interviews. The Program Evaluation Lifecycle conceptual framework was considered to ensure the alignment of the program lifecycle and evaluation lifecycle (Scheirer et al., 2012; Urban, Hargraves, & Trochim, 2014) by matching a mixed methods pre-post approach to the early life stage of the program.

5.2.2 Recruitment and Participation

Recruitment flyers were distributed in person at the Department of Youth & Community Development (DYCD) in New York City to 70 afterschool program directors during a quarterly meeting. Fifteen program directors from the three predominant youth development afterschool programs in New York City (Cornerstone, Schools out of New York City, and Beacon) contacted the principle investigator via e-mail expressing interest in the IDOF curriculum. All 15 program directors were contacted via e-mail and telephone to determine eligibility. Those sites which included an afterschool program specifically accommodating middle-school aged youth, could facilitate weekly two-hour lessons, and served a primarily low-income population were invited to participate in the study. Initially four sites were eligible and expressed continued interest, however two dropped out before the start of the intervention for scheduling and logistical reasons. The remaining 2 afterschool program sites in low-income neighborhoods in New York City were enrolled in the study to offer the curriculum across three classrooms. Informed

written consent was given by parents. All middle-school aged children enrolled in the afterschool program at the two respective sites received the IDOF curriculum, however only those parents providing informed written consent for their children to participate in the study were included in the evaluation. All participating children and teachers received a gift valued at approximately $20 for their time. The Teachers College Columbia University (TC) Institutional Review Board (IRB) (Protocol # 15-386) approved all procedures, surveys, and protocols.

5.2.3 IDOF Curricular Components

Overview. IDOF is a nutrition education curriculum for middle school-aged children (grades 6-8) designed for an afterschool setting. The IDOF curriculum is the companion to the Public Broadcasting Services (PBS) documentary *In Defense of Food* based on Michael Pollan's best-selling books *In Defense of Food* and *Food Rules.* It consists of 10 sequential 2-hour educational lessons.

The curriculum was designed to help youth become critical of the corporate food supply and familiar and confident to select and prepare whole plant-based foods. In doing so, the curriculum aims to challenge students' current perceptions of what "food" is by combining activities that have "shock appeal," such as unveiling cunning marketing strategies, along with preparing and eating plant-based dishes with the objective of making these foods fun and cool.

The lessons are structured into three units, which highlight a particular concept related to Pollan's 7-word suggestion for healthy eating (Eat Food. Not too Much. Mostly Plants). Lessons 1-3 (Eat Food) explore the differences between *food* (defined as whole

or minimally processed foods) and highly processed food products, termed *phuds*. Lessons 4-6 (Not Too Much) explore the health consequences of eating too much (in general and too many phuds), and guides students to create plans to make realistic changes in their own lives. In lessons 7-9 (Mostly Plants) students look at what it means to eat mostly plants and spend time cooking and tasting healthy plant-based meals and snacks together.

Food Rules. Each lesson provides a take away "Food Rule" to help students put the lesson's theme into action. For example, Lesson one, titled *Where are the soda trees?* introduces students to the idea that *foods* can easily be pictured growing in nature, compared to "phuds," which are a departure from their natural sources.

Film Clips. Each lesson also introduces a film clip from the documentary film to reinforce the themes and messages of the lesson, and provides opportunities for thoughtful discussions, and engaging hands-on activities.

Food Preparation and Tastings. Most lessons provide a food preparation/tasting component to introduce students to tasty and healthful foods and to provide them with the skills to select and prepare whole plant-based foods (in place of highly processed foods).

Goal Setting. Most lessons also provide students with goal setting and self-regulation skills by having them complete action plans aimed at developing specific, actionable, and measurable goals to eat more whole plant-based foods and eat less highly processed foods.

Reflection through Student-Generated Expression. Summative reflections of each theme are provided by allowing students to examine their own food environments

by either taking a photo, drawing a picture, or writing about what they see as hindering or facilitating to eating more whole plant-based foods and less highly processed foods in an activity called *Capture It.* Students are invited to share their *Capture it* pieces with their peers and to discuss the facilitators and barriers together. Table 5.1 provides an overview and description of the IDOF program lessons, components, and theoretical constructs.

Table 5.1 Description of IDOF Curriculum Components

Unit	Lesson General Objective	Lesson Overview	Food Rule(s)	Examples of Coordinating Activities	Film Clip Synopsis	Determinants
Eat Food	**L1: Where are the Soda Trees?** Students are introduced to the *In Defense of Food* curriculum and the concept of *foods* versus *phuds*.	Students learn to differentiate *foods* from *phuds* and how eating healthfully can help them to do better at the things that are important to them (e.g. dancing, playing football).	*Eat food you can picture growing in nature.*	Students jot down things that are important to them. In small groups they sort pictures cards of foods and *phuds* as those that can be pictured growing in nature; those that can help them with the things that are important to them. *Food* tasting – students taste seeds. *Phud* Farm Skit – in small groups, students create a spoof of phuds that would "grow" on a farm.	**Meet Anthony Scavotto** Anthony is a young adolescent who suffers from health complications related to excess weight gain. Even though he and his family thought they were eating healthy, they were still eating mostly *phuds* and it has had effects on his ability to play the sports that he loves.	Positive & negative outcome expectations; Behavioral capability/competence Self-efficacy
	L2: Chemical Cuisine Students increase their awareness of the benefits of eating more foods and fewer *phuds.*	Student compare ingredients in a homemade versus highly process version of a cookie, and then other *food* and *phud* product ingredient lists to discover that *phuds* are not always what they appear to be.	*Eat foods with ingredients that a third grader could pronounce.*	Students learn about ingredients through a cookie relay race game. In a gallery walk around the classroom, students examine different ingredient lists and then cast ballots guessing what the product is. *Phud* tasting – students taste candy with temporarily altered taste buds to discover what a popular candy tastes like without all the excess sugar to mask its other ingredients.	**Salt, Sugar, Fat** The Western Diet is made up of highly processed foods, full of salt, sugar, and fat, which leads to big profits for food companies, but poor health for people. Learn about how highly processed foods are engineered to be irresistible.	Behavioral capability/competence; Negative & positive outcome expectations
	L3: The Claim Game Students explore how companies use marketing strategies on food packaging to get us to buy products.	Product packages are designed the *phuds/foods* within them look irresistible and seem healthier than they are. Now that students have looked inside the packages (in lesson 2), they are ready to examine the outside of packages.	*Avoid products that make health claims.*	Students play a word association game to highlight how engrained marketing for *phuds* is in the meaning we attribute to certain *phuds*. Students examine product packages critically for "tricky techniques" employed to get people to buy them. *Food* tasting – students taste unique fruits that come in fun "packages" of their own. Making action plans to eat fewer *phuds*.	***Phud* Phads** Magic bullet answers to health can often create phud phads and more confusion about what to eat to be healthy. Take an historical journey of ancient fads which made knowing what to eat to healthy just as confusing as it is now.	Behavioral capability/competence; Negative & positive outcome expectations Goal intention

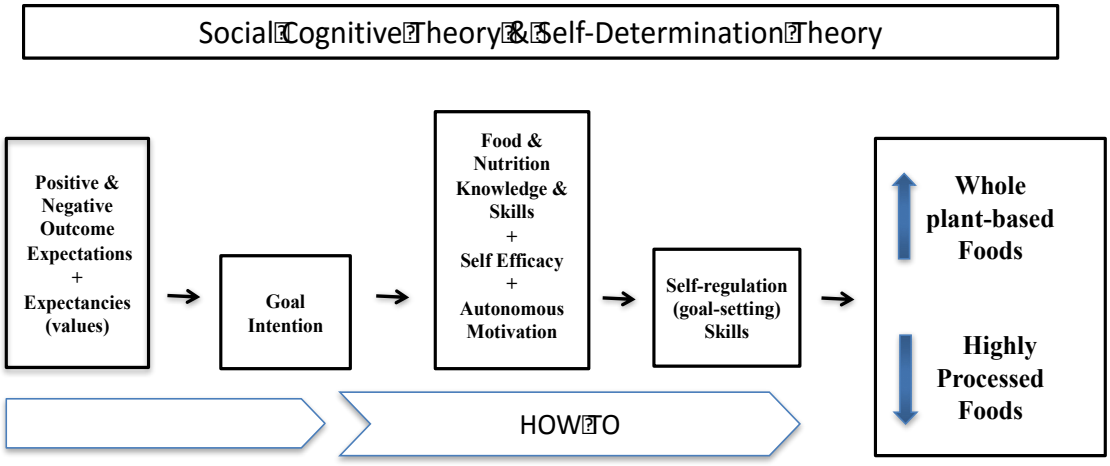
Not Too Much	**L4: Don't be Phoooled** Students examine how food advertising and marketing writ large influence us, often on a subconscious level.	We can't escape advertising, it is everywhere and it is persuasive. Building on what students learned about marketing techniques, this lesson dives deeper into its impacts on our food choices.	*Avoid foods you see advertised on television.*	Play a logo game to see how easily recognizable popular brands' logos are. Share Capture It pieces, a creative reflection on *phuds* they want to eat less of. Persuade your Peers – students create persuasive arguments for funny scenarios. Examine *phud* Ads for its persuasive intentions. Create a *Food* ad.	**Marketing Low-Fat** The science of eating low-fat foods was hijacked by food marketers producing scores of processed food products thought to be healthy because they were low-fat (despite being high in sugar) and creating greater consumer confusion.	Negative outcome expectations; Self-efficacy Behavioral capability
	L5: Supersized Students become aware of how our food environment influences when, what, and how much we eat.	Even though most people think they eat only until they are full, there are many environmental cues that strongly influence how much, when, what, and why we eat; the size of the container that food/drink comes in is one such example. Students explore how large container sizes can lead us to eat more than we should.	*Choose smaller plates and cups.*	A popcorn experiment demonstrates that the size of the bag that students serve themselves in, influences how much they take and will later eat. Measuring out liquids with different sized containers. Food tasting - making flavor shakers for homemade popcorn. Action plans to eat smaller portions when phuds are chosen.	**Serve More, Eat More.** When food and drinks are served in large containers we tend to consume more, even when we're not hungry/thirsty. Food companies use this strategy to sell more products. Health promotion specialists are using similar "tricks" to help eat less and choose healthier options.	Negative outcome expectations Self-efficacy Behavioral capability Self-regulation skills
	L6: Dia-beat It! Students understand that eating phuds instead of foods can increase their risk of getting sick.	Type II Diabetes is on the rise, especially in poor and minority subgroups. Students learn about commonly-consumed *phuds* and the amount of sugar they have in them and what that does to the human body.	*Make water your beverage of choice.* *Sweeten and salt your food yourself.*	A visualization activity to see how DMII prevalence has changed. Counting out sugar in popular snacks and beverages. Food tasting – make homemade gingerale Action plan to eat less sugary phuds. Create a spoken word poem.	**Sugar Flood** An animated story reveals what happens to your body when you consume excess sugar in the short term and chronically. AND **Diabetes: An Epidemic** A young African American spoken-word poet collaborates with health care works to raise awareness about the connection between unhealthy diets and rising rates of DMII. In her poem Death Recipe, she acknowledges the power of phuds and reveals familial tragedies that she has experienced firsthand.	Negative and positive outcome expectations; Behavioral capability/competence; Self-regulation skills/Autonomy support

Mostly Plants	**L7: Rooting for Plants** Students become more familiar with and excited about eating plant-based foods.	Students taste and gain experience in preparing all different parts of the plant to help them eat more plants.	*If it came from a plant eat it; if it was made in a plant don't.*	Play a guessing game using close ups photos of different fruits and vegetables. Make a plant-part salad with all parts of the plant (leaves, seeds, stems, flower, roots, and fruit). Action plan to eat "mostly plants"	**Going Farming!** In certain neighborhoods, finding fresh, healthy, and affordable plant-based foods is difficult. See how a school in the Bronx is responding by giving students opportunities to get excited about growing, preparing, and eating plant-based foods.	Positive outcome expectations; Functional/ procedural knowledge Self-efficacy Self-regulation skills/ Autonomy support
	L8: Color Your World Students build confidence and desire to eat plant-based foods.	Eating a variety of plant-based foods of all colors is important. Students learn how with more tasting and food preparation experiences.	*Eat your colors.*	Guessing game for various fruits and vegetables of all colors. Share Capture It pieces about a plant-based food they had an experience with at home or in their community. Action plan to eat more fruits and vegetables of all colors. Food tasting – make a five-color salad.	**Vegetable Surprise** When students are involved in producing fruits and vegetables, they are more likely to try them. Students at a summer camp make homemade pizzas topped with a variety of familiar and unusual vegetables from the garden.	Positive outcome expectations; Functional/ procedural knowledge Self-efficacy Self-regulation skills/Autonomy support
	L9: Lettuce Turnip the Beet Students create practical strategies to continue following the Food Rules.	Students use what they have learned thus far and apply it to different scenarios taking tips from other cultures that eat more healthfully than we do.	*Eat more like the French do.*	Explore how different cultures eat plant-based foods. Solves challenges to eating healthfully by reviewing different scenarios. Action plan – taking action to eat more plant-based foods at home. Food tasting – plant-based parfaits.	**Secrets of the French** Culture can be a powerful lever in shaping how we eat. French traditions and customs help the French to eat well and stay healthy. They eat at regular times, have routines, share food together, eat small portions, and slowly enjoy their foods.	Positive outcome expectations; Functional/ procedural knowledge Self-efficacy Self-regulation skills/ Autonomy support

Celebrate	**L10: Eat food. Not too much. Mostly plants.** Students celebrate and share what they have learned throughout the *In Defense of Food* curriculum.	If you eat whole plant-based foods most of the time, it's ok to break the rules once in a while as well. Students learn that eating well is about enjoying treats on occasion too and have a pizza party to celebrate all that they have learned.	*Break the rules once in a while.*	Students share culminating projects with their peers Students write out advice cards based on what they learned to be healthy for other students who have not taken this course. Food tasting – pizza party!	**Join the Movement** There is a food movement happening around us and all across the country people are getting together to grow food and advocate for healthier, local, and affordable *foods*.	Positive outcome expectations; Functional/ procedural knowledge Self-efficacy Self-regulation skills/Autonomy support

The IDOF Theoretical Model. The curricular objectives are grounded in the Social Cognitive Theory (Bandura, 1986) and the Self-Determination Theory's (Deci & Ryan, 1985) determinants of positive and negative outcome expectations, goal intention, factual/procedural knowledge and skills, self-efficacy, and self-regulation skills. The behavioral outcomes are to increase intake of whole/minimally processed foods, operationalized as fruits and vegetables (FV), and decrease intake of highly processed foods (HPF), operationalized as sugar-sweetened beverages, fast foods, and processed packaged snacks. Figure 5.1 provides the theoretical model for the IDOF curriculum.

