COMPUTER-BASED NUTRITION EDUCATION FOR ADOLESCENTS: SYSTEMATIC REVIEW AND FOCUS ON EMBEDDED VIDEOS

BY

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THESIS

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ABSTRACT

Despite our best efforts, the status of adolescent nutrition still does not meet recommendations. To better target the adolescent population, nutrition education is rapidly spreading into the world of technology. Unfortunately, it may be doing so at a faster rate than research can support. Computer-based nutrition education interventions are being utilized more frequently than in previous decades; however, there is a lack of research to support their overall efficacy and a lack of evaluation of which elements within the interventions deliver the greatest impact. First, a systematic review was conducted to evaluate the efficacy of computer-mediated nutrition education interventions for adolescents. A systematic literature search of research conducted within the past 10 years resulted in a final review of fourteen articles after application of inclusion and exclusion criteria. These studies were evaluated for their ability to achieve stated objectives and for quality using the United States Department of Agriculture Nutrition Evidence Library appraisal guidelines for Research Design and Implementation. Ten out of fourteen studies were randomized controlled trials, and most focused on elements of healthy eating (n=10), while fewer focused on changes in weight status (n=4). Most interventions were behaviorally focused with few measuring changes in nutrition knowledge (n=3). Approximately half of the interventions produced positive changes in nutrition-related variables. Health behavior theory emerged as a potentially important factor to producing desired effects, as the application of a theoretical framework was more highly associated with studies that resulted in statistically significant changes. However, these changes could not be attributed to an individual theory or combination of theories. The area of intensity, which includes dose and duration, as well as the areas of parental involvement and gender were identified as important areas for future research. Evaluation of the impact of parental involvement and skill-building strategies is required to provide evidence for their inclusion in future interventions. This review contributes to the understanding of current research in this area and will improve the results and applicability of future research. Second, to examine the efficacy of a video component within an online nutrition education intervention, a qualitative study was conducted using focus groups with middle-school students (6th to 8th
grade, n=41). To compare differences in information delivery, the study used the Healthy Outcomes for Teens Project intervention containing 6 videos about nutrition and physical activity and included an alternate page consisting of textual versions of the same scenarios with voiceover narration. Following a crossover design, students viewed the video and narrated-text versions of the scenarios and participated in small focus groups of 2 to 6 students. Focus group responses were transcribed, coded, and analyzed for themes using the guidelines for thematic analysis. Students who first watched the videos recalled a greater number of scenarios without prompting, recalled more details about the scenarios, and used less forgetful phrases than those who listened to the narrated text. Broad, non-specific interpretations were provided in both the video and narration groups; however, about 70% responded with an interpretation that showed understanding of the nutritional message, with the video group providing a higher percentage of intended interpretations of the scenarios. After the crossover, the video-first group remembered a similar amount and described in similar detail the stories remembered; conversely, the narration-first group showed greater recall in both amount of stories recalled and details remembered. After the crossover, the groups lessened in the percentage of correct interpretations (53%), however, the video-first group provided a higher percentage of intended interpretations of the nutrition messages compared to the narration group. A similar amount of girls and boys reported that they would recommend the videos rather than the narrated text to their friends. These results indicate the possible advantage of nutrition education videos to improve recall and retention of nutrition information in adolescents and emphasize that straightforward, clear nutritional messaging may be important for increasing accurate comprehension of nutrition information by all adolescents.
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CHAPTER 1.

INTRODUCTION

The prevalence for adolescent overweight, obesity, and type 2 diabetes (T2D) have risen in the previous three decades, and the rise in overweight and obesity has been noted as a contributing factor to the concurrent rise in T2D.\textsuperscript{1-3} However, in recent years, the prevalence rate of overweight and obesity appears to be tapering.\textsuperscript{4-5} Nevertheless, improving adolescent nutrition has an important role not only in reversing and preventing overweight, obesity, and T2D, but also in ensuring that this population grows and develops adequately, especially since about 80% of physical growth occurs during the ages of 10 to 15 years.\textsuperscript{6-7} For example, during adolescence at least 50% of adult bone mass is gained for both males and females,\textsuperscript{8} but adolescents frequently do not receive the adequate amount of calcium or vitamin D since those requirements are increased.\textsuperscript{9-10} Therefore, they are at risk of early osteopenia, osteoporosis, and other possible adverse effects related to calcium and vitamin D deficiencies, e.g. insulin resistance, multiple sclerosis, and cardiovascular disease.\textsuperscript{10-13} Clearly, adequate nutrition in adolescence is necessary for the foundation of good health in adulthood. This stage of life also has consequences for how adolescents pattern their eating behaviors. Early, middle, and late adolescence differ in their stages of cognitive development and, therefore, how adolescents view the importance of healthy eating and their capability to recognize how their current eating behaviors influence their future health.\textsuperscript{14} Adolescence, with its significant cognitive changes coupled with increased nutritional requirements, is a vulnerable stage for human development and, therefore, a perfect target for nutrition education.

Since adolescence is the gateway to adulthood, it is no surprise that an estimated 90% of adolescents who are overweight or obese remain overweight or obese as adults.\textsuperscript{15} With this as a motivation, nutrition education can help improve the dietary behaviors of adolescents. In a 1995 review\textsuperscript{16},\textsuperscript{17} of school-based nutrition education programs, it was concluded that nutrition education could be effective in improving eating behavior when “behavioral change was set as the goal and the educational strategies used were designed with that as the purpose.”\textsuperscript{18} Although not all of the studies achieved their
outcomes, and some exhibited gender-based differences in their results, those that focused on specific behaviors fared better than general nutrition education programs. More recent evidence from 2005 to 2011 also supports the overall effectiveness of school-based nutrition education programs in improving dietary behaviors. However, sizeable variation in outcomes and differential results based on subgroups were noted. In 2009, the Society of Nutrition Education published an executive summary regarding the state of nutrition education in pre-kindergarten through 12th grade and concluded that nutrition education was lacking due to insufficient and unstable funding which resulted in a lack of hours spent teaching nutrition and physical activity. Efforts to improve nutrition education included better coordination between federal, state and local initiatives along with specific considerations for interventions, such as targeting specific behaviors, devoting an adequate amount of time and intensity for teaching nutrition, and providing coherent, focused curricula. Traditional locations for nutrition education may be unavailable or unsustainable at present and, therefore, alternative and less costly methods for educational delivery would benefit both the schools and students. As such, computer-based methods for nutrition education are emerging as part of the solution to this problem.

Compared to the efforts to develop adequate nutrition education for children and adults, research regarding adolescent nutrition education is less available. Studies that target nutrition education with a focus on adolescents were shown to be more successful when the interventions (a) applied strategies that were matched with the audience’s developmental stage, (b) applied a behavioral focus and theoretical framework, (c) addressed specific behaviors and the environment, and (d) applied an appropriate intensity (dose and duration) for behavior change. In addition, taking advantage of new technology as a delivery method for nutrition interventions was suggested, as well as distributing effective programming in order to increase behavior change across larger populations. Computer-based interventions, especially web-based, are poised to handle this task.

The evidence mentioned thus far has focused on non-computer-based nutrition education interventions for children and adolescents. Yet, is this medium the most appropriate for their age group, especially in light of their heavy usage of the internet and new technology? Teenagers, 12 to 17 years old,
have been the most active internet users since 2004; only within the past few years have young adults
catch up with this younger demographic. Over one-third of teens own a smartphone, 80% own or share a
home computer, and about 25% own a tablet computer which is similar to the rate of adult ownership. Due to their familiarity with and preference for computers for entertainment and social networking, computer-mediated nutrition education interventions for adolescents have become increasingly researched. However, their overall efficacy is still in question, most likely due to their implementation being faster than research can support. Nevertheless, computer-mediated nutrition interventions are arguably the most developmentally appropriate way to deliver nutrition education to present-day adolescents.

The potential of computer-mediated nutrition education for adolescents has been repeatedly cited, with support for aspects such as computer-tailoring, behavior-based strategies, and multimedia and interactive experiences. Nevertheless, further research into the efficacy of computer-based nutrition interventions is necessary. Within computer-based nutrition interventions, which are software- or web-based interventions delivered over a stationary computer or laptop, there are multiple aspects that can influence the efficacy and nature of learning and understanding. Coupled with the great potential for this delivery method, an investigation is needed into which components should be included to achieve the greatest impact on nutrition-related variables.

Computer-mediated videos are popular for educational and non-educational uses and are already incorporated into some computer-based nutrition education interventions. Approximately one-third of teenagers video-chat online and/or create and upload videos to the internet, and therefore a percentage of the population is already familiar with this type of medium. Online instructional videos are already used and evaluated in adult educational settings for higher education and training purposes and are reported to be an effective method for teaching and to complement lecture-based instruction. However, their efficacy is unknown relative to their role in computer-based nutrition education for adolescents.
Since some computer-mediated nutrition interventions have included video education as part of their overall program, but have yet to study the specific impact of videos on the viewers’ retention and comprehension of nutrition-related information, this thesis will provide insight into the ability of embedded videos to enable retention and comprehension of nutrition-related information in an adolescent population. If applied to the development of computer-based nutrition education, this could make a significant difference in the amount and understanding of nutrition information delivered to adolescents. With more knowledge retention and comprehension of proper nutrition and healthy behaviors, and influenced by the effects of observational learning and peer modeling, adolescents may be more likely to perform a given health behavior and to display better attitudes toward healthy behaviors. With this addition to computer-based nutrition education, we can expect to see a shift in adolescent nutrition as we move forward.

**Hypotheses**

Before considering the efficacy of components within computer-mediated nutrition education interventions, the impact of computer-based interventions in the target population must be assessed. I hypothesized that (a) evidence in the literature will support the efficacy of computer-mediated nutrition education interventions in adolescents. In addition, focus groups were used to explore the potential advantage of videos over narration in an online nutrition education intervention for adolescents. The hypotheses were that (b) students who watched short nutrition education videos would retain and recall a higher number of scenarios and more details about the scenarios compared to students who listened to narrated text containing the same nutrition information, and that (c) students would be better able to interpret the intended nutritional messages when communicated through video compared to narration.
REFERENCES


CHAPTER 2.

REVIEW OF LITERATURE

This review of literature will provide the background for the claim to investigate (a) the efficacy of computer-mediated nutrition interventions in adolescents and (b) the video component of an online nutrition education intervention for adolescents. Descriptions of adolescent development and how improper nutrition compromises adequate development is provided, along with descriptions of specific consequences, i.e. overweight, obesity, and type 2 diabetes, with which this thesis is concerned. Nutrition education interventions are known to improve nutrition behaviors in youth, however, as you will see, the move to computer-based programming is newer and has yet to be thoroughly evaluated. It also brings with it new concerns with which nutrition educators will need to be familiar, e.g. computer science and educational psychology; issues with the implementation and evaluation of computer-based interventions are also noted. Concepts that apply to video education and evidence regarding the use of videos in nutrition education are presented, and this will be the foundation for the evaluation of embedded videos in the online intervention.

Adolescence

The age of adolescence

Adolescence is the “transition stage between childhood and adulthood” and its onset is signaled by puberty. The age of adolescence has been estimated by a number of entities and remains an estimate because puberty begins and ends differently for each individual; at the present time, there is no determined age boundary for adolescence. For example, the United States Department of Health and Human Services (HHS) defines the boundary of adolescence between the ages of 11 to 18 years for early to middle adolescence and 19 to 24 years for late adolescence; the American Medical Association states that adolescence contains the ages of 10 to 24 years; the Center for Disease Control and Prevention (CDC) sets the age of adolescence at 12 to 19 years; and Psychology Today defines the ages between 13 and 19 years, with exceptions for the beginning of puberty to begin as early as 9 years old. For the
purpose of this thesis, the age of adolescence will follow the HHS definition of early to middle adolescence, 11 to 18 years.

Adolescent development and nutrition

Although there is no agreement as to the age of adolescence, it is widely agreed that there are three stages of biological, cognitive, and psychosocial development during this time: early, middle, and late adolescence. Early adolescence is characterized by the onset of physical and endocrine changes and rapid physical growth, and therefore increased nutritional requirements, emerging sexual curiosity, the beginning of abstract thinking, and strong peer influence. Middle adolescence continues pubertal changes, although slowing for girls, and is coupled with growing independence from parents and growing closeness to their peer group, an increased sense of morality and moral reasoning, sexual interest, and increased health risk behaviors. Late adolescence, which typically begins at or after 18 years of age, is marked by the general completion of female physical development and the continuance of male development, complex thinking, a sense of identity, and increased impulse control and emotional stability.  

Adolescent development coincides with the development of personal eating behaviors and patterns and is a vulnerable period for the onset of overweight and obesity that stems from the adoption of unhealthy eating behaviors. Early adolescents are present-thinkers and tend to be more concerned with short-term aspects of food, e.g. taste, and cannot see the connection between their current eating behaviors and future health. Peer attachment in middle adolescence can socially influence eating behavior and their emerging moral reasoning can make them categorize foods into “good” and “bad.” Promisingly, late adolescence is a stage for independence, increased future-thinking, and the ability to make personal decisions, including those about proper nutrition. With heightened nutritional needs and a tendency to eat excess saturated fat and sugar, adolescents run the risk of fueling their bodies inefficiently; this, coupled with pubertal hormonal changes that foster fat accumulation and declines in physical activity, can lead to an increase in fat mass without the accompanying increase in muscle or skeletal mass.
In 2013, the CDC released a Data Brief of changes in energy and macronutrient intake in children and adolescents from 1999-2000 and 2009-2010. Estimates indicated that energy intake decreased by roughly 100 calories in that ten year span and consumption of protein, carbohydrates, and fat were within the recommended range for adolescents, with the exception of saturated fat intake which as 1 to 2% higher than the recommended 10%.\textsuperscript{11} Despite this data, adolescent overweight and obesity prevalence continues to increase, although this effect may indeed be slowing down.\textsuperscript{12-13}

**Description and diagnosis of overweight, obesity, and type 2 diabetes in adolescents**

*Overweight and obesity*

Overweight and obesity are defined by the World Health Organization (WHO) as “abnormal or excessive fat accumulation that may impair health”\textsuperscript{14} and by the CDC as “ranges of weight that are greater than what is generally considered healthy for a given height [and] have been shown to increase the likelihood of certain diseases and other health problems.”\textsuperscript{15} The clinical measurement of overweight and obesity is the body mass index (BMI) and is a calculation of weight and height: $\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m}^2\text{)}}$ or $\text{BMI} = \frac{(\text{weight (lb) / height (in}^2\text{)}) \times 703}{\text{}}$.\textsuperscript{16} BMI categories are underweight ($\text{BMI < 18.5 kg/m}^2$), normal weight ($18.5-24.9 \text{ kg/m}^2$), overweight ($25-29.9 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$).\textsuperscript{15} Children and adolescents are measured using percentiles and growth charts, which are explained later.

*Diabetes*

Diabetes is “a group of diseases marked by high levels of blood glucose resulting from defects in insulin production, insulin action, or both.”\textsuperscript{17-18} Insulin is a hormone produced and released by pancreatic beta cells and acts to deliver glucose to the body’s cells that use glucose as an energy source.\textsuperscript{17} The proper action of insulin is especially important after a meal when the blood glucose level peaks. When insulin binds to its receptor on the cell membrane, it initiates the translocation of glucose transporter vesicles to the cell’s surface; the glucose transporter can then allow glucose to pass into the cell, thereby lowering the blood glucose level. The liver and brain do not need insulin to uptake glucose, however skeletal muscle is insulin-dependent and is the largest consumer of glucose.\textsuperscript{19-22}
There are three major types of diabetes: gestational, type 1, and type 2. Gestational diabetes is a type of diabetes that develops during pregnancy and leaves the mother with a 40-60% chance of developing type 2 diabetes (T2D) within a decade. Type 1 diabetes is characterized by the autoimmune destruction of pancreatic beta cells, and usually appears early in life, although this is not always the case. Type 1 diabetes is the largest cause of diabetes in children and constitutes approximately 80% of newly diagnosed cases annually. Exogenous insulin is required for these individuals, as is a well-planned, nutritious diet and physical activity. T2D is characterized by the progressively insufficient production of insulin by the pancreas as well as insulin resistance in its target cells. Although it is at times asymptomatic, the characteristic symptoms of T2D (in children, adolescents and adults) include “fatigue, frequent urination, increased thirst and hunger, weight loss, blurred vision, and slow healing of wounds or sores.” Nutritional management, physical activity, and medication – sometimes including insulin – are prescribed to manage T2D. Of course, constant blood glucose monitoring is necessary in all types of diabetes to keep blood glucose under control.

Diabetes is diagnosed in one of four ways: (1) a fasting blood glucose test (preferred), (2) an oral glucose tolerance test, (3) a random blood glucose test if the patient is symptomatic, or (4) a hemoglobin A1c (HbA1c) test. To be diagnosed with T2D using a fasting blood glucose test, one must have a blood glucose level greater than or equal to 126 milligrams per deciliter (mg/dL) after fasting for eight hours. The second, third, and fourth ways of diagnosing T2D require at least two tests, each on different days. Using an oral glucose test, diabetes is diagnosed if a blood glucose level of 200 mg/dL or above is seen two hours after ingesting a glucose solution. Two measurements of 200 mg/dL on two different days will result in a diagnosis of diabetes using the random blood glucose test. The amount of glycated hemoglobin in the blood, or HbA1c, can account for the level of blood glucose during the previous 3 months. When blood glucose levels rise, excess glucose can penetrate the red blood cells and attach to the hemoglobin proteins that carry oxygen. Over time, chronically high blood glucose levels raise the percentage of hemoglobin molecules that are glycated, and this level is maintained for about 3 months – the lifespan of a red blood cell. Normally, 5.7% or less of hemoglobin is glycated. Pre-diabetes is marked
by an HbA1c level between 5.7 to 6.4% and diabetes is diagnosed if the level is 6.5% or above. If a patient currently has diabetes and shows a high HbA1c level, it indicates poor glucose control during the previous 3 months and is a risk factor for the development of diabetes complications. Patients with diabetes are advised to complete the HbA1c test twice annually; more tests may be necessary if glucose levels are not within a recommended range.26

**Prevalence of overweight, obesity, and type 2 diabetes in adolescents**

*Overweight and obesity*

To measure overweight and obesity in children and adolescents, growth charts from the CDC use percentiles to estimate a BMI that correlates with their age and sex. A BMI-for-age between the 85th and 95th percentile categorizes a child or adolescent as overweight, while any BMI-for-age above the 95th percentile is obese.27 These categories were previously referred to as “at risk for overweight” and “overweight,” respectively.28

In the United States, in 2011, an estimated 15.2% of 9th to 12th grade students were overweight.29 In 2009-2010, 18.4% of adolescents age 12 to 19 years old were obese; the prevalence for boys was 19.6% and for girls, 17.1%.30 Altogether, roughly 33.6% of adolescents are overweight or obese. This figure is triple what it was three decades ago.31 As children grow into adolescents, the prevalence of obesity increases,30 and obese adolescents are highly likely to remain obese into adulthood.32-33 Therefore, targeting adolescent nutrition is a way to curb adult obesity before the onset of long-term consequences.

*Diabetes*

One of the long-term consequences with the most publicity is T2D. Previously considered as an adult’s disease, T2D surprised the medical community with its appearance in overweight and obese children and adolescents34 and, as of 2010, was prevalent in 215,000 people under 20 years old, i.e. 0.26% of all people in this age group.35-36 The prevalence for T2D in adolescents is shifting toward a higher ratio of T2D:T1D diagnosis for certain ethnicities. In those 10 to 19 years old, it is reported that the rate of newly diagnosed T2D is now similar to that of T1D for non-Hispanic Black and Hispanic youth and
higher than that of T1D for Asian/Pacific Islander and American Indians. T1D is still the most prevalent
diagnosis for non-Hispanic White youth.\textsuperscript{24}

**Complications of overweight, obesity and type 2 diabetes in adolescents**

*Overweight and obesity*

One major complication of adolescent overweight and obesity is the high risk of remaining so
into adulthood. This begins the process of adverse health effects much earlier in life and lays the
foundation for the early development of chronic and serious complications. For example, adolescent
overweight is more influential than adult onset obesity for determining the mortality risk for
cardiovascular disease, and even if someone loses the weight as an adult, they are still at higher risk for
developing heart disease because of the early foundation laid as an adolescent.\textsuperscript{37-38} The short- and long-
term comorbidities seen in adolescent overweight and obesity are numerous and coincide with those seen
in adults: insulin resistance and hyperinsulinemia, T2D, hyperlipidemia, lowered HDL cholesterol, early
signs of heart disease, hypertension, gallstones, sleep apnea, asthma, orthopedic problems, menstrual
dysfunction, polycystic ovary syndrome, hepatic steatosis, depression and anxiety, and others.\textsuperscript{28,39} With
modulation of nutrition, physical activity, and weight loss, alleviation of some or all of these conditions
can occur.\textsuperscript{39}

*Diabetes*

Long-term complications of T2D in adolescents correspond with those in adults: hyperlipidemia,
hypertension, heart disease, stroke, eye problems, kidney disease, nervous system damage, periodontal
disease, and others.\textsuperscript{36,40} Control of blood glucose, proper nutrition, increasing and maintaining physical
activity, and weight loss are ways to manage T2D and can help to prevent the development of
comorbidities.\textsuperscript{41} Major complications of diabetes are not common in adolescent T2D, however they are
the same micro- and macrovascular complications seen in adults, i.e. diabetic retinopathy, nephropathy,
neuropathy, coronary artery disease, and atherosclerosis.\textsuperscript{42}
Computer-mediated nutrition education interventions in adolescents

Challenges of adolescence in regard to nutrition education

Teaching nutrition education to adolescents is problematic. One has to guide them to meet their nutritional requirements, often with the guise that it is their own choice. You cannot be too didactic, or they may lose interest; you cannot be too fun, or the gravity of their adverse nutritional behavior is lost. Finding avenues through which to best communicate nutrition to adolescents is the purpose of this thesis, and the goal of many new nutrition education interventions that are delivered through the computer. Approximately 93% of adolescents 12 to 17 years old use the internet, and about 40% of those log-on multiples times per day. They, along with 18 to 29 year olds, are the largest population of online users.43

Computers in nutrition education

In the 1980s, the Journal of Nutrition Education dedicated an entire issue to highlight the use of computers in nutrition education. Warning nutrition educators and researchers not to ‘jump on the computer bandwagon,’ the issue gave guidance on how to best incorporate computers into nutrition programming, yet with little evidence in the way of computer-assisted instruction, which can provide education without the need for educators to be present, and without a research section due to the deficiency of controlled trials in this area.44

The Agriculture and Consumer Protection Department of the Food and Agriculture Office (FAO) of the United Nations recognized the growing potential of computer-based nutrition programming in the 1990s, even though there were still few examples of computer-based nutrition education and even less evaluation. Wisely, they emphasized that “the use of technology will not guarantee a more successful nutrition education or communication programme [and] the design and selection of appropriate technology for the purpose of the programme are critical.”45 They highlighted many important topics to be evaluated that would influence effectiveness of computer-based programs which are still under investigation today: audience learning style, instructional design, hypertext/hypermedia, learner control, ease of navigation, graphic design, the level of realism, feedback, and the balance of video, audio,
animation, text, and graphics. In line with their recommendations, chapter four of this thesis discusses an evaluation of video in an online nutrition education intervention.

