THE HOT PROJECT (HEALTHY OUTCOME FOR TEENS): AN INNOVATIVE ONLINE INTERVENTION FOR PREVENTION AND TREATMENT OF OBESITY AND TYPE 2 DIABETES

BY

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DISSERTATION
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ABSTRACT

The rate of childhood obesity has more than tripled in the past 30 years from 5% to 18%. The risk of developing Type 2 diabetes increases in a dose-dependent manner with the increase in body mass index. Overweight and obesity are caused by caloric imbalance. Thus, healthy lifestyle habits, including healthy eating and physical activity, are recommended for the prevention and management of obesity and Type 2 diabetes. The HOT (Healthy Outcome for Teens) Project is an innovative online intervention for adolescents for the prevention and treatment of obesity and Type 2 diabetes by focusing on healthy eating and physical activity. The primary purpose of the HOT Project was to determine if web-based modules would increase awareness about obesity and diabetes prevention, behavior, and psychosocial variables, through active online learning (AOL) versus passive online learning (POL) with the same content framed within a behavioral theory. The HOT project was a six-phase intervention. First, the website was adapted from an adult website to use with the middle school students by recruiting a teen council for their opinions. Second, the intervention, framed within Social Cognitive Theory (SCT), was implemented in three schools in east central Illinois. Third, focus groups were conducted with the participants of the SCT intervention to assess their acceptability of the intervention. Fourth, the website was adjusted based on the results of the two studies. Fifth, the intervention was again implemented in two schools and this time framed within the Theory of Planned Behavior (TPB). Sixth, focus groups were conducted to explore the observational findings of the TPB intervention. The participants improved knowledge from both the SCT and TPB interventions but for the SCT subjects, active online learners showed significantly more improvement than the passive online learners. The subjects in
the SCT trial showed some improvement for outcome expectations but not for self-efficacy. However, the subjects in the TPB trial, showed improvement for all constructs of theory implemented in the study. The results suggest that an interactive web-based intervention is a suitable target for reaching middle school students for addressing health problems. Moreover, TPB is more appropriate for this population for short-term interventions.
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CHAPTER 1

INTRODUCTION

1.1 Background Information:

In the United States (US), 16% of children and adolescents, 6 to 19-years-of-age, are overweight; and 19% are obese (Foster et al, 2010). Obesity is defined as a body mass index (BMI) at or above the 95th percentile according to the gender and age specific growth charts from the Centers for Disease Control (CDC, 2000), whereas a BMI at or above the 85th percentile to the 95th percentile is considered overweight (Thunfors, Collins & Hanlon, 2009; CDC, 2011). Measurements of height and weight are needed to calculate BMI, and a BMI growth chart is used by health professionals to assess whether a child or adolescent is overweight (US Department of Health and Human Services [USDHHS], 2007). About 80% of overweight or obese children are likely to remain obese as adults, which can lead to chronic weight-related disease and disability in adulthood (Thunfors, Collins, & Hanlon, 2009). This will result in enormous future costs due to direct medical costs and indirect costs associated with lost productivity, disability and death (Ligthwood et al, 2009).

Research indicates that the increase in overweight and obesity is caused by a decline in physical activity, unhealthy eating patterns, or a combination of the two, with genetics and lifestyle both playing important roles (USDHHS, 2007; Hall et al, 2011). The American Diabetes Association, the North American Association for the Study of Obesity, and the American Society for Clinical Nutrition have jointly issued the statement to use lifestyle modifications, specifically healthy eating and physical activity, for prevention and treatment of obesity and Type 2 diabetes (Klein et al, 2004). Federal guidelines suggest that adolescents engage in 60 minutes of moderate- to-intense physical activity most days of the week and to limit sedentary behavior to
less than two hours a day (Hall et al, 2011). Adolescents fall short of this recommendation as the data from the National Survey of Children’s Health shows that only 30% of children and adolescents engage in vigorous physical activity for at least 20 minutes each day (Hall et al, 2011). A conventional weight management therapy is to follow a low fat diet with 30% calories coming from fat (Klein et al, 2004). Of all the consequences of childhood obesity, the most serious is the development of Type 2 diabetes (Foster et al, 2010).

Historically, Type 2 diabetes was rarely found in children and adolescents, but now there has been a significant increase in incidence of Type 2 diabetes, parallel to the rise in incidence in overweight and obesity in adolescents (Hall et al, 2011). Type 2 diabetes in adolescents is a serious disease as it can cause complications such as retinopathy, neuropathy, cardiovascular and renal disease, that can manifest when they are adults, if not earlier (Foster et al, 2010). This is a significant public health issue because the longer the individuals have these conditions; the greater the risk of complications, resulting in discomfort, ill health, days lost from school and work, and increased medical costs.

Adolescence is a period spanning 10-19 years of age, according to the World Health Organization. It bridges the gap between childhood and adulthood (Kanahols, Magnusson, & Alehagen, 2011). A review by Stice et al indicates that intervention effects are stronger for adolescents as compared to preadolescents and children because older participants are better able to understand the intervention content (Stice, Shaw, & Marti, 2006). Research evidence indicates that nutrition education programs are more effective with adolescents if they are framed within a behavioral theory and also focus on improving knowledge (Contento et al, 2007). Such programs improve psychosocial variables related to the behavior, which ultimately lead to behavior change (Boudreau & Godin, 2009).
Several meta-analyses of the efficacy of obesity prevention efforts indicate that the effects of weight management interventions are fairly small. To enhance the efficacy of healthy weight interventions, new and advanced approaches are needed (Mauriello et al, 2007). Internet has increasingly become a preferred medium of instruction for delivery of health behavior change interventions with adolescents (Hightow-Weidman, Fowler & Kibe, 2011). Literature provides little guidance on the design, acceptance and evaluation of interactive web-based programs; collaboration with adolescents for formative evaluation will be able to take advantage of the existing interests of adolescents (Thunfors, Collins & Hanlon, 2009).

To reach the adolescent population, research evidence supports employing a user-centered approach and including age-relevant information (Ferney & Marshall, 2006; Hightow-Weidman, Fowler & Kibe, 2011). A user-centered approach focuses on the intended audience throughout the design process by seeking their input for intervention development and improvement. This strategy is particularly helpful for web-based interventions to make them appealing and easy to use by the target populations based on their feedback (Ferney & Marshall, 2006). Specifically, adolescents demand interactive features, social interaction features, age-relevant reading material, and an attractive website which is easy to navigate (Hightow-Weidman, Fowler & Kibe, 2011). Literature both supports and also discourages the use of interactive features, and more research is needed at this time to determine the optimal level of interactivity for teens in an educational website (Baranich & Curie, 2006).

**Significance and Scope:**

Obesity is the most prominent modifiable risk factor for Type 2 diabetes and the evidence supporting the link between obesity, poor eating habits and early onset of this disease is
increasing (CDC, 2003). These statistics signify the importance of the HOT (Healthy Outcome for Teens) project intervention for management of obesity and Type 2 diabetes. Moreover, adolescents are not completely aware of the risk factors for type 2 diabetes as indicated by a study conducted by Mahjerin and colleagues (2008). The results indicated that adolescents could name some risk factors, but did not mention physical inactivity, family history or obesity as risk factors, indicating lack of knowledge (Mahjerin et al, 2008). Thus, effective physical activity and healthy eating interventions are needed for this population for a preventable disease for which they have lack of knowledge also.

For the scope of the HOT Project, the middle school population is a suitable target, as diabetes develops in adolescence if not earlier (Hall et al, 2011). Additionally a review by Mauriello et al indicates more school-based interventions are needed for the teens to combat overweight and Type 2 diabetes (2007). Secondly, using a web-based medium to reach adolescent population is a timely change in pedagogy, as the use of Internet by adolescents has been escalating (An et al, 2009). Moreover, teachers are overwhelmed meeting their students’ academic and social development needs and find it increasingly difficult to provide quality instruction in the area of health education (Castelli et al, 2011). Thus effective web-based learning can be used as an efficient method of instruction for health education in middle schools.

1.2 The HOT (Healthy Outcome for Teens) Project:

Keeping the above literature in mind, we developed a web-based obesity and Type 2 diabetes prevention intervention, named the HOT (Healthy Outcome for Teens) Project, for middle school students that promoted physical activity and healthy eating.
The HOT Project was a six-phase intervention. The first phase involved the development of the website by the website development team seeking help from a teen council. For the second phase, the website was implemented as the first intervention. For the third phase, focus groups were conducted with the participants of the first intervention to assess the acceptability of the intervention. For the fourth phase, the website was then adjusted based on the results of the first intervention and the first set of focus groups. For the fifth phase, the HOT Project was implemented for a second intervention. For the sixth phase, focus groups were conducted with participants of the second intervention to explore observational findings during the second intervention.

Two versions of the website were created with the same content, one each for the control and the treatment group. The control website used passive online learning (POL) and only contained text and no interactive features. On the other hand, the treatment website used an active online learning (AOL) format, and incorporated interactive features such as videos, pictures, games, voiceovers and animations. Two behavioral theories were used to guide the implementation of the HOT intervention. Social Cognitive Theory (SCT) was used as a guiding framework for the first intervention of the HOT Project and the Theory of Planned Behavior (TPB) guided the implementation of the second intervention of the HOT Project.

1.3 Objectives and Long-range Goal:

The primary purpose of the HOT Project was to determine if web-based modules would increase awareness about obesity and Type 2 diabetes prevention by incorporating lifestyle modifications (healthy eating and physical activity) through AOL more than POL with the same content.
Another primary objective was to determine if web-based modules would increase psychosocial variables and behavior (healthy eating and physical activity) related to obesity and Type 2 diabetes prevention in adolescents through AOL more than POL with the same content.

The long-range goal of the HOT Project is to develop sustainable and efficacious on-line programs to promote healthy eating and physical activity to treat and prevent obesity and Type 2 diabetes in youth.

1.4 Organization of the Dissertation:

The HOT Project research reported here is organized as follows: Chapter One includes introduction, significance, and objectives of the project. Chapter Two reviews the literature on obesity, Type 2 diabetes, school and internet-based interventions, adolescent-focused interventions, and the use of behavioral theory in interventions. Chapter Three focuses on the first study, which describes the improvement in SCT variables related to healthy eating, physical activity, and Type 2 diabetes. Chapter Four focuses on the focus group results with the participants of the first study. Chapter Five focuses on the second study, which describes the improvement in the theory of planned behavior variables related to healthy eating, physical activity and Type 2 diabetes. Chapter Six discusses the focus group results with the participants of the second study. Chapters Three, Four, Five and Six all begin with an introduction, followed by objectives, study methods, results, and discussion. Chapter Seven gives conclusions and recommendations for future directions. Finally there is an appendix section that includes materials such as study questionnaires.
REFERENCES


2.1 Obesity as a Precursor to Diabetes in Adolescence:

The prevalence of overweight and obesity in children and adolescents has more than doubled in the past thirty years (Morris, 2006). This epidemic affects all regions of the US, boys and girls, and all ethnicities (Morris, 2006). However, Hispanic, Asian-descendant, American-Indian-descendant, and African Americans have higher incidence than Caucasians (Halpern et al, 2010). Overweight and obesity have detrimental effects on many systems in the body leading to metabolic syndrome, early atherosclerosis, dyslipidemia, hypertension and Type 2 diabetes (Halpern et al, 2010). Obesity and, in particular, central adiposity lead to insulin resistance, which is the common pathophysiologic link for metabolic syndrome, cardiovascular disease and Type 2 diabetes (Halpern et al, 2010).

The prevalence of Type 2 diabetes in childhood and adolescence has been escalating parallel to the epidemic of overweight and obesity (Copeland et al, 2011). The risk of developing diabetes increases in a dose-dependent manner with the increase in BMI (Klein et al, 2004). Obese people are 3 to 7 times more likely to develop Type 2 diabetes than normal weight people and those with a BMI greater than 35 are 20 times more likely to develop diabetes (Klein et al, 2004). The condition is more common in minority populations than in Caucasians (Copeland et al, 2011). Family history increases the risk for developing Type 2 diabetes, with the first-degree relatives five times more likely to develop diabetes than controls of the same age, gender and weight with no family history of diabetes (Copeland et al, 2011).
Westernized lifestyle, high-calorie diets and reduced physical activity, are associated with obesity, insulin resistance and Type 2 diabetes (Klein et al, 2004). Insulin resistance is also associated with conditions such as polycystic ovary syndrome and acanthosis nigricans (Copeland et al, 2011). In adolescence, insulin resistance is also associated with Tanner stages 2 to 4 in puberty. Type 2 diabetes in young people is more frequently diagnosed around age 13 which coincides with the physiologic peak of insulin resistance around Tanner stage 3 (Copeland et al, 2011).

The etiology of Type 2 diabetes in children and adolescents is multifactorial, comprised of genetic and environmental factors. The condition develops when there is insulin action resistance and beta cell function failure (Morris, 2006). There is a strong association of insulin resistance with central adiposity. Type 2 diabetes is also linked with other conditions concomitant with insulin resistance which include hyperlipidemia, hypertension and non-alcoholic hepatic steatosis (Morris, 2006). Type 2 diabetes can lead to debilitating complications which include atherosclerotic cardiovascular disease, stroke, myocardial infarction and sudden death, renal insufficiency and chronic renal failure, limb-threatening neuropathy and vasculopathy, and retinopathy leading to blindness (Morris, 2006). When Type 2 diabetes develops in childhood and adolescence, risk for these complications increases and they can occur at an earlier age (Morris, 2006).