Figure 5. 1 Theoretical Model for the IDOF Curriculum.

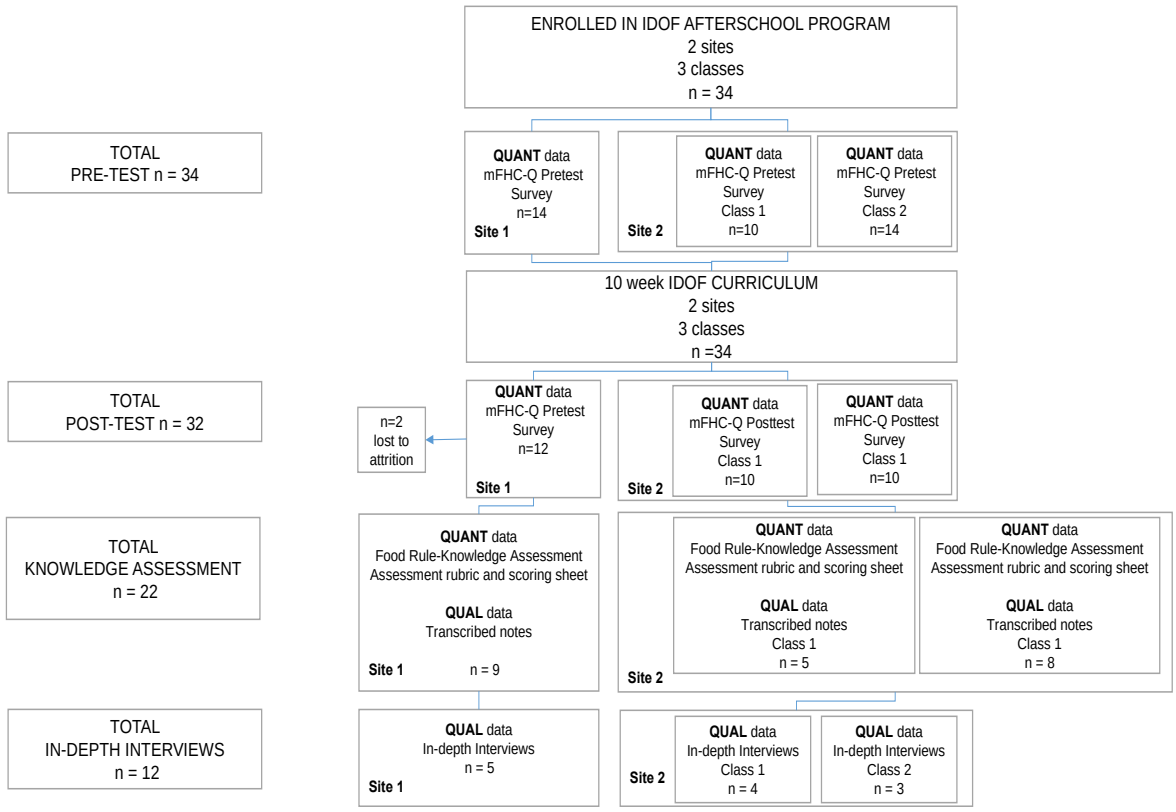


5.2.4 Description of Outcome Evaluation

The study was conducted over a 14-week period from September to December 2015. A total of 10 IDOF lessons were taught by the regular afterschool program teachers, one lesson per week, over 10 weeks. Sites were provided with all the curriculum materials (lesson plans and lesson materials) at least two weeks in advance of each

lesson. Prior to implementing the curriculum, a 2-hour professional development training was conducted by study investigators for all teachers from the participating sites. Teachers were given an additional 1-hour training two weeks into the curriculum and further support as needed throughout the curriculum delivery period. A flow chart for this study is presented in Figure 5.2.

Figure 5.2 Mixed Methods Study Flowchart.



mFHC-Q – modified Food Health & Choices Questionnaire; QUANT – Quantitative; QUAL – Qualitative

5.2.5 Measures

Pretest Posttest Questionnaire. The Food Health and Choices Questionnaire (FHC-Q), a self-report survey instrument (Gray, Koch, Contento, Bandelli, & Di Noia, 2016) was modified for this study (mFHC-Q) (approximately 55 minutes) to measure frequency of FV and HPF intake (operationalized as sugar-sweetened beverages,

processed packaged snacks, and fast food); six hypothesized theoretical determinants of FV and HPF intake including: 1) outcome expectations, 2) goal intention, 3) self-efficacy, and 4) self-regulation skills, 5) autonomous motivation, 6) expectancies (attitudes); and the demographic variables: age, ethnicity, and gender. Each behavior or determinant (except for goal intention for FV) was represented by a scale consisting of 3 to 9 items. Questions for behavioral outcomes were asked with the stem, "In the past week, I ate/drank …", and response options included "0 times", "about 1-2 times", "about 3-4 times", "almost every day", and "2 or more times every day." For the psychosocial determinants, items used a 5-point Likert scale with scores ranging from 1 to 5. The codebook of measures by domain is included in Appendix D.1.1.

The mFHC-Q survey items were adapted from the previously validated FHC-Q. However, items pertaining to behaviors (e.g. screen time and physical activity) or determinants not covered in the IDOF curriculum (e.g. FHC knowledge items) were removed as those were not relevant to this study. The food and beverage behavioral outcome items in the FHC-Q were adopted from the Beverage and Snack Questionnaire (BSQ; (Neuhouser, Lilley, Lund, & Johnson, 2009) previously validated in middle-school aged youth against 4-day food records . The psychosocial determinants in the FHC-Q, included in the mFHC-Q, underwent two cognitive testing sessions with elementary school-aged children to ensure student's understanding of the survey questions as well as for test-retest reliability testing (Lee et al., 2013).

Food Rules Assessment. An analytic rubric was developed specifically to assess depth of comprehension that students need to demonstrate understanding (Allen & Tanner, 2006) of each of the 11 food rules when provided the assessment prompt "What

does this food rule mean?" How would you use this food rule?" A 3-point rubric score was used: 1 point (student is unable to provide meaning accurately and cannot provide a cogent example of its use), 2 points (student provides partial meaning or a cogent example), or 3 points (student provides accurate meaning and at least one cogent example). On the basis of 11 food rules, a students' score could range from 11 to 33. The coding rubric is included in Appendix D.1.3.

Semi-structured Interview Protocol. The lead investigator created an interview script which was informed by standard interview techniques (Krueger & Casey, 2009; Vaughn, Schumm, & Sinagub, 1996). The protocol included six-open ended core questions, probes, follow-up questions, and member checks during the interview. Interview questions are included in Appendix D.1.6.

5.2.6 Data Collection

mFHC-Q administration. The mFHC-Q pretest was administered in September 2015 and the posttest was administered in December 2015 across all three sites. The mFHC-Q was administered by the lead investigator and trained research assistants and conducted in the regular afterschool classroom for each site using an electronic Audience Response System (ARS) at pretest and a combination of the ARS (n=26) and paper-and-pencil surveys (n=6), administered at posttest. Paper and pencil surveys and those administered using ARS have a high degree of reliability, as demonstrated by Lee et al. (2013). Age was later calculated as a continuous variable from student records provided by each site manager, replacing the categorically-collected age-variable in the mFHC-Q survey.

Food Rules Assessment administration. A purposeful sample of participants, identified as the "moveable middle," (the 70% of the sample who received the greatest dose of the curriculum as regular afterschool attendees) was selected to participate. The lead investigator (female, MHSc.) conducted the one-on-one assessments using the 2-open ended questions ("What does this food rule mean?" How would you use this food rule?") and probes (please tell me more about []; what is an example of that []). All one-on-one assessments were held in a private room at each site over a two-week period in December 2015 within one week's completion of the curriculum and lasted for approximately 15 minutes. Extensive notes were taken during the assessment with enough detail to provide an accurate score for each food rule; otherwise assessments were audio-recorded and extensive notes were then taken within 24 hours. A score was assigned for each food rule.

Semi-structured Interview. A purposeful sample (2-4 participants from each classroom) was selected from the "moveable middle" to capture a range of participants observed to demonstrate varying degrees of understanding of the material. Each interview took approximately 30 minutes to complete, was held in a quiet and private room at each respective site in December 2015, and was led by the lead investigator (female, MHSc.) who has experience conducting interviews with adolescents. The interviews began with the clarification of terms for: '*food*,' (W/MP foods) and '*phuds*' (HPF), and a brief explanation of the reasons for undertaking this research. All interviews were audio-recorded.

5.2.7 Data Analysis

mFHC-Q. Pretest & Posttest data were coded and entered for computer analysis using the Statistical Package for the Social Sciences (SPSS), version 24 (2016) for Mac.

Missing Data. Missing data analysis indicated that 6.32% of data across all values were missing. However, 93.75% of data cases were incomplete, ruling out listwise deletion of missing data. Data appeared to be missing at random, according to missing patterns analyses conducted in SPSS 24 (IBM, 2016) and R (R Core Team, 2016). Given the nature of the study (a development project) and small sample size to survey-item ratio (32:49), the decision was made to analyze all available data, rather than imputing data. Greater than 20% missing data from 1 item making up the goal intention key [drink fewer sweetened beverages] led to the removal of this item from analysis. Mechanical errors with the ARS in pretest (failing to capture 1/3 of responses for goal intention (FV) (3 items) and 2 items in posttest expectancies/attitudes (HPF) and suboptimal Cronbach's alpha coefficient values (0.474) for expectancies/attitudes scales, lead to the removal of goal intention and expectancies from analyses. Cronbach's alpha coefficient values for all remaining psychosocial determinants ranged from 0.716 to 0.890 rendering a 49-item questionnaire for analysis.

Descriptive statistics and frequency distributions were calculated for all categories of data (scales and individual items). Bivariate correlations were used to determine initial associations between all measures. Paired t-tests were used to evaluate baseline to post-intervention changes in behavioral outcomes and psychosocial determinants.

Food Rules. Notes collected during each assessment were reviewed for accuracy. The lead investigator and a trained research assistant (male, EdM) reviewed three

transcripts before coming to a consensus on their scores and achieving a percent agreement of 92%; and a chance-corrected (Kappa) interrater reliability of 0.817 (almost perfect or perfect agreement) (Landis & Koch, 1977; Viera & Garrett, 2005). Changes to the coding rubric were then applied to the rest of the transcripts and participants' scores were refined accordingly. A total score was determined for each participant by summing the individual food rules scores divided by the total possible score that could be achieved (33 points). Participants were grouped into three categories, *low comprehension*, *moderate comprehension*, and *high comprehension* based on the cut-points ≤ 0.60 (≤ 20/33points) = low; > 0.60 to < 0.80 (>20/33 points to 26/33 points) =moderate; >0.80 (>26/33 points) = high. A total score for each food rule across the cohort was generated by summing each participant's score for a particular food rule, divided by the total possible score for the cohort. Qualitative notes and scores were imported into Nvivo 11 (QSR International, Melbourne Australia, 2015) for analysis. Transcripts were reviewed for emergent codes within each comprehension group and across the sample.

Interviews. Interviews were audio recorded and then transcribed verbatim by an outside source. All transcriptions were reviewed along with their original audio recording a minimum of two times to ensure accuracy. The lead researcher reviewed transcripts beginning with an open-coding process using line-by-line coding to identify themes, patterns of words, perceptions, and ideas which were then classified into categories. An initial codebook of themes (using an framework analysis approach (Ritchie & Spencer, 2002) included a priori themes based on key determinants from the SCT (outcome expectations: physical, social, self-evaluative; expectancies/attitudes; physical environment; knowledge/skills; and self-regulation skills) and the SDT

(autonomous motivation; extrinsic motivation). Two independent coders met to review the coding scheme after reviewing two transcripts together and definitions of the determinants were derived and informed from Contento (2016) and Burgermaster (2015). Additional theoretical constructs (moral responsibility; ambivalence/conflict of values) were also included (Burgermaster, 2015; Glanz, 2005). The lead researcher and a trained research (male, EdM) assistant met to come to consensus on their codes after coding three of the 12 transcripts. Discrepancies between coding pairs were resolved through discussion to generate the final coding scheme. A percent agreement of 85% across coding pairs indicated acceptable levels of reliability. After establishing reliability between coders, the lead investigator reviewed and coded the remaining transcripts. Each interview transcript was imported into the qualitative software NVivo 11 (QSR International, Melbourne Australia, 2015) and themes were extracted from the imported text files.

5.3 RESULTS

Participants. A total of 32 participants (94% response rate) completed the surveys at both pretest and posttest. A subsample of this group was selected for the qualitative assessments. Demographic characteristics of participants grouped by assessment (pre/posttest, one-on-one food rules assessment, and interviews) are presented in Table 5.2. On average, participants participated in 52% (SD=0.23; 11.9-100%) of the curriculum.

Table 5.2 Descriptive Characteristics of Study Sample by Assessments.