*Evaluation of computer-aided instruction in nutrition education*

Computer-aided (or computer-assisted) instruction (CAI), as it becomes a more popular arena for nutrition education and more advanced in its technology, is now undergoing evaluation to identify factors that make a successful program, compared to earlier evaluation which compared CAI to traditional, lecture-style instruction. Matta et al. in 1989 described four factors that would impact the effectiveness of CAI: (a) students, (b) medium, (c) environment, and (d) subject matter. The investigation of medium “involves determining which technology is comparatively more effective to the other systems available,” including the use of audio or video elements. Also, CAI presents two types of environments to consider: one is the physical environment in which the user is accessing the computer, and the second is the actual computer itself. This is an area where video education and computer-mediated video education may differ in terms of development and effectiveness.

To continue to aid in evaluation efforts of CAI, and connect it to nutrition education, Matheson et al. in 1999 provided a process evaluation model previously applied to a CAI program in nutrition for 6th grade students. The evaluation model focused on identifying changes in learning and whether or not context affected the learning that took place. Learning, defined as the assimilation of new ideas or concepts into a pre-existing cognitive structure, and operationalized by the authors as the “changes in students’ knowledge structures of basic nutrition concepts” was measured with pre- and posttest questionnaires. Context was measured using interviews and observational data. The interaction of change and context was proposed to help researchers explain the level of change that took place and the reasons behind that change.

*Evidence of computer-mediated nutrition education in adolescents*

Research in CAI in nutrition education increased rapidly after the 1990s, presumably spurred on by the previous lack of evidence and increasing interest and ease of development. Only within approximately the past 5 years have systematic reviews and meta-analyses been published to summarize
the available evidence in adults and children. However, nutrition educators will often have to settle for reviews in non-nutrition areas or in broad fields, e.g. eHealth,49-50 until more research specific to nutrition education is completed. Even harder to find is information in this area regarding adolescents. Therefore, to add to the literature in this field, chapter three of this thesis provides a systematic review of computer-mediated nutrition interventions in adolescents.

**Use of videos in nutrition education**

**Concepts that affect video education**

1. Observational learning

   Observational learning is a concept outlined in the Social Cognitive Theory, developed by Albert Bandura.51 It posits that individuals learn by observing others, their behaviors, and consequences thereof. Four factors influence observational learning: attention, retention, production, and motivation. Peer modeling and the consequences or value of that modeled behavior influences the attention paid by the observer. Retention, which is the ability to retain information over time and is an outcome studied in chapter four of this thesis, is related to the intellectual capacity of the observer.52-53

   During a formative research study using focus groups and interviews with adolescents to create a website for nutrition and physical activity, short videos with animated role models were made in order to model barriers and solutions discovered during the formative research phase.54 Rationale for the usage of videos was the application of observational learning, based in the Social Cognitive Theory.

2. Peer modeling

   Peer modeling is related to observational learning, however it specifically uses models that are similar in age, gender, ethnicity, or in other ways to the observers in order to increase attention, motivation, and other factors associated with observational learning. Peer modeling has been noted to increase self-efficacy, or the belief in one’s ability to perform a behavior, in children more than observational modeling with a non-peer model.55-56 Younger children can be
also influenced by peer models of older children. All six videos evaluated in chapter four utilized peer models of adolescents at or above the age of the target audience.

In an effort to increase the consumption of fruits and vegetables in children 4 to 11 years old, the Food Dudes program included six videos to represent peer modeling with an in-school rewards-based system. The Food Dudes characters were animated, which opens the possibility for the positive effect of both animated and live action peer models on self-efficacy and behavior change. Fruit and vegetable intake increased, however since the program was also rewards-based, the influence of peer modeling could not be separated from the influence of rewards.

3. Personal agency

Personal agency was again described by Albert Bandura as “bringing one’s influence to bear on one’s own functioning and environmental events.” Contento et al showed that a middle-school program (C3: Choice, Control and Change) that aimed to increase personal agency, as well as competence and self-regulation and resulted in decreased sedentary behaviors (TV watching and video games) and sugar-sweetened beverage intake, and increased overall self-efficacy and intention to eat healthier. Peer modeling was also used in part of the curriculum. However, even though self-efficacy and intention were positive, desired behavior change only occurred in fruit and packaged snacks. The program chose behaviors over which the 11 to 13-year-olds would have a large amount of control, so it is possible that these items were perceived by the participants as most controllable and therefore changeable over the program’s seven to eight week period. One of the concepts that comprises personal agency is self-efficacy, and therefore it has ties to peer modeling as a strategy to effect learning and behavior change within a video application.

4. Setting/environment

In 1984, Kleemeier et al demonstrated that the setting in which an educational video is shown affects short-term knowledge retention. Parents in a pediatric office waiting room remembered very little relative to parents who viewed the video in a separate room. The
difference in memory between the two groups is most likely due to differences in attention, which is critical for informational retrieval, encoding into working memory and then long-term memory, and thus learning.\textsuperscript{62-63} Similar to ‘jumping on the video bandwagon,’ the setting of video viewing should be considered prior to implementation. Videos within a computer-based intervention have two environments, the physical environment and the computer environment. Both harbor potential consequences for the ability of the observer to pay attention. For example, an intervention in a school computer lab may provide an environment more conducive to attention, unless a student is distracted by a classmate. Similarly, the location of the video component within the computer intervention could influence how much that student pays attention to the video, especially if competing with other forms of media.

5. Cognitive load theory

Cognitive load is the “total amount of mental activity imposed on working memory at an instance in time”\textsuperscript{63} and has three arms: (1) intrinsic load is the complexity inherent in the subject matter; (2) extrinsic load is the cognitive demand based on instructional design; and (3) germane load involves deeper thinking processes like interpretation, classification, inference, and differentiating.\textsuperscript{64-66} Cognitive load theory explains that working memory, the part of memory that deals with the present and conscious processing and encoding of information, is limited in capacity and duration while long-term memory is theoretically unlimited. However, in order to be incorporated into long-term memory, information must be encoded and processed by working memory. Application of this theory to instructional design argues that instructional materials (subject matter) or instructional design may lead to high cognitive load and hindered learning, and the manipulation of one or both can alleviate excessive cognitive load and therefore lead to enhanced learning.\textsuperscript{63-64} Essentially, effective instructional design will “[ensure] that as much of a learner’s working memory as possible is free to attend solely to encoding to-be-learned information.”\textsuperscript{63} In general, the lower the cognitive load, i.e. the fewer elements involved, the easier learning will be.\textsuperscript{66} In a 2002 meta-analysis, Allen et al\textsuperscript{67} showed that university students
increasingly preferred video instruction over written materials when the amount of information communicated was reduced. Therefore, video education in terms of instructional design has shown that it too is subject to the cognitive load theory, and that the amount of information or design of a video will make a difference.

6. Learning style

Learning style is an individual’s characteristic and preferred way of learning. More specifically, it is the “characteristic cognitive, affective, and psychosocial behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment.” Commonly named learning styles are the four originating from research by Bandler and Grinder: audio, visual, and kinesthetic (active, hands-on), and tactile. However, more styles can be defined and re-categorized depending on the how many dimensions are being considered, e.g. print, aural (listening), interactive (verbalization), haptic (touch), kinesthetic (movement), olfactory (smell), and visual. Learning style theory describes how matching learning style with instruction can result in optimal learning. Its application in computer instruction has been to utilize the flexibility of computers to match the user’s learning style, or conversely to deliver a multimedia compilation of methods to a wide audience with the chance of reaching a range of different learners with one program. In regard to this thesis, differences in recall and comprehension from visual information, i.e. video, and text/audio information could be based on the participants’ characteristic learning styles. With visual information ubiquitous, it is likely that adolescents will characteristically populate the visual learning style.

7. Agent similarity hypothesis

The similarity-attraction hypothesis is simple and logical: “the more similar people are, the more they will be attracted to one another.” The agent similarity hypothesis stems from the similarity-attraction hypothesis and applies it to the use of Animated Pedagogical Agents (APAs). APAs can be used in CAI and the hypothesis states that there will be “increased learning and more positive perceptions the greater the similarity between the learner and the agent.” In terms
of video education, observational learning may improve if peer models appear similar to the users of a program. When given a choice in a multimedia science education program, college students chose APAs to provide instruction and minority students more often chose ethnicity-matched APAs. Surprisingly, the minority students who chose ethnicity-matched APAs showed lower retention than minority students who did not choose ethnicity-matched APAs. No influence of gender was found for choice of APA, meaning that students were not more likely to choose gender-matched APAs. Also, gender-matched APAs did not improve learning outcomes compared to those who did not choose same gender APAs. Therefore, ethnicity rather than gender may be more influential when considering what aspects of APAs, or peer modeling, may influence learning outcomes.

In middle-school students, when APAs were assigned, gender-matched APAs were more preferred in girls, while boys preferred opposite-gender APAs. When given the ability to choose APAs, however, girls and boys strongly preferred to match the agents to their gender (76% of females and 77% of males). Also, reasons for choosing the gendered APAs were given. Reasons that boys chose the male APAs were perceived teaching effectiveness, perception of a cool personality, age, and clothing; reasons that girls chose the female APAs were being of the female gender, perceived teaching effectiveness, having a realistic appearance, and perception of a smart personality. These results suggest that female and male middle-school students may project different values onto peer models during observational learning, and that compared to the previous study with college students, younger students may be more influenced by the gender of APAs or peer models.

8. Cognitive theory of multimedia learning

Multimedia learning is defined as “learning from words and pictures” while multimedia instruction is the use of those elements to foster learning. In this concept, words include printed and narrated text; pictures include static images, e.g. photos, graphs, and dynamic images, e.g. video, animations. The cognitive theory of multimedia learning is similar to the original
cognitive load theory but adds that (a) visual and auditory information are processed separately, i.e. “dual-channel assumption”; (b) each channel has limited processing capacity at any time; and (c) that “meaningful learning” takes place after a substantial amount of processing within and between the visual and auditory channels. Interaction between the two processing channels adds to the risk and complexity of cognitive load. Mayer et al, the creator of the cognitive theory of multimedia learning proposed nine suggestions to reduce cognitive load in multimedia instruction and provide better transfer of information, and only those that could pertain to video instruction are listed here: (a) move some essential information from visual to auditory channel, e.g. text to narration, or demonstration to additional verbal script; (b) add time between successive pieces of information to allow processing; (c) provide pre-training so that make sure learners know related terms, language, or how systems work; (d) eliminate extraneous material; and (e) provide cues for how to process the material. In college students, a multimedia program in introductory nutrition education course allowed students to learn the same information three times faster than a “drill-and-practice” program (2 hours vs. 6.5 hours, respectively), although there was no difference between the groups’ posttest knowledge scores. Although the multimedia program used audio, video, and graphics, and it is unknown which element produced a greater impact on the increased speed of learning, if it was not the combination of all three.

Evidence of stand-alone video and computer-mediated video education in nutrition

I. Stand-alone video education in nutrition

Isolated programs using videos in nutrition education allow us to evaluate how useful the actual component may be outside of a multimedia intervention. Support for its individual efficacy will strengthen its value in a multimedia program, even though it may then encounter the issues pertaining to the cognitive theory of multimedia. The programs discussed are not in adolescents.

StampSmart, a United States Department of Agriculture-funded multimedia nutrition education program targeting female Supplemental Nutrition Assistance Program (SNAP) participants, teaches about low-fat, low-cholesterol diets that are rich in vegetables. The
program used a soap opera format, titled *Sisters at Heart*, that is viewed as a 15-minute video with “infomercials” that provide tailored nutrition education. In addition, strategies to improve self-efficacy, outside of modeling by characters, included interactive activities with feedback, stage-matched behavior messaging and tips to motivate action. The intervention was delivered one time and lasted 30 minutes; participants viewed the program at a kiosk in the SNAP office. Approximately 80% of the sample (*n*=377) was African-American. Participants showed higher scores for self-efficacy for eating and preparing low-fat foods at posttest (Intervention: 4.10 ± 0.08 (± SE); Control: 3.67 ± 0.07; *P* < 0.001) and higher knowledge scores at the 1- and 3-month follow-up (I: 5.08 ± 0.09; C: 4.33 ± 0.08; *P* < 0.001). Fat intake lowered in both groups, and groups were not significantly different from each other. Non-significance for this variable was most likely due to the disparate values between groups at baseline.

Special Supplemental Nutrition Program for Women, Infants and Children (WIC) clinics in North Carolina applied their version of the *StampSmart* program, called *FoodSmart*. Follow-up occurred after one month, however because less people than anticipated returned to the WIC office, follow up telephone surveys were conducted over the following one to two months post-baseline (*n*=307). The video soap opera, called *Baby Oh Baby*, emphasized proper prenatal nutrition and infant feeding along with general healthy eating behaviors. Similarly, the video lasted about 15 minutes and the entire intervention about 30 minutes. About 55% of the sample was non-Hispanic White and 30% African-American; no other ethnicities were specified. After adjusting for baseline knowledge, overall low-fat knowledge and infant feeding knowledge were higher in the intervention group at follow-up compared to control (Low-fat: I: 2.76 ± 0.46 (± SD); C: 2.63 ± 0.55; *P* < 0.05; Infant feeding: I: 2.62 ± 0.62; C: 2.40 ± 0.75; *P* < 0.01). Also, immediately following the intervention, self-efficacy for eating and preparing low-fat foods was higher (*P* < 0.05) for intervention participants, but this effect did not remain at follow-up. Fat intake and fruits and vegetables intake did not change after 1 to 2 months.
An at-home video series was provided to low-income, stay-at-home females \( n=93 \) in the Expanded Food and Nutrition Education Program (EFNEP) and SNAP-Education (SNAP-Ed) programs to educate them on the food pyramid, food safety, meal planning, budgeting, healthy eating around breakfast and snacks. The program, called *Eating Right is Basic Series* (3rd edition), consisted of 12 weekly lessons delivered via video cassette recordings (VCR). The control group received traditional nutrition lessons by program assistants based on the video series. These same assistants would hand-deliver and pick up the videotapes from the participants’ homes, make telephone calls to encourage participation and discuss the videos, and conduct three home visits to demonstrate recipes and lead hands-on activities. The video presented “a female voice [narrating] the scripts that are printed on the back of [the *Eating Right is Basic*] flipchart pages”; no more information was given about the video. Fifty-seven percent of the participants were White and 43% African American. Intake of fruit, calcium, vitamins D and C improved in both groups, with dietary fiber improving more in the video group; however, the amount of change in dietary intake did not differ between both groups. Knowledge was not measured. This program used much more basic technology and cost about one-third of the traditional program, so at the very least it was cost-effective. It included a more significant amount of educator contact than is being studied in this thesis as well as what was studied in the previous programs of *StampSmart* and *FoodSmart*. Similarly positive outcomes resulted from these two previous studies that used less interaction and much less time.

The *Set the Pace* DVD was developed for parents and guardians of pre-school children in Head Start programs. Focus groups with parents and guardians revealed that a visual format for nutrition education was preferred, and their responses informed the content of the DVD including barriers to healthy eating and strategies for overweight prevention. The 15-minute DVD included observational learning with parents and children preparing snacks, grocery shopping, and engaging in physical activity together, as well as used Head Start parents as peer models. A group of Head Start parents \( n=16 \), 100% female) participated in a workshop during which they viewed
the DVD and completed two pre- and posttest questionnaires related to (1) motivation to implement strategies for healthy eating and overweight prevention and (2) barriers to meal preparation, fruit and vegetable consumption, and physical activity. Cronbach alpha ranged from 0.64 to 0.92 for items on the questionnaires. Behavior change was not measured. However, after watching the DVD, parents reported intending to prepare meals and eat together more often with their children (68%), eat less fast food (44%) and more fruit and vegetables (63%), be more physically active with their children (73%), and to attempt the recipes and activities from the DVD (87% and 67%, respectively).

II. Computer-mediated video education in nutrition

Multimedia nutrition interventions have included videos, yet separate evaluation of video or any other component is needed to determine their relative impact on outcomes. Examples of such interventions include Health in Motion that included video, audio, and animations and increased fruit and vegetable consumption in high school students; an internet and video intervention that decreased fat intake and increased physical activity in low-income 7th grade students; and the University of Illinois Extension Healthy Outcomes for Teens Project (HOT Project), which included video, audio, games and animations and increased knowledge of diabetes prevention in 6th to 8th graders. Evaluation of the video component in chapter four will add to the research regarding the efficacy of the HOT Project online nutrition education and diabetes prevention website (http://urbanext.illinois.edu/hot/).

Summary

Adolescence is a crucial junction for physical and cognitive growth and development, a vulnerable time for the onset of overweight, obesity, and T2D, and a difficult population in which to persuade and encourage healthy eating behaviors. Computer-based approaches have grown in popularity, and therefore development and implementation, but research to support their overall effectiveness has yet to catch up. Advances in computer technology have led to the ability to include multiple channels of communication and message delivery, and therefore multimedia nutrition education is poised to be an
even more potent effector of overweight and diabetes prevention in adolescents. Trials have shown positive effects in their respective samples, but have also applied a mixed formula of components that presently leave nutrition educators with no information as to the makings of an effective program. This thesis provides additional information to the small pool of literature regarding this topic and is part of a critical need for evaluation of component effectiveness in multimedia nutrition education interventions.
REFERENCES


CHAPTER 3.

SYSTEMATIC REVIEW OF COMPUTER-BASED NUTRITION EDUCATION INTERVENTIONS FOR ADOLESCENTS

Introduction

The prevalence of overweight in adolescents continues to be a public health concern. The 2009-2010 National Health and Nutrition Examination Survey (NHANES) revealed that 18.4% of adolescents aged 12-19 were obese.\(^1\) In 2011, the Center for Disease Control and Prevention (CDC) estimated that 15% of high school students were overweight and 13% were obese\(^2\); furthermore, among certain at-risk ethnic groups the figures were almost double the national average.\(^3\) Global trends are similar to the U.S., with child and adolescent overweight and obesity increasing especially in urban areas\(^4\); however the rates of increase differ among countries. For example, compared to the U.S. whose obesity levels in ages 6 to 19 years rose from approximately 5 to 15% from the 1970s to 2000, in the Netherlands obesity increased from approximately 3 to 3.5% in ages 2 to 19 years from 1981-2004.\(^5\)

Unfortunately, many overweight adolescents age into overweight adults, with subsequent associated chronic medical conditions, such as diabetes and cardiovascular disease.\(^6\)-\(^8\) Moreover, having at least one obese parent increases the odds of remaining obese in adulthood by more than double, regardless of being obese as a child.\(^9\) Because adolescence is marked as a crucial risk period for the development of obesity and its related consequences, targeting obesity at the threshold of adulthood is critical.\(^10\) However, their constant growth rate, growing intellectual capacity, and desire for autonomy can pose challenges to educators and health care providers. Recommendations for reaching these individuals often encourage school-based programs because adolescents spend a large part of their day at school. In addition to healthy changes to the school environment, reviews of these interventions suggest having a behavioral focus and using innovative multimedia technology tools.\(^11\)

The merits of using a web- or computer-based method of delivery for this audience are many. It is a fast, efficient, and low-resource tool that is heavily utilized among the adolescent population.\(^12\)-\(^13\) Interventions targeting adolescent health behavior using the computer as an interface extend beyond
nutrition into smoking, HIV prevention, alcohol use, as well as teenage pregnancy, and this method of delivery for health education has grown in popularity for targeting this population in the last 10 years. Unfortunately, however helpful in defraying costs and time this method may be, the overall effectiveness of web/computer-based nutrition interventions targeting adolescents is not known. Therefore, the purpose of this systematic review is to evaluate the most recent research regarding the use of this tool in the adolescent population in order to guide future research and implementation. To do so, the aims are to assess the efficacy of web/computer-based interventions in achieving their outcomes; identify which characteristic(s) of the interventions made the most significant impact on improving nutrition-related variables; and, based on the body of evidence, ascertain recommendations for research and practice.

**Methods**

*Literature Search*

A systematic literature search (Figure 1) was conducted by searching Internet databases (PubMed, CINAHL, Google Scholar, Proquest, Scopus) and manually searching related articles and journals with content related to health, nutrition, or diabetes as well as technology or communication. The National Library of Medicine’s Medical Subject Headings (MeSH) search terms and non-MeSH terms were included in a combination of the following key terms, at least one from each sub-listing: (1) web-based, internet, internet-based, online, computer, computer-based; (2) adolescent, youth; (3) diet, nutrition, intervention, nutrition intervention, obesity, obesity prevention, weight loss, weight maintenance, weight management, health promotion. When possible, search results were further limited by (a) the “English” language, (b) the species “Humans,” and (c) the period of “10 years.”
Figure 1. Retrieval and inclusion/exclusion process for articles used in systematic review

**Initial retrieval results using ≥3 key words with overlap between results**
- PubMed (n = 271)
- CINAHL (n = 3302)
- Proquest (n = 144)
- Google Scholar (n = 33700)
- Scopus (n = 71)

**Abstracts read, including first 100 of each search resulting in 500 or more articles: 1282**

- Articles excluded (n = 1259). Reasons include incorrect age group, case study, dissertation, non-computer or clinical intervention, ≥50% non-computer adjunct components (e.g. weekly counseling sessions, classroom curriculum, discussion groups)

**Manual search of related reviews and articles retrieved**

- Articles kept for further evaluation (n = 32)

- Articles excluded (n = 18). Reasons include additional publications for same study that did not provide adequate data; incorrect age group; ≥50% non-computer adjunct components; non-computer intervention

**Studies included in systematic review (n = 14)**
Inclusion criteria for articles included the following: (1) adolescent sample population between 7th to 12th grade or 11-18 years of age; (2) implementation of a web/computer-based nutrition/dietary education or behavioral intervention program; (3) published within the past 10 years (2002–2012); (4) randomized controlled trial (RCT), non-randomized controlled trial, or intervention with no control; (5) primary research articles in peer-reviewed journals; and (6) written in English. Both theory-based and non-theoretical frameworks for interventions were included. Studies must have measured nutrition-related outcomes, e.g. anthropometric, knowledge, or behavioral outcomes. Study designs that included one or more parents were considered only if the primary target of the research was the adolescent. Studies that included non-computer adjunct components and/or social or environmental changes were considered only if the main method of intervention was the web/computer-facilitated program. Exclusion criteria comprised the following: (1) interventions with ≥ 50% non-computer component(s); (2) a study population < 11 and > 18 years or < 7th grade and > 12th grade; (3) a focus on physical activity only; and (4) articles that were not peer-reviewed. Supplemental articles and periodic follow-up reports, whose results were also included in the final published article, were excluded as well.