The American Diabetes Association, the North American Association for the Study of Obesity and the American Society for Clinical Nutrition have jointly issued the statement to use lifestyle modifications for the prevention and management of Type 2 diabetes (Klein et al, 2004). The treatment goals are to reduce weight gain, maintain linear growth, increase physical activity, normalize glucose levels, and control comorbidities, such as hypertension, dyslipidemia and
hepatic steatosis (Halpern et al, 2010). Lifestyle modifications include weight loss and increased physical activity (Klein et al, 2004). The weight loss and increased physical activity increase insulin sensitivity and glycemic control in patients with Type 2 diabetes and prevent diabetes development in high risk individuals, such as those with impaired glucose tolerance (Klein et al, 2004). A moderate decrease of 500-1000 calories leads to a slow and progressive weight loss (Klein et al, 2004). A conventional therapy for treating obesity to prevent and manage Type 2 diabetes is following a low fat diet (25 to 30% calories coming from fat). A low fat diet has shown success with maintaining long-term weight loss, decreasing the risk of cardiovascular disease, and decreasing total energy intake and weight loss (Klein et al, 2004). For physical activity, the recommendation for school-aged children is to engage in moderate-to-intense physical activity for 60 minutes most days of the week and to limit sedentary behavior to less than two hours a day (Halpern et al, 2010). Aerobic exercise is most beneficial for weight loss and to reduce metabolic changes (Halpern et al, 2010). Regular physical activity in addition to long-term maintenance of weight and weight loss also helps to improve insulin sensitivity, glycemic control, hypertension, dyslipidemia and the risk of coronary heart disease (Klein et al, 2004).

2.2 Adolescents as Learners:

Teaching middle school students is a challenging task as the teachers need to take into account the developmental changes in students as they transition from childhood to early adolescence (Allison & Marsha, 2007). By middle school, cognitive-motivational processes become important influences for their behavior rather than making choices based on purely what they like as they did in childhood. Adolescents make choices to align with the desired outcomes
using self-regulation. Thus, programs that focus on motivators and knowledge are effective, especially if designed within a theoretical behavioral framework for this population (Contento et al, 2007). Early adolescence is also the time when self-concept and self-esteem are unstable and the programs for this population must help young learners demonstrate their abilities and strengths in successful ways to keep them committed to a program (Allison & Marsha, 2007). The interventions must equip the adolescents with the ability to exert personal influence over their environment as well as their own behavior and feel the sense of personal agency and competence (Contento et al, 2007).

Adolescence is an important stage of life for health-related interventions, because many of the health risk behaviors such as lack of physical activity, low consumption of fruit, cigarette smoking, unprotected sex and excessive alcohol consumption, acquired in adolescence tracks in adulthood, thus affecting not only current health but also future health (Crutzen et al, 2008). This underscores the need for interventions for this age group to direct them to healthy behaviors by providing opportunities to learn about food and health, develop skills to apply the information, and incorporate these newly learned skills into everyday life (Casazza & Ciccazzo, 2006).

Traditional classroom instruction helps acquire knowledge but knowledge does not automatically transfers to learning of behavior and skills (Brug, Campbell & Assema, 1999; Gee, 2003; Casazza & Ciccazzo, 2006; Park et al, 2008). The recommendation is to use a combination of instruction methods in the classroom using web-based instruction as an integral part too in this digital age (Gee, 2003; Casazza & Ciccazzo, 2006; Park et al, 2008). Games are also an effective medium of instruction as it helps to retain and learn information and tweak knowledge by getting immediate feedback on their learning maneuvers in the game (Gee, 2003; Casazza & Ciccazzo, 2006). It also promotes social interaction by student discussing the games and viewing scores of
each other (Gee, 2003). Use of visual aids such as pictures, cartoons, maps, graphs, charts, diagrams, videos and other multimedia resources can enhance learning in adolescents as they engage different senses, accommodate visual learners and help reinforce key ideas by presenting information in alternative formats (Wantland et al, 2004; Allison & Marsha, 2007; Contento et al, 2007). The use of multiple and varied visual aids also can capture the interest of adolescents, who need frequent stimuli to keep them engaged (Brug, Campbell & Assema, 1999; Mayer, 2003; Allison & Marsha, 2007). Additionally, since young adolescents are extremely interested in their peers, opportunity to interact with them and seeing friends rating for different opinions can improve their engagement and interest in the material (Allison & Marsha, 2007). However, research has also shown that the degree to which interactive features are added to the intervention material can be distracting from the learning objective; thus thought should be given to the types and amount of visual aids and interactivity added to the program (Tolbert, 2011).

Schools are an excellent venue for such interventions as they offer continuous regular contact and they can also offer opportunities to learn about nutrition and health in classroom using multiple techniques (Casazza & Ciccazzo, 2006). However, for the interventions to be effective the topics must be tailored to the needs specific to adolescents and the intervention must be understandable, relevant and entertaining to the adolescent population (Casazza & Ciccazzo, 2006). Traditional nutrition education models are successful in increasing the knowledge of participants, but such interventions have done little in terms of leading to a behavior change (Casazza & Ciccazzo, 2006; Park et al, 2008). However, theory driven, behavioral-focused interventions have shown promise to help the adolescent subjects progress along the continuum of the Stages of Change model or form intentions if Theory of Planned
Behavior-based, because they focus on factors that motivate one to change current lifestyle patterns and assist in building new skills and behavior (Casazza & Cicccazzo, 2006).

The US Department of Education reports that Internet access has increased every year since 1994 (Casazza & Cicccazzo, 2006). About 70% of approximately 17 million youth, 12-17 years of age, currently have access to the Internet (An et al, 2009). Among the teens that have access to the Internet, approximately 26% have accessed the Internet for health-related information (An et al, 2009). These data underscore the potential for evidence-based Internet interventions for changing adverse health behaviors including those associated with overweight and obesity for adolescent population (An et al, 2009). Computer-assisted learning engages the learner in the educational material as it is a dynamic, reflective and iterative process (Koch et al, 2010). It helps the learner to learn at their own pace, increasing subject satisfaction with the material (Koch et al, 2010). Research conducted by Mayer at al suggests that students learn more deeply from well-designed multimedia messages using a combination of sensory skills, and student engagement is enhanced if narrations are designed in a polite, conversational tone (Mayer, 2003). Silk et al conducted a study to test the effectiveness of print, website and game modalities and the results of this study indicated that website performed better than the other two modalities (Silk et al, 2008). Some possible explanations for this finding are that websites are most often used for information, whereas games represent intellectual challenges; secondly, when playing a game the motivation is to understand the game, focus on the game and scoring points rather than focusing on learning nutrition information; thirdly, media such as websites allow users to spend as much time as needed for learning information (Silk et al, 2008). Some additional advantages of Internet-based interventions include more learner control, independence, decision making and convenience, making it an effective medium of instruction.
sensitive to the learning preferences of youth (Long et al, 2006; Bensley et al, 2011). Internet-based interventions can also assist in wider representation of the target audience by allowing inclusion of participants from multiple states and settings (Park et al, 2008).

Crutzen et al conducted research using the Delphi technique to assess Internet-delivered interventions aimed at adolescents to determine what intervention features were important with regard to visiting the intervention, staying on the intervention site and also revisiting the intervention site (Crutzen et al, 2008). According to experts in the Delphi panel, three intervention features were identified as important with regard to visiting the site, and included recommendation by word-of-mouth, an attractive interface at first sight, and perception of the Internet intervention as relevant (Crutzen et al, 2008). Five intervention site features were associated with regard to staying on the intervention, and included being able to associate themselves with the look and feel of the intervention, use of visual material (e.g. graphs, videos, pictures) and interactive features (e.g. tests, forums, games), easy navigation structure, not too time consuming, and should also be free of charge (Crutzen et al, 2008). Three intervention site features were identified as important with regard to revisiting the site and included opportunity to form implementation intention indicating a time when they would like to revisit, provide new content on a regular basis, and also a chance for the adolescents to monitor their progress in changing a behavior (Crutzen et al, 2008).

2.3 **School-based Interventions to Prevent Obesity and Diabetes in Adolescents:**

The prevalence of overweight and obesity is escalating at an alarming rate in children and adolescents, yet it is being poorly controlled (Stice, Shaw & Marti, 2006; Katz, 2009). Overweight and obesity have detrimental effects on adolescents’ physical and emotional health.
It can affect children’s quality of life, their performance in school, decrease their self-esteem, and lead to depressive symptoms (Katz, 2009). Obese children are also subjected to teasing, discrimination, and victimization by their peers (Katz, 2009). Schools are popular setting for health promotion and weight control interventions because they offer continuous, intensive contact with children (Katz, 2009). They offer infrastructure, physical environment, policies, curricula, and personnel for assisting in program implementation (Katz, 2009). A review conducted by Katz et al. demonstrates that some of the school-based interventions influencing childhood obesity, diabetes epidemics, and health promotion have shown positive findings (Katz, 2009). According to the review conducted by Katz et al, common strategies of school-based interventions include parent or family member participation, changing of the physical environment, nutrition/physical activity (PA) related classroom instruction, incorporation of nutrition/PA/TV reduction lessons across curricula, use of participatory and skill building activities, dissemination of educational print materials, modification to the frequency and intensity of physical education (PE) activities, teacher training, and student training in behavioral techniques such as self-monitoring (Katz, 2009).

A review conducted by Stice et al examined participant, delivery, intervention and design features of school-based interventions to identify what produced larger intervention effects. The report identified six intervention moderators to be strongly associated with positive results (Stice, Shaw & Marti, 2006). Firstly, intervention effects were stronger for children and adolescents as compared to preadolescents, with the strongest effect for adolescents. This may be because older participants are better able to understand the intervention material and are beginning to develop control over their food and physical activity choices. Secondly, the obesity prevention programs are more effective when delivered solely to females versus males or mixed-gender samples.
Thirdly, interventions with shorter duration produced significantly larger effects than those of longer duration. Fourthly, effects are significantly larger for interventions that focus solely on obesity prevention than focusing on additional health behaviors too. Fifthly, pilot trials tend to produce larger effects than large demonstration trials. This is thought to be because the interventionists are more passionate about new interventions which contribute to larger effect sizes. Another reason is that demonstration trials are more methodologically rigorous which makes them more immune to experimenter bias. Finally, self-presenting participants show better results than mandatory participation (Stice, Shaw & Marti, 2006).

The National Institute of Health (NIH) funded a multisite study, Child and Adolescent Trial for Cardiovascular Health (CATCH), to test the effectiveness of a school-based intervention to reduce cardiovascular risk factors in elementary schools (Nader et al, 2004). The intervention was multi-component and included a classroom curriculum accompanied by a complementary family component, a physical education curriculum, a school foodservice component and a program to promote smoke-free school policies. After three years of intervention, the program CATCH positively affected the school environment and the physical activity behaviors of the students (Hoelscher et al, 2004). School cafeterias’ decreased the amount of fat and saturated fat in the foods offered. Intervention schools increased the amount of time spent in moderate-to-vigorous physical activity (Nader et al, 2004). However, the difference in change in energy intake by treatment group was not statistically significant from the control group. Also, there were no differences in physiological measures such as BMI or serum cholesterol level either in the elementary school intervention group or in the present follow-up. Most of the intervention effects were maintained at both the three year follow-up and 5 year follow-up assessments, except the dietary behavior and adherence to CATCH curriculum in
classrooms (Hoelscher et al, 2004; Nader et al, 2004). There was a significant difference in the institutionalization of the catch curriculum between the treatment and control schools \((P = 0.004)\) but was still less than half the suggested time of 10-16 hours/week. Another noteworthy finding of this study is that training the teachers in the CATCH study schools was strongly associated with all aspects of CATCH classroom curriculum implementation (Hoelscher et al, 2004). This has also been observed in the implementation of other programs such as an intervention by Harvey-Berino et al to show the way to consume 5-a-day of fruits and vegetables (Hoelscher et al, 2004).

The HEALTHY study was a randomized, controlled, middle school-based intervention designed to reduce the risk factors for Type 2 diabetes (DeBar, 2009). The intervention was conducted in 42 schools and the students were followed from grades 6 to 8 (DeBar, 2009). The nutrition, physical activity and behavior intervention components in the HEALTHY study were disseminated using social marketing-based communication strategies (DeBar, 2009). The communication messages focused on educating students about the study themes, promoting study activities, encouraging participation and highlighting the study-related environmental changes being made in the schools (DeBar, 2009). This comprehensive school-based program did not result in greater decreases in the combined prevalence of overweight and obesity in intervention schools as compared to the control schools. However, the intervention group did show some significant reductions in various indices of obesity such as BMI z-score, percentage of students with waist circumference at or above the 90th percentile and fasting insulin levels which may reduce the risk of childhood-onset Type 2 diabetes (Foster et al, 2010).
2.4 Advantages and Disadvantages of Online Learning:

The Internet has considerable potential for delivering health behavior change programs. It may be a preferred source for delivering interventions over print, broadcast and face-to-face media. The advantages of Internet interventions include novelty and appeal, flexibility and convenience of use, instantaneous interactivity, provision of information which is individually tailored and facilitation of interpersonal interaction and social support (Ferney & Marshall, 2006). Moreover, with Internet interventions, larger numbers of people in diverse settings can be reached. It also offers privacy and the intervention is accessible from multiple sites (Ybarra et al, 2006). When designing an intervention website, it is important to focus on the intended audience. This is known as a ‘user-centered approach’ to website design (Ferney & Marshall, 2006). The internet interventions may especially be valuable for adolescents as they have adopted technology as another environment in which they interact and learn (NIH, 2009). Internet use is universal among the youth as 93% of teens use it (Ybarra et al, 2006). Madden and Gross have reported that youth spend 40 minutes or more online per day (Ybarra et al, 2006). Although youth may seek health information online, they primarily spend their time multi-tasking, most often communicating through instant messaging (Ybarra et al, 2006). Web-based interventions have shown promise for promotion of weight loss, diabetes self-management, and healthy eating. They have also been successful for HIV prevention, eating disorders, smoking cessation and alcohol abuse (Ybarra et al, 2006). Most of the computer-based interventions targeting behavior change are either grounded in Bandura’s Social Cognitive Theory (SCT) or Azjen’s Theory of Planned Behavior (TPB) (Bandura, 1989; Ajzen, 1991; Ybarra et al, 2006). More research is needed to determine the effectiveness of web-based interventions. They have shown promise to
bring short-term change in health behaviors but little is known about their efficacy to maintain behavior change over the long run (NIH, 2009; Bull, McFarlane & King, 2011).