Variable	Completers	Drop-outs	Food Rule Assessment	Interviews
	n=32	n=2	n=22	n=12
Gender				
Female (%)	16 (50%)	2 (50%)	14 (63.6%)	6 (50%)
Mean Age in years (SD)	12.06 (± 0.62)	11.5 (±0.70)	12.00 (± 0.62)	11.92 (± 0.67)
Ethnicity				
Hispanic (%)	11 (34.4%)	2 (100%)	9 (40.9%)	4 (33.3%)
Black (%)	18 (56.3%)	--	11 (50%)	7 (58.3%)
White (%)	1 (3.1%)	--	1 (4.5%)	1 (8.3%)
Mixed (%)	2 (6.3%)	--	1 (4.5%)	--

5.3.1 Behavioral and Psychosocial Determinants Outcomes: Pre-post Survey

Behavioral Outcomes. Table 5.3 shows that there was a significant increase in mean frequency of FV intake at posttest compared to pretest; $t = 3.359$, $p < 0.01$, an effect size that is considered to be large ($d = 0.59$). Small effect sizes (0.34) were seen for mean intakes of HPF and the change in score from pretest to posttest was not statistically significant ($p=0.064$). Within class comparisons show a trend towards increased intake of FV from pre-to-post across all three classrooms. Two of the three classrooms (C1 and C2) showed significant increases in FV intake, while one did not; one of the three classrooms (C1) showed significant decreases in HPF, while two did not.

Outcomes for Determinants. Statistically significant increases in outcome expectations and self-efficacy for fruit and vegetable intake occur from pre to posttest; all other determinants show no statistically significant changes.

Table 5.3 Behavioral Outcomes for Participants from Pre to Posttest

	Mean (SD)		Effect Size	Statistic	p-value
	Pre	**Post**	**Cohen's d**	**t (df)**	
Measure					
FV Intake[a] (n=32)	1.70 (0.63)	2.15 (0.60)	0.59	3.359 (31)	p=0.002
C1 (n=12)[b]	1.87 (0.51)	2.47 (0.67)	0.87	3.013 (11)	p=0.012
C2 (n=10)[b]	1.35 (0.37)	1.92 (0.56)	0.67	4.630 (9)	p=0.001
C3 (n=10)[b]	1.83 (0.84)	1.99 (0.41)	0.15	467 (9)	p=0.651
HPF Intake[a] (n=32)	3.20 (1.23)	2.76 (1.02)	-0.34	-1.919 (31)	p=0.064
C1 (n=12)[b]	3.86 (1.21)	2.92 (1.07)	-0.70	-2.413 (11)	p=0.034
C2 (n=10)[b]	3.00 (1.15)	2.41 (1.05)	-0.47	-1.471 (9)	p=0.324
C3 (n=10)[b]	2.59 (1.0)	2.9 (0.91)	-0.31	0.966 (9)	p=0.359

Note: FV=mean frequency of fruit and vegetable intake; HPF=mean frequency of highly processed food intake. C1, C2, C3 = Classroom 1, Classroom 2, Classroom 3 respectively. Effect size is based on change in frequency (number of times FV and HPF were consumed per week). Change in FV intake translated to an increase in approximately 0.75 servings/day; changes in HPF translated to a decrease in approximately 1.8 serving/day.
FV and HPF intake at pre and posttest are presented: Response options: 0 times per week (1); 1-2 times per week (2); 3-4 times per week (3); everyday (4); or 2 or more times everyday (5).
a – within sample values
b – within class values

Table 5.4 Outcomes for Psychosocial Determinants for Participants from Pre to Posttest (n=32)

	Mean (SD)		Effect Size	Statistic	p-value
	Pre	**Post**	**Cohen's d**	**t (df)**	
Measure					
Outcome Expectations FV	2.7 (1.4)	3.6 (1.1)	0.45	2.559 (31)	p=0.016
Outcome Expectations HPF	4.2 (1.2)	3.7 (0.9)	-0.27	-1.529 (30)	p=0.137
Self-efficacy FV	2.8 (1.2)	3.5 (1.0)	0.47	2.642 (30)	p=0.013
Self-efficacy HPF	3.2 (1.3)	3.5 (0.9)	0.15	0.837 (30)	p=0.409
Self-regulation setting skills	3.5 (1.3)	3.4 (1.1)	-0.07	-0.418 (31)	p=.679
Autonomous Motivation	3.8 (1.4)	3.8 (1.2)	0.01	-0.041 (30)	p=0.968

Note: FV=fruit and vegetable; HPF=highly processed food

Relationship between Determinants and Behaviors. Bivariate correlations were conducted with posttest means. As seen in Table 5.5, a moderate positive correlation between FV intake and self-efficacy to eat more FV ($r=.499$; $p<0.01$) and positive outcomes expectations for eating FV ($r=.436$; $p<0.05$) was found. There is a moderate negative correlation between intake of HPF and self-efficacy to eat less HPF ($r=-.508$; $p<0.01$). Additionally, there was a strong positive correlation between self-efficacy to eat more FV and the positive outcome expectation of eating FV ($r=.607$; $p<0.01$), and a moderate positive association between self-efficacy to eat more FV and self-regulation skills ($r=.514$; $p<0.01$) and an autonomous motivation to eat healthy ($r=.401$; $p<0.05$).

Table 5.1 Bivariate correlations among all survey-measured variables at posttest.

	FV Intake	HPF Intake	Self-efficacy (FV)	Self-efficacy (HPF)	Outcome expectations (FV)	Outcome expectations (HPF)	Self-regulation skills	Autonomous Motivation
FV Intake	--							
HPF Intake	.091	--						
Self-efficacy (FV)	**.499****	-.283	--					
Self-efficacy (HPF)	.069	**-.508****	**.350***	--				
Outcome expectations (FV)	**.436***	-.274	**.607****	.072	--			
Outcome expectations (HPF)	-.044	.164	-.230	-.137	-.265	--		
Self-regulation skills	.297	-.299	**.514****	-.051	**.364***	-.067	--	
Autonomous Motivation	.238	.012	**.401***	.120	.314	-.144	.008	--

*$p < 0.05$, **$p < 0.01$.

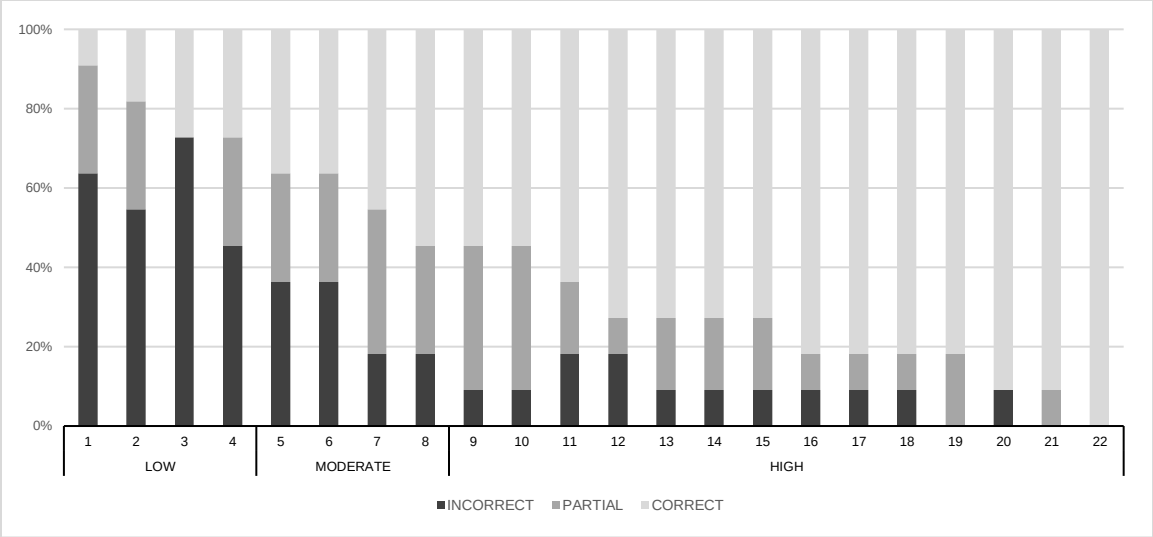
5.3.2 Food Rules

A total of 22 participants were selected for the one-on-one assessments (64% female; mean age of 12 (± 0.62); 40.9% Hispanic, 11% Black, 9% White/Other). 66% of the participants were categorized into the high comprehension group (18% in the moderate, and 18% in the low) based on their summative food-rule assessment scores. Furthermore, those in the high comprehension group had a greater proportion of complete scores (3 of 3) indicating that they were either able to present a complete understanding the food rule or provide a cogent example of how they used the rule in their lives demonstrating the development of critical thinking skills. Figure 4 provides the distribution of participants grouped by comprehension level and the proportion of incorrect, partial, and correct scores earned across the assessment.

A common theme generated among the high comprehension groups was the demonstration of the application of self-regulation skills, which was not seen with any members of the low comprehension group. Self-regulation was defined as: an indication of the use of goal setting/action plans, self-assessment, planning, and included strategies to avoid, moderate, remind, encourage, track, reward, and substitute for healthy behaviors (Bandura, 1986; Contento, 2016; Ryan & Deci, 2000).

> *"I pick a day in the week that… you can pick sweet foods, like every Friday."*
>
> *"Take small portions of food. Instead of a bag of chips, take a handful."*
>
> *"If you choose bigger plates, it makes you eat more; I would get a smaller plate and eat less junk."*

Figure 5.3 Distribution of Participants' Correct Responses by Comprehension Level.



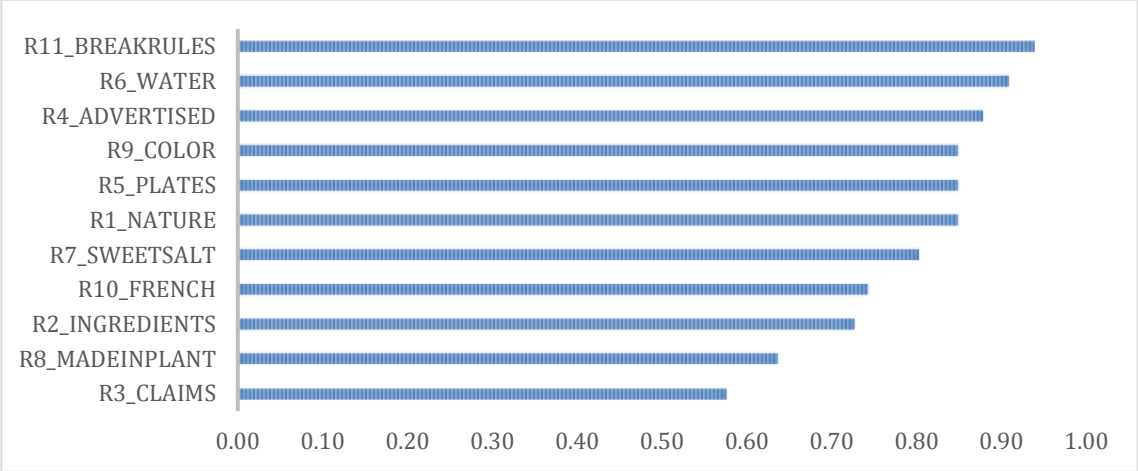
Note: n=22; Participants are grouped into 'low;' 'moderate;' and 'high' comprehension groups with distributions of the percentage of their correct, partial, and incorrect responses. Each bar graph represents one student.

Participants were able to recall and provide a deeper level of understanding for some food rules more than other. The food rules: "Break the rules once in a while" and "Make water your beverage of choice" ranked the highest, while "Avoid products that make health claims" and "If it came from a plant, eat it. If it was made in a plant, don't;" ranked the lowest. Figure 5.4. provides each food rule and the total score achieved across all participants.

Commonly seen across the most well understood food rules was also the demonstration of an application of self-regulation skills.

> *"I drink water more than soda. I drink water 3 times a day."*
>
> *"Drink water instead of juice. When I'm at my house, I choose water."*
>
> *"You can eat phuds once in a while, but not every day. Twice through the week; like I eat phuds only twice through the week."*
>
> *"You can eat something that's unhealthy but once a week. Like if every day you eat fruits and vegetables, one day you can eat sugar snacks."*

Figure 5.4 Distribution of Scores of Total Possible for each Food Rules Based One-on-One Assessments.



Note: Appendix D.1 and Figure 5.1 provide a description of each food rule.
R11_BREAKRULES – "Break the rules once in a while."
R6_WATER – "Make water your beverage of choice."
R4_ADVERTISED – "Avoid foods you see advertised on television."
R9_COLOR – "Eat your colors."
R5_PLATES – "Choose smaller plates and cups."
R1_NATURE – "Eat food you can picture growing in nature."
R7_SWEETSALT – "Sweeten and salt your food yourself."
R10_FRENCH – "Eat more like the French do."
R2_INGREDIENTS – "Eat foods with ingredients that a third grader could pronounce."
R8_"MADEINPLANT – "If it came from a plant, eat it; if it was made in a plant, don't."
R3_CLAIMS – "Avoid products that make health claims."

5.3.3 In-depth Interviews

A convenient sub-sample of 12 participants were selected for the in-depth interviews based on participant availability however they were representative of the overall sample (50% female; mean age (11.92 ± 0.67); 33% Hispanic; 58% Black; 8.3% White/Other). Tables 5.5 and 5.6 provides themes and illustrative quotes from the semi-structured interviews.

Meaning and Definitions Associated with *Foods* and *Phuds* (HPF). W/MP and HPF were defined based on three key themes: their influence hedonic properties and origin/composition.

Compared to HPF, participants felt that W/MP foods are nourishing, provide vitality, and help them to achieve a physical outcome (such as good health, increased

energy, or strength). They were defined as delicious and satisfying and those that come from natural origins ("grows from the ground;" or composed of known and trustworthy ingredients). They were typically described as "good for you" with fruits and vegetables as the primary examples and seeds and chicken to a lesser extent.

Conversely, HPF were generally defined as those which contribute to poor health (e.g. cause diabetes, "put you in the hospital," or are physically hindering (e.g. "don't let me run fast for football") and are from questionable origins ("with phuds [HPF] you really don't know what you are eating;") or seemingly unnatural processes ("it is processed in factories and I don't think comes from nature and they're not fresh;" "like a cupcake, where can you find one of those growing, in a field? No!"). They were typically described as being composed of sugar and calories and generally described as "bad" or "junk food."