Quality Ratings

Each article was reviewed separately by the two authors using the United States Department of Agriculture (USDA) National Evidence Library’s (NEL) appraisal guidelines for Research Design and Implementation and given a quality rating of positive, negative, or neutral. The two reviewers convened to finalize quality ratings and to complete a cross-sectional review of four weighted validity questions (Questions 2, 3, 6, and 7) to confirm that these were graded consistently and accurately. These four questions cover the unbiased selection of study subjects (Question 2), the comparability of study groups at baseline (Question 3), the adequacy of the intervention description and any intervening factors (Question 6), and the relevancy and validity of the outcome measures (Question 7). The authors used the Conclusion Grading Chart developed by the 2010 Dietary Guideline Advisory Committee (DGAC) to determine a grade for the strength of the body of evidence. The criteria cover the quality and quantity of
studies and subjects, the consistency of findings, and the magnitude and generalizability of study outcomes.

**Results**

An intermediate review of the resulting 32 articles was conducted independently by each author and 18 articles were excluded. The remaining 14 articles, half published within the last four years, underwent a full review during which a detailed evidence worksheet was assembled (Table 1) and quality assessed revealing nine positive ratings, three neutral, and two negative. The body of evidence received a grade of “Limited” due to the limited number of studies and relatively weak study designs. All main components were delivered by computer via internet or CD-ROM. Significant findings (P < 0.05) are reported along with gender differences and sample sizes for intervention (I) and control (C) groups, if given. Follow-up times are listed as time following the post-intervention assessment.
Table 1. Evidence table of web/computer-based nutrition education interventions for adolescents (n=14)

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Study Design</th>
<th>Sample</th>
<th>Intervention (Duration)</th>
<th>Theories</th>
<th>Follow-up(^1) (months)</th>
<th>Main outcomes &amp; Results in Total Sample at Follow-up</th>
</tr>
</thead>
</table>
| Williamson (2006) | RCT          | 11-15 yr Overweight/Obese African-American Females \(n=40\) | **HIPTeens** Weight loss and healthy lifestyle promotion (2 years) | | 6, 12, 18, 24 | BMI = ND  
Body weight = ND  
Avoidance of fatty foods (Adol.) = ↑  
Exercise (Parents) = ↑ |
| Doyle (2008) | RCT          | 12-18 yr Overweight/Obese Ethnically diverse \(n=66\) | **StudentBodies2** Weight loss and improvement of disordered eating behavior (16 weeks) | | 4 | BMI z-score = ND  
BMI = ND  
Weight = ND  
Dietary restraint = ↑ |
| Di Noia (2008) | NRCT         | 11-14 yr Low income African-American \(n=507\) | Promote fruit and vegetable consumption and self-efficacy (4 weeks) **TTM** | None | | F/V = ↑  
Self-efficacy = ND |
| Jones (2008) | RCT          | 9\(^{th}\)-12\(^{th}\) grade Overweight/Obese Binge-eating tendency \(n=87\) | **StudentBodies2-BED** Weight gain prevention and reduction of disordered eating (16 weeks) | | 5 | BMI = ↓  
BMI z-score = ↓  
Dietary fat/sugar = NC  
Binge eating = ↓ |
| Chen (2011) | RCT          | 12-15 yr Normal/Overweight Chinese-American \(n=50\) | **Web ABC Study** Promote healthy diet and physical activity (8 weeks) **TTM; SCT** | | 4, 6 | BMI = NC  
MVPA = ↑  
F/V = ↑  
Knowledge = ↑  
Self-efficacy = NC |

\(^1\) Follow-up is displayed as time since post-intervention.
<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Quality rating</th>
<th>Study Design</th>
<th>Sample</th>
<th>In-school interventions</th>
<th>Follow-up (months)</th>
<th>Main outcomes &amp; Results in Total Sample at Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frenn (2003)</td>
<td>Negative</td>
<td>NRCT</td>
<td>7th-8th grade Urban, Low-income 12-15 yr n=130</td>
<td>Decrease dietary fat and increase moderate/vigorous physical activity (4 weeks?) <em>TTM; Health Promotion model</em></td>
<td>None</td>
<td>% Dietary fat = NC MVPA = ↓ (Less in Int. group)</td>
</tr>
<tr>
<td>Frenn (2005)</td>
<td>Positive</td>
<td>NRCT</td>
<td>7th grade Low income Culturally diverse n=103</td>
<td>Decrease dietary fat and increase moderate/vigorous physical activity (4 weeks) <em>Health Promotion model; TTM</em></td>
<td>None</td>
<td>% Dietary fat = ↓ MVPA = ↑</td>
</tr>
<tr>
<td>Haerens (2006)</td>
<td>Neutral</td>
<td>RCT</td>
<td>7th-8th grade 13-14 yr Flemish n=2287</td>
<td>Increase physical activity and healthy eating (Once per year) <em>TPB; TTM</em></td>
<td>12, 24</td>
<td>ISPA = ↑ Dietary fat = ↓ (Girls) LTPA = NC Fruit = NC SSB = NC</td>
</tr>
<tr>
<td>Haerens (2007)</td>
<td>Positive</td>
<td>RCT</td>
<td>7th grade 12-13 yr Flemish n=304</td>
<td>Reduce dietary fat (Once) <em>TTM; TPB; SCT; Attitude, social influence and self-efficacy model</em></td>
<td>3</td>
<td>Dietary fat = ↓ (General schools) Dietary fat = ND (Vocational schools)</td>
</tr>
<tr>
<td>Mangunkusumo (2007)</td>
<td>Positive</td>
<td>RCT</td>
<td>7th grade 9-12 yr Dutch n=469</td>
<td>Promote fruit and vegetable consumption (Once)</td>
<td>None</td>
<td>F/V = NC Awareness = NC Knowledge = NC Self-efficacy = NC</td>
</tr>
<tr>
<td>Casazza (2007)</td>
<td>Neutral</td>
<td>NRCT</td>
<td>9th-12th grade 13-18 yr n=275</td>
<td>Compare computer vs. traditional delivery method of intervention to improve diet and exercise (16 weeks)</td>
<td>None</td>
<td>BMI = ND PA = ↑ Knowledge = ↑ Social support = ↑ Self-efficacy = ↑</td>
</tr>
<tr>
<td>Author (Year)</td>
<td>Study Design</td>
<td>Sample</td>
<td>Intervention (Duration)</td>
<td>Theories</td>
<td>Follow-up (months)</td>
<td>Main outcomes &amp; Results in Total Sample at Follow-up</td>
</tr>
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</tr>
<tr>
<td>Mauriello (2010)</td>
<td>RCT</td>
<td>9th-11th grade 13-18 yr n=1182</td>
<td><strong>Health in Motion</strong> Promote energy balance behaviors (Three times in 2 months)</td>
<td><strong>TTM</strong></td>
<td>4, 10</td>
<td>F/V = ↑ PA = ND TV = NC Behavioral risk = ↓</td>
</tr>
<tr>
<td>Maes (2011)</td>
<td>RCT</td>
<td>12-17 yr Europe n=621</td>
<td><strong>HELENA Food-O-Meter</strong> Improve diet and eating habits (Twice in 2 months)</td>
<td></td>
<td>2</td>
<td>% Energy from fat = ND Nutrient intake = NC</td>
</tr>
<tr>
<td>Ezendam (2012)</td>
<td>RCT</td>
<td>12-13 yr Dutch n=759</td>
<td><strong>FATaintPHAT</strong> Prevent weight gain, improve diet and increase physical activity (10 weeks)</td>
<td><strong>TPB; Precaution adoption process; Implementation Intentions</strong></td>
<td>4, 24</td>
<td>BMI = NC PA = NC Dietary intake = ND</td>
</tr>
</tbody>
</table>

NRCT = Non-randomized controlled trial  
NR = Not reported  
NC = No change from baseline  
ND = No significant difference between treatment and control groups  
MVPA = Moderate to vigorous physical activity  
PA = Physical activity  
TPB = Theory of Planned Behavior  
TTM = Transtheoretical Model  
SCT = Social Cognitive Theory  
Int. = Intervention  
RCT = Randomized controlled trial  
LTPA = Leisure-time physical activity  
ISPA = In-school physical activity  
SSB = Sugar-sweetened beverages  
F/V = Fruits and vegetables
Impact on Nutrition-related Outcomes

Randomized Controlled Trials for Weight Loss (n=2)

Williamson et al\textsuperscript{22} and Doyle et al\textsuperscript{23} both conducted RCTs to achieve weight loss, used Tanner scoring to adjust body mass index (BMI) for pubertal status, and conducted power analyses which resulted in adequate samples for both studies. Williamson et al\textsuperscript{24} found during the first six months that adolescents decreased their percentage body fat (I: -1.12%; C: +0.43%). At 6 and 12 months, adolescents also showed lower increases in BMI (I: 0.0 and +0.24 kg/m\textsuperscript{2}; C: +0.75 and +1.4 kg/m\textsuperscript{2}, respectively), yet regained weight over the second year to be statistically undifferentiated from control. Adolescents reported declines in fatty food consumption at 12 and 18 months, however at 24 months consumption mirrored the control group.\textsuperscript{22}

Doyle et al\textsuperscript{23} recorded a significant decrease in BMI z-score from baseline to post-intervention (I: -0.08, \(n=33\); C: +0.01, \(n=33\)). This amounted to a stabilization of weight for the intervention group (I: -0.06 kg) compared to weight gain by the control group (C: +2.14 kg). However, during the four month follow-up period, weight increased in both groups (I: +1.9 kg; C: +1.69 kg) and increases in mean height reduced overweight status, resulting in an insignificant difference between groups for BMI z-score, BMI, and weight. Dietary restraint scores, related to control of binge-eating, increased in the intervention group (I: +0.51; C: -0.38).

Although follow-up data for both studies revealed weight regain, outcomes during the interventions showed promising trends in weight maintenance or reduction in younger and older adolescents.

Randomized Controlled Trials for Preventing Weight Gain (n=2)

At the 4-month follow-up, Ezendam et al\textsuperscript{25} discovered lower intake of snacks (I: -0.6 pieces/day, \(n=412\); C: +0.3 pieces/day, \(n=360\)), increased intake of vegetables (I: +11 grams/day, \(n=436\); C: -7 grams/day, \(n=377\)), and lower odds of drinking > 400 mL/day of sugar-sweetened beverages (SSBs) (OR: 0.54), none of which were retained at the 2-year follow-up. BMI and waist circumference were not
measured at the 4-month follow-up. The intervention did not prevent weight gain at two years; percentages of overweight/obese students increased similarly (I: +2.1%; C: +3.2%).

Jones et al\textsuperscript{26} confirmed that intervention participants decreased their BMI (I: -0.82 kg/m\textsuperscript{2}, \(n=52\); C: +0.53 kg/m\textsuperscript{2}, \(n=35\)) and BMI z-score (I: -0.21; C: -0.03) from baseline to the 5-month follow-up. Post-intervention values were self-reported and therefore not included in the analysis. Additionally, the intervention group showed a decrease in their number of objective and subjective binge-eating episodes (I: -12.87 episodes; C: -5.68 episodes) and weight/shape concerns from baseline to follow-up. Unfortunately, dietary intake was not measured.

Computer-mediated healthy lifestyle promotion produced small, albeit unsustainable, changes in the diet of young adolescents; however, using a computer intervention to regulate binge-eating and teach weight maintenance in older, overweight/obese adolescents seemed effective for preventing future weight gain due to overeating.

\textit{Randomized Controlled Trials for Healthy Eating (n=6)}

Two RCTs conducted by Haerens et al\textsuperscript{27,28} resulted in short- and long-term decreases in dietary fat intake, with gender differences favoring female participants in both studies; no differences in water, SSB, or fruit intake were shown in one study and no power analysis was reported.\textsuperscript{27}

Mauriello et al\textsuperscript{29} showed an increase in fruits and vegetables (F/V) (I: +1.44 servings/day; C: +0.47 servings/day) that was sustained for 10 months after the intervention. However, no change in percent overweight was eventually found. The study was adequately powered.

Results from Chen et al\textsuperscript{30} found that a higher number of adolescents in the intervention group increased both their F/V intake and nutrition knowledge, and decreased their waist-to-hip ratio (WTHR) and diastolic blood pressure. Although there were 4- and 6-month follow-ups, results were not reported in a way that indicated whether or not significant differences occurred at the post-intervention, 4-month or 6-month measurements. Therefore, maintenance could not be determined. An \textit{a priori} power analysis revealed an inadequate sample size.
Mangunkusumo et al\textsuperscript{31} assessed post-test evaluations three months after baseline, and no outcomes produced significant results. A power analysis did confirm an adequate sample size. Similarly, Maes et al,\textsuperscript{32} at post-intervention and 2-month follow-up, reported no significant changes since both groups increased their percentage of energy from fat by the same amount (I: +0.46\%, \(n=381\); C: +0.47\%, \(n=240\)). No power analysis was conducted.

Two studies\textsuperscript{27,29} have demonstrated that long-term results were achievable using computer-mediated methods in both middle- and high-school aged adolescents. Short-term results were again observed,\textsuperscript{28,30} however two unsuccessful trials underscored that further work is still needed.

\textit{Non-Randomized Controlled Trials (\(n=4\))}

After modifications to a previous trial which showed a decreasing trend in fat intake with gender differences favoring females,\textsuperscript{33} Frenn et al\textsuperscript{34} confirmed a small but significant decrease in percentage intake of dietary fat (I: -0.8\%, \(n=40\); C: +0.1\%, \(n=49\)).

Casazza et al\textsuperscript{35} recorded via two 24-hour dietary recalls no difference between groups in fat, saturated fat, F/V or fiber intake from baseline to post-test; a power analysis confirmed an adequate sample size. However, the results of a food frequency questionnaire showed a significant decrease only in fat intake in the computer-based instruction group (C) compared to lecture-based instruction (L) and control groups (C: -33.5 grams/day; L: -13.7 grams/day; C: -7.4 grams/day).

Di Noia et al\textsuperscript{36} showed that self-reported daily F/V intake and scores related to perceived benefits of eating F/V increased in the intervention group (I: +0.71 servings/day, \(n=117\); C: -0.08 servings/day, \(n=390\) and I: 51.80; C: 49.21, respectively). Perceived barriers and self-efficacy showed no difference between groups.

Although the results of these non-randomized studies should be interpreted with caution, each study demonstrated an impact on a nutrition-related variable(s).

\textit{Impact of Intervention Characteristics on Nutrition-related Variables}

Most studies focused on a 7\textsuperscript{th} to 8\textsuperscript{th} grade population, while only five included high school-aged students.\textsuperscript{23,26,29,32,35} Half of interventions targeted adolescent sub-populations including low-income
minorities, minority females, overweight and obese adolescents, or overweight and obese minorities. Two interventions targeted disordered eating behaviors, including overeating and binge eating, in addition to instruction on healthy eating and lifestyle behaviors. Eleven programs focused on multiple nutrition-related energy balance behaviors, while the remaining three focused on either F/V consumption or dietary fat. Seven interventions also added strategies and/or feedback to increase the amount of physical activity.

**Duration**

Program lengths reporting significant positive effects \((n=9)\) averaged six sessions and ranged from a one-session 50-minute computer-facilitated (CD-ROM) fat intake intervention to a 16-session trial for weight management. However, the majority of those \((n=6)\) lasted \(\geq\) four sessions. Of those without significant results, lengths ranged from 52 weekly sessions to one 15-minute session. Sessions lasted between 15 minutes to 1 hour. However, duration was at times questionable due to variable participant participation. For example, Jones et al showed successful weight maintenance at the 5-month follow-up, yet noted that in the first cohort only 50% completed more than eight weeks of the 16-week program while 31% never logged on. This suggests actual duration may differ from the delineated program duration.

**Setting**

Five studies were conducted outside of a school setting, while more \((n=9)\) were in-school interventions. Both programs for weight loss were conducted outside of school, while all in-school interventions were concerned with either a targeted nutrient (e.g. dietary fat) or healthy lifestyle promotion. There were interventions outside of school that found significant effects on nutrition-related outcomes as well as those with overall insignificant results. Similarly, some in-school interventions had positive effects while others had little to no influence on changing dietary outcomes. Setting, surprisingly, did not seem to make a difference in regard to adherence/attrition. There was an outside of school intervention with high recruitment and low attrition (8%) , while the

\(^2\)References 22, 23, 26, 30, 33, 34, 36.
remaining outside of school interventions recruited relatively small samples, yet still had low and high attrition rates ranging from 7.4% to 30%. In-school programs also displayed both low and high attrition rates (from 3.5% up to 50%). Low participation regardless of attrition was also recorded in both settings as a failure to read nutrition feedback, incompletion of intervention modules, or lack of logging on to the website.

**Behavior Theory**

The prevailing theories were the Transtheoretical Model (TTM) and the Theory of Planned Behavior (TPB), applied either alone, as a pair, or included within a multi-theory approach. Of the five programs without significant effects, none utilized a theoretical framework. Of the nine programs with significant results, seven were framed with one or more theories.

**Computer-tailoring**

Most studies used computer-tailoring to provide personalized feedback to each individual user. Eight of the nine studies (89%) with significant results at follow-up applied computer-tailoring, compared to two of the five studies (40%) that did not have significant results.

**Skill-building**

Various skills were explicitly mentioned in most interventions with commonalities being the use of consciousness-raising (n=3) and self-evaluation (n=3), goal setting (n=4), self-monitoring (n=3), barrier identification (n=5), problem-solving (n=4), and building social support (n=7). The applications of each skill differed between interventions, however, it was most common to use online discussion forums to create an area of social support (n=3) and online journals and/or weight/activity graphs for self-monitoring and goal setting related to dietary intake and physical activity (n=5). Two unsuccessful trials did not include skill building components and both relied on knowledge and increased awareness through tailored feedback in order to change behavior. A third unsuccessful program incorporated many skill building processes yet did not find significant differences after four weeks. In contrast, Haerens et al delivered two different one-time interventions without skill building and found a decrease in fat intake.
that was sustained at three months and one to two years following; however, one also included environmental changes to the nutrition environment at school.

**Parental Involvement**

Six studies involved parents, either by sending educational materials home (n=4) or by including parents as independent study participants with separate access to the intervention website. However, only one evaluated the influence of parent participation on the adolescents’ outcomes in comparison to a control with no parental involvement. Haerens et al concluded that parental involvement aided in the decrease of girls’ fat intake by the end of the first year compared with a non-parental control, yet at the 2-year evaluation no significant differences were seen between the interventions with and without parental support.

**Gender**

Gender differences became apparent in three studies, however not all studies evaluated their results based on gender. Within those studies, dietary changes occurred most often in females. Doyle et al implemented the Student Bodies-2 web-based program which used gender-specific interfaces and content, e.g. masculine/feminine color schemes and gender-specific media portrayals of attractiveness, yet their outcomes were not separated by gender and there was no mention of this aspect’s impact on results. Furthermore, Haerens et al, after a 2-year evaluation of a CD-ROM delivered intervention, found a significant decrease in fat intake for adolescent girls but not boys.

**Discussion**

Because web- or computer-based nutrition programs are relatively new, it is not surprising that few studies or reviews have been published in this area specifically for adolescents. One recent study found web-based programs to be as effective as face-to-face programs for low income adults, and a similar comparative study would be useful for adolescents. One of the interventions in this review included such a comparison, and demonstrated that a computer-based nutrition intervention was equally as effective as a lecture-style intervention delivering the same information. Three reviews similar to this review have been published; however, they have covered interventions for children as well as adolescents.
and have, in two cases, focused specifically on an overweight and obese population. Only a few interventions overlap between reviews. A review covering six distinct RCTs of web-based weight management programs for overweight children and adolescents concluded that web-based interventions demonstrated the potential to decrease childhood obesity, albeit after the consideration of more rigorous methodologies, appropriately implemented theoretical frameworks, increased long-term effectiveness, and gender-appropriate interventions. Another review of electronic interventions for overweight and obese children and adolescents concluded that poor study quality and evaluation obstructed a clear viewpoint about the effectiveness of electronic interventions in this population, despite 11 of 15 studies reporting positive obesity-related outcomes. A review by Whiteley et al. that examined internet-based interventions for overweight prevention in youth determined that while some results were positive, others were inconclusive, and that a lack of randomization, insufficient number of youth, and length of intervention were areas that should be addressed in future research. Therefore, several of our findings can also be useful to both nutrition practitioners and researchers in developing and improving the proper application of web/computer-based methods.

Most of the interventions with significant outcomes used behavior theories. Although using a behavior theory within nutrition interventions has been supported, much discussion has emerged on how to use behavior theory and which theory to use. The difficulty in answering these questions is evident in the results of this review. Although 57% of interventions applied a theoretical framework(s), we could not conclude that any particular behavior theory led to better outcomes; we can only recommend using a behavior theory/model rather than none. There was also insufficient evidence to indicate if a combination of theories improved outcomes compared to a single theory or to another combination. Application of the appropriate theory will most likely depend on the intervention, the outcomes, and mediating variables.