Ferney & Marshall conducted focus groups with 40 adults to determine their preferences for intervention website features (2006). Four themes emerged in this study. For design theme, participants wanted the site to be easy to use, easily accessible, and fast speed and quick download time of a website. For interactivity theme, participants wanted more interactive features, opportunity to email, and the ability to record, track, and monitor individual progress. For environmental theme, participants wanted information about community specific activities and also information about unusual and uncommon activities. For content theme, the participants did not want the website to be too long or repetitious and liked the feature of providing links to related websites. Participants also felt that including some audio and other multimedia features would make the website content more appealing.

Computer-based alcohol consumption programs have shown promise in decreasing the number of drinks and heavy drinking episodes (Brug, Campbell & Assema, 1999; Kypri et al., 2004; Neighbors, Larimer & Lewis, 2004). The IHEALTH study conducted with freshmen students has also shown promise for addressing unhealthy alcohol use by college students (Saitz et al., 2006). Two versions of the website were created with the intervention site having more extensive information and interaction (Saiz et al., 2006, 2006). The results from the IHEALTH study conducted with freshmen students has also shown promise for addressing unhealthy alcohol use by college students (Saitz et al., 2006). The IHEALTH study conducted with freshmen students has also shown promise for addressing unhealthy alcohol use by college students (Saitz et al., 2006). The IHEALTH study conducted with freshmen students has also shown promise for addressing unhealthy alcohol use by college students (Saitz et al., 2006).
intervention comprised of 5 modules to lower depression and anxiety levels (Saitz et al, 2007). Analysis of this intervention indicates that depression and anxiety scores decreased significantly. When the results were compared with a similar program offered in an abnormal psychology course, the web-based intervention showed greater improvements.

Despite the promising characteristics of interactive web-based interventions, studies evaluating the effects of web-based interventions targeting dietary intake have had mixed results. A study conducted by Kroeze et al to determine the efficacy of web-based and print-delivered intervention to reduce fat intake indicated that interactive and print delivered computer-tailored interventions can have similar short-term effects on fat intake, but the effects of print-delivered intervention are maintained in the longer term (Kroeze et al, 2008). This may be because print delivered information may be easier to read and process than information from a computer screen. People may also be more likely to save and reread print delivered information. Other explanations could be greater memorability and/or cognitive processing of printed information compared to on-screen information (Kroeze et al, 2008). The task of developing effective web-based interventions requires the use of educational psychology to achieve a balance between entertainment and learning, as animation and sound in some interventions can distract from the learning process (Green & McNeese, 2007). The choice of pedagogy should depend on desired outcomes as it is suggested that traditional classrooms produce better mastery of recalled information whereas the more technology intensive classroom produce improved skills, hypothesis generation, and better ability to address a new problem. Traditional classrooms encourage perseverance and support serious learning by teaching to read critically, make connections between new information and what is already known and collaborating with peers (Green & McNeese, 2007). There may also be gender differences in how different teaching
styles are perceived. A study discussing the development and evaluation of edutainment software indicated that girls were more engaged and concerned with the story whereas the boys were more interested in the games/activity modules (Zin & Nasir, 2008).

2.5 Theory-based Interventions:

To promote healthy behavior among children and adolescents, it is necessary to effectively understand the correlates of behavior (McClain et al, 2009). Theory-based research is important to understand health behavior by providing a framework to examine the relationships among theoretical constructs, to assess the impact of the various constructs, and to identify factors and determinants to be studied (McClain et al, 2009). Substantial evidence is lacking due to the dearth of research on theory-based interventions (Cerin, Barnett & Baranowski, 2009; McClain et al, 2009). McClain and colleagues determined that the psychosocial correlates of dietary behavior in children and adolescents were perceived modeling, dietary intentions, norms, liking and preferences (McClain et al, 2009). However, for adults, knowledge, self-efficacy and social support were identified as important predictors of dietary behavior. This research supports the hypothesis that cognitive based models for adults may not be suitable for adolescents who tend to be less rational and more affect driven (McClain et al, 2009). Thus, it is important to study children separately from adults and to focus on more affect driven psychological models for children and adolescents (McClain et al, 2009). There is a general consensus that to enhance the effectiveness of dietary behavior interventions, theoretical frameworks should be applied to the development and application of the interventions (Cerin, Barnett & Baranowski, 2009; Guillaumie, Godin & Vezina-Im, 2010). There is a synergistic feedback loop between dietary interventions and theories. Theories inform behavioral interventions by pinpointing possible
determinants of dietary behavior and in turn findings from theory-based interventions provide a foundation for theory development and refinement (Cerin, Barnett & Baranowski, 2009).

Systematic reviews indicate that most frequently used theoretical frameworks are the Theory of Planned Behavior (TPB), SCT, and the Health Belief Model, or a multicomponent approach combining several theories (Bandura, 1989; Ajzen, 1991; Guillaumie, Godin & Vezina-Im, 2010). These theories share common assumptions that emphasize the active role of the person and are characteristics of cognitive behavioral theories (Sirur et al, 2009). The two assumptions are that people are able to use foresight, planning, and decision making processes (cognitive processes); and are goal-directed and focus on self-regulating (behavior) (Sirur et al, 2009). The theories of behavior change guide the interventions, preferably randomized controlled trials, and are hypothesized to lead to changes in the theoretical constructs (mediators), which in turn are hypothesized to lead to changes in the dietary behavior (Guillaumie, Godin & Vezina-Im, 2010; Cerin, Barnett & Baranowski, 2009). Hence, there are two essential steps to evaluate the extent to which a theory provides a reasonable explanation of changes in the observed behavior (Cerin, Barnett & Baranowski, 2009). Firstly, to assess whether the intervention produced significant changes in the hypothesized mediators and secondly to assess whether the intervention induced changes in the behavior outcomes are attributable to changes in the mediators or not (Cerin, Barnett & Baranowski, 2009). A review conducted by Cerin et al suggests that interventions for youth should focus on SCT and TPB constructs because these constructs are important and reliable mechanisms of dietary behavior changes using interventions. However, this review had its limitations, suggesting that more research is needed to determine mechanisms underlying health behavior change in youth. Moreover, published experimental studies reporting information about effective mediators and theories of behavior change are lacking, possibly due
to failure to produce intervention effects in the mediators, a failure to detect significant associations between mediators and dietary outcomes, and the misconception that significant intervention effects are an essential condition for mediation to occur (Cerin, Barnett & Baranowski, 2009).

2.6 Social Cognitive Theory-based Interventions:

Programs developed in accordance with the SCT have proved to be effective in changing individuals’ health behaviors (Schnoll & Zimmerman, 2001; Resnick, 2002; McAuley et al, 2003; Nahm et al, 2010; Poddar et al, 2010). Social Cognitive Theory is commonly used in nutrition education interventions that impact behavior related to nutrition (Poddar et al, 2010). There are four constructs of the SCT which are employed in interventions (Poddar et al, 2010). Outcome expectancy is the good or bad consequences expected to result from the behavior. Self-efficacy is the confidence in one’s ability to perform the behavior. Self-efficacy is the key concept and mediator, influencing other concepts (Sirur et al, 2009). Self-regulation is the ability to regulate actions pertaining to the behavior. Social support is the emotional support from family and friends to perform the behavior. Concepts consistent with self-efficacy and outcome expectations are found in all theories. Bandura’s SCT holds the assumption that environmental factors, personal factors and attributes of behavior itself influence the behavior change (Bandura, 1989; Collins et al, 2009). This interaction is referred to as reciprocal determinism, as each factor may affect or be affected by other factors (Collins et al, 2009).

Researchers have used SCT-based interventions with children and adolescents to investigate factors influencing eating behavior, food choices, and health (Pokhriyal & Smith, 2010). A study conducted with Hmong American children investigating health and diabetes
perception employed SCT’s reciprocal determinism factors (Pokhriyal & Smith, 2010). The results indicated that environment was the most important determinant for Hmong children’s health and behavior perceptions than either personal or behavior influences (Pokhriyal & Smith, 2010). Specifically, parental modeling, easy access to junk food, and media were important environmental factors influencing Hmong children’s eating behavior (Pokhriyal & Smith, 2010). Poddar and coworkers conducted a web-based nutrition education intervention with college students to increase their dairy intake and incorporated SCT constructs (Poddar et al, 2010). The objective of this study was to improve outcome expectations, self-efficacy, self-regulation, and behavior related to dairy intake in 294 students enrolled in a personal health class randomized to either the intervention (n=148) or a comparison group (n=146) (Poddar et al, 2010). However, the intervention only improved self-efficacy and self-regulation (Poddar et al, 2010). A review conducted to determine the effect of theory-based interventions on physical activity participation among overweight/obese individuals has shown that the self-efficacy construct of SCT improves the most for interventions aimed at increasing physical activity (Gravel et al, 2010). A study was conducted by Nahm et al to determine the effectiveness of SCT-based structured hip fracture prevention website vs. conventional website groups for older adults. Results indicated that the participants of the theory-based intervention were more satisfied with the intervention. The theory-based intervention participants also showed improvement in calcium intake (Nahm et al, 2010).

Bill and coworkers conducted an online SCT-based nutrition, physical activity (PA), and weight gain prevention intervention called Web-Based Guide to Health intervention (WB-GTH) to examine the influence of the intervention at 6 months and 16 months (Anderson et al, 2011; Anderson, Winett & Wojcik, 2011). The results of the study indicated that the participants lost
weight because of improved diet and PA, which followed improvements in the constructs of SCT employed in the intervention (self-efficacy, outcome expectations, self-regulation and social support). Bandura posits that SCT interventions may be more effective if they follow the order to first increase self-efficacy and social support (Bandura, 1989). Improving social support and self-efficacy may be an effective pathway for increasing the use of self-regulatory strategies. Further, improved social support, self-efficacy, and self-regulation may lead to improved outcome expectations which could contribute to successful maintenance of healthy behaviors (Anderson et al, 2011). The WB-GTH intervention also targeted different theoretical constructs at different times, with initial focus on self-efficacy and self-regulation and latter focus on social support and outcome expectations (Anderson, Winett & Wojcik, 2011). The intervention was most successful with improvements in self-efficacy, social support and self-regulation but not much effect on outcome expectations, which were high even at the start of the intervention (Anderson et al, 2011; Anderson, Winett & Wojcik, 2011).

Literature in the field of theory application to health-based interventions suggests that the TPB and SCT are equivalent for behavior prediction whereas TPB seems to be an appropriate choice to predict intention (Guillaumie, Godin & Vezina-Im, 2010). Intentions are essentially proximal goals, that is, behavior will take place within a relatively short period, whereas the goals construct in SCT can either be distal or proximal. Thus, SCT is different from the TPB in its ability to predict behavior that may occur at a later time and also predicting adherence behavior over a longer period (Sirur et al, 2009). And it is also known that more time is needed to bring about a behavior change than forming intentions. Thus, SCT is more appropriate for longer interventions and TPB more suitable for interventions of shorter duration (Guillaumie, Godin & Vezina-Im, 2010).
2.7 Theory of Planned Behavior Interventions:

The TPB, a modified version of the Theory of Reasoned Action (TRA), is an expectancy value model that is used in interventions to provide a framework to identify predictors of a behavior of interest (Ajzen, 1991; Lautenschlager & Smith, 2007; Pawlak, Malinauskas & Rivera, 2009). Review articles analyzing TPB-based interventions suggest that the TPB model can predict healthy dietary behavior in adolescents of both genders and from different ethnic groups (Lautenschlager & Smith, 2007). The theory helps to understand the effects of attitude, subjective norms, and perceived behavioral control on behavioral intention (Ajzen, 1991; Pawlak & Malinauskas, 2008). Behavioral intention, in turn, is considered the proximal predictor of behavior and is the summary motivation to perform the behavior (Pawlak & Malinauskas, 2008; Rhodes, Macdonald & McKay, 2006). Attitude is the belief an individual holds about the consequences of engaging in a behavior combined with the evaluation of each consequence (Ajzen, 1991; Backman et al, 2002). Subjective norm is the belief that the person believes specific people or groups want him/her to engage in a behavior and the person’s motivation to comply with each person or group (Ajzen, 1991; Backman et al, 2002). Perceived behavioral control is a combination of the belief regarding the presence or absence of resources and opportunities to perform the behavior and the perceived importance of each resource or opportunity (Backman et al, 2002). Azjen (1991) hypothesizes that behavioral control primarily influences behavior through intention, and it can influence behavior directly also, as behavioral control reflects actual control (Rhodes, Macdonald & McKay, 2006). The theoretical model of TPB has been applied to interventions for adults and youth to identify determinants of specific dietary behaviors such as the use of table salt (Shepherd & Farleigh, 1986), consumption of milk and high fiber bread (Beg, Jonsson, & Connor, 2000), sweet biscuits and whole grain bread.
(Sparks, Hedderley & Shepherd, 1992) and organic vegetables (Sparks & Shepherd, 1992). It has also been applied to interventions focusing on a low fat diet (Nguyen, Otis & Potvin, 1996), consuming sweet and fat snacks between meals (Meters & Oostveen, 1994), and weight loss (Schifter & Azjen, 1985).