Physical Outcome Expectations of Consuming HPF. The most prominent pre-occupation amongst participants was the risk associated with eating HPF, such as becoming diabetic or gaining weight. Most participants discussed diabetes through a personal fear of the outcome, through association (e.g. how a family member suffers from it), or as was discussed in the curriculum in relation to activities discussed in the program.

The Environment and HPF. Generally, participants found their environments (physical and social) were challenging and hindered their ability to eat fewer HPF. Their social environment (such as whether family or friends consume HPF at home, school, and in their neighborhoods); and their physical environment (temptations offered by food

marketing and access/availability) were commonly discussed as challenges to eating fewer HPF.

Overcoming Challenges to Eating Fewer HPF. The most commonly discussed ways to overcome barriers associated with eating fewer HPF were those related to the application of self-regulation skills, demonstrating an ability to think critically to rationalize resistance to HPF, and implementing strategies to influence the salience of HPF, by either decreasing a stimulus or increasing the salience of the gain from resisting HPF.

Table 5.5 Themes and Illustrative Quotes from In-depth Interviews

Physical Outcome Expectations of Consuming HPF	
Theme	**Illustrative Quotes**
Physical Outcome Expectations	"I don't want to die because I have diabetes and when I think about this it's like, I get this, or shall I get this? Do I take these cookies or should I get this fruit? I don't know." "They showed us some videos and in one of the videos this girl was talking about how she used… how her family used to eat and they got diabetes and stuff. And I don't want diabetes." "[When I see phuds, I think] I don't want to get fat." "Because we watched a show [curricular video] about diabetes, lots of phuds [HPF] show up in diabetes and if you keep on eating them you will really get diabetes. That's what scared me."
The Environment and HPF	
Social norms	*"[What makes it hard to resist HPF] I think it's school. My friends…cuz, they eat it." – male* *"My dad [makes it hard to resist HPF]. By buying junk food from the supermarket, buying Doritos' and Lays and all that." – male* *"Because they [Classmates and friends] eat Phuds [HPF]." – female*
Marketing of HPF	*"Like if you […] just saw an advertisement for how they [HPF] taste so good and then you see an orange but they make the burger look so good and then it throws off the orange. It throws the orange off, the sandwich thing. I'll go with the sandwich."*
Neighborhood Access	*"Like whenever I go to the store I always see like, it's a whole aisle of phuds [HPF]. When you are like, I am trying my best to resist it but it's like something telling me to buy it, buy it, buy it." – male* *"It's easy for me to eat my rice and apples and pears and stuff because those are the things that in my house and then if we go out there's like pizza and salad and it's more hard for me. Because it's like pizza is good and salad is good, and you can't choose both." – female* *"It's just that I see a bunch of snacks and snacks and snacks!" – female*

Overcoming Challenges	
Self-regulation	*"I watch how much snacks I eat. Because like if it's like pizza, I would take like two slices instead of like four. I see how much it is and I am like, I decide the minimum size I can have." – female* *"I actually don't get them [HPF] all the time. I only get them once, like on Fridays." – female*
Critical thinking skills	*"I feel like I want to have it but I don't want to have it because I know what's in it and how it's made."* *"[Something she thinks about] How did they [food companies] just put them together and make it taste good? That makes it so tempting. So, it's just that we can buy it more."*
Decreasing Salience	*"Like, I don't know, like say I got cookies right here, or a chocolate or whatever, like if I get this and I am thinking of me in the future how I would look fat and if I get this bag of apples or whatever it's like I picture me like slim. So, I pick the one what I want to look like in the future." – female* *"Sometimes, when I really hungry, it's hard.. then I think, I'll get fat, or I just keep on walking [holds hand to cover eyes]. I think I could spend my money more wisely and drink water instead of soda and get … um.. like, sunflower seeds instead of chips."* *"Well, […], I could not look at the brand or not look at the picture because it encourages me… encourages me to eat it. And I know when I have a phud, I should get just a little. And sometimes, I just try to think about something else."* *"I keep… gain control over it. When I see chocolate, I just walk away from it." – female*

Supports for Eating W/MP Foods. Discussions about W/MP foods were generally positive. Participants discussed facilitators to eating fruits and vegetables such as adopted self-regulation skills and increased preferences for fruits and vegetables. Throughout the interviews, they discussed the support that they received from their parents/family members at home in the provision of fruits and vegetables and in the decision making process to incorporate them into their diets.

Table 5.6 Supports for Eating W/MP Foods

Theme	Illustrative Quote
Self-regulation Skills	*"I decided to make like a schedule at home, like what should I eat most of the time, so I should eat foods… more than phuds. So my mom helped and we made this chart and it showed me how much I ate … food than phuds. So we will always have to check to see if I am doing good because my mom wants me to, like be more healthier." – female* *"My schedule does [helps me eat W/MP foods], because you know, I tell to my mom about it so she said: yes and say it to help me more. In the beginning, like, there was like a chart with foods and phuds and like, we always had to color, like in*

	marker, to see how much foods I was eating so like, sometimes for snacks, I would always eat like fruits, because you know, they are like, we didn't really buy them much before. And I would always check my chart and I would open up a note and like for, today… of phuds I am like up to here [gesture of a small amount] and like for my fruits I am like up to there [gesture of a large amount], but like every single day I keep on going up and up and up, more fruit." – male
Preferences	*"My mom usually cooks something that's like with veggies.. she gives us a lot of like vegetables, and vegetables and curry. And before I used to say yuck, but now she says I'm eating them a lot now." – female* *"I eat more greens because I don't think that they are just going to taste nasty. So, I never ate them before but now I'm eating them… they taste better." – female* *We made a… so one time we made a salad and I think that was very good so and also we made a yoghurt, that was also good. So I was like, maybe eating healthy is, like good. - female*
Social Support/Modeling	*"I get real foods when I go shopping with my mom, where I can get anything I want. Cuz we used to eat a lot of phuds, like we'd get takeout or fried foods, a lot! And… we talk about things when we go to the grocery store, like when we look at the cereals and stuff. With my mom, I told her that we shouldn't have anything with sugar over… like over.. 15 um 15 grams or if it has a lot of like, weird ingredients in it. We usually get a lot of food, like fruits and vegetables, like oranges and broccoli."* - female *"Like when my mom goes food shopping I don't pick up a lot of snacks no more, I like to pick fruits and vegetables, not only vegetables, a lot of fruits."* - female "I eat a lot because when I told my mom about this program, she was like…she bought a lot of fruits and vegetables for the house." – female *"My mom and some of my friends [helps me eat W/MP foods]. Because basically I am always with my mom so she always tell[ing] me you've got to eat this and sometimes I say, I don't want to but she forces me to." - male*

5.4 DISCUSSION

5.4.1 Main Findings.

The aim of the IDOF curriculum is to improve eating behaviors by increasing intake of FV and decreasing intake of HPF. The current study is an initial evaluation of a larger curriculum development project. This study is not an efficacy trial and a control group was purposefully not selected in order allocate resources towards a richer understanding of the program's impacts through both qualitative and quantitative methods (Urban et al., 2014).

Behavioral Outcomes. Findings from this study demonstrate that youth participating in the IDOF curriculum increased their intake of fruits and vegetables from pretest to posttest with a large mean effect size (d=0.59; p=0.002). While a statistically significant change in HPF intake was not seen, a small mean effect size (d=0.34; p=0.064) in the direction hypothesized were revealed. These findings are based on changes in frequency of consumption per week and translate to approximate changes of 0.75 serving/day for FV and 1.8 servings/day for HPF. Research exists that demonstrates that dietary behavioral additions may be easier to implement than dietary behavioral subtractions which may have also contributed to the findings revealed in this study (Verplanken & Faes, 1999).

The obtained effect size for FV intake is comparable to other studies with children and adolescents in school-and-afterschool-based settings. A recent meta-analysis found that behaviorally-focused and theory-driven nutrition education programs generated medium combined effect sizes on FV intake (pooled effect size; g= 0.524) (Diep, Chen, Davies, Baranowski, & Baranowski, 2014). Of these studies, only two were delivered in out-of-school time and with middle-school aged adolescents. In a 9-week program with Boy Scout troops, short-term increases in fruit (d = 0.4; p=0.028) but not in vegetables (d = 0.02) were seen (Thompson et al., 2009); while larger effects were seen in a 12-week community-based afterschool program with African American girls (g=0.847; p=0.003) (Wilson et al., 2002) than compared to this study. In a slightly younger age group, Branscum and Kaye (2012) generated small effect sizes for FV intake (d=0.29) in a multi-site afterschool program.

At baseline, participants reportedly consumed fruits and vegetables only 0 to 1 time per week, which increased to approximately 3 to 4 times per week. Although these changes generated medium effect sizes, the magnitude of change is low in comparison to dietary recommendations which encourage consumption of 3 to 5 servings per day (United States Department of Agriculture, 2012) and baseline levels were extremely low. Other studies using the same instrument found middle-school aged minority youth in New York City (albeit of a different race/ethnicity composition) to consume fruit and vegetables approximately 3-4 times per week (Majumdar et al., 2013); and with a slightly younger age group to consumed FV 1-2 times per week (Abrams, 2014).

Psychosocial Determinants and HPF. Psychosocial determinants related to HPF intake (negative outcome expectations and self-efficacy for decreasing HPF) showed no statistically significant change from pretest to posttest. A ceiling effect was seen for negative outcome expectations associated with HPF (4.2 out of 5) demonstrating that participants were coming into the program with a high relative understanding of the connection between diet and disease. Some studies support these findings, showing that minority youth tend to be familiar with the negative outcomes associated with developing diabetes (Bandura, 2004; Mahajerin, Fras, Vanhecke, & Ledesma, 2008).

Findings from the in-depth interviews triangulate those from the pre-posttest by demonstrating that many participants have personal experiences with diet-related diseases, having ill family members and observing them managing or failing to manage diabetes and other health complications. Activities from the IDOF curriculum that focused on diabetes, and in particular trigger films presenting minority community members struggling with inequality as it relates to health, were particularly salient to

participants. Elements of this research suggest that messages surrounding diet-related diseases may resonate when community representation is an essential feature of the message. For instance when messages include relatable reflections of race and class experiences. Other research supportive of these findings suggests that adolescents are more likely to personalize health-related messages if they believe there are similarities between themselves and the program messaging (Cuijpers, 2002; Stephenson et al., 2004). Furthermore, Vangeepuram, Carmona, Arniella, Horowitz, and Burnet (2015) and Necheles et al. (2007) have demonstrated that urban minority youth are viewing health differences through an equity lens and feel that large community-based advocacy initiatives and changes to their neighborhood "foodscapes" are necessary to support dietary changes. This research highlights some of the difficulties that participants in this study express in making dietary changes. Although participants discussed the application of both critical thinking skills and self-regulation skills to help them decrease HPF intake, these may not be enough to compete with the realities of their physical and social environments - which are often "food product swamps."

Psychosocial Determinants and FV. Outcome expectations for FV ($d=0.45$; $p=0.016$) and self-efficacy ($d=0.47$, $p=0.013$) significantly increased from pre to posttest. Although self-regulation skills did not change, bivariate correlations revealed a moderate positive association between self-efficacy and self-regulation skills ($r=.514$; $p<0.01$). These findings are consistent with previous literature that indicates that these three mediators are typically associated (directly and indirectly) with changes in FV intake in children and adolescents. Self-efficacy has been shown to be a strong behavioral predictor for FV intake in school-based NE with adolescents (Bruening, Kubik, Kenyon,

Davey, & Story, 2010; McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009; Pearson, Ball, & Crawford, 2011) and is closely related to self-regulation (Bandura, 2004; Dewar, Lubans, Plotnikoff, & Morgan, 2012; Schnoll & Zimmerman, 2001).

Nystrom, Schmitz, Perry, Lytle, and Neumark-Sztainer (2005) demonstrated that self-regulation skills are positively associated with fruit and vegetable intake in adolescents; and coupled with an intervention that targeted self-efficacy and self-regulation skills, Schwarzer (2007) revealed sustained increases. The curriculum emphasized building both self-efficacy for FV intake through food tasting and preparation and self-regulation skills with the application and thematic reinforcement of actionable behavioral cues, given through Food Rules and written action plans.

While self-regulation skills did not quantitatively shift from pre to posttest, in-depth interviews and one-on-on assessments demonstrated that participants were applying self-regulation skills towards the target behaviors. For example, they reported keeping records of their intake of FV versus HPF with the support of their parents, a strategy that has also been identified in the literature to enhance health behavior change (Cullen, Baranowski, & Smith, 2001). They applied reward structures to increase intake of FV while limiting HPF (e.g. *"You can eat something that's unhealthy but once a week. Like if every day you eat fruits and vegetables, one day you can eat sugar snacks."*); and self-management strategies, such as actions to decrease portion sizes (*"I watch how much snacks I eat. Because like if it's like pizza, I would take like two slices instead of like four. I see how much it is and I am like, I decide the minimum size I can have").*

Food Rules. Participants demonstrated self-regulation skills through the operationalization of many of the Food Rules, though some more so than others. This study reveals that more conceptually accessible Food Rules were commonly described as strategies to achieve the target behaviors. For example, Break the rules once in a while; Make water your beverage of choice; Eat your colors; Choose smaller plates and cups were discussed in detail by participants across qualitative assessments. Whereas, those that required first a necessary understanding of terms or did not provide easily actionable or concrete meaning - Avoid products that make health claims; If it came from a plant eat. If it was made in a plant, don't – were not discussed and adopted by participants. Social psychological research of self-regulation reveals that the adoption of a new goal can be influenced by the level of specificity (e.g. how concrete versus abstract) or their motivational orientation (e.g. approach – "do this actions;" versus avoidance – "don't do this actions") which may have influenced why some Food Rules more than others resonated with the participants (Mann, De Ridder, & Fujita, 2013). Additionally, findings from the implementation analysis of this curriculum (reported elsewhere) indicate that the written action plan accompanying each lesson was a commonly omitted activity. This may indicate the thematic focus of a particular actionable food rule tied to curricular activities more than the act of writing down the action may have driven the adoption of these self-regulation strategies.