Ritterband et al. also recognized a gap in behavioral/theoretical grounding for internet interventions and attempted to create an original model for behavior change to help researchers create and test web-mediated interventions for any target behavior. Although to our knowledge the model has not yet been tested, the authors underscored the importance of applying a behavior change theory to internet
interventions with additional considerations regarding website characteristics. In addition to theoretical framework, intervention content and website (or software) characteristics should be considered as part of the model for behavior change, e.g. delivery of content (audio, video, animations, testimonials, graphics), appearance, burdens of using the website (difficult navigation, intervention too long), message style (text vs. animations), and audience engagement. For instance, in a process evaluation of an online weight loss program for adults,\(^46\) the investigators were surprised that social support features were not liked and not used by participants, even though social support has been shown to be important to in-person programs. In another evaluation of a nutrition-related website for adults,\(^47\) simple activities for making a healthy plate were used much more often than more complex activities involving carbohydrate counting, and participants would return to the site to “make a plate” until they received correct scores. Therefore, website characteristics play a key role in behavior change and therefore should be considered along with traditional behavior change methods.

Additionally, researchers developing web/software interventions should be concerned with factors regarding website usage and adherence, including user expectations and support. Aligned with these considerations, certain interventions within our sample included such elements as email counseling, gender-specific interfaces, multimedia interaction, and computer-tailored feedback. Computer-tailored feedback in nutrition education has been successful,\(^48\)\(^49\) as has the use of e-counseling.\(^50\)\(^51\) In our review, computer-tailoring was also associated with studies that achieved positive outcomes. However, other elements did not seem to affect nutrition-related outcomes; therefore it may be that other intervention components negated their beneficial effects. More common application of these methods and further evaluation will bring us closer to understanding their specific impact on nutrition-related variables.

The results of this review provided inadequate information to conclude the influence of parental involvement. Parental involvement, according to the 2007 Pediatrics Expert Committee, should be progressively reduced as children age beyond 12 years.\(^52\) Compared to children, there is less evidence or evaluation that supports the inclusion or participation of parents as an important component of nutrition education interventions for adolescents, particularly for computer-mediated interventions. Hingle et al.,\(^53\)
based on a systematic review of parental involvement in child and adolescent dietary interventions, suggested that although there was a lack of consistency in results and overall low quality of reporting, *direct* methods of parental involvement tended to result in better outcomes than the more common *indirect* methods. Family-oriented clinical interventions have demonstrated significant effects on weight and dietary outcomes,\(^54-55\) and it has been shown that parental restrictions of unhealthy foods may help reduce consumption of these foods in adolescence.\(^56\) However, for web/computer-based nutrition interventions for adolescents, it is unclear at present if this is an important component for success. The dynamic of the parent-adolescent interaction may differ when considering computer-mediated nutrition interventions, as the *adolescent* is considered the primary food-chooser and not the *parent*. Therefore, it may be that future interventions must choose whether or not to include direct, instructional materials that enhance parental influence or to focus on altering the adolescent’s independent food choices.

Choosing the optimal nutrition-related outcomes is also important. Although the USDA NEL concluded that there is moderately strong support that dietary energy density is associated with childhood adiposity,\(^57\) none of the interventions addressed dietary energy density. There was limited support for F/V intake as a protective measure of adiposity in children,\(^57\) however seven studies addressed F/V intake. Although it was noted that studies have not been isocaloric, the USDA NEL found moderate support that dietary fat was associated with childhood adiposity,\(^57\) and seven studies accordingly addressed dietary fat. Adolescents are the highest consumers of SSBs, which are an important contributor of calories in the diet.\(^58-60\) The USDA NEL concluded that strong evidence existed for the association between SSBs and increased childhood adiposity.\(^57\) However, only three studies in this review addressed SSB intake. Addressing these identified dietary factors in nutrition interventions is a priority for decreasing the overall prevalence of overweight and obesity in adolescents and therefore future adults.

Optimal duration of a web/computer-based nutrition intervention could not be concluded due to fidelity to treatment issues and varying program lengths, outcome measures, and results. Logically, program lengths will be dependent on the expected outcomes for the interventions and having reasonable effect size coupled with an adequate sample size, but data related to these were inconsistent. Suggestions
for optimal program duration for adolescent nutritional interventions have been given. Connell et al\textsuperscript{61} suggested that at least 50 hours of in-school instruction was adequate to produce behavior change; Sharma,\textsuperscript{62} based on a review of in-school obesity prevention programs for K-12\textsuperscript{th} grade, recommended that dietary interventions last at least six months. However both reviews considered only in-school, non-computer interventions. Therefore, it is clear that appropriate program duration requires further investigation, keeping in mind that computer-mediated instruction may have substantially different requirements.

Both web/computer-based and traditional interventions have experienced gender-based differences in outcomes, especially dietary outcomes. *Planet Health*, a 2-year intervention for middle-school students, was able to increase F/V consumption in girls but not in boys.\textsuperscript{63} The same trend in favor of better outcomes for girls can be found in traditional interventions which cater to younger children as well.\textsuperscript{64-66} However, no gender differences were found in nutrition knowledge when active vs. passive websites were compared.\textsuperscript{67} In the current review, gender differences were found in three studies, however evaluation based on gender in other studies may have produced additional insight. Paying closer attention to gender-specific learning styles, preferences, or expectations for weight loss or weight management could help improve nutrition-related outcomes in future investigations.

Also to be considered is weight maintenance rather than weight loss and methods of measuring the weight outcomes for web/computer-based interventions. Fowler-Brown et al\textsuperscript{68} emphasized that weight maintenance rather than weight loss should be considered for any obese or overweight child above age two without medical complications. This suggests that dietary and weight management interventions for a general population of adolescents are to pursue strategies for energy balance, i.e. encouraging healthy lifestyle habits such as proper nutrient intake and portion size as well as daily physical activity. However, even when working with obese adolescents, weight stabilization methods, e.g. portion control, decreases in fat and sugar, and controlling binge eating, may prove a more effective goal via web/computer-based instruction in this population, especially for long-term maintenance.
Of those articles measuring BMI ($n=6$), only 2 mentioned using Tanner scores or correcting for pubertal status when analyzing BMI. For adolescents up to age 20, the BMI is appropriately standardized according to gender and age to account for growth, but not for those actively undergoing puberty. Therefore, the sexual maturation stage also must be taken into account when assessing the risk of obesity during the age when pubertal changes are taking place.

Based on the concerns apparent in our review and similar reviews, important issues to be addressed in future research include (a) replication of studies that measure dietary energy density, F/V, dietary fat, and SSBs; (b) rigorous methodology, including power analyses, randomization, and comprehensive reporting of the intervention and components; (c) inclusion of long-term maintenance strategies and evaluation; (d) attention to website characteristics, participation and adherence; (e) the inclusion of a theoretical framework for behavioral change; (f) direct methods of parental involvement, if any, and evaluation of such methods; (g) investigation of gender-specific programs; and (h) comprehensive recording of dose and duration for future comparison.

Web/computer-based nutrition education programs have the advantages of wide reach, lower resource requirements, and time flexibility for the user. As discussed, web/computer-based nutrition interventions have the potential to influence adolescents in order to improve overall dietary habits and curb the expansion of overweight and obesity. However, their results at present specify that further research is necessary in order to achieve their full potential.
REFERENCES


CHAPTER 4.

LEARNING THROUGH ONLINE VIDEOS IN A NUTRITION EDUCATION INTERVENTION IN MIDDLE-SCHOOL STUDENTS

Introduction & Rationale

Computer-based nutrition interventions can incorporate multiple components; however, with many failing to evaluate the impact of each component on the outcomes, research is needed to highlight the efficacy of certain online intervention components in regard to their influence on intervention effects.

There is a need for evidence-based research to support the inclusion of videos in computer-based nutrition education interventions. Observational learning and peer modeling are accepted concepts for visual learning in psychology\(^1\)-\(^2\); however, that alone is not enough to include videos in an intervention without evaluation of their ability to enhance learning in an intervention.

Evaluation of video education has been conducted in other areas, e.g. adult training programs, higher education and patient education,\(^3\)-\(^8\) including nutrition education for adults.\(^9\)-\(^11\) Results from those assessments included increased short-term knowledge, understanding, and self-care behaviors with additional considerations such as differences in learning style and cognitive load, the influence of interactivity in videos, and the complexity of the behavioral task on which the video is focused. However, a similar evaluation has not been conducted for nutrition videos in adolescents and has not been conducted for computer-mediated video education in nutrition interventions. Therefore, the inclusion of videos as a component of nutrition education interventions is an area that deserves evaluation, as it can be costly to develop educational videos compared to other modes of communication. However, if their instructional benefit is found to outweigh their cost of production, then their inclusion in computer-based nutrition education would be a wise investment.

Hence, in order to evaluate the inclusion of videos in the web-based nutrition education intervention Healthy Outcomes for Teens (HOT) Project, focus groups were conducted with a group of middle-school students (6\(^{th}\) to 8\(^{th}\) grade) to assess the difference in learning, measured as recall and understanding of nutrition messages, between video and narration within the context of the larger
intervention. Based on previous quantitative research, students who completed the fully interactive HOT project modules showed higher knowledge scores at posttest compared to a control group, which only had access to a text-based, non-interactive, “passive” version of the website containing the same information. Subsequent qualitative evaluation of this intervention using focus groups revealed the website’s “kid appeal.” The students liked the multimedia features, including the videos, and suggested that more videos and other features be added to the website. However, before the time and expense of additional video production is undertaken, it should be assessed whether or not the videos can demonstrate usefulness as part of the intervention compared to cheaper modes of communication, e.g. online text and narration, and if the issues surrounding video education could possibly impact the instructional capability of the current videos. This evaluation would provide insight as to the educational advantages or disadvantages of the current online videos and can inform researchers of the potential of issues to address if they decide to develop additional videos.

Focus groups can be used to procure valuable, qualitative information about an intervention from one’s target population and have been used in the development and evaluation phases of computer-based nutrition education programs. The results can inform researchers and interventionists about additional issues, ideas, and solutions that were not considered during the initial program development and that could be salient to their population and the effectiveness of their program. To assess computer-based interventions, since they already circumvent face-to-face contact, focus groups are an important method that provides insight about the usage and performance of the program and allows users to offer personal, informative feedback.

Therefore, focus groups were also utilized in this study to see if there differences for recall and comprehension between two instructional mediums, video and narration, to evaluate the usefulness of the current videos and to explore if these differences may be related to concepts associated with video education. It may be that regardless of delivery method, the use of scenarios or the design of scenarios is influential in the students’ ability to retain, recall, or comprehend the information. Either way, these insights would benefit researchers in the further development of this intervention and others.
Methods

Setting and Human Subjects

A junior high school in a Midwestern county whose Physical Education teachers had previously worked with University of Illinois researchers regarding the HOT project agreed to participate in the study and allow access to the students taking PE class. Consent was confirmed from the school principal as well as the three Physical Education teachers. The junior high educates 442 students and is comprised of approximately 43% White and 37% Black students, with slightly more males enrolled (54%).

Approximately 63% of 6th and 7th grade students and 78% of 8th grade students met or exceeded the reading standard achievement tests. The Institutional Review Board for the University of Illinois approved the study, and written parental consent and child assent was obtained for all participants.

Description of the Healthy Outcomes for Teens (HOT) Project

The HOT project is an interactive, multimedia program that includes audio voiceover for the written parts of the website, videos, games, interactive and non-interactive animations, and graphics. The program was adapted from a diet and physical activity program for undergraduates and a successful adult diabetes education program called Your Guide to Diet and Diabetes. Formative research to create the program involved a group of high school students as the HOT Council. These students were slightly older than the target population. The HOT Council provided information about appropriate content, order of content, and combination of media for the intervention. Focus groups with the HOT Council and observational data also informed the use of technology to explain complex ideas and how to increase the use of the website in the target population. Thereafter, five modules containing diabetes-related nutrition and physical activity messages were developed. The modules contained distributed interactive learning features, such as animation, games, songs, and videos, which were supposed to distribute learning across different interactive mediums to enhance learning.

Presently, the intervention includes 7 educational modules that inform students about the definition, process, and symptoms of diabetes, how to balance calories with healthy food choices and physical activity, different ways to be physically active, different types of macronutrients and how
carbohydrates affect blood glucose, reading nutrition labels, food groups and proper serving sizes, stress and its symptoms and management, and ways to keep blood glucose under control. The website also includes a “Fun Place” with 8 nutrition-related games. The second module “Getting balanced with food and physical activity” contained the 6 short videos to be studied, 3 focusing on healthy eating and 3 on physical activity.

The intervention was framed in the Social Cognitive Theory, which explains that a person’s environment, personal characteristics, and behavior are connected and influence each other. Therefore, inclusion of videos was based on the observational learning concept outlined in the theory as a way to show students how to make healthier food choices and overcome barriers to physical activity using peer models. In addition, the concept of subjective norm from the Theory of Planned Behavior was applied to video development. Subjective norm is the “perceived social pressure to engage or not to engage in a behavior” and is based on a person’s motivation to comply with their perceptions about what important people in their life think they should do concerning a behavior. In the videos, this was applied by having two people interacting with each other, one being the important referent that informs or motivates the other person to adopt a healthy behavior.

The video scripts were developed by a research team prior to this study, and pilot-tested among college students for flow, language, content, and perceived believability. Video length was targeted to be one minute or less, and for all 6 videos is approximately 30 seconds. Student actors were recruited from a church’s drama group, with written parental approval. Student actors were paid $50 for a day of shooting the video segments. One graduate student and one University of Illinois staff member volunteered to play the older characters. Permission was obtained from the management of David Christopher Hall to shoot the scenes in the on-campus kitchen and family rooms of the Family Resiliency Research Home. The web development office of the University of Illinois Extension filmed and edited the scenes. All videos were filmed in one day, multiple takes of each video reviewed, and one video for each topic was selected and embedded within the HOT Project website.
Alternate webpage design

An alternate website for the HOT project was created with help from the University of Illinois Extension Office web development team. A graduate researcher translated the videos into short, written paragraphs that contained descriptions of the video scenario, some of the same words and phrases from the original scripts, and the same nutrition-related information (Table 2); nutrition messages that were intended to be conveyed by the scenarios are shown in Table 3. The same researcher recorded audio voiceovers for the written scenarios to be added to the website, so that students could listen and read along. Both the video and narration lasted similar lengths of time, approximately 30 seconds.

The original website and the alternate website were identical, except the alternate webpage for the second module. On this page, two links were added: (1) “Watch videos” that navigated to the original six videos, and (2) “Listen to audio only” that navigated to the written scenarios with audio playback. On both pages, students could click a play button that began the video or audio playback.
<table>
<thead>
<tr>
<th>Narrated script</th>
<th>Screenshot of video clip</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Making Dinner</strong> Johnny and his older sister Elizabeth are at home thinking about what to eat for dinner. Their parents are not home, and Johnny would like to order a pizza with the money their parents left them. Instead, Elizabeth suggests going to the grocery store to buy ingredients to make a pizza. She explains to Johnny that making pizza at home is easy and would allow them to eat a variety of fresher food. When Johnny hears this, he agrees with sister that they should make pizza at home – but only if it is thick crust pizza!</td>
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<tr>
<td><strong>Basketball at the Park</strong> Pablo is jogging around the neighborhood and decides to stop by his friend Luke’s house to ask if Luke would like to jog with him. Luke says he likes running, but not without a purpose, so Pablo suggests that they play basketball at the park instead. Pablo likes this idea better and joins Luke and other friends to play basketball.</td>
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</tr>
<tr>
<td><strong>Bike to the Mall</strong> Emily and Cara are hanging out on the weekend when Emily says she’s bored. Cara suggests going to the mall since it’s too hot to do anything outside. Emily agrees that this sounds like a good idea, but since they don’t have a ride to the mall, she thinks they should do something outside anyway. Cara says she doesn’t want to get hot and sweaty, but Emily tells her that sweating is good for her pores and can improve her complexion. Cara compromises by suggesting that they bike to the mall and Emily thinks this is a good idea too because every little bit of exercise counts.</td>
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</tbody>
</table>
### Packing your Lunch

Sam is at Rebecca’s house afterschool and they are talking about school lunches. Sam says he hates school lunches because they are greasy. Rebecca brings her own lunch to school and suggests that Sam bring his lunch too, but Sam says he doesn’t have time to pack his lunch in the morning. Rebecca assures him that it is not that hard to pack your lunch once you get used to it, and shows him that she packs her lunch afterschool to get ready for the next day. Sam says that he will try to start packing his lunch the night before, and Rebecca reminds him that packing his own lunch is healthier and will make sure that he doesn’t have to eat any more of those greasy school lunches.

### Get Up and Do Something

It is Saturday afternoon and Eric’s mom is telling him to stop playing video games and go do something active. Eric says there is nothing to do! His mom tells him there are lots of choices, like jogging, biking or rollerblading. Eric doesn’t want to do any outside activities, he would rather stay inside. His mom reminds him of his Christmas present, a ping pong table, that he could play with instead of going outside. Eric agrees this could be a good idea, but points out that he doesn’t have anyone to play with. His mom says she will play with him and may even beat him!

### Popcorn and Water

Cynthia is hanging out at her friend Laura’s house on the weekend and tells Laura that she is starving! Laura says to Cynthia that she has potato chips and soda they can eat. In Health class, Cynthia learned that air-popped popcorn is a low-calorie alternative to potato chips and that drinking 8 glasses of water each day can make skin look prettier. Cynthia shares this information with Laura, and Laura gets excited about improving her skin and agrees that they can eat popcorn and water instead.
<table>
<thead>
<tr>
<th>Scenario</th>
<th><strong>Overall theme:</strong> Be physically active</th>
<th>Scenario</th>
<th><strong>Overall theme:</strong> Healthy food choices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Get up and do something</strong></td>
<td>Find a way to play inside, if you don’t want to play outside</td>
<td><strong>Popcorn and water</strong></td>
<td>Choose snacks lower in calories; Choose drinks lower in calories</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Find low calorie alternatives to your food choices</td>
</tr>
<tr>
<td><strong>Basketball at the Park</strong></td>
<td>Encourage a friend to play with you if you have no one to play with</td>
<td><strong>Packing your lunch</strong></td>
<td>Make your own lunch if you do not want the school lunch, or if the school does not provide healthy alternatives</td>
</tr>
<tr>
<td></td>
<td>If you don’t like an activity, find another activity that you like to do</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bike to the mall</strong></td>
<td>Find ways to increase your activity, like active transportation</td>
<td><strong>Making dinner</strong></td>
<td>Making pizza at home can be cheaper and healthier than buying pizza from a restaurant</td>
</tr>
</tbody>
</table>
Planning and recruitment

The principal investigator (PI) and graduate researcher met with two PE teachers 2 weeks before the study began to provide details on the study’s goals and activities, discuss class periods to recruit, plan dates and times of school visitations, and to reserve computer labs for the necessary dates. Planning and coordination with the PE teachers also continued throughout the study.

Target recruitment was set at 60 students from 2nd and 3rd period classes, 6th and 7th grade, respectively. Sixty students was the maximum estimated number of participants that the researchers could accept within the two classroom periods, based on the calculation of 10 students per focus group and 3 focus groups per period (30 students per class period). Guidelines recommend 6 to 10 focus group participants, with at least 3 focus groups conducted. There is not a reliable guideline or rule for choosing a sample size for focus group research, unless quantitative measurements are anticipated, therefore researchers are left to estimate based on their needs and explain their rationale based on their own judgment. This study was not designed to be representative nor powered to collect quantitative data.

The PI and graduate research assistant recruited on one day (Tues., Feb. 12, 2013) during both periods at the beginning of each class, while students were in the gymnasium. Informational flyers describing the study and compensation along with parental consent and child assent forms were given out to students who were interested in participating (see Appendices 1-3). Students were instructed to take home, sign, and return the consent and assent forms in 2 days to their PE teacher. Researchers explained during recruitment that compensation for attending one website viewing and one focus group was $20 in cash and compensation for completing the second website viewing and second focus group was an MP3 player valued at $20. The students were told during recruitment that the first 60 students to return their forms to the P.E. teacher would be included in the study. One PE teacher also recruited students from his Health classes during 2nd and 3rd periods, which were held in a separate room from the gymnasium. Additional consent/assent forms were accepted until the first day of the study (Tues., Feb. 19, 2013) due to lower than expected recruitment. Due to this low recruitment, another round of recruitment occurred on
the first day of the study at the beginning of the 4th and 5th class periods, 6th and 8th grade, respectively. These students were instructed to return their consent/assent forms in one week (Mon., Feb. 25, 2013). Forms returned the morning of Tuesday, Feb. 26, 2013 were also accepted. All completed consent/assent forms were stored in a locked filing cabinet in the PI’s office.

**Design**

The study consisted of 2 website viewings and 2 focus groups, for a total of 4 meetings, once per week, conducted over the course of 6 weeks (Feb. 19 to Mar. 26). Each website viewing was followed by a focus group and separated by at least one week. During the first website viewing, students in both the video and narration groups completed 3 modules (1, 2, and 6) that covered topics on diabetes (Module 1), physical activity and healthy food choices (Module 2), and stress (Module 6). The website content that each group viewed was identical, except for one webpage in Module 2 that showed a link to the videos and a link to the narrated text. Students in the video group were instructed to click the link to watch the videos, while students in the narration group were to click the link to listen to the narrated text. Therefore, the only difference between the websites for the two groups was whether or not they watched videos or listened to narrated text of the same scenarios. During the second website viewing, both groups completed 2 modules (2 and 5) that covered physical activity and healthy food choices (Module 2) and portion sizes and macronutrients (Module 5). The additional modules, other than the target module (Module 2), were added to observe the capacity of the videos to stand out in relation to other information and other media present in the intervention.