Although the TPB can be used in interventions to influence behavioral intentions, it does not address the processes by which the intentions are translated into action (Gratton, Povey, & Clark-Carter, 2007). Intention represents a person’s motivation in the sense of a conscious decision to exert effort to perform the behavior. The adoption of health behaviors actually involves two phases: motivational and volitional (Gratton, Povey, & Clark-Carter, 2007). The TPB can account for the first stage by forming intentions on the basis of attitude, subjective norm and perceived behavioral control. The second stage, however, is where a person plans to act out the behavioral intention by developing strategies to do so and this volitional stage is called the ‘implementation intention’ phase (Gratton, Povey, & Clark-Carter, 2007). The TPB does not target this volitional stage. Gratton and colleagues conducted a study to compare a motivational intervention based on the TPB with a volitional intervention based on implementation intentions for increasing fruit and vegetable intake (Gratton, Povey, & Clark-Carter, 2007). The results of the study indicated that when the two interventions were compared to the control, the volitional intervention was the only one to increase consumption significantly over the control, suggesting that it was more effective at changing behavior (Gratton, Povey, & Clark-Carter, 2007). Making only implementation plans is also sometimes not sufficient because it does not address existing situational cues and unwanted behaviors (e.g. habitual responses, spontaneous reactions to current demands or social pressure) (Araujo-Soares, McIntyre & Sniehotta, 2009). In that case, coping plans are needed for relapse prevention and they help to
cope with risk situations and assist in maintaining newly adopted behavior in the face of
difficulties (Araujo-Soares, McIntyre & Sniehotta, 2009). Coping planning seems especially
important for adolescents, as they may fail to implement their implementation intentions due to
situational demands or peer pressure, if they do not plan how to shield their intentions and action
plans from those influences (Araujo-Soares, McIntyre & Sniehotta, 2009). A study was
conducted by Araujo-Soares et al aimed to test the direct predictors of the TPB, and also
assessed action planning and coping planning as predictors of changes in physical activity in 157
adolescents (Araujo-Soares, McIntyre & Sniehotta, 2009). The results of the study indicated that
intention to change behavior was the most important determinant of increase in physical activity
(Araujo-Soares, McIntyre & Sniehotta, 2009). Secondly, the study results also indicated that the
interaction between action planning and coping planning was more important for predicting
behavior change than either of the planning measures alone (Araujo-Soares, McIntyre &
Sniehotta, 2009). At low levels of coping planning, action planning may even have detrimental
effects (Araujo-Soares, McIntyre & Sniehotta, 2009). This is in contrast to previous research
carried out with adults, which found action planning effects more important than interactions
(Araujo-Soares, McIntyre & Sniehotta, 2009). These contrasting findings indicate that planning
processes may play a different role in adolescence than in adulthood, because adults may be
more capable of following their action plans by forming spontaneous self-regulatory strategies
generalized from past experiences (Araujo-Soares, McIntyre & Sniehotta, 2009).

A study was conducted by Backman et al to determine psychosocial predictors of
healthful dietary behavior in adolescents (n=780 adolescents) using the TPB (Backman et al,
2002). The results from the study revealed that intention to eat a healthful diet was the primary
predictor of healthful dietary behavior (Backman et al, 2002). The intention was most influenced
by attitude, followed by perceived behavioral control and subjective norm. Positive attitudes toward healthful eating included liking the taste of healthful foods, feeling good about themselves, tolerating giving up the foods they like, and losing or maintaining a healthful weight. For subjective norm, mother, siblings, and friends were important predictors. Personal behavioral control was influenced by knowledge about how to eat a healthful diet, availability of healthful foods, and motivation and access to enough money. These findings indicate that attitudinal, normative and control factors should be used in the development of nutrition education interventions to promote healthful eating among teens (Backman et al, 2002). A study conducted by Blanchard et al. examined the use of TPB to examine the Five-a-day intentions and behavior of college students (Blanchard et al, 2009). The results indicated that affective attitude and perceived behavioral control were significant predictors of intention, which in turn was a significant predictor of behavior (Shepherd & Farleigh, 1986). A study conducted by Hewitt et al supported the application of TPB for prediction of food choice-related intention and behavior among children (Hewitt & Stephens, 2007). In this study, subjective norm, behavioral belief, attitude and perceived behavioral control significantly predicted intentions, which in turn predicted self-reported dietary behavior. The model’s explanatory power was not increased by parental influence (Hewitt & Stephens, 2007).

2.8 Summary of Review:

Keeping the above literature review in mind, computer based interventions are needed for adolescents to improve their healthy behaviors, such as healthy nutrition and physical activity. The CDC recently reported 16-33% of children and adolescents in the US are overweight or obese (Park et al, 2008). The trends of overweight and obesity have leveled off since 2000;
however the high prevalence and the associated consequences continue to be a public health concern in the US (Ogden et al, 2010). Moreover, according to CDC estimates, less than 50% of adolescents are physically active on a regular basis, more than 60% exceed the daily recommended fat intake, and less than 20% eat the recommended five servings a day of fruits and vegetables (Park et al, 2008; Allison & Marsha, 2007). Thus, to improve the health of this population, interventions must be focused to modify these behaviors. Obesity is the leading modifiable risk factor of Type 2 diabetes, because excess adipose tissue plays a role in causing defects in insulin regulation and thus contributes to the pathogenesis of Type 2 diabetes (Park et al, 2008; Allison & Marsha, 2007). Thus, initiation of prevention programs is a public health priority for this population for the prevention and treatment of obesity and Type 2 diabetes; and the programs should be age relevant, fun, and participatory to capture adolescent attention (Allison & Marsha, 2007). The developmental stage of adolescence poses unique challenges for health educators and research supports the acceptance of technology-based instruction in this population (Allison & Marsha, 2007).

The use of computer-based interventions shows promise and is supported by numerous studies, one of which is the results of a review conducted by An et al to assess web-based weight management programs for adolescents (An et al, 2009). The study reported that Internet interventions as either stand-alone or as combined with other behavioral approaches demonstrate the potential to improve outcomes in management of adolescent obesity (An et al, 2009). Similarly, study conducted by Brug et al with adolescents indicated that computer-mediated approaches to nutrition education increased exposure and were more thoroughly read, recalled, and viewed as personally relevant as compared to traditional print-based materials (Brug, Campbell, & Assema, 1999; Brug, Oenema, & Campbell, 2003). Another meta-analytic review
conducted by Wantland et al to determine the effectiveness of Internet versus more traditional interventions revealed significant improvements in knowledge gained and behavior outcome when internet programs were used (Wantland et al, 2004). Thus, our study utilized a web-based approach for teaching lifestyle modifications to prevent and treat obesity and Type 2 diabetes in middle school population.
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CHAPTER 3
HEALTHY OUTCOME FOR TEENS (HOT PROJECT): CHANGE IN SOCIAL COGNITIVE THEORY CONSTRUCTS IN A RANDOMIZED CONTROL TRIAL

3.1 Introduction:

Although Type 1 diabetes had once been more prevalent in children than Type 2 diabetes, over the last decade this has changed due to obesity, inactivity, and higher fat and lower fiber diets (Libson & Arslanian, 2003). Environmental factors and genetic predisposition are important determinants for the expression of this disease (Callahan & Mansfield, 2000). The risk factors for Type 2 diabetes in children include obesity, minority status, a family history of diabetes, and puberty. The overweight prevalence among children and adolescents has almost tripled in the last 20 years, with the latest national estimate suggesting that 34% of children ages 2-19 are overweight or at risk of being overweight (Thunfors, Collins & Hanlon, 2009). The average age of onset of Type 2 diabetes mellitus in children, 12 to 14 years, coincides with relative insulin resistance that occurs during pubertal development (Callahan & Mansfield, 2000). The estimated 30% lifetime risk for developing diabetes for children born in 2000 or later may, in fact, underestimate the risk of developing diabetes because of the dramatic increase in childhood obesity (Rappaport & Usher, 2006). It is clear that many interventions must be implemented to slow this trend. Since Type 2 diabetes is strongly associated with obesity and sedentary lifestyle, programs designed to increase exercise and decrease obesity must be used as first line approaches (Callahan & Mansfield, 2000).

Health interventions for youth have traditionally targeted parents and schools as youth spend most of their time either at school or at home. Schools are a popular setting for health promotion and weight control interventions, because they provide a safe and supportive environment with policies and practices that support healthy behaviors (Katz, 2009). Several
meta-analyses of the efficacy of obesity prevention programs indicate that the effects of the
current obesity preventive approaches are fairly small (Stice, Shaw & Marti, 2006; Katz, 2009).
Moreover, research literature suggests that more obesity prevention and treatment interventions
are needed specifically for the adolescent population (Gellar et al, 2012). To enhance the
efficacy, new strategies are warranted and may include the application of electronic media.

Internet use is universal among youth as 93% of teens use it (Bull et al, 2009). Online
interventions may especially be valuable, as adolescents have adopted the Internet as another
environment in which they interact and learn (Ybarra et al, 2006). Marketers also know that
teens are rapidly developing social networks online (Facebook Groups, 2011). Such online
environments are appealing, as teens can customize its features and have the opportunity to
“vote” on issues and to compare their responses to that of their friends (Facebook Groups, 2011).
The Internet is also the main news source for young populations (Sova, 2006). Indeed, more
businesses are moving to the Internet to reach teens (Friedman, 2011).

It is estimated that 25% of teens spend more than 2 hours a day involved in online social
networking and 33% share self-created media online (Friedman, 2011). An estimated 26% of
teens have also accessed the Internet for health-related information (Lenhart, Rainie & Lewis,
2001). Internet interventions have demonstrated the potential to improve outcomes in obesity
management in adolescents when implemented as family-based Internet intervention (White et
al, 2004), for adolescent girls (Williamson et al, 2005; Williamson et al, 2006), and as interactive
weight management programs (Celio, 2005). However, there are no web-based weight
management and diabetes prevention interventions for adolescents implemented in the school
setting, which may provide the best venue for such interventions. Limited evidence exists
regarding the optimal incorporation of theoretical frameworks for weight management programs.
for children and youth via the Internet (Doshi et al, 2003; An et al, 2009). Our intervention, the HOT (Healthy Outcome for Teens) Project is innovative as it aims to fill the gaps in research literature by implementing the study in a school setting and incorporating a theoretical framework to guide its implementation.

Theory adds coherence and effectiveness to interventions by guiding methods, as well as intervention evaluation (McClain et al, 2009). A review conducted by Cerin et al. suggested that interventions aimed at youth will improve their efficacy by targeting key constructs of the SCT or the TPB (Cerin, Barnett & Baranowski, 2009). Programs developed in accordance with the SCT have proved to be effective in changing individuals’ health behaviors, including nutrition behavior (Schnoll & Zimmerman, 2001; Resnick, 2002; McAuley et al, 2003; Nahm et al, 2010; Poddar et al, 2010). There are four constructs of SCT, which are employed in interventions (Poddar et al, 2010). **Outcome expectancy** is the good or bad consequences expected to result from the behavior. Outcome expectancy has been documented as a determinant of PA and healthy eating among high school students (Winters, Petosa & Charlton, 2003; Petosa et al, 2005; Ball et al, 2009). Self-efficacy is the confidence in one’s ability to perform the behavior. Bandura considers self-efficacy to be the central determining factor of human action (Taymoori, Rhodes & Berry, 2010). **Self-efficacy** has been shown to be an important correlate of physical activity (PA) and healthy eating in adolescents (Berry, Naylor & Wharf-Higgins, 2005). **Self-regulation** is the ability to regulate actions pertaining to the behavior. It has been shown to be a significant predictor of adolescents’ PA and healthy eating (Winters, 2001; Suminski 2003; Hortz & Petosa, 2008; Ball et al, 2009). **Social support** is the emotional support from family and friends to perform the behavior. Family support and peer social support have also been shown to be related directly and indirectly (via self-efficacy) to PA and healthy eating in adolescents.
(Sallis, Prochaska & Taylor, 2000; Motl et al, 2007; Ball et al, 2009). Within the causal system, the SCT identifies these constructs as key mediators between external stimuli, such as an intervention, and behaviors, such as physical activity (Dishman et al, 2004). Bandura’s SCT holds the assumption that environmental factors, personal factors and attributes of behavior itself influence the behavior change (Collins et al, 2010). This interaction is referred to as reciprocal determinism, as each factor may affect or be affected by other factors (Collins et al, 2010).

**Background for the HOT Project**

The HOT Project: Healthy Outcome for Teens is an innovative online educational intervention for middle school children focusing on preventing diabetes and obesity by balancing food intake with physical activity. The website information was modified to the reading level of middle school participants and was adapted to reflect the triadic reciprocity of the SCT variables such as social persuasion. The study was conducted in a Midwest county with three schools participating in the intervention and included students from the 6\(^{\text{th}}\), 7\(^{\text{th}}\) and 8\(^{\text{th}}\) grades, 62% of who received free/reduced lunch. The racial demographics were similar in the three participating schools. Sample size calculations, based on a power analysis for a 2 (treatment or control) x 2 (measures: pre/post) fixed effect of variance with alpha at 0.05, and an effect size (f) of 0.25, revealed that 132 participants would result in 81% power (Sample Power 2.0, SPSS, Chicago, IL, 2000). A 25% drop-out rate was included for a recruitment goal of 165 participants (Figure 3.1). The study was approved by the university Institutional Review Board and parental consent and child assent were obtained.

The content and outcome measures were identified in a previous study (Herrejon et al, 2009), and briefly included an overview of diabetes and food, food groups and diabetes, physical
activity and weight management, and eating for target blood glucose levels organized in five modules. Two versions of the website were created with exactly the same information except the site for the treatment group had interactive features such as videos (observational learning), narrated text (social persuasion), and knowledge/skill based games (outcome expectancies, self-efficacy); while the control group had passive, non-interactive texts.

The purpose of this study was to improve knowledge, outcome expectancies, self-efficacy, self-reported food intake and skills through an online intervention which compared a passive online learning (POL) control group and a treatment group (n=129) that used active online learning (AOL).

3.2 Methods:

Middle school students (n=181) participated in the randomized controlled intervention, which was incorporated in the regular school day in the physical education or health class, or provided as an after-school program (Figure 3.1). To assess comparative gain in knowledge, self-reported intake and meal planning skills, and change in SCT constructs (outcome expectancies and self-efficacy), six questionnaires were administered online, pre/post, to both the AOL and POL groups. Demographic data included self-reported gender, age, weight and height. Body mass index (BMI) was calculated using the formula BMI = (weight / (height x height)) x 703, using weight in pounds and height in inches. BMI Z-scores were also calculated to use for data analysis (CHOP, 2011). BMI Z-scores were assigned 3 categories with -1 being the underweight category (Z score values < 0), 1 being the normal weight category (Z score values from 0 to 2.19), and 2 being the overweight category (Z score values > 2.20) (Cole, Flegal & Nicholls, 2007).
Personal factors for outcome expectancies were measured using previously validated survey items for exercise outcome expectancies (EOE; (Steinhardt & Dishman, 1989) and nutrition outcome expectancies (NOE; (Baranowski et al, 2000). Personal factors for self-efficacy were reflected by exercise self-efficacy (ESE; (McAuley, 2003), and weight efficacy lifestyle questionnaire (WELQ; (Abrams, 1983). Items for NOE originally referred only to fruits and vegetables (10 items); however, parallel questions were developed for low-fat eating (10 items), referred to as NOE-FV and NOE-fat respectively. The Planning a Meal (PM) referred to a skill-based activity in choosing the correct portion sizes for the plate (Herrejon et al, 2009). Rapid Eating Assessment Plan (REAP) referred to measuring behavior (Gans, 2003). All six surveys are included in Appendix 1. Data collected via the Internet was captured in Excel and then exported to SPSS (version 19.0, for Windows, 2010, SPSS, Inc, Chicago, IL) for analysis.