5.4.2 Strengths and Limitations.

A strength of this study was the application of an evaluation lifecycle approach by using qualitative research methods to accompany quantitative efforts to translate

outcomes of this brand new curriculum. Secondly, this intervention was conducted with an underserved minority youth population, where diet-related disease disparities are more prevalent. This study also followed a systematic approach to curriculum development and evaluation, allowing for program design and evaluation to be co-created.

These results are constrained by the small sample size and low statistical power, which may contribute to the lack of observed intervention effect for HPF and some of the psychosocial determinants. Also, by studying mean differences, regression to the mean biases may have been introduced. Behavior change is complex and at the time of posttest assessment (only one-to-two weeks following the completion of the curriculum) may not have actualized. Although the survey instrument was tested for validity and reliability, there is a methodological concern and potential for measurement error associated with the three-item scale measuring self-regulation skills. Other NE studies conducted using this instrument, generated similar pre and post-test values (Abrams, 2014). Furthermore, this study is limited by self-reported dietary intake data collection and for which social desirability was not accounted for. However, almost all dietary behavior studies with groups, whether school-aged or adults, use self-reports. Here comparisons are made pre and post intervention and between groups using the same method so that social desirability and validity issues are minimized. Still, the results need to be interpreted with caution.

5.4.3 Implication for Research and Practice.

Despite the small sample size, the findings of this study suggest a possible mechanism for change in FV intake (as related to positive outcome expectations, self-

efficacy, and self-regulation skills) that could be explored further and more vigorously through a mediation analysis with a larger sample. It also draws attention to the social and environmental temptations that exist in the food environments of minority youth that should also be addressed in the development of NE programs in order to better support dietary change. Lastly, self-regulation skills and the generation of action plans have been demonstrated across the literature to be helpful in encouraging dietary behavior change. The use of thematically-focused, conceptually accessible, and actionable "rules" or guidelines may be a promising approach to help students recall and enact self-regulation strategies and warrants further investigation in more controlled settings. While some of these findings are promising future research is needed to determine whether a causal link can be drawn and whether or not dietary changes persist over a longer period of time.

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CHAPTER 6: DISCUSSION

6.1 Main Findings of this Study.

This dissertation is a curriculum development project describing in detail the development and evaluation of the *In Defense of Food* Curriculum. The curriculum was developed for a middle-school aged audience and afterschool setting as the companion guide to the documentary film and book with the same name by Michael Pollan. The aim of the curriculum is to increase intake of whole/minimally processed foods and decrease intake of highly processed foods in youth.

Little information is available about planning effective nutrition education in afterschool settings. Therefore, this first study sought to examine the perspectives of teachers and afterschool program staff on the positive aspects and challenges of delivering a nutrition education curriculum in the afterschool setting. Important findings related to pedagogical elements necessary for creating a successful learning environment included: the importance of student-centered learning, applying scaffolding and differentiation strategies that are generative and engage learners of different types, and aligning curricular activities with the developmental needs of the cohort. In particular, it was important to ensure that the activities are fun and culturally relevant. Important findings related to practical considerations suggested that the logistics of the unique financial, space, and time demands of afterschool settings must also be considered.

The second study demonstrated how the application of the Nutrition Education DESIGN Procedure was used to develop the content of the curriculum. DESIGN is a stepwise process that

guides nutrition educators to develop theory-driven and behaviorally-focused educational lessons and materials that enhance motivation and facilitate the ability to change behavior. The behavioral outcome of eating more fruits and vegetables and fewer highly process foods was selected in Step 1. In Step 2, the determinants of behavior change were explored both through an investigation of the literature and through in-depth interviews with a convenient sample of middle-school aged youth. In Step 3, these determinants were mapped onto a theoretical model (the Social Cognitive Theory and Self-Determination Theory) which were then used to guide the development of general obejctives of the curriculum in Step 4. Lesson plans and activities are generated based on their close connections to theory determinants and sequenced according to instructional design principles in Step 5. In Step 6, an evaluation plan is also outlined linking program development with evaluation. The conceptual framework was based on Pollan's guidelines for healthful eating: Eat food (not food-like substances here called "phuds"); not too much; and mostly plants.

The third study is a mixed methods process evaluation that applied a previously developed comprehensive framework to measure components related to program implementation and reception. Findings from this study demonstrate that certain types of activities may be less suitable for the afterschool context; primarily those that involved in-class presentations and sharing of culminating projects, worksheets, or extension activities requiring participants to complete tasks outside of the classroom setting. However, youth were particularly engaged and interested in watching the film clips, in food tasting and preparation activities, and activities involving food marketing. A general learning curve as teachers gained mastery over the material may have also been observed, demonstrating greater difficulty surrounding the facilitation of activities at the beginning of each curricular theme and related to food tasting and preparation

activities. Implementation recommendations generated from this study point to the need for stronger professional development to not only support skills, but also foster greater teacher motivation for the curricular message.

Lastly, study four investigated the impact of the curriculum both quantitatively and qualitatively on the behaviors and psychosocial determinants targeted in the development of the curriculum. Favorable findings for fruit and vegetable intake were seen but not for highly processed foods. Even though participants recognized the health implications of poor dietary choices, social and environmental impediments may have been too large to overcome. Participants widely applied self-regulation skills learned in the program and especially those related to cognitively accessible and actionable sound bites created by Pollan, called *Food Rules*, that were provided in each lesson.

6.2 Lessons Learned from Assessment to Outcome.

The present study describes the development of a curriculum from the origin of the idea, to the design, training, implementation, and finally outcomes, from root to fruit. In doing so, it presents a detailed and practical account of the process from a single continuity of understanding that generated an ability to see connections across each phase providing recommendations for program bridging pedagogical suggestions to practice, inclusions and exclusion of curricular materials, and ideas for expanding the program.

In the initial assessment phase, afterschool program staff and teachers emphasized the inclusions of activities that were action-oriented, hands-on and participatory, and veered from the traditional didactic model seen in academic settings. Implementation fidelity and extent (% completion) data from the process evaluation reinforce these findings demonstrating that

individual worksheets, that required students to sit at their desks and work independently were commonly omitted or delayed from the curriculum and likely misalign with afterschool tenants of active learning and building personal and social skills with engaging activities (Durlak, Weissberg, & Pachan, 2010; Pierce, Auger, & Vandell, 2013; Shernoff, 2010). Field notes generated from this study indicate that teachers often delayed or omitted these worksheets in an effort to regain classroom order and in response to student exasperation with the amount of written work being asked of them. The process evaluation of the *Gimme 5* program similarly found that goal setting worksheet activities were amongst the lowest proportion of activities to be completed (Davis et al., 2000). A recommendation derived from this research is to minimize the number of worksheets used in this setting.

In this study, a proportion of the worksheet activities were specifically focused on goal setting/self-regulation skills. Given the importance of goal setting/self-regulation skills in predicting diet-related behavior change (Kreausukon, Gellert, Lippke, & Schwarzer, 2012; Nystrom, Schmitz, Perry, Lytle, & Neumark-Sztainer, 2005) finding creative and alternative ways of operationalizing goal-setting/self-regulation skills, may be necessary for an afterschool context. Other researchers have successfully used digital software (Moeller, Theiler, & Wu, 2012) or mobile and web applications (Lyles, Amresh, Huberty, Todd, & Lee, 2017), or applied group goal setting plans (Annesi, Westcott, Faigenbaum, & Unruh, 2005; Ory, Jordan, & Bazzarre, 2002) that may align better with the afterschool tenants of building relationships and social skills.

Although goal setting/self-regulation skills did not change quantitatively from pre to posttest, in-depth interviews and one-on-on assessments in the outcome evaluation demonstrated that participants were applying self-regulation skills towards the target behaviors. For example,

they reported keeping records of their intake of FV versus HPF with the support of their parents, a strategy that has also been identified in the literature to enhance health behavior change (Cullen, Baranowski, & Smith, 2001). They applied reward structures to increase intake of FV while limiting HPF (e.g. *"You can eat something that's unhealthy but once a week. Like if every day you eat fruits and vegetables, one day you can eat sugar snacks."*); and self-management strategies, such as actions to decrease portion sizes (*"I watch how much snacks I eat. Because like if it's like pizza, I would take like two slices instead of like four. I see how much it is and I am like, I decide the minimum size I can have").* In particular, youth demonstrated goal setting/self-regulation skills through the operationalization of many of the Food Rules, though some more than others. The application of Food Rules in this study may reveal that more conceptually accessible rules can be applied to achieve target behaviors and that the thematic focus of a particular actionable food rule tied to curricular activities, more than the act of writing down an action, might have driven adoption of the self-regulation strategies demonstrated by youth in this study. These findings suggest that in addition to finding alternative ways to operationalize goal setting in an afterschool context, program developers may also consider thematically tying actionable and conceptually accessible food rules to their lessons.

Another connection found across phases of this study was the importance of culturally-relevant material, as first discussed by participants in the initial assessment study as essential to a successful afterschool program. Findings from Step two of the DESIGN procedure, the needs assessment and literature review, revealed cultural beliefs, values, and norms generated from the target audience that were integrated into the development of the curriculum. These included the importance of being good at sports and their admiration of athletes, which were incorporated primarily into marketing activities generated in the curriculum. The importance of cultural

relevance was reinforced in findings from in-depth interviews with youth in the outcome evaluation and from field notes related to student engagement in the process evaluation.

Activities from the IDOF curriculum that focused on diabetes, and in particular trigger films presenting minority community members struggling with inequality as it relates to health, were particularly salient to youth and were referenced throughout the in-depth interviews, exemplified in these quotes.

"They showed us some videos and in one of the videos this girl was talking about how she used… how her family used to eat and they got diabetes and stuff. And I don't want diabetes;"

"Because we watched a show [curricular video] about diabetes, lots of phuds [HPF] show up in diabetes and if you keep on eating them you will really get diabetes. That's what scared me."

Field notes analyzed in the process evaluation demonstrated that a high frequency of positive experiences occurred with film clips and film clip discussions, again, specifically for those demonstrating similar race and class experiences, and with marketing activities.

All students were interested in answering the film questions. They asked if the clip could be played again – Observer 1

These connections across phases of this study suggests that messages surrounding diet-related diseases may resonate when community representation is an essential feature of the message as in when messages include relatable reflections of race and class experiences. Other research suggests that adolescents may be more likely to personalize health-related messages if they see similarities between themselves and the program messaging (Cuijpers, 2002; Stephenson et al., 2004). Therefore, recommendations derived from these connections and other

literature suggest matching study content to observable characteristics of the target audience, thereby ensuring minority representation in film clips and other media are predominate features (Conn, Chan, Banks, Ruppar, & Scharff, 2014; Resnicow, Baranowski, Ahluwalia, & Braithwaite, 1998).

Youth expressed that their physical and social environments were challenging in decreasing intake of HPF. Field notes collected for each classroom and site in the process evaluation may have contributed to these feelings and speak to the need for more comprehensive and expansive programs that incorporate physical and social supports.

Generally, participants found their environments (physical and social) were challenging and hindered their ability to eat fewer HPF. Their social environment (such as whether family or friends consume HPF at home, school, and in their neighborhoods); and their physical environment (temptations offered by food marketing and access/availability) were commonly discussed as challenges to eating fewer HPF. Field notes taken in the process evaluation imply that facilitator and site differences may have also exacerbated these challenges. Site 1, had a snack program that offered fresh fruit, the teacher was highly motivated and modelled positive behaviors as demonstrated by the field notes and process measures. Students in Class 1 also generated the largest and most positive changes in dietary intake and psychosocial behaviors. Conversely, Site 2 had a tuck shop that offered highly processed foods. Class 3 (within Site 2) was facilitated by a teacher that demonstrated social modelling for HPF, and was generally less engaged in the materials. Class 3 also demonstrated the smallest change in dietary intake for FV and increased their intake of HPF. Although, these are qualitative connections, and statistical analyses linking process to outcome have not been made, they may point to the importance of ensuring a culture of health can be generated to support curricular messaging.

Many health-promotion interventions to date have adopted the social ecological model or other systems-based approaches to incorporate familial, school-based, and/or community-wide support to bolster the messages of settings-based health promotion programs with youth (Elder et al., 2007; Robinson, 2008). Vangeepuram, Carmona, Arniella, Horowitz, and Burnet (2015) and Necheles et al. (2007) have demonstrated that urban minority youth are viewing health differences through an equity lens and feel that large community-based advocacy initiatives and changes to their neighborhood "foodscapes" are necessary to support dietary changes.

Although it was beyond the scope of this particular project to generate and measure family, site, or community-level material and change, extensions of this work may be helpful to generate more positive outcomes. However, recommendations for curriculum including improving teacher buy-in and site buy-in by supporting target behaviors in class and similarily generating site-wide policies that shape the foods offered at each site.

6.2 Implications of the Present Research.

This curriculum is unique in that it was conceived to counter a prevailing narrative in nutrition science and food marketing that we can actively reduce risks or ailments by consuming (or refraining from) a single certain ingredient or product (such as a vitamin or dietary fat). In alignment with Michael Pollan's pedagogy, this study shifts the focus towards a whole-diet approach based on familiar qualitative distinctions such as whether something is highly-processed versus whole.

Although people interpret healthy eating in complex and diverse ways, this study demonstrates that this binary qualitative distinction was easily understood by youth. They generated meaning for whole/minimally processed foods that were distinct from highly

processed foods, and applied critical thinking skills related to these distinct meanings to help them achieve target behaviors. For example, in reference to HPF, one participant said *"I feel like I want to have it[HPF] but I don't want to have it because I know what's in it and how it's made."* A qualitative review study exploring how people interpret healthy eating found that across cohort, people were categorizing foods according to their definitions of health (Falk, Bisogni, & Sobal, 2000), using dichotomous categories such as "good food" versus "bad food" (Bisogni, Jastran, Seligson, & Thompson, 2012). In a study with pre-adolescents, factor analysis of dietary behavior data found that they were similarly conceptualizing behaviors related to consuming fast food, processed packaged snacks, and sugar sweetened beverages collectively as unhealthy behaviors rather than distinct behaviors (Burgermaster, Gray, Tipton, Contento, & Koch, 2016). Some research shows that categorization is a cognitive process that helps people store and retrieve information about food and eating, and therefore acts in a way to simplify information and decision making which might be at play here (Blake, Bisogni, Sobal, Devine, & Jastran, 2007; Furst, Connors, Sobal, Bisogni, & Falk, 2000).