The students were aided with typing the website address into the web browser on their computers, and then were given general instructions on which modules to complete, how to navigate through each module using the navigation buttons, and which scenarios to view – either videos or narration. After these general instructions, students were allowed to continue through the website by themselves, as it was self-guided. The researchers remained in the computer room to answer general questions. After completion of all three modules, students could spend the rest of the class period playing the games that were included in the HOT project intervention website.
Second and fifth periods (6th and 8th grade) watched the videos first (video-first group), \( n=18 \). Third and fourth periods (7th and 6th grade) listened to the narrated text first (narration-first group), \( n=23 \). The study was designed with a crossover design to compare the two delivery methods (Figure 2). During the second website viewing, the video-first group listened to the narrated text, while the narration-first group watched the videos. This way, a paired sample would allow comparison of learning between the two delivery methods within the same participants in order to decipher if learning capability is due to the users or due to the delivery method.
Figure 2. Schematic of crossover design

**VIDEO**
- 2nd & 5th periods, n=18
- 6th & 8th grade
- Website viewing #1
- Modules 1, 2 & 6

Focus group #1
(4 focus groups)

1 week

**NARRATION**
- 3rd & 4th periods, n=23
- 7th & 6th grade
- Website viewing #1
- Modules 1, 2 & 6

Focus group #1
(5 focus groups)

1 week

**NARRATION**
- 2nd & 5th periods, n=15
- 6th & 8th grade
- Website viewing #2
- Modules 2 & 5

Focus group #2
(4 focus groups)

1 week

**VIDEO**
- 3rd & 4th periods, n=20
- 7th & 6th grade
- Website viewing #2
- Modules 2 & 5

Focus group #2
(4 focus groups)
Focus groups

Each student was to participate in 2 focus groups; each meeting occurred in the computer lab during the students’ PE class. A maximum of 3 focus groups were conducted per period, with 2 to 6 students per group. This allowed for approximately 10 to 13 minutes per focus group in order to fit within each 40-minute class period. Focus groups are normally conducted until theoretical saturation is reached, i.e. when the focus group responses do not reveal any new information or themes. However, in this study, focus groups were conducted until all students who signed up to participate were involved in 2 focus groups in order to make a comparison.

Focus groups for each class period were held one week after each website viewing in order to gauge retention of information over time and the ability of students to recall details about the scenarios and the nutritional message provided in the scenarios. Focus group questions were created by one graduate research assistant who also served as the moderator using the guidelines outlined by Krueger. Questions followed an “hourglass” pattern in which they began with open-ended questions, followed by transition and key questions, and closed with ending questions which were also broad (see Appendices 4 and 5). Questions were asked regarding their overall ideas from the website, information they regarded as new, information they remembered from the six scenarios on the website, interpretations of the main message for each of the six scenarios, and their perspectives on the difference between learning from videos versus narration and their perspectives on the believability and the value of the scenarios as part of the intervention.

The quality and clarity of the questions were tested twice with a group of graduate students and the PI who acted as focus group participants. Changes were made to unclear words or phrases, excess questions were removed to remain within the allotted timeframe, and prompts were added to key questions. The final script was used to guide the moderator through each focus group with the middle-school students. Pseudonyms were adopted by the students so that their focus group responses would remain anonymous. Students chose their own pseudonyms and, at times, were provided with pseudonyms. These names were used by the moderator and other focus group members to address each other during the
focus groups. Students who provided written consent to being audio-taped were placed together, and those who did not consent participated in separate, non-recorded sessions.

Two additional graduate researchers, excluding the moderator, were present at all times. One researcher, a PhD/RD, acted as the co-moderator and was responsible for taking notes about the perceived ethnicity (Caucasian, African/African-American, Hispanic, Asian/Asian-American, or Uncertain) and perceived weight status (Obese, Overweight, Normal weight, or Underweight) of each participant and for summarizing each participant’s statements during the focus groups during both recorded and non-recorded sessions. To estimate weight, the co-moderator visually judged and recorded the participants’ body weight without using a body weight comparison chart. The moderator and co-moderator were responsible for taking observational notes as well. These notes are included in the final report. The third researcher supervised groups of students back and forth from the gymnasium to the computer lab.

Thematic analysis

Thematic analysis, as defined by Braun and Clarke,29 is a means to “identify patterns of meaning across a dataset that provide an answer to the research question being addressed.” The method of thematic analysis outlined by Braun and Clarke was used to complete the analysis of focus group data, using both inductive and semantic approaches which allowed for “coding and theme development [to be] directed by the content of the data” using a non-interpretive, explicit understanding of participants’ responses.29-30 Overall, the process entails six steps: (1) familiarization with the data, (2) coding the data, (3) identifying themes from the codes, (4) reviewing and revising themes, (5) defining and explaining themes, and (6) contextualizing and reporting the results.29-30

All audiotaped focus groups were transcribed by an undergraduate research assistant immediately following the focus groups. The transcripts were checked for errors and corrected by the moderator. The PI, moderator, and a trained undergraduate research assistant independently read and coded the transcripts and met three times to agree on codes, themes, and negative cases within each focus group. Negative cases were single responses or responses without consensus from other participants and, therefore, did not fit into major themes. Major themes shared by focus groups were reported, as well as negative cases.
In addition, another graduate research assistant who did not participate in the study provided an unbiased analysis of the accuracy of participant responses compared to the intended messages for each scenario. To do this, the researcher was provided a list of participants’ responses to Question 6 (What do you think was the main message of this scenario?) for each scenario, as well as a list of the intended messages for each scenario. The research assistant then compared the participants’ responses to their corresponding intended messages and rated the responses as accurate, approximate, or inaccurate. This analysis was calculated into a percentage of accurate, approximate, and inaccurate responses and reported in the results.

Subsequently, one graduate research assistant analyzed the data across all first focus groups to identify themes of recall and comprehension, separating them into two groups: video-first and narration-first. This analysis was repeated across all second focus groups to compare any differences in recall and comprehension after the crossover. Numbers of responses and numbers of participants responding were also counted for a quantitative perspective of the scenarios recalled. Patterns based on gender or grade differences were also investigated. To investigate gender differences in responses, a percentage of appearance for each scenario was calculated by dividing the number of times the scenario was mentioned by the total number of responses for each gender, within both focus groups.

Results

Forty-one students signed up to participate, and due to school absences, conflicting band practice, and one instance of disciplinary action, a total of 35 students completed all required meetings, two website viewings and two focus groups [$n=11$ (2nd period); $n=13$ (3rd); $n=9$ (4th); $n=2$ (5th)]. All students, except one, had not participated in any HOT project research studies. The focus group participants were ethnically diverse with 11 Caucasian students (31%), 18 African-American (51%), 5 Hispanic (14%), and one Asian-American student (3%). Estimates of weight status revealed that about 17% of participants were overweight or obese ($n=6$); however, perceived weight was not recorded for two focus groups which represents a lack of estimated weight information for 11 participants. However, the Center for Disease Control and Prevention currently estimates the rate of overweight and obesity of adolescents (12 to 19
years) as approximately 17%\textsuperscript{31-32}; therefore, it is likely that the sample was representative of the population. There were 24 girls (69%) and 11 boys (31%). Sixth grade students were the most represented at \(n=20\), 7th grade students followed with \(n=13\), and only two 8th grade students participated. All focus groups except for two were recorded with a digital voice recorder.

Overall themes are summarized in Table 4 and are reported below along with a number of exemplary quotations, listed with participants’ pseudonyms, gender, and grade. They are also separated by focus group for clarification, when necessary. Quotations from students in the video-first group appear first, and quotations from the narration-first group follow.
Table 4. Summary of overall themes

<table>
<thead>
<tr>
<th>Questions</th>
<th>Overall Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main idea (Questions 1-3)</td>
<td>Students reported the website was about staying healthy, diabetes &amp; prevention, balancing calories, and food groups &amp; portion sizes</td>
</tr>
<tr>
<td>New information (Question 4)</td>
<td>The topics of diabetes and stress were reported as new information</td>
</tr>
</tbody>
</table>
| Retention and Recall (Question 5) | Students retained more scenarios 1 week after watching videos  
Recall was more detailed 1 week after watching videos |
| Message Comprehension (Question 6) | About 50-70% of students accurately interpreted the intended nutrition and physical activity messages, while the rest reported general, non-specific interpretations |
| Believability (Question 7)    | Scenarios were believable to students                                           |
| Value of scenarios (Question 8 or 9) | Students wanted to keep the scenarios for better understanding and to provide examples |
| Recommendations to peers (Question 9) | More students recommended the videos as better for learning compared to narration |
Themes for General Questions (Questions 1-3, Focus groups 1 & 2)

These questions referred to the website in general, not specifically to the videos or narrated text, and were asked in both the first and second focus groups.

1. Can you name some things that the website talked about?
2. What do you think was the main idea of those sections you mentioned? (What was it trying to tell you?)
3. What makes you think that was the main idea? (Was there something that caught your attention? Made that idea stand out? Talked a lot about that topic?)

In total, six different themes were identified. In response to questions 1 and 2, the analysis resulted in four themes, depending on which modules they viewed: modules 1, 2, and 6 for the first viewing or modules 2 and 5 for second viewing. After the first website viewing, the responses focused on staying healthy, calories in and calories out (i.e. balancing calorie intake with physical activity), and diabetes and prevention. For the second viewing, which included modules 2 and 5, the main ideas were staying healthy and food groups/food portions. In response to question 3, two additional themes appeared showing that, in focus group 1, many students considered these topics as the main idea(s) because the website “talked a lot about” them; yet, in focus group 2, students cited the visual or interactive aspects as the reasons why they considered those topics as the main topics.

Staying Healthy

Middle-school students from each grade, and in both video and narration groups, reported that "stay healthy," eat/eating healthy," "healthy choices" and "be active" were topics or ideas that the website talked about. This was also a consistent answer for the main idea of the modules they completed. The words "healthy" and "active" were used repeatedly by students as descriptors.

Focus group 1

- *How to eat healthy.* – Zeus, M, 6th (video-first)
- *How to be active.* – Mariya, F, 6th (video-first)
- *Health and fitness and stuff.* – Moonfire, F, 6th (video-first)
Talked about health and why it was good to eat, like, healthy and stay active. – Lebron James, M, 6th (video-first)

How to eat healthy [and] how exercise can help you a lot. – Aphrodite, F, 6th (video-first)

People have to learn how to eat healthy. – Falcon, F, 8th (video-first)

To do healthy things and be active, I guess. – Hello Kitty, F, 7th (narration-first)

To get kids to, like, start eating healthy, go outside, do active things. – Kite, F, 6th (narration-first)

Focus group 2

To make sure that your body gets nutrients that it needs and make sure your body stays healthy. – Anonymous, 6th (video-first)

Not to be lazy, to be fit. – Heavenly flower, F, 6th (video-first)

It talks about healthy things you can do to stay fit. – Juan #1, M, 6th (video-first)

Healthy food choices. – Juan #2, M, 6th (video-first)

You should eat healthy. – Lucas, M, 6th (video-first)

Eat healthy food. – Kiki, F, 6th (video-first)

Be active. – Santa, M, 6th (narration-first)

Eating healthy and exercise are really useful in keeping you healthy. – Eagle, M, 6th (narration-first)

Diabetes and prevention

Diabetes, the causes, and how "to prevent it" was also a consistent answer for what topics they remembered from the website and the main idea of the sections completed. This was mainly mentioned in first focus group because module 1 defined and explained the process of diabetes, and this section was absent during the second website viewing.

Focus group 1

Different kinds of diabetes...stay healthy and prevent diabetes. – Nicole, F, 6th (video-first)

Diabetes, um, how to control your temper...for the glucose. – Heavenly Flower, F, 6th (video-first)

Do not go overweight...that's also the cause of diabetes. – Moonfire, F, 6th (video-first)
• **Diabetes.** – Jabeya, F, 7th (narration-first)

• *I remember that they were talking about diabetes...how, like, you gotta do certain things, like, maybe about diabetes, like watch your sugar and stuff.* – Latisha, F, 7th (narration-first)

• *Um, like, there's different types, A and B, and...it was like [a] car garage, like a medicine* had to go inside for your body to work. – Green, F, 7th (narration-first) (*medicine=insulin)

• *I think it was about, like, how you got, like, diabetes...from calories and then...you shouldn't, like, sit down and get all fat and stuff cuz that gives you diabetes so you get up and do, like, exercises, sports, and all that kind of stuff.* – Green, F, 7th (narration-first)

**Focus group 2**

• **How to keep away diabetes.** – Nicole, F, 6th (video-first)

• **Diabetes...the same as last time.** – Chipmunk, F, 6th (video-first)

**Calories in = Calories out**

Also, there was mention of "calories in and calories out" and the need to “burn” calories after you eat that spoke to an understanding of the relationship of weight maintenance through diet and exercise that was explained during the food/exercise portion of the intervention. Or, at the very least, it pointed to recognition of the catch phrase within module 2: “**Calories In = Calories Out.**”

**Focus group 1**

• **Calories in, calories out.** – Shay Shay, F, 6th (video-first)

• *It shows how much calories were in the food and, like, what did they do to burn them.* – Ray Allen, M, 6th (video-first)

• *If you eat too many calories you can exercise more to lose some weight.* – Lucas, M, 6th (video-first)

• *I think the main idea of the website was about, um, you watching what you eat and, like, what you play, like, so that...your life could be healthy and stuff.* – Latisha, F, 7th (narration-first)

**Focus group 2**

• **Calories in and calories out when you eat this much.** – Nicole, F, 6th (video-first)
• *Calories in, calories out.* –Shay Shay, F, 6th (video-first)

• *They talked about calories in and calories out.* –Santa, M, 6th (narration-first)

**Food groups and portion sizes**

In the second focus groups, students commented that the website focused on food groups and portion sizes, which were areas explained in Module 5 of the intervention.

**Focus group 2**

• *I think it was about, like, about...all the food groups and how much you should eat of each group every day.* –Lebron James, M, 6th (video-first)

• *It showed...one picture...the pyramid*, like what we should eat, what food groups there are and stuff. –Ray Allen, M, 6th (video-first) (*Food groups were shown using MyPlate*)

• *Bread, dairy, vegetables...grains, something about grains.* –Kiki, F, 6th (video-first)

• *Eat in portions, like don’t eat it all; eat little bit of each food group at a time.* –Ray Allen, M, 6th (video-first)

• *I remember when it was talking about the, like, the proportions of everything, like, you should eat of all the food groups.* –Eagle, M, 6th (narration-first)

• *I remember in the passage it was saying that like, for instance, one cup of salad equaled a ping pong or something like that...with the plate and with the dairy, meat, protein, stuff like that...then I was understanding what it was saying...just like showing you how big the quantity was.* –Sharlay, F, 7th (narration-first)

**Website talked a lot about the main topics**

During the first focus groups, when asked to describe which aspects of the site helped them form the main ideas, students told us in different ways that they considered those topics as the main ideas because the website was mainly about those topics and that the website "talked a lot about" the topics.

**Focus group 1**

• *Because they talked a lot about it.* –Leopard, M, 6th (narration-first)
• They were making, like, points about it...and, um, so they made a big section about it and they’re like how diabetes is bad and stuff. –Blue, F, 7th (narration-first)

• I think that was the main idea because, um, when we was reading the texts, it was mostly about how diabetes can get into your body and how you need to treat it to be healthy...and, like...when we listened to the audio things. –Latisha, F, 7th (narration-first)

• Started talking more about, like, eating...healthier, um I remember...listening to that. –Kite, F, 6th (narration-first)

Visual/interactive elements pointed to the main idea

In the second focus groups students gravitated toward the visual or interactive formats as the reason they considered a certain topic as the main idea.

Focus group 2

• There was [a] plate and food matching game, and crosswords. –Nicole, F, 6th (video-first)

• There was a section where you picked how...much would you eat. –Juan, M, 6th (video-first)

• Because, basically, that’s what it was talking about. –Chipmunk, F, 6th (video-first)

• Videos, audiotapes you could listen to. –Shay Shay, F, 6th (video-first)

• They showed the food groups*. –Ray Allen, M, 6th (video-first) (*=shown with MyPlate)

• Like, when you talk about those stories, like, if you don’t like the food at school, just pack it up again, like pack your own food, and then like they will tell you to eat healthy and like to go out and play. It doesn’t tell you, like, go play video games. It doesn’t talk about...that...it talks about...eating healthy stuff. –Kite, F, 6th (narration-first)

• Because the majority was talking about, um, how to get exercise and what type of healthy food you should eat. –Bubbles, F, 6th (narration-first)

• Because there were videos on exercising and eating healthy. –Leopard, M, 6th (narration-first)

Themes for new information (Question 4, Focus group 1)
The following question was asked to both video and narrative groups, but only in the first focus groups:

4. If we showed this website to another 6th/7th/8th grade class, what information would be new to them?

One theme emerged: diabetes and stress management as new information.

Diabetes and stress as new information

Diabetes was mentioned in answers about information they believed would be new to them and/or to other middle-school students. Insulin or "medicine," the "process of diabetes," and the different types of diabetes came up as particular points of unfamiliarity.

- **About diabetes and all.** –Juan, M, 6th (video-first)
- **Um, the different types of diabetes...how you can take insulin and stuff for diabetes.** –Tinkerbell, F, 7th (narration-first)
- **Anybody can have diabetes; it doesn’t matter if you’re...what size you are or things like that...explaining the process of diabetes, like, it was explaining how if you don’t have enough, if your body can’t pump enough insulin, you have to, you have diabetes and you have to take in insulin.** –Jabeya, F, 7th (narration-first)
- **The signs of diabetes...the differences between type one diabetes and type two** –Dora, F, 7th (narration-first)
- **How to get diabetes.** –Hello Kitty, F, 7th (narration-first)
- **Maybe about, like, when it talked about, like, diabetes...cuz, like, I didn’t know some...of the stuff about that.** –Kite, F, 6th (narration-first)

Students who mentioned personal connections to diabetes (mother, father, etc.) also responded with an unclear, or previously unclear, understanding of the disease.

- **I thought what was new to was that I didn’t know that people had to take insulin in order for the stuff to help with the diabetes [because I remember] when my mom was pregnant she, um, she had to do
insulin cuz, um, she had baby diabetes and I was like why do you have to take a shot? And she was explaining the stuff to me but I didn’t really understand. –Moonfire, F, 6th (video-first)

- My dad, he’s a diabetic...he’s gone since last Thursday without insulin and he’s been drinking water cuz that’s the main thing...that’s like insulin and that keeps him healthy. –Bluefire, F, 6th (video-first)

- I think it was about, like...how you got diabetes, like from calories and then, like, you shouldn’t, like, sit down and get all fat and stuff cuz that gives you diabetes so you get up and do like exercises, sports, and all that kind of stuff. –Green, F, 7th (narration-first)

Stress and "what to do to get it off your mind" also appeared as a piece of new information, however less often than diabetes. In addition to defining stress, identifying situations that attribute to stress and ways to relieve stress, the stress module also explained how stress affects blood glucose levels in those with diabetes, but this aspect was not brought up by students.

- Um, like, the stress reliever thing...like, if you are stressed, what to do to get it off your mind. –Ray Allen, M, 6th (video-first)

- Stress. –Bob, M, 7th (narration-first)

- A lot of people eat... sweets and stuff, like ice cream, when they’re stressed out. –Anonymous, 7th (narration-first)

- Also, the stress thing. They are telling you also to eat, like, it doesn’t matter if you are depressed, they are trying to, like, give you good food to eat while you like depressed or stressed or something instead of eating bad ones. –Lou Lou, F, 7th (narration-first)

- They was talking about stress, and about, like, what causes it and stuff to prevent it. –Pink, F, 7th (narration-first)

Themes for retention, recall, and message comprehension (Questions 5-6, Focus groups 1 & 2)

The following questions were asked to both video and narrative groups, both before and after the crossover to assess recall of scenario details and comprehension of the intended messages of the scenarios:
5. Do you remember the scenarios that were on the website? (The stories about 1 or 2 people which talked about food or exercise) Can you describe what happened in the stories?

6. What do you think was the main message? [or] What do you think the message of that story was?

Retention and recall

Focus groups were conducted one week after each website viewing to reflect short-term retention of information. Unprompted recall of scenarios for each group is shown in Table 5. If the number of participants responding is less than the number of total responses, then one participant responded more than one time. In other words, a single participant gave multiple responses, which would decrease the number of participants responding while increasing the number of responses.

During focus group 1, those who watched the videos first remembered 2 more scenarios from the website (out of 6 total), without prompting, compared to the narration group. The video group had a slightly higher number of responses and participants answering the question.

During focus group 2, one week after watching the videos, the narration group was able to remember 1 more scenario than the video group. However, the narration group showed double the amount of responses and participants when compared to the video group.

Intragroup comparison showed that the video group recalled the same number and the same scenarios in both focus groups; however, the number of responses and participants responding decreased slightly after completing the narration as seen in focus group 2. On the other hand, the narration group increased the number of scenarios recalled from focus group 1 to focus group 2, and doubled the number of total responses and number of participants responding.

In terms of details recalled, during focus group 1, the video group provided more details of the scenes with less utterances of forgetfulness compared to the narration group. However, during focus group 2, the video group decreased in the amount of details they could recall after listening to the narration, compared to an increase in the amount details recalled by the narration group after watching the videos (Table 6).
Table 5. Table for unprompted recall of scenarios between video and narration groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Focus Group</th>
<th># of Scenarios (of 6)</th>
<th># of Responses (total)</th>
<th># of Participants Responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>FG1 (n=18)</td>
<td>5</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Narration</td>
<td>FG1 (n=23)</td>
<td>3</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Video</td>
<td>FG2 (n=15)</td>
<td>5</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Narration</td>
<td>FG2 (n=20)</td>
<td>6</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>
Table 6. Unprompted recall of scenarios in focus groups 1 and 2

<table>
<thead>
<tr>
<th>Focus group 1</th>
<th>Narration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Video</strong></td>
<td><strong>Narration</strong></td>
</tr>
<tr>
<td>1 Get up and do something: Mom told her son to go play ping pong or play with her. – Mariya, F, 6th</td>
<td>1 Bike to the mall: There was a story, like, when they want to go to the mall and then something about like, like they didn’t have a ride or something, so then they rode their bikes. – Green, F, 7th</td>
</tr>
<tr>
<td>2 Basketball at the park: Boy asked for water after the game. – Mariya, F, 6th</td>
<td>2 Packing your lunch: When they was…gonna go to school and uh, the brother was, like…I don’t want to go to the school cuz I hate those greasy lunches…and his sister was like how about you make your own lunch [because] that’s what I do because I don’t like it either so that I could be healthy too…he was like ok. – Blue, F, 7th</td>
</tr>
<tr>
<td>3 Bike to the mall: Two friends on a hot day, one of the friends wanted to go to the mall, and the other person suggested to bike to the mall. – Nicole, F, 6th</td>
<td>3 Unknown: One of them wanted to go exercise and one of them didn’t…one of them wanted pizza and I guess one didn’t want pizza, I can’t remember but you know I remember parts of it. – Sharlay, F, 7th</td>
</tr>
<tr>
<td>4 Bike to the mall: I remember the one where it was hot outside with the two girls where they decided to ride their bike to the mall. – Moonfire, F, 6th</td>
<td>4 Popcorn and water: I think the other one was telling them how there is a better food and then they both went to eat potato chips I think, or something. – Lou Lou, F, 7th</td>
</tr>
<tr>
<td>5 Making dinner: There was this one that they…ordered pizza but, um, the girl said we should go down to the store and buy the dough and the stuff for, um, pizza instead of eating out. – Shay Shay, F, 6th</td>
<td>5 Bike to the mall: The girls that rode to the mall…like one said it was too hot to go outside but they didn’t have a ride so one suggested riding bikes. – Dora, F, 7th</td>
</tr>
<tr>
<td>6 Basketball at the park: Baseball…um, basketball at the park…the boy was…sitting on his couch playing video games, and another boy came in and he wanted…to go outside and play basketball and need to be active. – Bluefire, F, 6th</td>
<td>6 Popcorn and water: A girl, it was two girls, and they wanted a snack and one person suggested popcorn and water and she, um, cuz she learned that in health class. – Tinkerbell, F, 7th</td>
</tr>
<tr>
<td>7 Bike to the mall: On one video, um, it showed…this girl that she said she was bored and then her friend wanted to go to the mall so they rode their bikes to the mall. – Lebron James, M, 6th</td>
<td>7 Bike to the mall: There was a bike story and a mall story when somebody went to the mall, I can’t remember. – Bubbles, F, 6th</td>
</tr>
</tbody>
</table>
Table 6. (Cont.)