Cronbach alpha was > 0.75 for all surveys except PM. Cronbach alpha for NOE was assessed for 12 positive outcome statements and for 8 negative outcome statements separately. Composite scores were used for all surveys except PM, for AOL vs. POL comparison using the Mann Whitney test. Comparison was also evaluated for pre-scores vs. post-scores for individual statements in the surveys for within AOL and POL groups separately using Wilcoxon Signed Rank Test. Tests of kurtosis and skewness were used to assess the data normality, and nonparametric tests subsequently were used. Comparison of baseline data for AOL and POL were not significantly different, except for NOE data. To compensate for this, a difference in scores between the pretest and posttest was computed as a new variable for NOE data. Data from the REAP were evaluated as a total and for items related specifically to fat (12 items), REAP-fat, and fruits and vegetables (2 items), REAP-FV. Analysis also included descriptive statistics (i.e., median, 25/75th percentile and frequencies). The alpha level was P<0.05.
The Mann Whitney test was used to determine if there were any distribution differences based on gender, BMI Z-score, or school for WELQ, OEE, ESE, NOE-FV, NOE-fat, REAP-FV, and REAP-fat with pre-scores and post-scores separately for AOL and POL.

Composite scores were computed for NOE-FV, NOE-fat, REAP-FV, REAP-fat for pre-and post-scores and were used to conduct the Mann Whitney test comparing AOL and POL. Bivariate correlations (Spearman’s rho) were calculated to assess relationships among outcome expectation indicators, behavior indicators, and fat, fruit, and vegetables indicators. Stepwise regression analysis was used to predict the variance in outcomes expectancy, self-efficacy and behavior variables.

3.3 Results:

Demographics: There was no difference based on gender for any pre-scores (n=86 males; n=85 females). However, for post-scores, the only significant difference based on gender was NOE-fat for the AOL group as indicated by Table 3.1, with females having higher outcome expectations for fat (P = .019). Based on schools (three schools), the OEE was significantly different for AOL group within pre-scores data (P = .022) (Table 3.2); and REAP-fat was significantly different for AOL based on schools with post-scores (P = .045) (Table 3.3). There was no difference based on BMI Z-scores categories for pre-scores. However, for post-scores, WELQ was significantly different for POL based on BMI Z-scores categories (P = .042) (Table 3.4). However, BMI Z-scores were not matched between the AOL and POL groups at the start of the study and the underweight and overweight categories were under represented.

Planning a Meal-Skills: At pre-test, most students could not correctly place the correct portion of meat, vegetable, starch, fruit or dairy on the plate (Table 3.5). There were significant
differences for the comparison between pre and post for the AOL for all the PM items ($P<.001$), whereas there was no difference in the POL group. Comparison of post-results for PM items, AOL vs. POL was significantly different ($P<0.0001$). The largest improvement for the AOL group was for vegetables, followed by fruit. The smallest improvement was for meat. The POL group did worse on the post-test for starch than they did for pre-test.

**REAP, ESE, WELQ**: At post-intervention, no significant differences were found for composite scores of WELQ ($P=0.465$), ESE ($P =0.925$), and REAP ($P =0.310$) between AOL vs. POL (Mann Whitney Test) (Table 3.6). Significant improvement in seven of the 19 WELQ statements were found for the AOL group, which focused on eating under social pressure and stress ($P<0.05$). Significant improvements were also found for REAP-fat and REAP-FV categories for both AOL and POL groups, for pre-scores vs. post-scores comparison.

**NOE and OEE**: At post-intervention, significant improvements with the AOL group were found for EOE ($P=0.001$). The posttest-pretest variable for NOE total showed no significant differences for NOE in POL vs. AOL analysis (Table 3.6).

**NOE and REAP fruit and vegetable and fat categories**: The POL and AOL NOE-FV pre-scores were significantly different, so a variable of difference was computed (NOE-FV post-scores – NOE-FV pre-scores). There were no significant differences for AOL vs. POL for NOE-FV, NOE-fat, REAP-FV, and REAP- fat (Tables 3.7 & 3.8).

**Regression Analysis**: Significant equations were found for both the AOL and POL post-treatment groups for the WELQ, OEE, NOE-FV, REAP-FV, and NOE-fat; as well as total ESE and REAP-fat for the AOL group, as shown in the table 3.9. For REAP-FV, total ESE and NOE-fat explained 42% variance for AOL ($P<0.002$) and NOE-FV explain 36% of the variance for POL ($P<0.002$). For REAP-fat, 22% of variance is explained by REAP-FV for AOL group.
Several significant equations were found to explain the variance in outcome expectancies, with the WELQ and ESE explaining 49% of the variance in OEE for the AOL group (P<0.001), WELQ and gender explaining 52% of the variance in OEE for the POL group (P<0.00). Similarly, OEE helped explain the variance in WELQ data for both groups. Outcome expectancies for nutrition relative to fat (NOE-fat) variances were explained by NOE FV, REAP FV, WELQ, and ESE for the AOL group (P<0.001) (Table 3.9).

3.4 Discussion/Implications:

In HOT Project, subjects in the AOL group improved significantly for all five categories of planning a meal (PM) questionnaire. This result suggests that for skill acquisition, an active learning venue is more effective than a passive online approach, as indicated by the PM survey results. Research literature indicates that the choice of pedagogy must take into account the desired outcomes, as it is suggested that traditional classrooms produce better mastery of recalled information; whereas the more technology intensive classroom produce improved skills, hypothesis generation, and better ability to address a new problem (Green & McNeese, 2007). However, in HOT intervention, there appeared to be no advantage to active learning venue for self-efficacy for exercise, certain eating behaviors, and certain items of weight efficacy, as there were no significant differences between AOL and POL for these measures. Although these three surveys (ESE, REAP, WELQ) had good reliability, and composite scores were not overtly skewed to the positive (possible range for WELQ, 1-9; ESE, 0-100; and REAP, 1-4), no significant improvement in mean values were found. Dishman et al. conducted a 2-year intervention that emphasized changes in instruction and the school environment to increase physical activity, employing key constructs of the SCT (Dishman et al, 2004). The intervention
had statistically significant effects on self-efficacy, providing the first experimental evidence that increase in self-efficacy led to increase in physical activity (Dishman et al, 2004). Their positive findings may have been possible because of the long duration of 15 months of the LEAP (Lifestyle Education for Activity Program) intervention. In contrast, the HOT project was a two-week long intervention, which may have been too brief a period to have an effect on self-efficacy (Nahm et al, 2010).

Both AOL and POL groups improved significantly for REAP-fat and REAP-FV categories of the REAP survey, for pre-scores vs. post-scores comparison in our study. Similar results have been seen in a short duration study conducted by Muth et al. to improve nutrition in school aged children (2008). Students who participated in the intervention reported increasing fruit and vegetable intake and improved knowledge of the types of food to eat most (Muth et al, 2008). In contrast, a study conducted by Long et al to prevent diabetes in adolescents, statistically improved the fat intake but no significant effects on fruit and vegetable consumption (Long et al, 2006). Thunfors and coworkers suggest that pre- to early adolescence may be a more fruitful age than later adolescence for implementing interventions to encourage health behaviors (Thunfors, Collins & Hanlon, 2009). Surveys have shown that fruit and vegetable intake decreases through adolescence, suggesting a need to intervene targeting improvement in fruit and vegetable intake of adolescents (Larson et al, 2007). Our HOT Project is in line with the above information and targeted early adolescents in the 6th, 7th and 8th grade.

In HOT study, there was a significant difference in outcome expectancies for exercise (OEE) in the AOL group, suggesting that the activity demonstrations in the AOL group had some impact. However, active learning did not influence self-efficacy related to exercise (ESE). Taymoori et al. indicated self-efficacy and outcome expectations to be direct predictors of
physical activity for adolescent girls (2010). Social support was modeled as an antecedent of self-efficacy and outcome expectations (Taymoori, Rhodes & Berry, 2010). The HOT Project study did not incorporate family/peer support directly and the physical activity behavior was not measured post intervention.

Our study failed to show improvements in weight self-efficacy (WELQ) and outcome expectations for nutrition (NOE). Taymoori and colleagues suggest that social support from friends and parents prior to 12th grade lay the foundation for maintaining healthy habits such as healthy eating and physical activity by increasing self-efficacy for overcoming barriers and making them aware of the expectations of their family and friends (Taymoori, Rhodes & Berry, 2010). Self-regulation is also considered an antecedent to self-efficacy and can influence behavior by acting as a motivator (Taymoori, Rhodes & Berry, 2010). Similarly, Strong et al. suggests that social support and self-regulation are not only important to initiate behavior change but for long-term maintenance as well (Strong et al, 2008). Adequate self-regulatory skills such as planning and self-monitoring are important to maintain healthful behaviors. The HOT intervention did not include social support and self-regulation as mediating variables, which may be antecedents to the variables (self-efficacy and outcome expectations) included in our study, and thus limited the improvement in self-efficacy and outcome expectations related to healthy eating. A web-based nutrition education intervention conducted by Poddar et al. to increase dairy intake in college students was also based on SCT constructs and targeted all four constructs of the model to bring about a change in health behaviors. The intervention only improved self-efficacy and self-regulation (Poddar et al, 2010). The studies employing SCT mentioned above, suggest that targeting self-regulation and social support along with self-efficacy and outcome expectations are important to initiate behavior change and for long term maintenance also.
In HOT intervention, NOE-fat showed improvements for AOL for those at risk for high BMI, but not NOE-FV. Research suggests that dietary patterns generally meet recommendations but are low in fruits, vegetables, and whole grains (Strong et al, 2008). Adolescents use dietary strategies to regulate their energy and fat intake or plan/track their food intake more than using dietary strategies to eat more fiber, fruits and vegetables (Strong et al, 2008). Another finding of our study supports the above notion that whole grain intake is harder to effect, as the POL improved the least for the starch category of PM survey. Our study results also indicated that NOE-fat was different based on gender, with females having higher outcome expectations for fat intake. This may be explained by the fact that females eat less than males and eat more healthy foods (Chambers & Swanson, 2010). However, females are more likely than males to eat for emotional reasons (Chambers & Swanson, 2010). Females also feel peer pressured to eat healthy foods as a sign of femininity and males feel peer pressured to eat unhealthful foods as a sign of masculinity (Gellar et al, 2012). Males are more active than girls at all ages and the decline in physical activity in adolescence is steeper in girls than boys. This suggests that girls balance the weight equation by decreasing food intake and boys expend more energy by being more active (Lubans et al, 2011). In contrast to our study results, Strong et al. indicated no sex difference in percentage of energy consumed from macronutrients including fat (Strong et al, 2008).

Our study results indicated no significant improvement in NOE between the AOL and POL groups, but the AOL group showed significant improvement in OEE. Some research has suggested that less cognitively-based and more emotionally-based determinants drive adolescent health-related behavior (McClain et al, 2009). Strong motivators and determinants of health behavior in this age group include immediate satisfaction of psychological needs and adherence to the individual’s personal meanings (McClain et al, 2009). Strong et al. in their study to
identify constructs relevant to youth indicated that improved health and functioning, improved psychological health, being in better shape and social benefits are suitable outcome expectations for physical activity to use with adolescents, and feeling better, more energy, and effective weight loss are favorable outcome expectations for healthy eating with adolescents. Addressing outcome expectations such as disease risk reduction may be more meaningful to older adults (Strong et al, 2008). The OEE survey of the HOT study focused more on physical appearance, emotional health, fitness and friendship; factors important to adolescents as indicated by McClain et al (2009). On the other hand, NOE survey in HOT project focused on cost, taste, approval from parents, and diseases; which are not as relevant to the youth.

Our regression analysis results suggested that WELQ is more associated with OEE than with ESE or NOE. This may be explained by the fact that healthy eating and exercise are the two factors that balance weight (Hewitt & Stephens, 2007; Mauriello et al, 2007). The HOT Project results also indicated that habits especially about fat and weight are significant in explaining NOE-FV. NOE-fat and NOE-FV are inversely related in our study, as the subjects in the HOT intervention developed outcome expectation to increase fruit and vegetable intake and decrease fat intake. Healthy People 2020 goals also emphasize incorporating more fruits and veggies in your diet and to limit total and saturated fat for weight management (Healthy People, 2020)

The HOT Project intervention showed that the treatment group (AOL) had significantly greater increases in overall knowledge and modular knowledge as compared to the control group (POL) (Castelli et al, 2011). The intervention also helped the AOL to acquire skills in planning a meal and improved outcome expectations for exercise. However, outcome expectations for nutrition and self-efficacy measures did not show significant improvements. According to Li et al., interventions first improve knowledge, which improves change in mediators (constructs of a
theory), which in turn lead to behavior change (Li et al., 2011). Knowledge can change instantly but mediators take time to change, mostly becoming apparent in a follow-up (Magoc, Tomaka & Bridges-Arzaga, 2011). We did not have a follow-up assessment with the HOT Project participants to give the participants time to internalize information and cause a change in behavioral determinants. Li et al. suggest that follow-up response is most favorable up to 6 months post-intervention, with the subject participation and enthusiasm declining after that (Li et al., 2011).