A great deal of research emphasizes the importance of greater familial and community support in youth-based nutrition programs. The findings from this study support the existing evidence for its importance. In this study, parents, particularly mothers, may have been involved in providing social support for healthy behaviors. In in-depth interviews in the outcome evaluation, youth described the role that their parents played in assisting them with applying self-regulation skills and in the purchase and provision of healthier foods at home, supportive actions that have also been well documented in the literature (Gustafson & Rhodes, 2006; te Velde et al., 2014). The transmission of support appeared to be bidirectional, in that youth indicated that they were also responsible for the transmission of health-related messaging from the IDOF curriculum

to their family members, especially to those with existing diet-related diseases. Some research exists that demonstrates differences in health discourse associated with income and race. For example, in interviews with families (20 high income and 20 low income) to examine lay knowledge about food and health, Coveney (2005) found that low-income parents were more likely to discuss food and health as it related to qualitative distinctions, such as appearance and function, whereas high-income families were more likely to use the technical language that is associated with contemporary nutrition science discourse. If expanding or incorporating family supports of nutrition education materials, taking a whole diet perspective and one based on qualitative, rather than quantitative distinctions may also be appropriate.

6.3 Strengths and Limitations.

Literature surrounding health promotion programs with adolescents often conclude a high degree of heterogeneity and a lack of systematic approaches to assess differences in target groups. A strength of this study is the application of comprehensive and systematic frameworks for both the development and implementation of the curriculum. In doing so, this study contributes to the cumulative and comparable science being generated around setting-based nutrition education program development and evaluation. Another key strength of this study is the consideration for evaluation requirements in the planning phases.

Limitations of this study include the small sample sizes of three classrooms and 32 adolescents. Another limitation of this study is attached to the time and resources associated with making a product in an evolving discipline.

This study is based on the experience of one curriculum development project, involving three years of research and development, and resulting in a comprehensive, 10-session

afterschool curriculum. IDOF is now on offer nationally and free in the educational market. The information gained, is particularly relevant to developing other curriculum interventions in settings involving children and adolescents, that are intended to change nutrition behavior. In particular, its emphasis on shifting the narrative of current health discourse from focusing on individual nutrients to incorporating more holistic and accessible messaging can provide a model for development of other curricula that are responsive to the increasing emphasis on eating patterns that are both health-promoting and environmentally sustainable.

6.4 Conclusions.

This curriculum is the first to explicitly challenge nutrition reductionism and focuses effort on alternative approaches to nutrition dissemination, thereby adding to the current growing social food movement and will hopefully inspire a greater shift in focus from part-to-whole.

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APPENDIX A: ARTICLE 1 SUPPLEMENTAL MATERIALS

A.1 Semi-Structured Interview Protocol for Afterschool Program Staff and Teachers
*Generic probes (e.g. "Can you tell me more about that?" and "I think what I heard you say is…is that what you meant?" and "Would you give me an example of a time when that happened?") will be employed whenever necessary to attain additional detail from participants beyond the specific probes provided with each question.

Introduction: Hi _____, my name is Hiershenee Bhana. I am a doctoral student and researcher at Teachers College Columbia University. I am developing an afterschool nutrition curriculum for middle school students. I'm doing some research to try to determine what will help this program to be effectively implemented in middle school afterschool programs.

You signed a consent form, which I have, and you have an assent form as well. I just want to check with you one more time to make sure it is okay that I record our interview. When I type up our conversation, I will change your real name, so your privacy will be protected. No one will know your name or which responses were your responses when they read or hear about this research project. What pseudonym, fake name, would you like to use?

Do you have any questions about the recording or your privacy? During this interview, I want you to remember that there are no right or wrong answers! Your real, honest stories and opinions will help me, teachers, professors, and researchers to improve the nutrition programs that we bring to organizations like yours. Do you have any questions before we begin? Now I will start the recording.

Definition of Terms: When I say nutrition programs, what does that mean to you?
Background: Tell me about your role at _____. What experience have you had with nutrition programs at your site?

Core Questions	**Probes**
1.What are the positive aspects of afterschool programs? Nutrition-related programs? What are challenges for after school programs?	What are strengths of afterschool programs? What do you think are weaknesses of afterschool programs? What types of considerations do you make when deciding to adopt a new curriculum? When would you reject an afterschool curriculum? What are the most common issues you have with curricula?
2.What are the resources (time, money, manpower) that influence an afterschool program?	What resource considerations do you feel are important in using a curriculum for afterschool programs? Which resource requirements would preclude you from adoption a curriculum? Describe a typical afterschool program.
3.What aspects are important to you in a good quality curriculum?	What suggestions would you give a curriculum developer for afterschool programs? For middle-school aged children? Describe an activity that has been/would be successful for afterschool programs with middle-school age children? In which ways was this successful? In which ways could it be improved?

APPENDIX B: ARTICLE 2 SUPPLEMENTAL MATERIALS

B.1 Semi-structured Interview Protocol

*Generic probes (e.g. "Can you tell me more about that?" and "I think what I heard you say is…is that what you meant?" and "Would you give me an example of a time when that happened?") will be employed whenever necessary to attain additional detail from participants beyond the specific probes provided with each question.

Introduction:

Hi _____, my name is [interviewer name]. I am a doctoral student and researcher at Teachers College Columbia University. I am developing an afterschool nutrition curriculum for middle school students, like you. I'm doing some research to try to find out more about the foods that middle-school students eat.

Your _____(mom/dad/guardian) said that I could talk to you. I just want to check with you to make sure it is okay that I speak with you about foods that you eat. I will record our interview. No one else but me will hear the recording. When I type up what I learn from our conversation, I will change your real name, so your privacy will be protected. No one will know your name or which responses were your responses when they read or hear about this research project. Do you have any questions about the recording or your privacy? Now I will start the recording.

During this interview I want you to remember that there are no right or wrong answers! Your real, honest stories and opinions will help me, teachers, professors, and researchers to improve the programs for other middle school students, like you. Do you have any questions before we begin?

How old are you? _____
What grade are you in? _____
What is your gender? _____

Defining Terms:

What is food? What are examples of healthy foods?

What is processed food?

What is junk food?

How are healthy food, processed food, and junk food related? (What makes them different?)

Fruits and Vegetables

1. What are your thoughts and feelings about eating fruits and vegetables? (Probe: like/dislike)
2. What would motivate you to eat them?
3. What are the benefits of eating them?

Strategies to Employ:

4. What makes it easy for you to eat them?
5. What makes it hard to eat fruits and vegetables? (Probe: confident to do so?)

6. Another middle schooler, like you, said that she struggles to eat fruits and vegetables, can you give her any advice on how to eat more of them?
5. What do you know about setting goals when it comes to food? How would you set goals for eating fruits and vegetables?

APPENDIX C: ARTICLE 3 SUPPLEMENTAL MATERIALS

C.1 Process Measures

Process data were collected for all three classrooms throughout the intervention. Both quantitative and qualitative data were collected as part of the process evaluation.

Figure C. 1 **Classroom Observation Form.**

Teachers College Columbia University ***In Defense of Food*** **Lesson Feedback Form**

Eat Food. Lesson 2: Chemical Cuisine		Observer			
Date	/ /	Start time		End time	
School		Class		Teacher	

What do you think the students really got from this lesson? Aim: To increase awareness of the benefits of eating more foods and minimizing phooods.

			√	**Notes** (e.g. choices about what to shorten/omit)
Curriculum Fidelity __ Altered sequence __ Omitted materials __ Inserted materials __ Delay of material *Fidelitys Score* = _____ (5 - number of checks on the list) *Will continue with this lesson next class?* Yes ___ / No ___		1. Cookie Relay Race		
		2. Compare Cookie Ingredients to Phoood Cookie		
		3. Spot the Phoood Gallery Walk		
		4. Learn the Food Rule		
		5. Fruit chew tasting		
		6. IDOF Film Clip		
		7. Review Key Points – Onion ball		

Student engagement __Uninterested (1) __Few/Some involved (2) __Most/All actively involved (3)	Describe specific situations to explain your choice.
Classroom Management __Major problems (1) __Minor problems (2) __No problems (3)	Describe specific situations to explain your choice.
Teacher attitude/motivation __Negative (1) __Neutral (2) __Positive (3)	Describe specific situations to explain your choice.
	Make additional notes here (and on back of sheet):

*Revised 9/14/15. Tested for validity and reliability in previous research studies (Contento et al. JADA, 2010).

Figure C. 2 **Student Exit Ticket.**

Teachers College Columbia University ***IDOF* Student Exit Ticket**

Eat Food - Lesson 2: Chemical Cuisine	
Date	/ / 2015
Site/Class	

Mark a check (✓) in the box to tell us how much you liked or didn't like each activity.

	Didn't like it at all	**Didn't like it**	**Neutral**	**Liked it**	**Liked it very much**
1. **Chocolate Chip Cookie Relay Race** The opening activity where you learned about cookie ingredients.					
2. **Looking at Chips Ahoy Ingredient List** The activity where you reviewed the ingredient lists in a Chips Ahoy Cookie.					
3. **Guess the Food by Looking at Ingredient Lists** The activity where you looked at ingredient lists and put your guesses into an envelope.					
4. **Learn a Food Rule** The activity where you learned a food rule to help you choose foods over phuds.					
5. **Taste Starburst after Drinking the Tea** The activity where you tasted starburst candy after drinking the tea.					
6. **The Film Clip** Watching the film clip.					
7. **Throwing the Onion ball** Throwing the paper ball around and peeling off a layer to answer questions about the lesson.					

Mark a check (✓) in the box to tell us how much you liked or didn't like today's lesson.

	Didn't like it at all	**Didn't like it**	**Neutral**	**Liked it**	**Liked it very much**
8. **Overall, how much did you like lesson 2?**					

Lesson 2: Unique ID: _____

APPENDIX D: ARTICLE 4 SUPPLEMENTAL MATERIALS

D.1 Outcome Measures for IDOF

D.1 1 Modified FHC-Q (mFHC-Q) Instrument Codebook.

Target population: 6th – 8th grade students
Constructs: Increase intake of Whole/Minimally Processed and Decrease intake of Highly Processed Food Intake

Behaviors

1. Consume more fruits and vegetables (FV)
2. Consume less highly processed foods (HPF)

Psychosocial Determinants

Behavior-specific

1. Goal Intention (FV & HPF)
2. Outcome expectations
    a. Negative outcome expectations (HPF)
    b. Positive outcome expectations (FV)
3. Self-efficacy (FV & HPF)
4. Expectancies (HPF)

General (not behavior-specific)

5. Goal-setting skills
6. Autonomous motivation

Behavior	**Number of Questions**
Behavior: Frequency of Fruits & Vegetables (FV)	8
Behavior: Frequency of Highly Processed Packaged Foods (HPF)	8
Mediator	
Goal Intention (behavior specific)	
• FV	1
• HPF	3
Negative Outcome expectations (behavior specific)	
• FV	3
• HPF	4
Self-efficacy (behavior specific)	
• FV	4
• HPF	5
Expectancies/attitudes (behavior specific)	
• HPF	4
Goal setting skills (general)	
• Healthy eating	3
• Autonomous Motivation (general)	3
Demographics (gender, race, age)	3
Total Collected	**49**
Total Included in Analysis	**40**

Coding: All mediator items are coded so the more desirable responses are the higher options.

I. FV Behavior

1.0 Frequency of eating FV

Stem: In the past week, I ate

Response options: 0 times, about 1-2 times, about 3-4 times, almost every day, 2 or more times every day

1.0.1 Frequency of fruits consumed by middle school children

Q1. apples [INTAKE_APPLES; T2INTAKE_APPLES]

Q2. grapes [INTAKE_GRAPES; T2INTAKE_GRAPES]

Q3. oranges [INTAKE_ORANGES; T2INTAKE_ORANGES]

Q4. bananas [INTAKE_BANANAS; T2INTAKE_BANANAS]

1.0.2 Frequency of vegetables consumed by middle school children

Q5. broccoli [INTAKE_BROCCOLI; T2 INTAKE_BROCCOLI]

Q6. farrots [INTAKE_CARROTS; T2 INTAKE_CARROTS]

Q7. dark green leafy vegetables [INTAKE_D.GREEN]

Q8. tomatoes [INTAKE_TOMATOES]

8 items (0.792)

II. HPF behavior

2.0 Frequency of consuming HPF

Stem: In the past week, I drank/ate…

Response options: 0 times, about 1-2 times, about 3-4 times, almost every day, 2 or more times every day

Q9. fruit drinks & sweetened iced teas (such as Snapple, Capri Sun, Kool-Aid, or Arizona) [INTAKE_ FRDRINK]

Q10. soda (such as Coke Pepsi, 7-Up, Sprite, or root beer) [INTAKE_ SODA]

Q11. sports drinks (such as Gatorade or PowerAde) [INTAKE_ SPDRINK]

Q12. flavored waters (such as Propel or Vitamin Water) [INTAKE_ FLWATER]

Q13. potato chips, tortilla chips, corn chips and puffs (such as Ruffles, Lay's, Pringles, Doritos, Fritos, or Cheetos) [INTAKE_SALTSNACKS]

Q14. candies (such as chocolate, candy bars, jelly bellies, gummies, or Lifesavers) [INTAKE_CANDY]

Q15. cookies, brownies, pies, or cakes [INTAKE_COOKIEPIE]

Q16. fast food (such as burgers, pizza, French fries, fried chicken, or tacos) [INTAKE_FASTFOOD]

8 items (0.890)

III. Goal Intention

3.0 Goal Intention for FV

Given the intervention, students will be able to express their intention to change their own fruit and vegetable behaviors.