<table>
<thead>
<tr>
<th></th>
<th>Get up and do something: I saw one where…he was playing some video game and his mother told him to, like, get up and then do something, and he said no, so then she said why don’t you go down to the basement and look for something to do, and he said there is nothing fun and…they had ping pong so then there was nobody to play with, that’s what he said, and the mother said [inaudible] and then she went down there. –Lucas, M, 6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Making dinner: The one where the guy wanted to order the pizza with the money his parents gave him, but, um, his sister said that they can go to the grocery store and buy the food to buy the ingredients to make the pizza. –Mr. Moe, M, 6th</td>
</tr>
<tr>
<td>9</td>
<td>Popcorn and water: That the girl was hungry and she asked for, the lady had asked her if she wanted some chips and she said, “Chips have how much calories?” And she said she just wanted popcorn instead. –Kiki, F, 6th</td>
</tr>
</tbody>
</table>

8th graders (n=2) retained and recalled all stories in both the first and second focus groups

### Focus group 2

<table>
<thead>
<tr>
<th>Video then Narration</th>
<th>Narration then Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Making dinner: A story that friends were going to order pizza but make pizza so healthier. –Mariya, F, 6th</td>
<td>1 Making dinner: Like one of them, um, he wanted to, um, a boy wanted to order a pizza, and a girl wanted to make her own…go buy the ingredients to make her own because she thought buying the ingredients would equal up to the same amount as him buying the pizza. They can make…two pizzas by buying the ingredients herself than just to order a pizza. –Sharlay, F, 7th</td>
</tr>
<tr>
<td>2 Bike to the mall: Another story about kids going to the mall. –Moonfire, F, 6th</td>
<td>2 Bike to the mall: One of them was talking about walking to the mall, I mean riding their bike to the mall, or driving. And the girl wanted to drive and the other wanted to walk. –Pink, F, 7th</td>
</tr>
<tr>
<td>3 Get up and do something: Mom and son, son kept playing video games. It was too hot and there was no one to play with. –Nicole, F, 6th</td>
<td>3 Packing your lunch: The video…when the boy, um, didn’t like the greasy school lunches, and his friend make, um, lunches to take to school, but he told her that he never had enough time in the morning, so he, so she told him to make it before he wakes up so he could not eat the greasy school lunches. –Green, F, 7th</td>
</tr>
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<td></td>
<td><strong>Table 6. (Cont.)</strong></td>
</tr>
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<td>---</td>
<td>----------------------</td>
</tr>
</tbody>
</table>
| 4 | **Popcorn and water**: Another about water and popcorn. Water makes your skin pretty.  
–Mariya, F, 6<sup>th</sup> |
| 4 | **Get up and do something**: The mom told her son to get up and they, and then the son was like I have no one to play with, and then the mom was like I’ll go downstairs with you and play, um, a game with you.  
–Purple, F, 7<sup>th</sup> |
| 5 | **Bike to the mall**: Two girls wanted to go to the mall [and] didn’t have a ride, one suggested bikes, the other said sweaty but went.  
–Mariya, F, 6<sup>th</sup> |
| 5 | **Bike to the mall**: The one were…they wanted to bike, and one of them said I get too sweaty, and the other girl said well it’s good to get sweaty…just for exercise so go do it.  
–Sharlay, F, 7<sup>th</sup> |
| 6 | **Basketball at the park**: Some friends were going to play basketball.  
–Juan, M, 6<sup>th</sup> |
| 6 | **Popcorn and water**: One where they was going to go watch a movie and eat, um, snacks. The one girl wanted to drink soda and eating something else that wasn’t healthy [many say “chips”] and then the other girl said…something about [many say “popcorn and water”]…yeah popcorn and water was healthier than pop and chips.  
–Green, F, 7<sup>th</sup> |
| 7 | **Bike to the mall**: It was one where…they wanted to go to the mall, and instead of a car, they rode their bikes.  
–Ray Allen, M, 6<sup>th</sup> |
| 7 | **Basketball in the park**: One of the videos was about the boy didn’t want to do nothing and the other boy wanted to play basketball…well, first, they wanted to run but he said he didn’t feel like it, so they played basketball.  
–Pink, F, 7<sup>th</sup> |
| 8 | **Get up and do something**: The one where they are playing, the one, um, he said he had nothing to do cuz no friends were gonna come out, but then his mom said he, she could play with him, and she said maybe even beat him.  
–Ray Allen, M, 6<sup>th</sup> |
| 8 | **Basketball in the park**: This boy was just staying at home and stuff and didn’t want to do nothing and his friend came over …and asked him if he wanted to play basketball.  
–Ashenika, F, 7<sup>th</sup> |
| 9 | **Basketball at the park**: The one where, um, they said they were gonna jog, they were gonna jog, but then one of the friends said he didn’t like jogging without a purpose, but then…he said let’s go to the park and play some basketball.  
–Ray Allen, M, 6<sup>th</sup> |
| 9 | **Get up and do something**: This boy was playing these games and his mom told him to go outside and do something, like play basketball or something.  
–Tinkerbell, F, 7<sup>th</sup> |
| 10 | **Popcorn and water**: I remember one where there was two girls and one of them said they were gonna eat popcorn and soda, I think, and the other one…said well let’s eat potato chips cuz it’s healither [everyone says “it was the other way around”].  
–Lou Lou, F, 7<sup>th</sup> |
| 11 | **Basketball in the park**: I remember one about the one kid told him he wanted to jog, and then the other kid said that he doesn’t want to jog without a purpose, and then the other kid…said he wanted to play basketball, and then the other kid said ok.  
–Sparrow, M, 6<sup>th</sup> |
<table>
<thead>
<tr>
<th></th>
<th><strong>Bike to the mall</strong>: I remember this other story, um, this girl wanted to go to the mall, but they had no ride so they were like let’s go biking or running to the mall, and this other girl said she didn’t want to get all sweaty, so they said um that they would just walk, I think, or ride their bikes to the mall. –Kite, F, 6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td><strong>Packing your lunch</strong>: There was this one about school lunches. They didn’t want, this kid didn’t like it, and this girl told him to, uh, bring his own food, like, some healthy food. –Kite, F, 6th</td>
</tr>
<tr>
<td>13</td>
<td><strong>Packing your lunch</strong>: I remember that video about school lunch, when he said he didn’t like the school lunches so he, so the girl decided to tell him…to learn how to make his own and then tell him to pack it like at night and then the next morning you can have it ready. –Bubbles, F, 6th</td>
</tr>
<tr>
<td>14</td>
<td><strong>Get up and do something</strong>: Um, the one where his mom wanted him to go outside and…I mean play ping pong or something…to get exercise. –Candy, F, 6th</td>
</tr>
<tr>
<td>15</td>
<td><strong>Bike to the mall</strong>: The bike ride to the mall when the friend was sitting down and they were talking about how they were going to get to the mall and one of them…suggested a bike ride so they can get some exercise and will have fun at the mall. –Bubbles, F, 6th</td>
</tr>
<tr>
<td>16</td>
<td><strong>Basketball at the park</strong>: A person’s friend was jogging and so he was visiting him and he invited him to run but he didn’t want to run, he didn’t like to run without a purpose, so they settled on playing basketball. –Eagle, M, 6th</td>
</tr>
</tbody>
</table>
Message comprehension

For message comprehension, students were asked to explain in their own words the main message of the scenario that was just described during the focus group. The percentages of interpretations that were accurate, approximate, or inaccurate are provided in Table 7.

Overall, in focus group 1, 71% of students accurately interpreted the nutrition or physical activity messages. Of those, a higher percentage of responses from the video group were accurate compared to the narration group (Video: 76%; Narration: 62%). Nearly the same percentage of students from both groups provided inaccurate interpretations (V: 19%; N: 15%).

In focus group 2, overall there was a decrease in the accuracy of message comprehension from 71% to 53%. Both groups decreased in accuracy from the first focus group, however the video-first group still maintained a higher percentage accuracy compared to the narration-first group (V:62%; N: 46%). During the second focus group, the percentage of approximate interpretations, or messages that were close to the intended message, increased for both groups. The percentage of inaccurate responses did not change drastically from one focus group to the next, or within groups.

In both focus groups, there were instances when the interpretation of nutritional messages from the videos and narrated scenarios was general, non-specific, and relatively simple. Also, misinterpretations of intended messages appeared. For example, it was not intended to portray all school lunches as unhealthy or to tell students not to eat school lunches, but rather to show students they could choose to bring their own food to school if they did not like the school lunch, or if they thought the school did not provide healthy alternatives (Table 8). Responses in Table 7 and 8 are from prompted and unprompted recall of scenarios.
Table 7. Message comprehension (%)

<table>
<thead>
<tr>
<th>Message</th>
<th>Video Focus Group 1</th>
<th>Narration Focus Group 1</th>
<th>Total</th>
<th>Video then Narration Focus Group 2</th>
<th>Narration then Video Focus Group 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate</td>
<td>16 (76%)</td>
<td>8 (62%)</td>
<td>24 (71%)</td>
<td>13 (62%)</td>
<td>11 (46%)</td>
<td>24 (53%)</td>
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<tr>
<td>Approximate</td>
<td>1 (5%)</td>
<td>3 (23%)</td>
<td>4 (12%)</td>
<td>6 (29%)</td>
<td>9 (38%)</td>
<td>15 (33%)</td>
</tr>
<tr>
<td>Inaccurate</td>
<td>4 (19%)</td>
<td>2 (15%)</td>
<td>6 (18%)</td>
<td>2 (10%)</td>
<td>4 (17%)</td>
<td>6 (13%)</td>
</tr>
<tr>
<td>Total</td>
<td>21 (100%)</td>
<td>13 (100%)</td>
<td>34 (100%)</td>
<td>21 (100%)</td>
<td>24 (100%)</td>
<td>45 (100%)</td>
</tr>
<tr>
<td>Video</td>
<td>Narration</td>
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<tr>
<td>1 Packing your lunch: If you make your own lunch like a sandwich, it’s better than lunch from the cafeteria. – Aphrodite, F, 6th</td>
<td>1 Bike to the mall: To…not be lazy, and like get into the car and drive so the main idea was…how you can go do something fun and still get exercise, so they rode their bikes. – Green, F, 7th</td>
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<tr>
<td>2 Making dinner: Homemade pizza is healthier than from a restaurant. – Mariya, F, 6th</td>
<td>2 Packing your lunch: Maybe you want to eat, like, healthy stuff, and he didn’t want to gain weight and stuff, probably. And he wanted a healthy body, and therefore, like, you gotta eat healthy stuff…to have a healthy body. – Blue, F, 7th</td>
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<tr>
<td>3 Making dinner: Homemade pizza is healthier and cheaper. – Nicole, F, 6th</td>
<td>3 Popcorn and water: There’s healthy food, but…it still has a good taste to it. – Lou Lou, F, 7th</td>
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<tr>
<td>4 Packing your lunch: Homemade lunches are healthier than food in the school cafeteria. – Aphrodite, F, 6th</td>
<td>4 Bike to the mall: Every little bit of exercise is important. – Dora, F, 7th</td>
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<tr>
<td>5 Unknown: Eat healthy and be more active. – Zeus, M, 6th</td>
<td>5 Popcorn and water: So they can choose better choices and stuff, instead of like chips and junk food and stuff. – Tinkerbell, F, 7th</td>
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<tr>
<td>6 Get up and do something; Basketball at the park: Exercising. – Mariya, F, 6th</td>
<td>6 Packing your lunch: Sometimes packing your own lunch would be the healthiest choice. – Jebeya, F, 7th</td>
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<tr>
<td>7 Bike to the mall: You can exercise and have fun at the same time. – Nicole, F, 6th</td>
<td>7 Bike to the mall: Exercise. – Bubbles, F, 6th</td>
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<tr>
<td>8 Bike to the mall: To go outside and be active. – Moonfire, F, 6th</td>
<td>8 Packing your lunch: Lunches like that are not healthy.…you can eat it, but just not, like, a whole bunch cuz it…makes you fat. – Candy, F, 6th</td>
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<tr>
<td>9 Making dinner: To eat healthier. – Shay Shay, F, 6th</td>
<td>9 Packing your lunch: Portions. – Bubbles, F, 6th</td>
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<tr>
<td>10 Basketball at the park: To not play video games all the time and be active. – Blue fire, F, 6th</td>
<td>10 Packing your lunch: You can choose your own foods, and then you won’t have to get it from what they have in the schools and then you can choose your own lunch, that you can eat healthy and have, like, a good snack in your lunch. – Joe, M, 6th</td>
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<tr>
<td>11 Packing your lunch: It’s healthier to pack your own lunch. – Moonfire, F, 6th</td>
<td>11 Packing your lunch: If you don’t like…in schools…they are giving…like some greasy food or something…to pack a good, healthy lunch. – Kite, F, 6th</td>
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<td></td>
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<tr>
<td>12 Get up and do something: There is no excuse not to be active because you can play in your house even if it’s raining outside. – Ray Allen, M, 6th</td>
<td>12 Basketball at the park: That we need to be active a lot, instead of playing video games and stuff. – Leopard, M, 6th</td>
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<tr>
<td>13</td>
<td><strong>Bike to the mall</strong>: That it’s not always good to just take a car, you can go somewhere fun and still be active. –Lebron James, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>13</td>
<td><strong>Bike to the mall</strong>: People should walk and ride their bike to get places to get active. –Leopard, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>14</td>
<td><strong>Get up and do something</strong>: To get exercise without using your hand, I guess. –Lucas, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
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</tr>
<tr>
<td>15</td>
<td><strong>Making dinner</strong>: I just had it in my head, but then I forgot. –Mr. Moe, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>16</td>
<td><strong>Popcorn and water</strong>: I forgot. –Kiki, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>17</td>
<td><strong>Popcorn and water</strong>: Don’t eat a big bag of chips; eat healthier food. –Falcon, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>18</td>
<td><strong>Basketball at the park</strong>: Hang out with your friend and be active. –Falcon, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>19</td>
<td><strong>Bike to the mall</strong>: If temperature is right, you can be outside and be active. –Falcon, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>20</td>
<td><strong>Bike to the mall</strong>: Be active. –Penguin, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>21</td>
<td><strong>Making dinner</strong>: Make your food at home. –Penguin, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
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<tr>
<td>22</td>
<td><strong>Popcorn and water</strong>: Eat healthier food to prevent being overweight. –Penguin, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
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</tbody>
</table>

### Focus group 2

#### Video then Narration

<table>
<thead>
<tr>
<th>1</th>
<th><strong>Get up and do something</strong>: If bad weather can still exercise. –Nicole, F, 6&lt;sup&gt;th&lt;/sup&gt;</th>
<th>1</th>
<th><strong>Bike to the mall</strong>: There’s nothing wrong with riding a bike even if it gets you sweaty, then go take a shower. –Sharlay, F, 7&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td><strong>Popcorn and water</strong>: You can still eat stuff you like, just healthier. –Mariya, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
<td><strong>Popcorn and water</strong>: Eating right can help your body. –Dora, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td><strong>Bike to the mall</strong>: Exercise. –Moonfire, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>3</td>
<td><strong>Popcorn and water</strong>: The more you eat healthier, the more, like, exercise and the more healthy you are. –Blue, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td><strong>Basketball at the park</strong>: Stay fit and not just [sit] at home playing videogames or watch tv or nothing. –Juan, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4</td>
<td><strong>Popcorn and water</strong>: You don’t have to…eat bad snacks…have fun and enjoy yourself. –Green, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td><strong>Packing your lunch</strong>: To pack your own lunch instead of the school lunch because it’s greasier. –Shay Shay, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>5</td>
<td><strong>Basketball in the park</strong>: There are…many different ways that you can get exercise and be healthy instead of running cuz running is like one of the main, but you can, like, play sports like basketball, softball, volleyball. –Green, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>6</td>
<td><strong>Packing your lunch</strong>: I thought that story was about how the school lunch was unhealthier. –Chipmunk, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>6</td>
<td><strong>Basketball in the park</strong>: Every little bit of exercise is important. –Dora, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>7</td>
<td><strong>Unknown</strong>: Ask your friend to walk in the park if you’re having trouble with what to do. –Bluefire, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7</td>
<td><strong>Basketball in the park</strong>: Just don’t be lazy. –Ashenika, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>8</td>
<td><strong>Basketball in the park</strong>: Go out and have fun. –Bluefire, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>8</td>
<td><strong>Basketball in the park</strong>: Instead of doing stuff that’s lazy, get active. –Jabeya, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>9</td>
<td><strong>Basketball in the park:</strong> Get up and be active. – Anonymous, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>9</td>
<td><strong>Get up and do something:</strong> Don’t sit in the house all day playing videogames, go outside and do activities. – Tinkerbell, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td><strong>Basketball in the park:</strong> Play 60 minutes a day…or more! – Anonymous, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>10</td>
<td><strong>Popcorn and water:</strong> To eat healthy. – Lou Lou, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>11</td>
<td><strong>Popcorn and water:</strong> Water helps make your skin all pretty and healthy. – Bluefire, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>11</td>
<td><strong>Making dinner:</strong> To eat healthier stuff. – Tinkerbell, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>12</td>
<td><strong>Bike to the mall:</strong> That you can go places with it being in car. You can get exercise and go where you want. – Ray Allen, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>12</td>
<td><strong>Packing your lunch:</strong> To, like, decide and debate if school lunch is better for you, or to pack your own lunch. – Jabeya, F, 7&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>13</td>
<td><strong>Bike to the mall:</strong> I think it shows, like, when you have fun, and you do activities, that sometimes it could be exercise, and you not knowing it. – Juan, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>13</td>
<td><strong>Basketball in the park:</strong> Be active. – Sparrow, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>14</td>
<td><strong>Get up and do something:</strong> To get your friends to exercise. – Lebron James, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>14</td>
<td><strong>Bike to the mall:</strong> Just cuz you have a car doesn’t mean you should always, like, use it. You should still take walks one in a while. – Kite, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>15</td>
<td><strong>Basketball at the park:</strong> You can have fun, and like exercise. – Ray Allen, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>15</td>
<td><strong>Packing your lunch:</strong> If you don’t want to eat stuff that you don’t want, just like bring something healthy to eat or like if you know something is like…greasy…that is going to make you, like, not healthy, just like pack your own lunch. – Kite, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>16</td>
<td><strong>Packing your lunch:</strong> School lunches can be greasy, make school lunches. – Bob, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>16</td>
<td><strong>Get up and do something:</strong> Go play outside. – Tiger, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>17</td>
<td><strong>Making dinner:</strong> Make your own pizza to eat healthy. – Bob, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>17</td>
<td><strong>Popcorn and water:</strong> To eat healthier, like not…drink too much soda or eat too much chips; to eat popcorn or water. – Kite, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>18</td>
<td><strong>Popcorn and water:</strong> Makes you healthy and evens your skin. – Bob, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>18</td>
<td><strong>Bike to the mall:</strong> Exercising. – Bubbles, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>19</td>
<td><strong>Bike to the mall:</strong> It’s healthier for you to ride your bike, run, or walk. – Falcon, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>19</td>
<td><strong>Get up and do something:</strong> It doesn’t matter what you do, um, exercise is helpful. – Candy, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>20</td>
<td><strong>Packing your lunch:</strong> Make healthier lunches at home, pack the night before or wake up early. – Falcon, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>20</td>
<td><strong>Packing your lunch:</strong> It’s about healthiness</td>
</tr>
<tr>
<td>21</td>
<td><strong>Get up and do something:</strong> Get up and exercise. – Penguin, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>21</td>
<td><strong>Basketball at the park:</strong> There is always something you can do to exercise. – Eagle, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>22</td>
<td><strong>Get up and do something:</strong> Don’t be lazy all the time. – Falcon, F, 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>22</td>
<td><strong>Making dinner:</strong> You should eat healthy foods. – Leopard, M, 6&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>23</td>
<td><strong>Popcorn and water:</strong> Drink water, it will make you more…dehydrated and healthy. – Candy, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>23</td>
<td><strong>Popcorn and water:</strong> Healthy snack. – Bubbles, F, 6&lt;sup&gt;th&lt;/sup&gt;</td>
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Themes for the believability and value of the scenarios (Questions 7-9, Focus group 1; Questions 7-8, Focus group 2)

The following questions were asked to both video and narrative groups, in both focus groups:

7. Did the stories seem believable? (Like something that would really happen? What made them seem believable?)
8. Do you feel like these stories could apply to you or other junior high students?
9. If you made the website, would you keep the scenarios (short stories)? (Do you think it would help the students understand the ideas? Or do you think they could understand even without the stories?)

Two themes emerged: the stories were believable, and the stories should be kept on the website.