The HOT Project study had its limitations in that the intervention post-test was administered very close in time to the pre-test, not giving the participants much time to internalize the information and bring about a change in measures of self-efficacy and outcome expectations. According to Nahm et al., self-efficacy and outcome expectations take time to change (Nahm et al., 2010). Changes in self-efficacy usually precede changes in outcome expectations (Poddar et al., 2010; Taymoori, Rhodes & Berry, 2010). A longer intervention may be needed to produce strong enough effects on mediating variables to achieve an increase in physical activity and eating a healthy diet (Ball et al., 2009). Secondly, the study did not specify that students were low in SCT beliefs at baseline. There would be increased chances of finding significant improvements if individual low in such beliefs were selected (Magoc, Tomaka & Bridges-Arzaga, 2011). Analysis could have been completed with this subset of students, but statistical power would have been lost. Thirdly, social support and self-regulation were not specifically addressed in the HOT intervention. Strengthening the content to include social support and self-regulation and further targeting self-efficacy and outcome expectations may be important to achieve behavior change. Fourthly, there was no post-intervention follow-up which may have indicated improvement in SCT mediators, allowing for changes in the types of self-
perception necessary for observing changes in SCT constructs (Magoc, Tomaka & Bridges-Arzaga, 2011). Finally, we did not measure BMI post intervention but BMI does not change significantly for a short two week intervention; and moreover BMI is less likely to be improved by a school based health education intervention (Hall et al, 2011). Despite its limitations, the strengths of the study include the application of a well-established theoretical framework, and the use of powerful statistical mediation techniques, which allowed the testing of SCT mediators. Moreover, validated questionnaires were used to assess SCT variables and behavior. Additionally the Cronbach alpha was high for all surveys except the PM survey.

3.5 Conclusions:

Future research is needed to determine which theories and theoretical constructs are most suitable for the adolescent population to improve health-related behavior. From the results of the study, we conclude that teens participating in active online version of the HOT Project intervention acquired skills for planning a meal, improved in confidence in eating under social pressure and stress, improved outcome expectations for exercise, and girls improved in outcome expectancies for nutrition related to dietary fat intake. However, no improvement was found for the self-efficacy constructs of the SCT for exercise and other outcome expectations for nutrition. To further optimize the effectiveness of this intervention we could either target self-regulation and social support constructs of the SCT along with self-efficacy and outcome expectations or frame the intervention within the Theory of Planned Behavior constructs. There is research evidence that constructs of the Theory of Planned Behavior such as attitudes, subjective norms, perceived behavioral control show more rapid changes than SCT constructs, thus making it more suitable to apply to short term interventions (Hall et al, 2011).
REFERENCES


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Winters ER. Test of a Social Cognitive Theory-based educational treatment to increase the frequency of voluntary moderate and vigorous physical exercise among adolescents school students. Columbus, OH: Ohio State University, 2001.

Figure 3.1: Consort Diagram for the Healthy Outcome for Teens Project

Assessed for eligibility (n = 252)

Excluded (n = 38)

Randomized (n = 214)

Allocated to control (n = 90)

Allocated to intervention (n = 124)

Lost to follow up: (n = 10) did not complete a pre or post-test

Lost to follow up: (n = 23) did not complete a pre or post-test

Analysis

Analyzed (n = 80)

Analyzed (n = 101)
Table 3.1: Post-intervention scores for NOE (Outcome Expectations Nutrition) Fat based on gender

<table>
<thead>
<tr>
<th>POL Group</th>
<th>Post Scores NOE Fat</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>25&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>Median</td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>ALO Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>Female</td>
<td>28.3</td>
<td>30</td>
</tr>
</tbody>
</table>

Mann Whitney Test; Significance P-value < 0.05
POL= Passive Online Learning; AOL= Active Online Learning
Table 3.2: Post Intervention Scores for OEE (Outcome Expectations Exercise) based on school

<table>
<thead>
<tr>
<th>POL Group</th>
<th>Pre Scores OEE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>25&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>Median</td>
</tr>
<tr>
<td>School 1</td>
<td>3.77</td>
<td>4.21</td>
</tr>
<tr>
<td>School 2</td>
<td>4.08</td>
<td>4.33</td>
</tr>
<tr>
<td>School 3</td>
<td>3.92</td>
<td>4.25</td>
</tr>
<tr>
<td>AOL Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School 1</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>School 2</td>
<td>3.92</td>
<td>4.33</td>
</tr>
<tr>
<td>School 3</td>
<td>3.67</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Mann Whitney Test; Significance P-value < 0.05

POL= Passive Online Learning; AOL= Active Online Learning
Table 3.3: Post Intervention scores for REAP (Rapid Eating Assessment Plan) questionnaire based on school

<table>
<thead>
<tr>
<th>POL Group</th>
<th>25&lt;sup&gt;th&lt;/sup&gt; percentile</th>
<th>Median</th>
<th>75&lt;sup&gt;th&lt;/sup&gt; percentile</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1</td>
<td>18</td>
<td>24</td>
<td>27.5</td>
<td></td>
</tr>
<tr>
<td>School 2</td>
<td>22</td>
<td>24</td>
<td>26.75</td>
<td></td>
</tr>
<tr>
<td>School 3</td>
<td>14</td>
<td>20</td>
<td>26</td>
<td>.483</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AOL Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1</td>
</tr>
<tr>
<td>School 2</td>
</tr>
<tr>
<td>School 3</td>
</tr>
</tbody>
</table>

Mann Whitney Test; Significance P-value < 0.05
POL= Passive Online Learning; AOL= Active Online Learning
Table 3.4: Post Intervention Scores of WELQ (Weight Efficacy Lifestyle Questionnaire) Based on BMI Z-score Categories

<table>
<thead>
<tr>
<th>POL Group</th>
<th>BMI Z-score categories</th>
<th>Post Scores WELQ</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25th percentile</td>
<td>Median</td>
<td>75th percentile</td>
</tr>
<tr>
<td>Underweight</td>
<td>3.13</td>
<td>5.89</td>
<td>4.39</td>
</tr>
<tr>
<td>Normal weight</td>
<td>5.89</td>
<td>6.89</td>
<td>6.11</td>
</tr>
<tr>
<td>Overweight</td>
<td>4.39</td>
<td>8.17</td>
<td>6.72</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AOL Group</th>
<th>25th percentile</th>
<th>Median</th>
<th>75th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>3.38</td>
<td>5.0</td>
<td>3.94</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>5.92</td>
<td>6.94</td>
<td>5.42</td>
</tr>
<tr>
<td>Overweight</td>
<td>7.57</td>
<td>7.97</td>
<td>6.61</td>
</tr>
</tbody>
</table>

Mann Whitney Test; Significance P-value < 0.05
BMI = body mass index; AOL=active online learning; POL=passive online learning
Table 3.5: Planning a Meal Survey

<table>
<thead>
<tr>
<th>Statement</th>
<th></th>
<th>Correct</th>
<th></th>
<th></th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>pretest</td>
<td>posttest</td>
<td>change</td>
<td></td>
</tr>
<tr>
<td>V4 (Meat)</td>
<td>POL</td>
<td>51.0</td>
<td>59.0</td>
<td>+ 8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>50.0</td>
<td>84.9</td>
<td>+ 34.9</td>
<td>0.001</td>
</tr>
<tr>
<td>V5 (Starch)</td>
<td>POL</td>
<td>42.2</td>
<td>21.0</td>
<td>-21.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>39.5</td>
<td>79.0</td>
<td>+39.5</td>
<td>0.001</td>
</tr>
<tr>
<td>V6 (Vegetable)</td>
<td>POL</td>
<td>10.8</td>
<td>16.7</td>
<td>+5.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>9.7</td>
<td>58.0</td>
<td>+48.3</td>
<td>0.001</td>
</tr>
<tr>
<td>V7 (Fruit)</td>
<td>POL</td>
<td>23.5</td>
<td>30.8</td>
<td>+7.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>24.2</td>
<td>70.6</td>
<td>+46.4</td>
<td>0.001</td>
</tr>
<tr>
<td>V8 (Drink)</td>
<td>POL</td>
<td>49.0</td>
<td>50.0</td>
<td>+1.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>44.4</td>
<td>86.6</td>
<td>+42.2</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Significance level: P value < 0.05; Frequencies and difference
AOL = active online learning; POL = passive online learning; V= survey question numbers
Table 3.6: Post-intervention POL vs. AOL comparison for REAP, WELQ, OEN, OEE, and ESE

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Median (25th, 75th)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Rapid Eating Assessment Questionnaire (REAP)</td>
<td>POL</td>
<td>2.04 (1.85, 2.33)</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>2.00 (1.82, 2.12)</td>
</tr>
<tr>
<td>Weight Efficacy Lifestyle Questionnaire (WELQ)</td>
<td>POL</td>
<td>6.50 (4.54, 8.17)</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>6.11 (4.85, 7.78)</td>
</tr>
<tr>
<td>Outcome Expectations Nutrition Questionnaire (OEN)</td>
<td>POL</td>
<td>2.65 (2.10, 3.00)</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>2.90 (2.50, 3.15)</td>
</tr>
<tr>
<td>Outcome Expectations Exercise Questionnaire (OEE)</td>
<td>POL</td>
<td>4.25 (4.00, 4.67)</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>4.00 (3.58, 4.42)</td>
</tr>
<tr>
<td>Exercise Self-efficacy Questionnaire (ESE)</td>
<td>POL</td>
<td>63.33 (47.92, 86.67)</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>63.33 (39.58, 92.08)</td>
</tr>
</tbody>
</table>

Wilcoxon Signed Rank test; Significance: P-value <0.05
AOL= Active Online Learning; POL= Passive Online Learning
### Table 3.7: Post Intervention POL vs. AOL comparison for total REAP (Rapid Eating Assessment Planning), REAP fruit and vegetable, and REAP fat

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>25&lt;sup&gt;th&lt;/sup&gt;, 75&lt;sup&gt;th&lt;/sup&gt;</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total REAP (1 often - 3 rarely)</td>
<td>POL</td>
<td>2.04</td>
<td>1.85, 2.33</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>2.00</td>
<td>1.82, 2.12</td>
</tr>
<tr>
<td>REAP Fruit and Vegetables (2 questions combined)</td>
<td>POL</td>
<td>4</td>
<td>3, 5</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>4</td>
<td>3, 5</td>
</tr>
<tr>
<td>REAP fat (Q 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21)</td>
<td>POL</td>
<td>24.00</td>
<td>21.00, 27.00</td>
</tr>
<tr>
<td></td>
<td>AOL</td>
<td>23.00</td>
<td>20.00, 25.00</td>
</tr>
</tbody>
</table>

Mann Whitney test; Significance: P < 0.05  
AOL= Active Online Learning; Passive Online Learning; Q= question number
Table 3.8: Post Intervention POL vs. AOL Comparison for Total OEN, OEN Fruit and Vegetable, and OEN Fat

<table>
<thead>
<tr>
<th></th>
<th>25th, 75th</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Outcome Expectations Nutrition (OEN)(1 strongly disagree – 5 strongly agree)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL</td>
<td>2.65</td>
<td>2.10, 3.00</td>
<td></td>
</tr>
<tr>
<td>AOL</td>
<td>2.90</td>
<td>2.50, 3.15</td>
<td>0.049</td>
</tr>
<tr>
<td>OEN Fruit and Vegetables (Q48, 49, 50, 51, 52, 53, 54, 55, 56, 57)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL</td>
<td>24.00</td>
<td>20.00, 28.00</td>
<td></td>
</tr>
<tr>
<td>AOL</td>
<td>28.00</td>
<td>22.00, 31.00</td>
<td>0.649</td>
</tr>
<tr>
<td>OEN Fat (Q38, 39, 40, 41, 42, 43, 44, 45, 46, 47)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL</td>
<td>26.50</td>
<td>20.00, 31.00</td>
<td></td>
</tr>
<tr>
<td>AOL</td>
<td>29.00</td>
<td>23.75, 32.00</td>
<td>0.164</td>
</tr>
</tbody>
</table>

Mann Whitney test; Significance: P <0.05 bolded
AOL= Active Online Learning; POL= Passive Online Learning
Table 3.9: Regression Models for the WELQ, OEE, NOE-FV, REAP-FV, and NOE Fat as Well as Total ESE for POL and AOL

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Independent variables</th>
<th>t</th>
<th>F</th>
<th>R²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POL group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WELQ total</td>
<td>-4.903 + 0.500 (Total OEE) + 0.403 (BMI Z score)</td>
<td>2.570</td>
<td>F = 11.318</td>
<td>0.519</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>OEE total</td>
<td>3.406 + 0.633 (WELQ total) + 0.390 (gender)</td>
<td>2.569</td>
<td>F = 11.311</td>
<td>0.519</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>NOE FV post</td>
<td>21.137 + 0.542 (NOE fat post) - 0.426 (REAP FV post)</td>
<td>-3.006</td>
<td>17.131</td>
<td>0.620</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>REAP FV post</td>
<td>6.911 - 0.595 (NOE FV post)</td>
<td>-3.476</td>
<td>12.084</td>
<td>0.355</td>
<td>.002</td>
</tr>
<tr>
<td>NOE fat post</td>
<td>-0.056 + 0.676 (NOE FV post)</td>
<td>4.298</td>
<td>18.474</td>
<td>0.456</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>AOL group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WELQ total</td>
<td>-1.015 + 0.60 (total OEE)</td>
<td>3.609</td>
<td>13.022</td>
<td>0.361</td>
<td>.001</td>
</tr>
<tr>
<td>OEE total</td>
<td>2.637 + 0.472 (WELQ total) + 0.386 (ESE total)</td>
<td>2.402</td>
<td>10.747</td>
<td>0.494</td>
<td>.001</td>
</tr>
<tr>
<td>ESE total</td>
<td>-84.031 + 0.478 (REAPFV) + 0.397 (total OEE) + 0.307 (BMI Z score)</td>
<td>2.100</td>
<td>8.911</td>
<td>0.560</td>
<td>.001</td>
</tr>
<tr>
<td>NOE FV post</td>
<td>-12.740 + 1.026 (NOE fat post) + 0.231 (REAP fat post) + 0.222 (WELQ total)</td>
<td>2.297</td>
<td>37.249</td>
<td>0.842</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>REAP FV post</td>
<td>4.957 + 0.422 (total ESE) - 0.365 (NOE fat post)</td>
<td>-2.101</td>
<td>8.103</td>
<td>0.424</td>
<td>.002</td>
</tr>
<tr>
<td>REAP fat post</td>
<td>13.094 + 0.464 (REAP FV post)</td>
<td>2.511</td>
<td>6.307</td>
<td>0.215</td>
<td>.020</td>
</tr>
<tr>
<td>NOE fat post</td>
<td>23.169 + 0.733 (NOE FV post) - 0.389 (REAP FV post) - 0.341 (WELQ total) + 0.173 (total ESE)</td>
<td>2.169</td>
<td>61.635</td>
<td>0.925</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Stepwise Regression Analysis; Significance: P < 0.05
AOL= Active Online Learning; POL= Passive Online Learning; WELQ= Weight Efficacy Lifestyle Questionnaire; OEE= Outcome Expectations Exercise; NOE= Nutrition Outcome Expectations; REAP= Rapid Eating Assessment Planning; FV= Fruits and Vegetables; ESE= Exercise Self-efficacy
CHAPTER 4

MIDDLE SCHOOL STUDENTS WANT MORE THAN GAMES FOR HEALTH EDUCATION ON THE INTERNET¹

4.1 Introduction:

As the prevalence of obesity and Type 2 diabetes continues to increase in adolescents and youth, the number of interventions aiming to attenuate this situation has also increased. Adolescent interventions targeting healthy behaviors have been implemented in school and home environments. Evidence suggests that the most promising approaches for adolescents involve both families and schools and include a combination of physical activity and nutrition or nutrition alone. These interventions have demonstrated significant weight reduction effects, with theoretical framework providing significant impact (Katz et al., 2005; Waller et al., 2005).