Stem: I would like to …

Response options: Not at all true for me, not true for me, neither true or not true, somewhat true for me, very true for me

~~Q17. Eat more fruits and vegetables [BEHINT_FV]~~ (mechanical error)

1 item

3.1 Goal Intention for HPF

Given the intervention, students will be able to express their intentions to change their own HPF behaviors.

Stem: I would like to …

Response options: Not at all true for me, not true for me, neither true or not true, somewhat true for me, very true for me

~~Q18. drink fewer sweetened beverages [BEHINT_SSB]~~ (22% missing data at posttest)

~~Q19. eat fewer packaged snacks [BEHINT_PPS]~~ (22% missing data at posttest)

~~Q20. eat fewer fast foods [BEHINT_FF]~~

3 items (0.837)

IV. Outcome expectations

4.0 Positive outcome expectations of FV

Given the intervention, students will be able to express their beliefs about eating fruits and vegetables.

Stem: Eating fruits and vegetables…

Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me

Q21. helps me do well at school. [OUTEX1_FV]

Q22. helps my body do what I want it to do. [OUTEX2_FV]

Q23. makes me feel good about myself. [OUTEX3_FV]

3 items (0.849)

4.1 Negative outcome expectations of HPF

Given the intervention, students will be able to express their beliefs about eating HPF.

Stem: Drinking lots of sweetened beverages such as fruit drinks, ice-teas, sodas, and sports drinks…

Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me

Q24**. [R]** contributes to our developing diabetes. [OUTEX3_SSB]

Q25. **[R]** contributes to weight gain. [OUTEX4_SSB]

Stem: Eating lots of packaged snacks such a -s chips, candy, and cookies…

Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me

Q26**. [R]** contributes to our developing diabetes. [OUTEX2_PPS]

Q27. **[R]** contributes to weight gain. [OUTEX3_PPS]

4 items (0.785)

4.1 Attitudes – Outcome Expectations of HPF

Given the intervention, student will be able to express negative attitudes towards eating HPF.

Stem: Drinking lots of sweetened beverages such as fruit drinks, ice-teas, sodas, and sports drinks…

Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me

~~Q28. **[R]** is cool [OUTEX6_SSBCOOL]~~

~~Q29. **[R]** is important to me [OUTEX7_SSBIMPORT]~~

Stem: Eating lots of packaged snacks such as chips, candy, cookie, and popsicles …

Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me

~~Q30. **[R]** is cool [OUTEX5_PPSCOOL]~~ mechanical error (33% missing data)

~~Q31. **[R]** is important to me [OUTEX6_PPSIMPORT]~~ mechanical error (33% missing data)

4 items (T1 0.474; T2 0.791)

V. Self-efficacy

5.0 Self-efficacy of eating FV

Given the intervention, student will be able to describe how sure they are that they can eat FV.

Stem: I am sure I can…

Response options: Not at all sure, a little sure, neutral, sure, very sure

Q32. eat fruits at school lunch [SELEFF2_FRLUNCH]

Q33. eat vegetables at school lunch [SELEFF3_VEGLUNCH]

Q34. eat vegetables at dinner [SELEFF4_VEGDIN]

Q35. eat fruits and vegetables for snacks [SELEFF4_F&VSNACK]

4 items (0.772)

5.1 Self-efficacy of avoiding HPF and choosing smaller sizes.

Given the intervention programs, students will be able to describe how sure they are that they can avoid HPF.

Stem: I am sure I can…

Response options: Not at all sure, a little sure, neutral, sure, very sure

Q36. drink fewer sweetened beverages after school [SELEFF1_SSB]

Q37. bring fewer sweetened beverages to school. [SELEFF2_SSB]

Q38. eat fewer processed packaged snacks at home. [SELEFF4_PPS]

Q39. bring fewer processed packaged snacks to school. [SELEFF5_PPS]

Q40. eat fewer packaged snacks when I'm with my friends [SELEFF6_PPS]

5 items (0.854)

VI. Goal setting skills

6.0 Goal Setting Skills (general)

Given the intervention programs, students will be able to set goals and follow through with them.

Stem: I believe that…

Response options: Not at all sure, a little sure, neutral, sure, very sure

Q41. I can set a goal for healthy eating. [GOSTR1_F&V]

Q42. When I have a goal I can follow through with it pretty well. [GOSTR2_F&V]

Q43. I know how to keep track of my food intake. [GOSTR3_F&V]

3 items (0.716)

VII. Autonomous Motivation

7.0 Autonomous motivation to eating healthy foods

Given the intervention programs, students will be able to express their autonomy in eating healthy foods.

Stem: the reason I would eat healthy foods is because…

Response options: Not at all true for me, not true for me, neutral, somewhat true for me, very true for me

Q44. It fits in with what I want to do with my life. [AUTMOT1_HEALTHY]

Q45. I personally believe it is the best thing for my health. [AUTMOT2_HEALTHY]

Q46. It is an important choice I really want to make. AUTMOT3_HEALTHY

3 items (0.864)

VIII. Demographics

8.0 Gender

Q47. Are you a boy or girl? [Response options: boy, girl]

8.1 Race

Q48. What is your race? [Response options: Hispanic or Latino, Black or African American, White, Asian, American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, I don't know]

9.2 Age

~~Q49. How old are you? [Response option: 9, 10, 11, 12]~~

IX. Social desirability scale

9.0 Students will either choose the socially desirable answer

Stem: When I think about myself and my daily routine, I…

Response options: Yes, no [socially desirable response=1]

Q46. always wash my hands before every meal. [Yes=1, No=0] [SD1_HANDS]

Q47. always brush my teeth after each meal. [Yes=1, No=0] [SD2_TEETH]

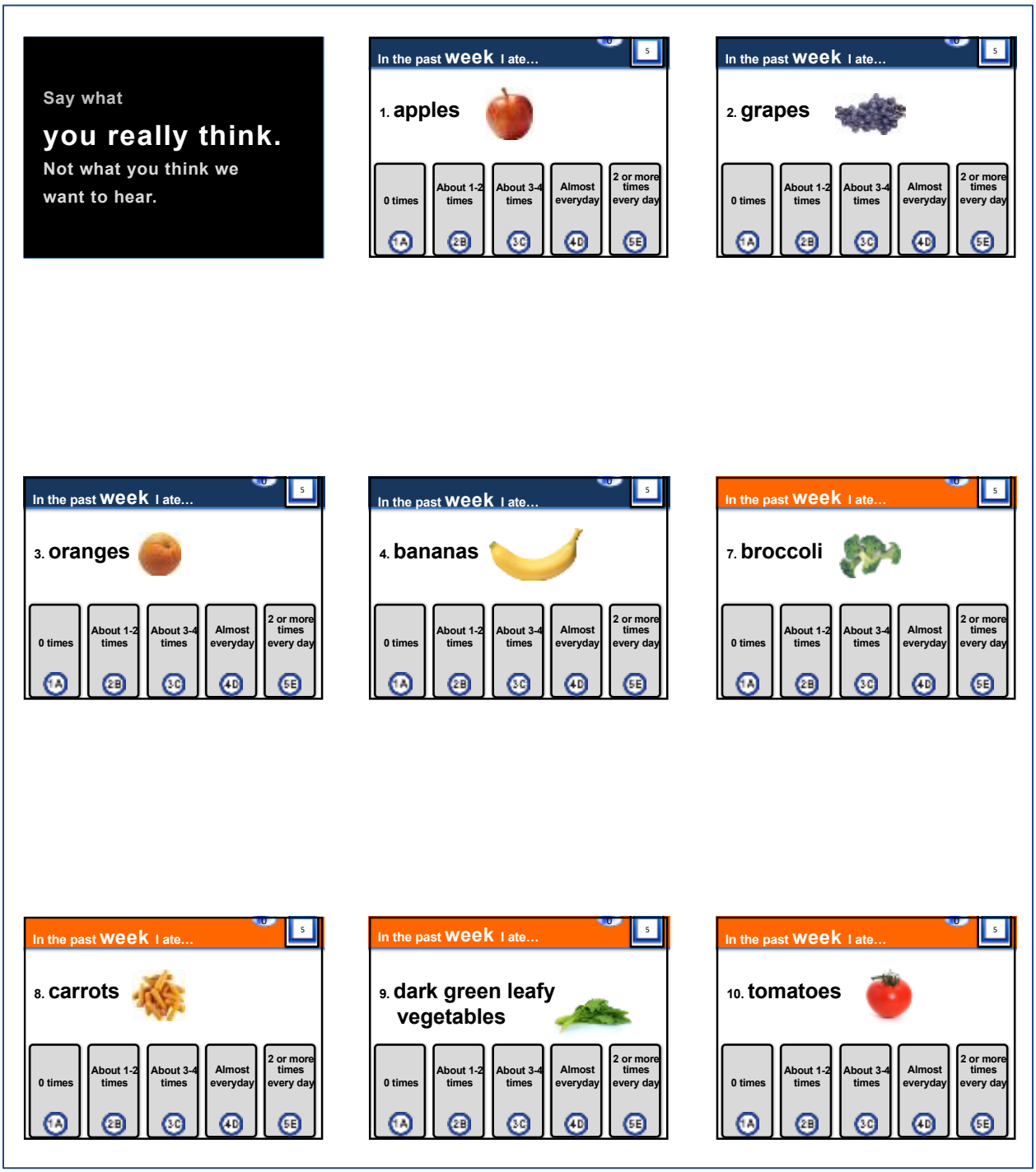
Q48. am always polite, even to people who are not very nice. [Yes=1, No=0] [SD3_POLITE]

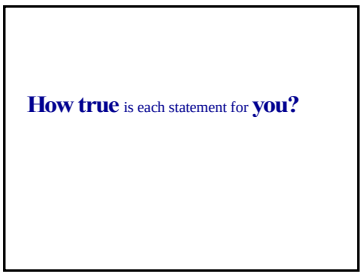
Q49. always listen to my parents. [Yes=1, No=0] [SD5_PARENTS]

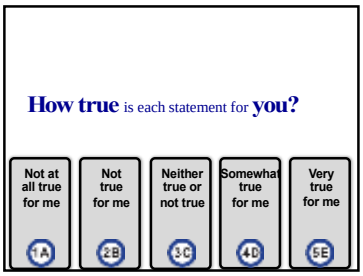
Q50. always do the right things. [Yes=1, No=0] [SD7_RIGHTTHING]

Q51. sometimes feel angry when I don't get my way. [Yes=0, No=1] [SD8_ANGRY]

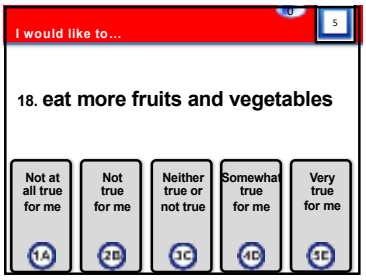
Figure D.1 mFHC-Q Instrument

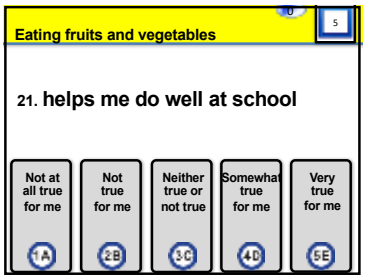


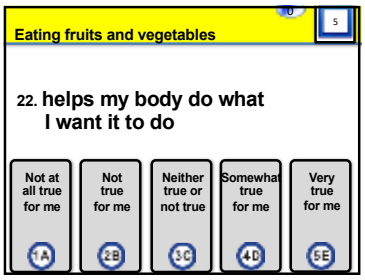

How true is each statement for you?

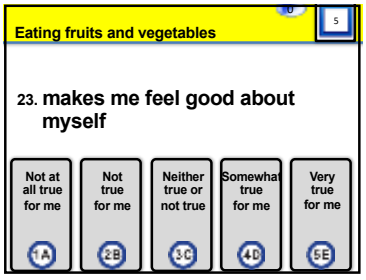

How true is each statement for you?
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E

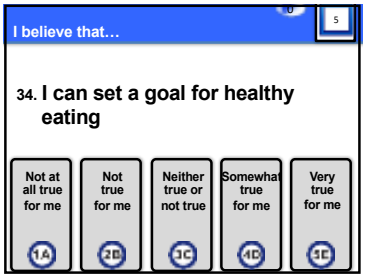

Say what
you really think.
Not what you think we want to hear.


I would like to…
18. eat more fruits and vegetables
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E


Eating fruits and vegetables
21. helps me do well at school
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E


Eating fruits and vegetables
22. helps my body do what I want it to do
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E


Eating fruits and vegetables
23. makes me feel good about myself
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E


I believe that…
34. I can set a goal for healthy eating
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E


I believe that…
35. when I have a goal I can follow through with it pretty well
Not at all true for me
1A
Not true for me
2B
Neither true or not true
3C
Somewhat true for me
4D
Very true for me
5E

D.1.2 Food Rules Artifacts Cards.
These cards were presented to the students (n=22) to assess their knowledge related to the food rules presented in each lesson.

Figure D. 2 Food Rules Artifact Cards

Lesson 1 **Eat food you can picture growing in nature.**
Lesson 2: **Eat food with ingredients that a third grader could pronounce.**
Lesson 3: **Avoid products that make health claims.**
Lesson 4: **Avoid foods you see advertised on television.**
Lesson 5: **Choose smaller plates and glasses.**
Lesson 6: **Make water your beverage of choice.**
Lesson 6: **Sweeten and salt your food yourself.**
Lesson 7: **If it came from a plant, eat it. If it was made in a plant, don't.**
Lesson 8:

Eat your colors.
Lesson 9: **Eat more like the French.**
Lesson 10: **Break the Rules once in a While.**

D.1.3 Food Rules Knowledge Assessment Rubric.
This coding rubric was used to generate scores for the Food Rules Assessment (n=22).