Scenarios viewed as believable

Students in both the video and narrative groups agreed that, overall, the scenarios were believable because they "could happen in real life" and/or because they could relate the scenes to themselves.

- *Because sometimes I don’t have anything to do when raining so I play basketball with [my] brother inside.* –Nicole, F, 6th (video-first)
- *Sometimes I don’t want to have the school lunch and bring my own lunch from home.* –Mariya, F, 6th (video-first)
- *Most of the time my dad makes pizza at home and it’s healthier.* –Nicole, F, 6th (video-first)
- *Sometimes afterschool I used to ride my bike.* –Bob, M, 7th (narration-first)
- *Me and my mom and my sister and brother...used to, like, ride bikes to the store or rollerblade or, like...race back and forth and do...activity stuff like to places.* –Green, F, 7th (narration-first)
- *Me and my family, we used to ride our bikes...to the store to get stuff cuz we didn’t, we wouldn’t really drive.* –Purple, F, 7th (narration-first)

Students also judged the scenarios as believable because it showed what kids “should” be doing in order to be healthy, i.e. indicating that students previously understood what actions/choices were
supposed to be healthy. So, the scenarios were deemed believable, or “true,” because the students knew that healthy choices were to be active and eat healthy foods.

- **All that is true about diabetics and everything, people that like actually have it, they need to eat healthy and stay active and all that.** – Juan, M, 6th (video-first)

- **They stated facts about food…and, um, it’s also true that people should, um, make healthier food choices.** – Jabeya, F, 7th (narration-first)

- **Instead of taking the car, like, you should be active, like, and instead of, like playing video games you should go out and go play basketball or go outside and play.** – Kite, F, 6th (narration-first)

- **Yeah, you should be active, and be healthy.** – Leopard, M, 6th (narration-first)

The uncommon aspects reported as unbelievable related to certain aspects of a story that were less relatable to one or more students and, after watching the videos, to the quality of acting as it seemed "the actors [were] being too serious" and using unrealistic scripts/words.

- **I’m not allowed to go outside of my house...not allowed to ride my bike...I stay inside, so it doesn’t relate to me.”** – Sharlay, F, 7th (narration-first)

- **I think that, um, the soda and popcorn one because, like...in my house we, like, can’t really, like, drink soda.** – Green, F, 7th (narration-first)

- **I think it was unnecessary for them to say things like that...to relate to the situation.** – Jabeya, F, 7th (narration-first)

- **I think the actors are being too serious about it, like they...weren’t trying hard to be like remembering that stuff so I don’t think they were real either...like I think they’re acting.** – Tinkerbell, F, 7th (narration-first)

- **I was getting kinda bored cuz they didn’t really show any emotion, they just acted it out.** – Jabeya, F, 7th (narration-first)
Students want to keep scenarios in the intervention

Also, in both the video and narrative groups, students responded as wanting to help other students by keeping the scenarios as a means to aid in comprehension. Students unanimously agreed to keep the scenarios in the intervention because "kids could understand better," "understand more," and because "some people [don't] know how to be healthy" and the stories could, therefore, provide them with examples.

- *Sometimes people understand better when they see it in video format.* – Nicole, F, 6th (video-first)
- *I would keep the stories. That way the kids could understand better and all that.* – Moonfire, F, 6th (video-first)
- *I'd keep them because you can get examples.* – Mariya, F, 6th (video-first)
- *They show like a lot of explanation, like telling you what to do at home and stuff.* – Juan, M, 6th (video-first)
- *Without the stories, it would be less comprehensive...I mean, they could understand it regardless, but with the stories, I think it helped them understand more.* – Sharlay, F, 7th (narration-first)
- *I believe it can be helpful to other people...it will make them want to do active things and healthy things.* – Anonymous, 7th (narration-first)
- *Instead of giving them information on what they should do, it's helping them understand it with a story, like with characters.* – Leopard, M, 6th (narration-first)

Additionally, whether or not the students watched the videos or listened to the narrated versions of the scenarios, they described the benefits of keeping the scenarios as being able to "see" what could happen in real life.

- *I'd keep [them] because in video it might not make sense, and reading it you can get your own picture.* – Nicole, F, 6th (video-first)
- *With the image in mind, you want to go outside and do it.* – Aphrodite, F, 6th (video-first)
• If we didn’t have them on the HOT project, I believe that people really wouldn’t be able to connect to them because they wouldn’t be able to see, like, actual people making the change. –Chipmunk, F, 6th (video-first)

• So then they could like have something to read what’s happening and to see if what if it could happen in real life. –Joe, M, 6th (narration-first)

• Like the video, it explains a little bit more because it, you can visualize it, because you can see it. –Blue, F, 7th (narration-first)

Some students also recognized the value of scenarios as the modeling of choices and the demonstration of the better choice.

• It gives a problem and a solution…like a kid, like, might not like the food and their friend packs a lunch and her friend tell her to pack a lunch too. –Kite, F, 6th (narration-first)

• I basically remember that every video had an important lesson that you could learn about, about what choices are healthier. –Blue, F, 7th (narration-first)

• They had two choices…each video had…two choices to pick, like, the bad one or the good one…and in all the videos they picked the good one. –Green, F, 7th (narration-first)

In terms of how the scenarios could be improved to add value, a small group of students agreed that the choices modeled needed to be more challenging, while another small faction agreed that the stories (narration and video) should be longer.

Themes for recommendation of video or narration for learning (Question 9, Focus group 2)

The following question was asked to both video and narrative groups, only in focus group 2, to gather which mode of delivery they would recommend to their peers and their reasons why:

9. What website do you think your friends would like better: #1 or #2?

Their responses pointed to one theme: videos were recommended to their peers.
Videos recommended to peers as better for learning

When asked which website the participants' friends would like better, with prompts to answer based on video or narrative scenarios and which provided a better way to learn, most students recommended the videos compared to the narration; the remaining students recommended both, neither, or did not respond. Those who recommended the videos provided such explanations as their "friends don't like to read" and that students will "pay more attention" to a video. Those who recommended the audio version said it "explained more"; however, some advocates of the video version also said that the videos "explained more."

- I think the video you watch more instead of listening to the stories. –Lucas, M, 6th (video-first)
- I think that, like, if you hear something it wouldn’t be as effective [as] if, like, you heard it and saw [it]. –Lebron James, M, 6th (video-first)
- Most kids...don’t like paying attention to stuff as much, so like if they have a video they will watch it more. –Ray Allen, M, 6th (video-first)
- Sometimes people understand better when they see it in video format. –Nicole, F, 6th (video-first)
- Videos made it more memorable to remember. –Eagle, M, 6th (narration-first)
- Because you actually get to see what they are doing and then when you just heard like a person reading it out to you, maybe you can understand more if you, um, look at what and how they are doing it. –Bubbles, F, 6th (narration-first)
- The videos made it easier to understand. –Leopard, M, 6th (narration-first)
- Like, the video, it explains a little bit more because...you can visualize it, because you can see it. –Blue, F, 7th (narration-first)
- The videos explain, like, what you should do. –Ashenika, F, 7th (narration-first)
- Because a lot of people don’t like reading and they like to see what happens, so I think [website] two would be better. –Lou Lou, F, 7th (narration-first)
Negative cases

Negative cases are responses that were only found once, or more than once but did not have a consensus with other participant responses, and therefore did not fit into the overall themes. There are no negative cases for questions 5 and 6, because single responses were counted for frequency. Negative cases are shown in Table 9.
Table 9. Negative cases for all periods in focus groups 1 and 2

<table>
<thead>
<tr>
<th>Questions</th>
<th>Negative cases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main idea</strong> <em>(Questions 1-3)</em></td>
<td>Control your temper, Don’t hurt people, No junk food, Don’t get fat/obese, Play less video games, Calorie counting, Tools and weights, Food pyramid, Different foods, Medicine, Forbidden health issues, Positive and negative effects, Choices, Body parts, Sports, Cancer, cholesterol</td>
</tr>
<tr>
<td><strong>New information</strong> <em>(Question 4)</em></td>
<td>Popcorn and water are healthy, Homemade pizza is better, Calories in food, Reading level is too high for other students, What to choose to eat healthy</td>
</tr>
<tr>
<td><strong>Believability</strong> <em>(Question 7)</em></td>
<td>Has a similar friend in real life, Showed some humor, Popcorn and water scenario unbelievable, Realistic to do independently, Biking to mall scenario unbelievable</td>
</tr>
<tr>
<td><strong>Value of scenarios</strong> <em>(Question 8 or 9)</em></td>
<td>Add more scenarios, Some people will believe it, Will make them want to do active and healthy things, Add quizzes for each scenario, Make easier for elementary school kids, Longer videos with shorter stories, Make choices more challenging</td>
</tr>
<tr>
<td><strong>Recommendations to peers</strong> <em>(Question 9)</em></td>
<td>Liked both mediums equally</td>
</tr>
</tbody>
</table>
Peripheral observations

Gender

A similar percentage of girls and boys recommended the intervention website with videos to their friends (Girls, 76%; Boys, 78%) rather than the audio version. The focus group question was asked in third person, but their supplementary explanations, when given, revealed that they too preferred to learn via the medium that they were recommending to their friends.

Certain scenarios were recalled more than others between girls and boys, regardless of medium. Compared to boys, girls more often recalled the scenarios ‘Bike to the mall’ (34% vs. 22%), ‘Popcorn and water’ (19% vs. 0%), and ‘Packing your lunch’ (13% vs. 0%). All three of these scenarios contained either an all-female cast (Bike to the mall, Popcorn and water) or female lead characters (Packing your lunch), i.e. the female character was educating the male character about nutrition choices. The boys did the same for the scenarios ‘Basketball at the park’ (44% vs. 9%), ‘Get up and do something’ (22% vs. 16%), and ‘Making dinner’ (11% vs. 9%), which contained either all male characters (Basketball at the park) or a male character and female lead character (Get up and do something, Making dinner).

Overall, across both genders, the most recalled scenario was ‘Bike to the mall,’ while the least recalled were ‘Making dinner’ and ‘Packing your lunch.’ The percentage of appearance for each scenario was calculated by dividing the number of times the scenario was mentioned by the total number of responses for each gender, within both focus groups. The results are shown in Table 10.

Grade

The website viewings were organized so that one group of 6th grade students would watch the videos first, and one group of 7th grade students would complete the narration section first. If the 7th graders remembered just as much, or more, than the 6th graders, then it could be proposed that the upper grade remembered the scenarios regardless of delivery method, therefore indicating an influence of grade, or perhaps age. However, the 7th graders did not remember more than the 6th graders after focus group 1, i.e. the narration group did not remember more than the video group. In focus group 2, 7th graders did recall more scenarios and more details than 6th graders.
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Girls</th>
<th>Boys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get up and do something</td>
<td>5 (16%)</td>
<td>2 (22%)</td>
<td>7 (17%)</td>
</tr>
<tr>
<td>Basketball at the park</td>
<td>3 (9%)</td>
<td>4 (44%)</td>
<td>7 (17%)</td>
</tr>
<tr>
<td>Bike to the mall</td>
<td>11 (34%)</td>
<td>2 (22%)</td>
<td>13 (32%)</td>
</tr>
<tr>
<td>Making dinner</td>
<td>3 (9%)</td>
<td>1 (11%)</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Popcorn and water</td>
<td>6 (19%)</td>
<td>0</td>
<td>6 (15%)</td>
</tr>
<tr>
<td>Packing your lunch</td>
<td>4 (13%)</td>
<td>0</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Total</td>
<td>32 (100%)</td>
<td>9 (100%)</td>
<td>41 (100%)</td>
</tr>
</tbody>
</table>
Observations

One 8th grade student was previously involved in the pilot testing of the HOT project invention when she was in 6th grade. This student was the only student who made a verbal recognition that the textual scenarios were “just the videos in words.” One 7th grade student voluntarily took notes while completing the modules during both the first and second website viewings. During the focus groups, this student also appeared to be a higher level student and commented on lowering the reading level of the website to accommodate the lower reading levels of other students. The 8th grade students displayed non-verbal cues of boredom and impatience (slumping, leaning to one side, sighing, and leg bouncing) during the website viewings. This may suggest that, although the intervention is targeted toward middle-school students, perhaps 8th grade students are too old to be engaged by the content or instructional design of this website.

Sixth and 7th grade students had difficulty with which link to choose in the second module. The verbal instructions given prior to beginning the intervention modules were to choose the link “Watch videos” or “Listen to audio only.” The link to choose was also written on the dry erase board at the front of the classroom. Almost all students during the first website viewings asked for help when they arrived to the choice between the two links. This was common, albeit less frequent, during the second website viewings. Students may not have listened to the instructions during either session because they were distracted by trying to type the HOT Project URL into their web browser immediately after they sat down. Also, it was noted that a number of students were confused with how to navigate through each module. Researchers showed the students to use the “Next” button on the bottom of each screen. After this first confusion, students did not ask again for help about navigation, thus this was not a problem during the second website viewings. The researchers also noticed during the first website viewings that completing three modules in the intervention almost did not allow the students to finish; therefore, during the second website viewings, students completed two modules instead of three.

Also, it was asked in every class period whether or not the moderator provided the voice for the audio-recorded scenarios on the website. In other words, the students recognized the voice from the
narrations as the same voice of the graduate research assistant/moderator. The researcher responded with “yes” and it is unknown whether or not this affected any outcomes.

**Discussion**

Computer-based interventions are at the forefront of nutrition education, especially those that are web-based. Yet, an intervention is only as strong as the sum of its parts. The potential for the success of computer-based nutrition education rests on the evaluation of components that can be included in future programs. Further research with computer interventions, e.g. dismantling studies, is needed to examine the contribution of internal components, such as videos, to nutrition-related behavioral, cognitive, and psychosocial outcomes.

Video segments have been added to computer-based nutrition interventions with the support of theoretical implications, but not with the support of empirical evidence. More often reported in the literature is the planning or development of nutrition education videos\(^{33-35}\) or the effects of video programs on nutrition behavior or knowledge\(^{36}\), what is lacking is research regarding the benefit of video compared to other delivery mediums of nutrition education, the effect of video as part of a multimedia educational approach, along with research on the aspects of video that may affect learning of nutritional information. There is evidence that nutrition education videos (offline) can improve healthy eating behavior in adults\(^{36}\); still, accounts of the video aspects that may have influenced behavior change were not under investigation.

To explore the application of embedded videos in online nutrition education, this study examined retention and recall of scenario details and comprehension of nutritional and physical activity information in video format as compared to narration in middle-school students. The results showed the advantage of videos to allow for enhanced short-term retention and a higher number of scenarios recalled after one week. The embedded videos also provided more accurate interpretations of nutrition-related messages. Yet, the results also indicated that, regardless of medium, the messages were not interpreted clearly by the entire audience, as up to 50\% of students did not provide accurate interpretations of nutrition-related
messages. This suggests that for this age group, there is possibly a need for clear and explicitly stated nutritional messages in conjunction with nutrition-related educational scenarios.

When the sequences of video/narration was compared to narration/video, there was no indication that the video-first group had better retention, recall, or comprehension after completing the narrated scenarios, since they recalled the same scenarios and number of scenarios during both focus groups and comprehension of messages decreased in the second focus group. Therefore, it could be assumed that there was no additive effect between video and narration in this instance. This lack of effect is in contrast to a 2007 study in which 8 to 10-year-old children showed improved recall after having a school lesson and then watching an educational film. In the same study, a similar improvement in recall was found in the group who watched the videos twice. Thus, it could be expected that the reinforcement of video and then narrated text would enhance recall and comprehension in our sample. However, better recall in the present study was seen in the narration-first group after watching the videos, and maybe this mirrors the design of the 2007 study more closely and could indicate a learning effect due to the order of educational material.

Comparisons of instructional efficacy between video and text formats were published in separate areas of research, and evidence within the area of nutrition education was not found. In 2005, pediatric residents were shown either a 2.5-minute video of a patient case or were instructed to read the same scenario in written format. Their results showed a greater improvement in the video group for data exploration and theory building and evaluation. Another comparison in 2009 illustrated that surgeons-in-training, after viewing video instruction of laparoscopic knot tying, needed to review the instructions less often, used less attempts to complete the task, and had better understanding of the procedure than those who used only textual and graphic instructions. Although this research is in areas unrelated to nutrition education, there is some support for the superiority of video when compared to text in the realm of education delivery.

However, it is plausible that multimedia could decrease comprehension in certain instances. In a comparison of formats to convey consent information, Campbell et al did not find differences between
format groups and also questioned the use of video to relay information to low-literacy adults. In their study, a group of adults was given consent materials in four different formats: (a) written format; (b) “enhanced print” with simpler language, topics headings, and pictures; (c) narrated videos; and (d) PowerPoint presentations with narration and pictures. Alternative media was cited as being useful for low-literacy populations, therefore the additional consent formats were added; however, the enhanced print material was shown to be better than the video for adults with reading levels below the 8th grade. This brings to light the difference between text and video in the application of information delivery; patient consent may be an area best suited for textual delivery. On the other hand, their video development may have also hindered information delivery. In another example, a series of research articles comparing print and video mediums of news broadcasts also reported a superiority of text in terms of recall and knowledge acquisition.41-48 Again, news may be an area best suited for the print medium, but all of these studies were conducted prior to 1992 and video formats are now far more advanced.

Additionally, in 2006, Liu et al49 found that after university students completed a computer-mediated, narrated educational module, the narration group recalled only one more phrase and a similar amount of key words when compared to a computer-mediated video module group, even though students aesthetically preferred the video module. The authors’ hypothesis was grounded in the cognitive theory of multimedia learning, and stated that the addition of video (visual information) to the instructional design may have resulted in excessive cognitive load and hindered efficient learning. However, these engineering students also rated the narrated modules as more difficult and, therefore, may have paid more attention to the information. Cognitive load is also related to the complexity, or difficulty, inherent in the subject matter; therefore, similar to the results of print news and patient consent, the engineering topics covered may have been better communicated via text than video format. Even further, the effect of instructional design should be taken into account as a possible detriment. The video module included a recording of an instructor lecturing and PowerPoint slides of the lecture, while the audio group only had the PowerPoint lecture with audio; the PowerPoint slides also included pictures and diagrams. This
 indeed could have resulted in an excessive, visual cognitive load and led to the audio group displaying better recall, which may have been reversed if students had only watched the lecture video.

With scarce evidence for comparison regarding grade, age or gender differences in computer-based nutrition education, one study from 2004 reported that younger students (8 to 9 years) scored higher in nutrition knowledge compared to older students (10 to 11 years) after completing an online nutrition intervention.16 The age difference between students, although seemingly small, could have had an impact on the students’ engagement in the website. In the present study, the older students in 7th grade did not remember more than the 6th grade students during focus group 1, meaning that the 6th graders who watched the videos were able to retain and recall more than the older students who did not watch the videos. During focus group 2, the 7th graders who had just watched the videos during the previous week were able to recall more scenarios than the 6th graders who had not watched videos recently. Therefore, it could be speculated that the medium of video had more influence over retention and recall than age. Also in the present study, 8th grade students’ recall was much higher than both 6th and 7th graders. Therefore, age may indeed make a difference for retention and recall, but perhaps only at a younger stage of adolescence. This may be due to the growing cognitive development stage of younger adolescents. Remember, there were only two 8th grade students, so grade comparisons using this sample are tenuous.

The same percentage of girls and boys preferred the HOT Project website with videos rather than narration. Therefore, gender may not play a role in the type of medium preferred. However, the gender of characters in the scenarios did seem to play a role in which scenarios girls or boys were more likely to recall, which displays a degree of gender-matching. Gender-matching, a topic within the similarity-attraction hypothesis, has been an issue in education research with concern for the learner-teacher relationship50-52 and, more recently, for animated pedagogical agents.53 However, this research concerns a direct instructional style and was sometimes subject-based (e.g. Math, Reading, Science, etc.) and, thus, may not reflect the same relationship that is found in an observational learning/peer modeling situation.

In addition to understanding whether or not the video is as effective as another medium of communication, it is equally important to understand how the construction of a video affects learning or
motivation. The difficulty of video delivery for nutrition education is that videos can be made in myriad ways. The considerations within educational video development can be numerous and can interfere with its overall impact. Some of these issues emerged in the focus groups of this study, i.e. gender, age, quality of acting, and relatability of situations, and did indeed seem to impact the how the students reacted to the videos.

Beneficial aspects of nutrition education videos have been reported via qualitative methods. In a series of focus groups with childcare providers, six characteristics of nutrition education videos were identified that supported their ability and motivation to learn about feeding children. The caretakers watched one to five minute video vignettes that showed clips of live footage of children in a childcare setting as well as skills that would support children at mealtimes. Characteristics of the video that caretakers said supported their ability to learn from the videos were (1) using real scenarios, not acting; (2) using short video segments; (3) communicating only one simple message; (4) showing a “skill-in-action”; (5) being able to relate to the setting/situation shown in the video; and (6) being able to conceptualize the information. Some effective aspects of video revealed in their results were echoed in this study, namely the use of short video segments, communicating one simple message, and relatability. Although the characteristics described were beneficial to adult learners rather than adolescents, this is the only attempt known by the author to describe useful attributes of learning and motivation in videos for nutrition education.

Additionally, although the HOT Project videos did use script to verbally identify a problem and a solution, only one of the six videos (Packing a lunch) showed a “skill-in-action.” This, along with the addition of simple, explicitly stated messages, may help the percentage of students who did not clearly interpret the nutrition-related messages.

Comparatively, the videos in the HOT Project used shorter segments than those in the caretaker study, approximately 30 seconds, and some students wanted them to be longer. In another study comparing vodcast (video podcast) formats, the highest knowledge scores were seen for nutrition education vodcasts between four and six minutes. Therefore, lengthening the HOT Project videos to a
few minutes may be considered and could help with a more detailed delivery of the intended message. Quality of acting was also mentioned, as it was in our focus groups, as a mediator of effective learning. Therefore, perhaps developing a looser script, or shooting *ad lib* scenes, would have alleviated some concern about the performers’ unnatural acting skills.

**Limitations**

The limitations of this study include an under-representation of male students and 8th grade students in the sample. Time limitations during focus groups prevented the moderator from asking each pre-determined question in each focus group and from asking each participant for a response. In these situations, opening and closing questions were sacrificed in order to facilitate discussion around key questions. Since, at times, not every person in the focus group answered each question, we could not gauge whether or not every person in the focus group remembered the scenarios or understood the messages correctly; we could only ascertain that data from a subsample of those who responded. Because of this, the focus group analysis specifically reports on themes of those respondents. A short questionnaire in addition to the focus groups would have helped in this area.