Interventions integrating lessons about nutrition, physical activity, and reduction in screen time into the standard curriculum have a more profound effect than those outside of the school day that do not address this content (Mo-suwan et al., 1998; Burke et al., 1998; Gortmaker et al., 2006).

However, researchers have also used interactive learning, such as computer and video games, as a means of enhancing learning and fostering prevention. Proponents argue that computer games promote active learning and can enhance understanding of complex topics, while others believe computer games do not enhance learning and may create distractions (Ke, 2008). A recent literature review of computer and video games in health and physical education concluded that although conclusive evidence may be lacking, online health education features

¹This chapter has been published. Muzaffar H, Castelli D, Goss D et al. Middle school students want more than games for health education on the internet. Creative Education, 2011; 2(4): 393-397.
can be motivating and engaging (Papastergiou, 2009). In addition, it is estimated that teens in the United States (US) spend more than two hours a day online (Hasker & Somosi, 2004), visiting such websites as MySpace, Facebook, and Twitter; the top three in social networking sites, with over two billion monthly visits collectively (Kazeniac, 2009; Wang, 2010).

Given findings from previous interventions and the rapidly changing dynamic of the US demographics, this study used innovative technology to develop a prototype website focused on increasing diabetes and overweight awareness (Healthy Outcomes for Teens: HOT Project). The purpose of this study was to use focus groups to stimulate evaluation of the HOT Project website, as a way to enhance sustainability and usability by the target audience.

**The Healthy Outcomes for Teens Project**

The HOT Project website included content specific to 14-17 year olds with type 2 diabetes or at risk for type 2 diabetes, focused on skills and knowledge assessment, an overview of diabetes and food, relationship between diabetes and food, physical activity and weight management, and eating for target blood glucose levels organized in five modules (Castelli et al, 2011). The website was adapted from a previously effective website targeting adults which was developed in 2006 (Herrejon et al, 2009). Similar to other healthy eating and physical activity online programs (Thompson et al, 2007), the HOT Project was framed in Social Cognitive Theory (Bandura, 1986).

An interactive, participatory design was used so that sustainability and usability could be maximized. A distributed interactive environment (DIL), which permitted self-regulation and exploration at their own pace, was used to ensure effectiveness and efficiency in learning (Kubik, Lytle, & Fulkerson, 2005; Ott et al, 2009). This non-linear design allowed individuals to revisit
information based upon interest and need. We developed a teen council to assist in the design, topic coverage, and interactivity (Castelli et al, 2011).

Two versions of the website were created with exactly the same information except the site for the treatment group had interactive features (animated pictures, videos, games and voiceovers) while the control group had passive, non-interactive texts. A total of 165 middle school students participated in the program which was incorporated in the regular school day in the physical education or health class, or in an after-school program (Castelli et al, 2011). The subjects were recruited from three middle schools, housed in different school districts of a Midwest county.

**Focus Groups**

Focus groups have been used successfully with the adolescent population to obtain qualitative information from relatively homogenous populations about attitudes, perceptions and opinions that can influence their behavior. Furthermore, focus groups also give the opportunity for exchange of ideas among the participants, to assess the degree of consensus and diversity of opinion, and to promote responses with depth and complexity (Weinger, O’Donnell, & Ritholz, 2001). Focus groups are conducted using a general format of open-ended questions and the data are analyzed qualitatively to determine appropriate codes, themes and patterns (Krueger, 1994; Weinger et al, 2001; Ott et al, 2009).

### 4.2 Methods:

The focus group interviews began with broad topics, progressing to more focused questions concerning which parts of the intervention they believed might be most compelling or
appealing (Krueger, 1994). The script was developed by the research team and was field-tested for flow and clarity of the discussion questions (Appendix 2). The University of Illinois Institutional Review Board approved the protocol, and parental consent and child assent was obtained. Subjects were recruited from three school districts that participated in the HOT project and were in the treatment group (n=101). Subjects (n=42) participated in the focus groups in the last session of the HOT Project. Twelve focus groups were conducted with 2 to 5 students in quiet private small rooms near the computer labs in the schools. Topic saturation indicated enough subjects had participated to provide robust findings.

Debriefing of moderator and co-moderator occurred immediately after the focus group to capture first impressions, and then highlight and contrast findings from earlier focus groups. These discussions were collected in formal observational notes as well as the fidelity-to-treatment logs. Additionally, each researcher recorded any unique demographics (i.e., gender, race) and situational events that may have taken place during the focus groups. The interview sessions took an average of 45-60 minutes. The focus group interviews were audio-taped and then transcribed verbatim.

4.3 Data Analysis:

Specifically, the focus group data were analyzed using content analysis, which involves identifying coherent and important examples, themes and patterns in the data (Patton, 1987). First, these data were analyzed inductively, without regard to theory, by coding discrete statements and identifying patterns and themes, according to inductive category development methods (Mayring, 2000). Two researchers analyzed the transcribed focus group data separately to develop a list of keywords and codes. Independent summaries of the codes and patterns were
presented in group debrief to audit the results. During the debrief, two analysts met with one principal investigator to arrive at a consensus for the final summary and to achieve greater than 85% agreement on the coding of the discrete statements. From the codes and frequency counts, three overarching themes emerged.

A negative case analysis was conducted to ensure that all ideas had been accounted within the act of coding (Lincoln & Guba, 1985). Negative cases were single or a collection of discrete statements that did not fall within the established defined codes. In this study, one negative case appeared suggesting that participants with relatives may have better insight into the prevention and treatment of diabetes. Given the potential effects of this finding, these data were again analyzed to determine if there was a difference in the responses of participants who had relatives with diabetes as compared to those without known relatives having diabetes for four questions. The four questions were frequency of Internet use, defining healthy outcome, defining diabetes, and recommendations for improving the website.

The second phase of analyses used deductive reasoning in that frequency counts and qualitative data, analyzed in a previous study (Castelli et al, 2011), were used to confirm the trustworthiness of the codes, patterns and themes in the present study. In this phase, the codes were compared holistically with the quantitative data of code frequency counts, knowledge test scores, risk for diabetes, and website hit counts, because themes should be identified before, during, and after the data collection (Denzin & Lincoln, 1998). Further, the patterns and themes were reexamined from a theoretical perspective for consistencies.
4.4 Results:

All subjects had access to the Internet, with more than 50% using it daily, up to two hours per day. There were no substantial differences between genders or across schools in use, both in frequency and time. The results indicated that the Internet appeared to be an extension of daily living utilized for communication and information access.

When asked about defining healthy outcomes or diabetes, the subjects gave responses in the categories of diet, physical activity, studying, sleeping, and friendship. The diet category had the most varied responses and included answers such as healthy eating in general, eating fruits and vegetables, eating in moderation, no junk food and eating less meat. The participants expressed interest in learning more information about healthy living, diabetes and varied topics such as leukemia. Subjects also recommended adding more games, videos, pictures, music, social interaction features, voiceovers and cartoons, and less reading and easy vocabulary. The students thought the use of humor on such a serious topic would be valuable to gain and maintain attention.

The secondary analysis for identifying differences in responses from those with or without diabetes family histories indicated one difference. Subjects with family history of diabetes (n=22) were more likely to comment on sugar level or sugar intake. Therefore, experience with a diabetic family member only minimally affected these findings.

Three main themes emerged from the focus group data analysis: kid appeal, healthy living, and living with and without diabetes.
Kid Appeal

The kid appeal theme was composed of three categories, namely social, entertainment, and information. These three categories were representative of the reasons these students used the internet, why and what they liked from the HOT Project website, and what recommendations they gave to make the website better.

Social: MySpace was by far the favorite website for these subjects, with Facebook being the third most favorite. These two websites fall in the social networking category. Other favorite websites were YouTube, yahoo, games, and music websites for entertainment. The subjects recommended adding some social interaction features on the website such as having their own home page, username and password; getting in touch with people who have diabetes; chatting with friends who are also participating in the HOT project; and allowing people to choose what’s on the page.

Entertainment: Games were the favorite part of the HOT Project followed by videos and pictures. Among the games, jeopardy was the most popular and some subjects also mentioned liking blast off, foods on a plate, and word search. In addition to entertainment from the website, the students also liked the information presented, surveys, and design of the web page. Subjects want to make the website more entertaining by adding more games, music, pictures, videos, and funny text.

Information: The diabetes, exercise and health information presented on the website was well perceived by the subjects and they recommended adding information about how to get active, more examples of people having diabetes, translating to other languages, more voiceovers, easier vocabulary, and making websites with information on how the brain works and cancer/leukemia.
**Healthy Living**

The second prominent theme in the focus group data was ‘healthy living’. Their responses fell in five categories namely diet, exercise, sleeping, friendship, and studying. Most of the answers were in the diet category and included responses such as eating healthy foods, eating fruits and vegetables, following a diet, eating in moderation, not eating junk food, and eating good nutrition. The exercise category included exercising, playing sports, and staying fit.

**Living with and without Diabetes**

The third theme emerging from the focus group analysis was ‘living with and without diabetes’. The responses of subjects who had relatives with diabetes to diabetes related questions were more knowledgeable. Twenty-two subjects had family members who had diabetes. The subjects’ responses to defining diabetes included “can’t eat a lot of sugar, blood glucose level low/high, insulin low/get shots, a sickness/disease, causes frequent urination, high blood pressure causes diabetes, and kidneys might die”. Subjects who had family members with diabetes were three times more likely to make a comment related to sugar intake or insulin level.

4.5 **Discussion:**

Despite developing a highly interactive website, the participants requested that there be more interactivity and social interaction. These concepts reflect the “Toy” and “Telephone” attributes of a 5-T model (Tool, Toy, Telephone, Territory, and Treasure of Information) used to describe elementary school students in Taiwan’s attitude toward the internet (Chou, Yu, Chen, & Wu, 2009). However, if the researchers were to accommodate this request, it is unclear at what point there would be too much interactivity. Some researchers have suggested that too much
interaction can be a distraction to learning and therefore future studies should examine the effects of hyper-interactivity on learning (Ke, 2008). Further study with this population is warranted.

A study by Schiffman et al. on Internet use among adolescent and young adults with cancer supports the findings of our focus groups. Most subjects reported Internet use daily and for an average of two hours (Schiffman, Csongradi, & Suzuki, 2008). They identified 21 desired features on a health website to make it more appealing to browse. Most of them fell in the three categories, social, information and entertainment; the same themes were also identified in the HOT Project study, and may reflect the Tool/Treasure of Information, Telephone/Territory, and Toy perspectives of the 5 T model (Chou et al, 2009).

Like older adults, Internet use for seeking health information is becoming popular in the adolescent population, thus making Internet a well-suited medium to provide a variety of resources (Schiffman et al, 2008). Brown, Teufel, & Birch, 2006 suggested adolescents learn the most about health from school and the Internet. Similar to our study, a project involving children aged 7 to 8 concluded that even young students valued fun in educational software (Sim, MacFarlane & Read, 2006). However, learning was not always correlated with fun and usability was important. Consequently, to enhance the impact of health-related websites, social and entertainment features must be incorporated with learning and usability remaining as the primary focus.

Most, but not all, responses concerning healthy living reflected content provided in the online modules. Indeed, most interventions for this age group that target obesity prevention focus on healthy eating and physical activity (Weight Realities Division of the Society for Nutrition Education, 2003; Zenzen & Kridli, 2009). Sleeping, friendship, and studying were also mentioned. Some studies report less sleep to be associated with higher BMI in children (Hitze et
al, 2009). Although the major determinant of sleep in this study conducted by Hitze et al. was age, physical activity was not a major determinant. In other studies as well, short sleep is a modifiable predictor of overweight and obesity in adolescents (Bibiloni et al, 2010). Interestingly, one study of sleep and children found fatigue equal to that of cancer patients in obese but not normal weight children (Varni et al, 2010). These findings suggest perhaps sleep could be included in healthy outcomes programs for this age group.

Research has found that peers or friends can influence body weight both positively and negatively. That is, friends can provide support or pressure for healthy behaviors, or conversely unhealthy behaviors (Lytle et al, 2004; Eisenberg et al, 2005). One study also reported that children with higher body mass indices tended to associate with similarly weighted peers, and this clustering also seemed to have gender influences as well, with similar genders being most sensitive to each other (Renna, Grafova, & Thakur, 2008). The mentioning of friends as part of a healthy outcome coupled with the request for more social interaction suggests that friends, peers, and positive guiding of this influence may be very important to successful outcomes.

Those subjects who had relatives with diabetes more frequently reported diabetes-related knowledge about treatment (care), but not necessarily prevention. The interpretation of family history of disease in adults has been explored to a limited degree. In one study, the adults had little worry that their children would develop a chronic disease although they themselves felt at risk (Walter & Emory, 2005). Unfortunately, there is a paucity of studies concerning children’s perception of risk for chronic disease for which they have a family history. Future research could explore this within a social learning context.