Table D. 1 Food Rules Coding Rubric

Food Rule:	**3 points** Student is able to provide meaning of the food rule correctly and provides at least one example of how to use the rule.	**2 points** Student is able to partially provide meaning or is able to provide a cogent example.	**1 point** Student is unable to provide meaning accurately and gives no examples of how to use the rule.
1. Eat food you can picture growing in nature.	- knows foods grow in nature (from trees, from the ground, on a farm) (e.g. apples, pears) and are good for you; - knows phuds don't grow in nature and are bad for you	- relates to the environment however without explicitly indicating its origin from nature; relates to eating healthy; relates to eating fruits and vegetables, or can provide examples of other "foods from nature" but doesn't connect any of these three together.	- is unable to recall examples of "foods from nature," or what that type of food is.
2. Eat food with ingredients that a third grader could pronounce.	- know that healthy foods should be made up of things that are commonly considered and pronounceable and gives examples (like eggs, fruits, chicken); - knows that foods with long and often ingredients that are unpronounceable are not healthy (e.g. HFC, or ingredients that sound like chemicals)	- names examples of unhealthy foods but can't explain what aspects (the long and unpronounceable ingredients) make them unhealthy. - provides incorrect examples (e.g. fried chicken)	- is unable to provide meaning.
3. Avoid products that make health claims.	- knows that food packages list nutrients and health claims that are persuasive but not necessarily healthy; - provides examples of specific claims (e.g. low fat; low calorie) - provides examples of products discussed in lesson (e.g. Frosted Flakes, Pop-tarts).	- incorrectly recalls a type of claim; - doesn't make a connection to phuds	
4. Avoid foods you see advertised on television.	- knows the types of foods advertised on TV as those that convince you to eat them but are unhealthy - can provide an example (e.g. Frosted Flakes, fast food, chips)	- can list types of foods but doesn't link to advertisements or marketing;	
5. Choose smaller plates and glasses.	- knows choosing smaller portions of foods you want to consume less of (like fast foods, chips, soda) - recognizes that size of container makes you eat more - knows to decrease portions by choosing small cups, bowls, plates, but also smaller orders (e.g. small and medium at fast	- recognizes using small portions but is incorrect in identifying the types of foods you would choose a smaller portion of	

	food restaurants).		
6. Make water your beverage of choice.	- knows water should be the beverage most consumed - recognizes that water should be substituted for other beverages like soda, juice etc.	- recognizes that drinking water is important but doesn't recognize the substitution for juice and sodas.	
7. Sweeten and salt your food yourself.	- knows when "others" (food manufacturers, fast food restaurants etc.) sweeten and salt the food, they may add more than you would add so it's good to add your own.	- can demonstrate an understanding of adding your own sugar and salt but can't connect that others adding it will make you consume more of it.	
8. If it came from a plant, eat it. If it was made in a plant, don't.	- recognizes that foods from a plant are healthier (e.g. fruits, leaves – like lettuce, vegetables) than those that are made in a factory - recognizes that factory-made foods can have added and undesired ingredients (like those with long names or that are unpronounceable)	- understand one part but not the other (e.g. understands plant-based foods from a plant, but not made in a plant as from a factory).	
9. Eat your colors.	- knows eating a variety of plant-based foods of different colors are healthy - give examples of a variety of colors of plant-based foods (e.g. apples-red; bananas- yellow)	- is able to recognize eating a variety is healthy, but doesn't make the connection to plant-based foods	
10. Eat more like the French.	- knows to eat smaller portions, eat slowly and enjoy the food; prepare foods from raw/simple ingredients)	- knows that the Western diet is unhealthy but can't provide reasons for why the French way of eating is better	
11. Break the Rules once in a While.	- knows that it's ok to eat unhealthy foods sometimes - provides examples like eating chips only 2 times per week, or small portions of it;	- understands the rule to eat in one way most of the time, but misinterprets which types of foods are the ones that should be eaten most or least often (e.g. eat less fruits)	

D.1.4 Food Rules Definitions Coding Aid

Definition of each of the Food Rules and used for Reference in Food Rules Assessment Scoring.

Table D. 2 Food Rules Definitions Coding Aid

Food Rule	Meaning
Eat food you can picture growing in nature.	Definition: Eat whole minimally processed foods. You know you are identifying them if you can picture them growing from a tree, from the ground, or on a farm in their natural state. E.g. apples, fresh corn, eggs, greens Implication: This food rule will help you distinguish food (whole minimally processed foods) from highly processed foods. Whole/minimally processed foods are those that people have been eating for generations; they don't typically have many additives, and haven't been heavily processed, packaged, or marketed. They contain a biochemical composition of nutrients that the human body has long been acquainted with and can help you be healthy while also giving you peace of mind that you are eating the right thing for your body.
Eat food with ingredients that a third grader could pronounce.	Definition: Eat foods that have ingredients that are easy to identify and to know what they are, so easy that a third-grader would know them when he/she sees them. Implication: Keep it simple; the more complicated and lengthy the ingredient list is, the more highly processed it is likely to be. Additionally, when food ingredients don't sound familiar, there is a greater chance that it is a form of sugar (corn-derivative) or fat (soybean oils), causing you to eat more of these things than you thought you were consuming and that can have a negative impact on your health. The foods that don't have typically have ingredient lists, like carrots, apples, and broccoli are the ones that can help keep you healthy.
Avoid products that make health claims.	Definition: Don't eat foods that come in packages which make claims about the health quality of the product. For example, less sugar; more fiber. Implication: Firstly, if a product has a health claim, it must first come in a package, which means it is more likely to be a highly processed food rather than a whole food. Food claims tend to make people think that the product is good for you, but if it is highly processed, it is more likely to be bad for you.
Avoid foods you see advertised on television.	Definition: Don't eat foods that you typically see advertised on television, they tend to be HPF. Implications: Food marketers spend a lot of money trying to convince you to buy their products. The types of foods that have big budgets for marketing are often the least healthy for you, even though their advertising indicates otherwise. So you are disproportionately being bombarded with ads for foods that are likely to be the least healthy for you but which tell you they are the best for you. Ads also have a social/emotional impacts on you. For example, they may make you feel like you will be cool, fun, smart, and strong if you consume their product; whereas the actual foods that will make us healthy and strong, like fruits and vegetables, are not often advertised to us.
Choose smaller plates and glasses.	Definition: Choose small plates and glasses to serve yourself on/in or select smaller portions when buying food out. Implication: The bigger the plate and glass, the more you will consume which can lead you to overeat, even when you think you're not. Choosing small plates and small glasses can help you eat the right amount. When you choose to consume a highly processed food, you can better manage how much you consume by selecting the smallest serving e.g. a small fries or bag of chips instead of a large.
Make water your beverage of choice.	Definition: Drink water in place of other beverages more often. Implication: Drink water most of the time and other beverages more sparingly. Beverages, like iced tea, soda, flavored waters, and coffee drinks often have a lot of excess sugar. Drinking water in place of those sweetened beverages can help you minimize the amount of excess sugar you consume.

Sweeten and salt your food yourself.	Definition: Add your own sweeteners and salt rather than letting food manufacturers do it for you. Implication: Highly processed foods often have more salt and sugar than you would add if you were making that food yourself. By selecting unflavored products and sweetening and salting the foods yourself, you can make it to your own taste, and consume less of the bad stuff. Making your own soda, for example, is easy and you can sweeten it yourself. It's likely that you will still be adding less sugar than the soda manufacturers.
If it came from a plant, eat it. If it was made in a plant, don't.	Definition: Eat more whole plant-based foods and less highly processed foods. Implication: If it came from a plant, it is likely to be a natural whole/minimally processed food, which is good for you, so eat it. If it was made in a factory, it is likely to be a highly processed food which is not good for you, so don't eat it.
Eat your colors.	Definition: Eat a variety of plant-based foods of all different colors. E.g. Red apples, orange carrots, yellow bananas, and green broccoli Implication: Eating a variety of plant-based foods which are different colors, can help you be healthy. Thinking about fruits and vegetables from all colors of the rainbow can help you track whether or not you are eating your colors by ensuring that you are eating a variety each day or week from all colors.
Eat more like the French.	Definition: Eat more like the French whose dietary patterns (including eating smaller portions, eating slowly, making meals into an occasion, and eating less highly processed foods) make it easier for them to be healthy. Implication: People who eat according to the rules of a traditional food culture (like the French, or Italian, or Japanese) tend to be healthier than those who adopt the modern Western diet of large portions, highly processed foods, and a high proportion of meat.
Break the Rules once in a While.	Definition: Eating unhealthy foods is ok once in a while. Implication: Obsessing about healthy foods is not good for your happiness and connection to food. It's ok to eating things that you enjoy, but which may not be the healthiest for you, on occasion, as long as every day is not an occasion. This can allow you to enjoy pizza at a party or ice cream on a hot summer day without worrying too much.

D.1.5 Semi-structured Interview Protocol.

Definition of Terms
What is food? What are phuds?
Foods – help your body do what you want, W/MP, plant-based foods, things you can picture growing in nature;
Phuds – things that don't help your body, you can't picture in nature, have many ingredients, are advertised everywhere; HPF

Importance of IDOF Message
i. What is important to you about eating foods/less phuds?
Probes: Has this changed? How? What thoughts cross your mind when you eat/buy foods/phuds? Have your thoughts changed? When people offer you foods/phuds? When you see foods/phuds?
ii. What did you learn here that you talked about with your family?
Probe: Friends?

Barriers and Facilitators
iii.. What helps you eat more foods/less phuds? What makes it hard for you?
Probe: what is around you at home, at school, in neighborhood

Social Support
iv. Who helps you eat more foods/phuds? How?
Probe: Who makes it hard? How? Who do you help? How?

Strategies
v. What could you do differently? What do you do differently? How have they helped? What has made this difficult? What could you do to address these challenges?
vi. If we offered this curriculum to other middle school students, what do you think would be the most important things we should teach them?

D.1.6 In-Depth Interview Coding Scheme

Table D. 3 In-Depth Interviews Coding Scheme

CODE	DEFINITION	EXAMPLE IN TEXT
BEHAVIOR		
W/MP Foods	Mention of consumption of W/MP, such as fruits and vegetables.	"I eat more vegetables. Hot vegetables."
HPF	Mention of consumption of HPF, such as fast food, processed packaged snacks, and sugar sweetened beverages.	"I used to drink lots and lots of drinks every day… I would drink like 6 times a day and now […] I don't.
DETERMINANTS		
Expectancies (attitudes/values)	Expresses value (favor for, including a preference for) a behavior or outcome of a behavior (Contento, 2016). I like ____; It is important _____;	"It's important to not eat too much phuds [HPF]."
Sub theme: Conflicting values	Values conflict with actions or desires.	"I know it's bad for my health, but I still get it anyways because this is how it is in school."
Outcome Expectations (physical or material), positive and negative.	Expresses risk of disease associated with eating HPF (phuds) or an indication of a positive physical or material outcome associated with eating W/MP foods.	"Eating phuds [HPF] has a lot of sugar and will give me diabetes."
Outcome Expectations (social)	Indicates that family members, friends, peer networks, and other important people eat in a certain way. _____ is what ____ is doing; My family/peer does _____; I eat this way because ___ does.	"My mom just loves a lot of candy."
Social Support/Modeling	Mention of people who help them to eat W/MP foods and fewer HPF.	"My older brother teaches me how to eat healthy and tells me about food that I didn't even know."
Outcome Expectations (self-evaluative)	The beliefs or expectations in how one will feel about themselves if they make a behavior change (Contento, 2016).	"When I eat FV, I feel good about myself." "If feel proud of myself when I eat less HPF."
Barriers or Impediments	An identification of personal barriers that impedes the ability to take a healthy action (increase W/MP foods; decrease HPF).	"Eating FV is hard for me because I am constantly tempted by junk foods."
Disinhibition or low self-regulation (Burgermaster, 2015; Glanz, 2005)	Demonstrates a lack of will power or self-control to meet a target behavior.	"It's like once you eat it, you can't stop. You just want more and more and more and more."
Moral Responsibility	Demonstrates a responsibility to help or tell other people of the	"I started explaining to him that phuds [HPF] are not good for him"

	IDOF message.	
Controlled Motivation	Engaging in a behavior for the purpose of achieving a reward, avoiding punishment, or living up to an external expectation.	"I eat F&V because my mom tells me to."
Autonomous Motivation	Engaging in a behavior because it is interesting or satisfying, such that a positive feeling is attained from the behavior itself.	"I eat F&V because they taste good."
Knowledge and Skills: Procedural, Factual, Critical Thinking skills	Knowledge parroted about W/MP foods and HPF from that which was taught explicitly in the IDOF curriculum or an extrapolation of what was taught in the curriculum.	"Eat more foods [W/MP foods] than phuds [HPF]."
	Procedural: demonstrate knowledge on how to do something.	"I know if it is a phud because I can look at the ingredient list and see many strange ingredients."
	Factual: Food and nutrition information and how to use it, such as information about ingredient lists or sugar content (Contento, 2016, p. 141)	"I told her that we shouldn't have anything with sugar over 15g."
	Critical Thinking skills: The integration of higher order thinking skills of analysis, evaluation, and synthesis related to what was taught in the IDOF curriculum (Contento, 2016, p. 142)	"I don't want to eat something with strange ingredients because you don't know what they put in there."
Self-efficacy/overcoming barriers	Expression of individual confidence in a personal ability to perform the given behavior."(Contento, 2016, p. p. 138) I am sure I can _____; I can _____; I do ____ to help me when I come across _____.	"Because we learned how to make the salad in that class and now I know how to do it, so I can do it myself." When someone offers me phuds [HPF], I just say no thank you and walk away so I don't have to think about it."
Self-regulation/self-direction skills	Indicates the use of goal setting/action plans, self-assessment, planning, and includes strategies to avoid, moderate, remind, encourage, track, reward, and substitute for healthy actions.	"I only eat HPF on Fridays and otherwise, I eat FV."
Physical Environment	Discussion of the physical availability of foods in their home, school, neighborhoods.	"You can teach people to go to other places that sell food where the food is healthy and not just around where you live."