The focus group questions were pilot tested with a group of graduate students, but not with middle-school students. Pilot testing would have been beneficial to reveal the time limitations and additional unnecessary questions, such as excess opening and closing questions, before gathering the actual data. Pilot testing may have also revealed that middle-school students were able to answer more direct questions, rather than indirect, third-person questions, which could have saved time and provided direct answers to our research questions.

**Conclusion**

At this time, an investment in the necessary research to create successful nutrition education videos is needed, especially for those audiences who have the most to gain from video education. In this study, embedded educational videos showed a slightly positive effect on retention and recall. Coupled with the outreach of computer-based nutrition programming, embedded videos could augment the educational process even further and could be a way to improve long-term retention of nutrition
information. The results of message comprehension showed that although many students could accurately interpret nutrition-related message from scenarios, a fraction of students (30-50%) could not. This means that video development may benefit by explicitly stating intended messages in addition to interpretive scenarios in order to reach the entire audience. The issues of gender and grade were shown to be possible mediating factors that could interfere with retention and recall. Both issues would need further study for our results to be corroborated, however these factors have also appeared in other research studies. Overall, this study provides insight as to the aspects surrounding embedded videos in computer-based nutrition education and adds to the scant amount of literature on the subject.
REFERENCES


CHAPTER 5.

SUMMARY AND CONCLUSION

Summary

Results of a systematic review of computer-based nutrition interventions showed potential for changing nutrition behavior in adolescents, however small, short-term changes should be expected. Researchers and practitioners were advised to apply a behavioral framework to their interventions in the future, as behavior theory was associated with most positive outcomes across the sample. Future research should investigate replication of previous studies, long-term maintenance strategies, website characteristics, and evaluation of parental involvement, gender-specific differences in nutrition outcomes, and intervention intensity. Adherence to robust research design will provide a better framework from which to draw conclusion and best practices.

Focus groups evaluating recall and comprehension of nutrition messages from online videos in a multimedia nutrition education program demonstrated enhanced short-term retention and recall compared to narration. This indicates that further investigation into the inclusion of videos in computer-based nutrition education is warranted in order to determine if this is indeed a component that could impart enhanced learning to the user.

The study also revealed that up to 50% of students had trouble accurately describing the specific, nutrition-related messages being delivered in both the video and narrated scenarios. This highlights that although embedded videos may draw the attention and enhance the retention of adolescents, if the message is not clear, important nutrition information may be lost. Gender showed an effect on the scenarios recalled, resulting in the potential gender-matching of characters to the gender identity of the observer; however, grade and, therefore perhaps age, did not seem to influence recall or comprehension in either medium.

Conclusion

The proper growth and development of adolescents depends on adequate nutrition. Inadequate nutrition or overnutrition lays the foundation for overweight, obesity, and type 2 diabetes as well as long-
term adverse health consequences as they grow into adults. Adolescents are populous on the internet and are savvy with computers; therefore, nutrition education has logically attempted to reach more of this population through computers. In doing so, it has opened new avenues for applications such as multimedia technology. Caveats of using multimedia in education interventions and one of their components, video, are numerous and are unfamiliar territory for many nutrition educators. Evidence regarding the use and evaluation of computer-mediated education, multimedia applications, and video in nutrition education are presently scarce, although growing. This thesis, therefore, adds to the little amount of information available and provides information to current and future researchers as well as to practitioners searching for information concerning development, implementation, and evaluation of issues surrounding these types of interventions for adolescents.

**Directions for future research**

Future research hinges on the deconstruction of multimedia programs with the purpose of determining which components are particularly efficacious and relevant within a certain age group, ethnicity, gender, learning style, etc. Research in developmental stage and components may also be a compelling area of research, as different components may inherently have different cognitive loads that are better understood by adolescents in certain cognitive stages of development. Further, the results indicate that nutrition researchers and practitioners who are planning to develop videos for future computer-based nutrition education would benefit from the consideration of the concepts that affect video education prior to video production. Finally, demonstration of clear messages should be explored with pilot-testing of videos with the target audience.
HOT Project!
Healthy Outcomes for Teens

**What:** We want 60 students to participate in a study about our Nutrition Education website for teens. Students will look at the website twice and be invited to join 2 focus groups to talk to us about their opinions of the website. (4 meetings)

**Where:** At school

**When:** During PE class

**Why:** $20 (after 2 meetings) and an MP3 player (after last 2 meetings)!

**Bring permission slip by:**

*University of Illinois at Urbana-Champaign*

University of Illinois
293 Ever Hall
905 S. Goodwin Ave.,
Urbana, IL
61801
Phone: 217-244-6281

Questions? Comments?
Whitney Ajie
ajie2@illinois.edu
Dr. Karen Chapman-Novakofski
kmc@illinois.edu
APPENDIX B.

PARENT CONSENT FORM

Parent Active Consent Letter for the Healthy Outcomes for Teens Discussion Group

Dear Parent:

We are from the Division of Nutritional Sciences and the Department of Food Science and Human Nutrition at the University of Illinois. We would like to include your child in a research project, along with his or her classmates. The research project is an evaluation of a web-based program called Healthy Outcomes for Teens. Children in the physical education classes at Eater Middle School in Rantoul will be invited to participate.

The amount of time needed for this project is about 20 minutes per session during PE class for four meeting times. Your child will learn about healthy eating and physical activity, and about diabetes prevention. This will be online. One group will include videos of kids eating healthy and choosing to be active. Another site will have just words instead of the video clips. Your child will see both, separated by about 1 month. In between seeing the websites, we’ll have a discussion group about the sites to see what they think about the scenarios in words or the videos. This discussion will be audio-taped and children will use made-up names so as to not be identified. The students in the group will be advised to keep the discussion confidential, but we cannot control whether or not the students talk about it afterwards.

Your child's participation in this project is completely voluntary. In addition to your permission, your child will be asked if he or she would like to take part in this project. Only those children who have parental permission and who want to take part will do so. Any child may stop participating at any time. You are free to withdraw your permission for your child's participation at any time. You can do that for any reason without penalty. These decisions will have no effect on your future relationship with the school. It will not affect your child’s status or grades there. For taking part in this project, your child will receive $20 for completing one session of viewing the website and 1 discussion session; if they do both viewings and discussions they will receive an MP3 player.

The information we get during this research project is kept strictly confidential. It will not become part of your child's school record. Any sharing or publication of the research results will not identify any of the participants by name. The findings from this study will be published as a student thesis, presented at a professional conference, and published in a scientific journal without revealing your child's name. No risks are expected with your child's participation beyond those they have in a normal school day.

Return this note to your child’s teacher before________. Please keep the second copy of this form for your records. Only the first 60 students that return their consent and their parents’ consent sheets to the PE teacher will be included.

We look forward to working with your child. We think that our research will be enjoyable for the children who participate. If you have any questions about this project, please contact us using the information below. If you or your child have any questions about his/her rights as a participant in research involving human subjects, please feel free to contact the University of Illinois Institutional Review Board (IRB) Office at 217.333.2670 or irb@illinois.edu. Your child is welcome to call these numbers if he/she identifies themselves as research participants.
Sincerely,
Karen Chapman-Novakofski, RD, PhD  Whitney Ajie
(217) 244-2952  (217) 244-6281
kmc@illinois.edu  ajie2@illinois.edu

******************************************************************************

I give permission for my child ____________________________ (name of child) to participate in the research project described above.

_______________________________
(Print) Parent’s name

_______________________________  ______________
Parent’s signature  Date
APPENDIX C.

CHILD ASSENT FORM

Healthy Outcomes for Teens Discussion Group
Adolescent Assent Form

Hello, __________________________. My name is Whitney Ajie and I am a student of Dr. Chapman-Novakofski from the University of Illinois. We are working on a research project about what is best to include in a web-based program on healthy eating and physical activity for students in middle school.

We want students look at these websites. It will take about 20 minutes during your PE class. About 2 weeks later we want to have a discussion about the site. The discussion will also be about 20 minutes during a PE class. We will do this twice, so we would see you 4 times. You would be part of a group of 3 to 6 students per group meeting.

You can decide whether or not you want to do this. It is up to you. You may decide to stop at any time. Whatever you decide is fine with me. You or your family will not get into any trouble if you decide not to finish the project. If any of the questions upset you during the discussion, you don’t have to participate. If you wish to talk about any questions that upset you later, let me know. If you want to, I will let your parents/guardians know that you would like to talk about certain issues with them. Participation in this project will not involve risks beyond those of ordinary life.

Everything you say is confidential. That means no one except me and my advisor at the University of Illinois will know who this information came from. Each focus group member will be asked to respect the privacy of each session. However, the researchers can’t absolutely guarantee that one or more group members won’t talk about what other people said after the session is over. We will audiotape the discussion so we get all of the information. You will use a fake name instead of your real name, so no one will know it is you talking. There is one exception to keeping things confidential. If you tell us about experiencing any abuse or neglect or about any risk of harm to yourself, we have to report this to school officials in order to make sure you are safe. The findings from this study will be disseminated as a thesis, presented at a national or state professional conference, and published in a peer-reviewed journal without revealing your name.

Do you have any questions for me? If you have any questions later, you can call me at (217) 244-6281 or e-mail me at ajie2@illinois.edu. You could also contact my advisor at kmc@illinois.edu or (217) 244-2852. If you have any questions about your rights as a participant in this study, you can call or email the Institutional Review Board (IRB) at the University of Illinois. Their phone number is (217) 333-2670, and their email address is irb@illinois.edu. You can call them and say that you are a research participant.

For participating in one viewing of the website and one discussion session, you will receive $20. If you participate in both viewing sessions and both discussion sessions you will receive an MP3 player. Only the first 60 students that return their consent form and their parents’ consent form to the PE teacher will be included.
If it is OK with you to participate, I need you to sign the statement below:

I voluntarily agree to participate in this study. I understand what my participation in the study involves and that I am free to stop at any time. A copy of this form has been given to me.

Are you willing to come for the discussion group and to be audiotaped?

Please CIRCLE one of the options below:

I agree              I do not agree to be audiotaped

____________________________________
(Print) Child’s Name

____________________________________
Child’s Signature

____________________________
Date
APPENDIX D.

FOCUS GROUP SCRIPT FOR FIRST FOCUS GROUP

Hi, my name is Ms. Whitney and this is Ms. Henna. We are going to talk today about the website you saw last week. I’m going to ask you some questions and remember, there are no right or wrong answers and we encourage everyone to participate, but it’s important to respect each other and try not to interrupt when another person is talking, okay? Remember we will be recording what we say with a voice recorder, and you’ve all said it is okay to record our conversation. Also, make sure to say your fake name instead of your real name whenever you talk to the group. For example, if my fake name is Hercules, I would say “I’m Hercules and I like playing soccer.” So I said my name, then I said what I wanted to say to the group, okay? So, let’s get started.

5:00 minutes:
Last week, we asked you to visit a website and complete 3 sections. It gave you a lot of facts, pictures, and had a voice reading to you.

1. Can you name some things that the website talked about? (Stress, diabetes, food/exercise)

2. What do you think was the main idea of those sections you mentioned? (What was it trying to tell you?)

3. What makes you think that was the main idea? (Was there something that caught your attention? Made that idea stand out? Talked a lot about that topic?)

4. If we showed this website to another 6th/7th/8th grade class, what information would be new to them?

10:00 minutes:
Thank you all for sharing. Now let’s discuss the Food & Exercise section. It talked about different people in situations that related to food and exercise. Those short stories are called “scenarios” and they can either be written down or made into videos, and they usually have a message to tell you.

5. Do you remember the scenarios that were on the website? (The stories about 1 or 2 people which talked about food or exercise) Can you describe what happened in the stories?
   - **Hints:** PIZZA, SCHOOL LUNCHES, POPCORN VS. POTATO CHIPS, PLAYING BASKETBALL, BIKING TO THE MALL, PING PONG
   - **If don’t remember:** What would help you remember the scenarios?

6. What do you think the message of that story was?
   - **Remember** there is no right or wrong answer. Different people may have different ideas
   - **If agree with 1 person:** What are some other possible messages you can think of?

7. Did the stories seem believable? (Like something that would really happen?)
   - What made them seem [believable/not believable]?
   - What would you change to make them more believable?

8. Do you feel like these stories could apply to you or other junior high students?
9. If you made the website, would you keep the scenarios (short stories)?
   - Do you think it would help the students understand the ideas? Or do you think they could understand even without the stories?

10. If you wanted to give your friend advice from what you learned from the website, what would you say?

11. Was there anything else you wanted to add?
FOCUS GROUP SCRIPT FOR SECOND FOCUS GROUP

Hi again, my name is Ms. Whitney and this is Ms. Karen. We are going to talk today about what you saw last Tuesday. This discussion will be similar to our first discussion. I’m going to ask you some questions; remember, there are no right or wrong answers. We will be recording what we say with a voice recorder, and you have all said it is okay to record our conversation. Say your fake name when you talk to the group, just like last time, and if you forget I will say it for you. Okay, let’s get started.

5:00 minutes:
Last week, we asked you to visit a website and complete 2 sections.

1. Can you name some things that the website talked about? (Food, exercise, macronutrients)

2. What do you think was the main idea of those sections you mentioned? (What was it trying to tell you?)

3. What makes you think that was the main idea? (Was there something that caught your attention? Made that idea stand out? Talked a lot about that topic?)

10:00 minutes:
Thank you all for sharing. Now let’s discuss the Food & Exercise section. It talked about different people in situations that related to food and exercise, and you may remember that I told you those short stories are called “scenarios.” They can be written down or made into videos, and they usually have a message to tell you.

🔍 4. Was there something you noticed that was different this time from the first time you saw the website?
   - **Yes:** What was different? (Or, what was different about the design?)
   - **Videos:** Did having videos change what you learned or remembered about that section? How so?
   - **NO Videos:** Did having the stories written down change what you learned or remembered about that section? How so?
   - **OTHER:** Does that change what you think about the website?

🔍 5. Do you remember the scenarios that were on website from last week? (The stories about 1 or 2 people which talked about food or exercise) Can you describe what happened in the stories?
   - **Hints:** PIZZA, SCHOOL LUNCHES, POPCORN VS. POTATO CHIPS, PLAYING BASKETBALL, BIKING TO THE MALL, PING PONG
   - **If don’t remember:** What would help you remember the scenarios?

🔍 6. What do you think the message of that story was?
   - **Remember** there is no right or wrong answer. Different people may have different ideas
   - **If agree with 1 person:** What are some other possible messages you can think of?

7. Did the stories seem believable? (Like something that would really happen?)
   - What made them seem [believable/not believable]?
   - What would you change to make them more believable?
8. If you made the website, would you keep the scenarios (short stories)?
   - Do you think it would help the students understand the ideas? Or do you think they could understand even without the stories?

9. What website do you think your friends would like better: #1 or #2?

10. Is there anything else you want to share about the website?
# APPENDIX F

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**RESEARCH DESIGN AND IMPLEMENTATION CHECKLIST**

### Research Design and Implementation Checklists

Each study the DEAN reviewed received a quality rating of positive, neutral, or negative, based upon a predefined scoring system. The appraisal of study quality is a critical component of the systematic review methodology because it affects the impact of evidence on the conclusions and judgments regarding the relevance (external validity/generalizability) and validity of each study’s results. Ratings were removed using two versions of the Research Design and Implementation Checklists.

The Research Design and Implementation Checklist: Primary Research includes ten validity questions based on the AHRQ domains for research studies. Sub-questions are listed under each validity question that identify important aspects of sound study design and execution relevant to each domain. Some sub-questions also identify how the domain applies to specific research designs.

### Research Design and Implementation CheckList: Primary Research

<table>
<thead>
<tr>
<th>Type</th>
<th>Question</th>
</tr>
</thead>
</table>
| RELEVANCE QUESTIONS | 1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (NA for some Epi Studies)  
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?  
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?  
4. Is the intervention or procedure feasible? (NA for some epidemiological studies) |
| VALIDITY QUESTIONS | 1. Was the research question clearly stated?  
1.1 Was the specific intervention(s) or procedure (independent variable(s)) identified?  
1.2 Was the outcome(s) (dependent variable(s)) clearly indicated?  
1.3 Were the target population and setting specified?  
2. Was the selection of study subjects/patients free from bias?  
2.1 Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognostic criteria), and with sufficient detail and without omitting criteria critical to the study?  
2.2 Were criteria applied equally to all study groups?  
2.3 Were health, demographics, and other characteristics of subjects described?  
2.4 Were the subjects/patients a representative sample of the relevant population?  
3. Were study groups comparable?  
3.1 Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)  
3.2 Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?  
3.3 Were concurrent controls used? (Concurrent preferred over historical controls.)  
3.4 If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?  
3.5 If case control study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some case-control studies.)  
3.6 If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., “gold standard”)?  
4. Was method of handling withdrawals described?  
4.1 Were follow up methods described and the same for all groups?  
4.2 Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%)  
4.3 Were all enrolled subjects/patients (in the original sample) accounted for?  
4.4 Were reasons for withdrawals similar across groups?  
4.5 If diagnostic test, was decision to perform reference test not dependent on results of test under study?  
5. Was blinding used to prevent introduction of bias?  
5.1 In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?  
5.2 Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)  
5.3 In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?  
5.4 In case control study, was case definition explicit and case ascertainment not influenced by exposure status?  
5.5 In diagnostic study, were test results blinded to patient history and other test results? |
6. Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervention factors described?
   6.1 In RCT or other intervention trial, were protocols described for all regimens studied?
   6.2 In observational study, were interventions, study settings, and clinicians/provider described?
   6.3 Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?
   6.4 Was the amount of exposure and, if relevant, subjective/patient compliance measured?
   6.5 Were co-interventions (e.g., ancillary treatments, other therapies) described?
   6.6 Were extra or unplanned treatments described?
   6.7 Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?
   6.8 In diagnostic study, were details of test administration and replication sufficient?

7. Were outcomes clearly defined and the measurements valid and reliable?
   7.1 Were primary and secondary endpoints described and relevant to the question?
   7.2 Were nutrition measures appropriate to question and outcomes of concern?
   7.3 Was the period of follow-up long enough for important outcome(s) to occur?
   7.4 Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?
   7.5 Was the measurement of effect at an appropriate level of precision?
   7.6 Were other factors accounted for (measured) that could affect outcomes?
   7.7 Were the measurements conducted consistently across groups?

8. Was the statistical analysis appropriate for the study design and type of outcome indicator(s)?
   8.1 Were statistical analyses adequately described and results reported appropriately?
   8.2 Were correct statistical tests used and assumptions of test not violated?
   8.3 Were statistics reported with levels of significance and/or confidence intervals?
   8.4 Was “intent to treat” analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?
   8.5 Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?
   8.6 Was clinical significance as well as statistical significance reported?
   8.7 If negative findings, was a power calculation reported to address type 2 error?

9. Are conclusions supported by results with biases and limitations taken into consideration?
   9.1 Is there a discussion of findings?
   9.2 Are biases and study limitations identified and discussed?

10. Is bias due to study’s funding or sponsorship unlikely?
   10.1 Were sources of funding and investigators’ affiliations described?
   10.2 Was there no apparent conflict of interest?
APPENDIX G.

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CONCLUSION GRADING CHART

2010 DGAC Conclusion Grading Chart

The 2010 Dietary Guideline Advisory Committee approved the use of the following predefined criteria to grade the strength of the evidence supporting each conclusion statement. These criteria guided members to carefully evaluate the:

- quality of studies (both strength of design and execution),
- quantity of studies and subjects,
- consistency of findings across studies,
- the magnitude of effect,
- generalizability of findings

reported in the body of literature supporting each conclusion. The chart below was used by the 2010 Dietary Guidelines Advisory Committee and defines the criteria used to determine each grade.

DGAC Conclusion Grading Chart used to evaluate the strength of the body of evidence supporting conclusion statements

<table>
<thead>
<tr>
<th>Elements</th>
<th>Strong</th>
<th>Moderate</th>
<th>Limited</th>
<th>Expert Opinion Only</th>
<th>Grade Not Assignable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>Studies of strong design Free from design flaws, bias, and execution problems</td>
<td>Studies of strong design with minor methodological concerns OR only studies of weaker study design for question</td>
<td>Studies of weak design for answering the question OR inconclusive findings due to design flaws, bias, or execution problems</td>
<td>No studies available</td>
<td>No evidence that pertains to question being addressed</td>
</tr>
<tr>
<td>Consistency</td>
<td>Findings generally consistent in direction and size of effect or degree of association, and statistical significance with minor very exceptions</td>
<td>Inconsistency among results of studies with strong design, OR consistency with minor exceptions across studies of weaker design</td>
<td>Unexplained inconsistency among results from different studies, OR single study unconfirmed by other studies</td>
<td>Conclusion supported solely by statements of informed nutrition or medical commentators</td>
<td>NA</td>
</tr>
<tr>
<td>Quantity</td>
<td>One large study with a diverse population or several good quality studies Large number of subjects studied Studies with negative results have sufficiently large sample size for adequate statistical power</td>
<td>Several studies by independent investigators Doubts about adequacy of sample size to avoid Type I and Type II error</td>
<td>Limited number of studies Low number of subjects studied and/or inadequate sample size within studies Unsubstantiated by published research studies</td>
<td>Relevant studies have not been done</td>
<td></td>
</tr>
<tr>
<td>Impact</td>
<td>Studied outcome relates directly to the question Size of effect is clinically meaningful Significant (statistical) difference is large</td>
<td>Some doubt about the statistical or clinical significance of the effect</td>
<td>Studied outcome is an intermediate outcome or surrogate for the true outcome of interest OR size of effect is small or lacks statistical and/or clinical significance</td>
<td>Objective data unavailable Indicates area for future research</td>
<td></td>
</tr>
<tr>
<td>Generalizability</td>
<td>Studied population, intervention and outcomes are free from serious doubts about generalizability</td>
<td>Minor doubts about generalizability</td>
<td>Serious doubts about generalizability due to narrow or different study population, intervention or outcomes studied</td>
<td>Generalizability limited to scope of experience</td>
<td>NA</td>
</tr>
</tbody>
</table>