The limitation of these findings must be noted. Because the focus group participants were recruited from the HOT Project intervention study, there is concern of limited transferability and
the possibility of selection bias. However, the focus groups sessions provided an opportunity for in-depth discussion of questions and reaction to comments made by other participants.

4.6 Conclusions:

These results confirmed the researchers’ hypothesis that “kid appeal” would make the program attractive to this audience. However, the teens also wanted more information and social interaction. Future studies should address other aspects of healthy outcomes, particularly sleep and academics. Finally, how adolescents perceive the impact of family history for disease needs to be more fully evaluated to successfully design effective education.
REFERENCES


Eisenberg ME, Neumark-Sztainer D, Story M et al. The role of social norms and friends’ influences on unhealthy weight-control behaviors among adolescent girls. Social Science & Medicine, 2005; 60: 1165-1173.


CHAPTER 5

THE HOT (HEALTHY OUTCOME FOR TEENS) PROJECT: USING A WEB-BASED MEDIUM TO INFLUENCE ATTITUDE, SUBJECTIVE NORM, PERCEIVED BEHAVIORAL CONTROL AND INTENTION FOR OBESITY AND TYPE 2 DIABETES PREVENTION

5.1 Introduction:

Overweight and obesity in childhood and adolescence have reached problematic proportions in the last 20 years in many industrialized countries, including the US (Hewitt & Stephens, 2007). The excess weight at such a young age has substantial health consequences, both short and long-term, medical and psychosocial, because many obese children go on to become obese adults (Backman et al, 2002; Hewitt & Stephens, 2007). One of the most noted diseases associated with obesity and overweight is Type 2 diabetes, which has also seen a parallel rise in incidence (Copeland et al, 2011). Consequently, implementation of obesity prevention interventions is urgently needed. Healthy eating and physical activity reflect energy balance behaviors that are intrinsically related for optimal weight management (Hewitt & Stephens, 2007; Mauroiello et al, 2007).

The rise in childhood overweight is the result of unhealthy behaviors among youth, including low intake of fruits, vegetables, and complex carbohydrates, high intakes of fat and total energy, and decline in physical activity (USDHHS, 2000; Lautenschlager & Smith, 2007; Gravel et al, 2010). Population surveys indicate that youth are not currently meeting physical activity guidelines (Rhodes, Macdonald & McKay, 2006). Only 30-40% of adolescents engage in >60 minutes of physical activity and only 10-20% adolescents eat the recommended servings of fruits and vegetables per day (Mauroiello et al, 2007). From the published literature, it is apparent that adolescents are underserved as a target population for healthy weight behavior change interventions (Mauroiello et al, 2007; Gellar et al, 2012). The focal point for adolescent
health promotion efforts should be increasing physical activity and healthy dietary practices (Mauriello et al, 2007). To reach the teen population, schools seem an optimal way to target large numbers of diverse adolescent students and they also offer students opportunities to learn about nutrition and health in a classroom setting using multiple techniques (Owen et al, 2006; Pyle, 2006; Mauriello et al, 2007).

Researchers have suggested that Internet-based programs have the most potential to be successful with younger, more technology-savvy participants, and more research is needed with this population (Weinstein, 2006; Monaghan & Wood, 2010; Kothe, Mullan & Amaratunga, 2011). About 70% of approximately 17 million youth, 12-17 years of age, currently have access to Internet and approximately 26% of them have accessed the Internet for health related information (An Y et al, 2009). These data underscore the potential for evidence-based Internet interventions for changing adverse health behaviors, including those associated with overweight and obesity for the adolescent population (An et al, 2009). Interactive and multimedia components keep the adolescents engaged and relay information in meaningful and persuasive ways (Mauriello et al, 2007).

There are two categories of web-based learning: active online learning (AOL) and passive online learning (POL). The active learning venue creates an interactive atmosphere where games, videos, pictures, voiceovers, and animations assist with keeping the audience engaged and allow better comprehension of the intervention material. In contrast, the POL venue is traditional, linear learning environment containing sequential elements like a slideshow (Castelli et al, 2011). The active learning venue has been associated with enhanced learning effectiveness and efficiency in adolescents (Castelli et al, 2011; Webb et al, 2010).
The use of a behavioral theory to guide the implementation of an intervention makes them more effective and assists in the identification of psychosocial variables and cognitive antecedents having an impact on the behavior (Boudreau & Godin, 2009; Gravel & Godin, 2010; Webb et al, 2010; Koethe, Mullan & Amaratunga, 2011). The TPB has received wide attention to use as a psychological model with adolescents for health behaviors such as healthy eating and physical activity, and more research is needed with teens in this regard (Backman et al, 2002; Rhodes, Macdonald & McKay, 2006; Gravel et al, 2010). This theory has been used successfully with adults and the results of those studies suggest high predictive validity of the TPB constructs to change behaviors (Gratton, Povey & Carter 2007; Gravel et al, 2010). Moreover, TPB has larger effects than the Transtheoretical Model and SCT in adolescents, as indicated by a review by Webb et al to determine the efficacy of theory use for lifestyle interventions (healthy eating, physical activity, smoking cessations, oral health etc.). The TPB suggests that intention to engage in a behavior is the proximal determinant of a behavior (Ajzen, 1991; Rhodes, Macdonald and McKay, 2006). An intention is a person’s motivation to make a conscious decision to perform the behavior (Soares et al, 2009). Intention can be predicted from the three main psychosocial factors of TPB: attitude, subjective norm, and perceived behavioral control (PBC) related to that behavior (Gratton, Povey & Carter, 2007; Lautenschlager & Smith, 2007; Araujo-Soares, McIntyre & Sniehotta, 2009). Attitude is the belief about the consequences of that behavior combined with the evaluation of each consequence (Ajzen, 1991; Lautenschlager & Smith, 2007). Subjective norm represents individual’s belief about what important others want him/her to do and the motivation to comply with those recommendations (Ajzen, 1991; Lautenschlager & Smith, 2007). Behavioral control is the belief about the amount of control they
have to successfully perform the behavior. According to Ajzen, PBC is assumed to influence behavior directly as well (Ajzen, 1991).

Research is in its infancy for appropriate, acceptable and efficacious adolescent web-based interventions focusing on physical activity and nutrition (Mauriello et al., 2007). The purpose of the present study is to determine if TPB constructs, (behavioral belief, attitude, subjective norm, perceived behavioral control, knowledge and behavioral intention) about engaging in preventive behaviors for obesity and Type 2 diabetes change after completing the intervention grounded in the TPB; and if there is a difference in the magnitude of change between POL and AOL. A secondary objective is to determine to what extent constructs of the TPB predict total intentions, as well as intentions for healthy eating, for physical activity, and for diabetes preventive behaviors.

**HOT (Healthy Outcome for Teens) Project**

The HOT Project is an innovative online educational intervention for middle school children focusing on preventing Type 2 diabetes and obesity by balancing food intake with physical activity. The website information has been modified to the reading level of middle school participants and was adapted to reflect the triadic reciprocity of the SCT variables for the first round of implementation. Based on the results of the first intervention and focus groups which are detailed elsewhere (Castelli et al., 2011; Muzaffar et al., 2011), segments of the intervention website have been updated. Specifically, an additional module was developed for the intervention website focusing on stress, physical activity and nutrition. Information was added about food groups and serving sizes. New games, new videos, new questionnaires, diabetes websites information, more voiceover, and some interactivity which allows them to see
the rating of the peers for different questions and sending motivational e-cards were also added. To establish face validity for the games and other activities on the website, they were tested with a group of summer camp students of the same age group at the University of Illinois at Urbana-Champaign. In order to further the research of this project, the new pre and post-tests (questionnaire) were aligned with the new website content and the literature in the area of diabetes and obesity for middle school aged children using the TPB as the guiding framework for the second round of intervention. The University of Illinois Institutional Review Board approved all protocols, and parental consent and child assent was received.

5.2 Methods:

The HOT Project intervention was enacted for a second round in two middle schools of a Midwestern county in winter/spring 2011. The students were recruited from the physical education class in one middle school and from the health class in the other. Only those students who brought back signed consent and assent forms were allowed to participate in the study. A total of 216 subjects were recruited, out of which 127 subjects were randomly allocated to the treatment group and 89 were allocated to the control group. The 6th, 7th, and 8th grades were randomly assigned as the entire class cohort to either the control (POL) or the treatment group (AOL). The study team went into the schools during the school day to conduct the study in the computer labs.

The AOL website included interactive elements such as videos (observational learning), narrated text (social persuasion), and knowledge/skill based games (knowledge and behavioral control); whereas the control website contained only text and images and therefore void of interactivity. Specifically, the modules of the website focused on overview of diabetes, energy
expenditure, physical activity guidelines and suggestions, food label reading and food portion control, and coping with stress. A principle investigator, graduate students, and undergraduate student researchers were present in the schools for the five intervention lessons ranging from 30 to 40 minutes to help the subjects with any queries. The study was feasible because it was implemented in a 40 minute class period. At the first lesson, students were introduced to the website and the TPB questionnaire was administered (Appendix 3). The students completed the first and the second module of the website at the second lesson. The third and the fourth module were covered in the third session. At the fourth session, fifth module was covered. At the last session, TPB questionnaire was administered and the subjects were given a change to go back to any of the module they would like to revisit. The POL group participants were given some games to play on paper, such as word search and crosswords, if they finished going through the modules earlier than the end of the session.

5.3 Questionnaire:

A questionnaire was developed to assess constructs of the TPB, in relation to healthy eating, physical activity and Type 2 diabetes, at pretest and posttest (Appendix 3). The survey was reviewed by experts in the fields of community nutrition/kinesiology for content and breadth of coverage.

Behavioral belief was assessed as a mean of 11 statements using a unipolar scale (1 to 5), with 1 representing strongly disagree and 5 representing strongly agree. Examples of statements include: 1) Reading Nutrition Facts labels will help me choose healthy foods. 2) Exercising regularly will help me have a healthy weight.
Attitude was assessed as a mean of 11 statements using a semantic differential scale (1 to 5). Examples of statements include: 1) For me, it is _________ to pay attention to “calories in” and “calories out” to stay in balance (very unimportant to very important). 2) Doing physical activity every day for the next 3 months would be _________ for me (very boring to very fun).

Subjective norm was assessed as a mean of 11 statements using a unipolar scale (1 to 5), with 1 representing strongly disagree to 5 representing strongly agree. Examples of statements include: 1) My friends want me to eat a healthy diet from all the food groups over the next 3 months. 2) My family wants me to be physically active every day over the next 3 months.

Perceived Behavioral Control was assessed as a mean of 10 statements using a unipolar scale (1 to 5), with 1 representing strongly disagree to 5 representing strongly agree. Examples of statements include: 1) I know I can eat at least five portions of fruit and vegetables daily. 2) I could be physically active every day over the next 3 months if I really wanted to.

Intentions were assessed as a mean of 10 statements using a unipolar scale (1 to 5), with 1 representing strongly disagree to 5 representing strongly agree. Examples of statements include: 1) I will look at the food label for serving size and calories to monitor intake. 2) I intend to be physically active every day in the next week.

Knowledge was assessed as a mean of 15 statements using a unipolar scale (1 to 5), with 1 representing strongly disagree to 5 representing strongly agree. Examples of statements include: 1) Physical activity goals are 60 minutes of activity most days. 2) Foods high in fat are calorie dense because fats provide 9 calories per gram.
The questionnaire was administered both pre- and post intervention and the improvement in these variables was the measure of interest to evaluate the curriculum effectiveness.

5.4 Data Analysis:

The intervention data, including TPB questionnaire responses and games results, were collected via the Internet and stored in an Excel database, from where they were exported into SPSS for analysis (Version 18.0, Chicago, IL, 2010). Cronbach alpha was calculated for the TPB questionnaire constructs (behavioral belief, attitude, subjective norm, perceived behavioral control, knowledge and intention) separately to assess if composite scores could be used for further assessment. Cronbach alpha was also calculated separately for physical activity, healthy eating and Type 2 diabetes questions for each of the six above mentioned categories. Nonparametric tests were used for analysis as the data was not normally distributed, indicated by tests of kurtosis and skewness. Mann-Whitney was conducted to confirm that there are no differences in pre-test scores across the POL and AOL groups, and that random sampling technique has resulted in the two groups having similar knowledge of content. Mann-Whitney (U) and Kolmogorov-Smirnov (Z) were used for post-test data comparison between the POL and AOL group. MANOVA was used to assess the difference in scores based on school and grade level with pretest and posttest data. In order to examine constructs (attitude, subjective norm and perceived behavior control) most predictive of intention at pre-survey and post-survey, stepwise regression analysis was conducted. Regression analysis was also then conducted to determine to what extent behavioral belief, attitude, subjective norm, perceived behavioral control and knowledge were predictive of healthy eating, physical activity and Type 2 diabetes-related
intentions separately. Spearman rho correlations were conducted to examine associations between the psychosocial variables. A P of 0.05 was utilized for all quantitative analysis.

5.5 Results:

The Cronbach alpha values for TPB questionnaire constructs indicated a high inter-item reliability for measuring specific TPB constructs. The coefficients ranged from 0.741 to 0.871 as shown in Table 5.1, which are considered in the substantial (0.61 – 0.81) to almost perfect (0.81 – 1.0) range (Landis & Koch, 1977). However, the separate Cronbach alpha for the healthy eating, physical activity and Type 2 diabetes-related questions for all constructs, except intentions, were weak as shown in Table 5.2. This may have been because there were very few statements in each category for each construct to avoid participant burden.

Mann Whitney test results, with the pretest scores, indicated that POL and AOL groups were the same for behavioral belief, attitude, subjective norm and knowledge, but significantly different for perceived behavioral control (PBC) and intentions. A difference variable was computed for PBC and intention (posttest – pretest), which then indicated no difference between the POL and AOL groups (P-values= 0.999 and 0.820 respectively). For post-scores, there was also no significant difference between POL and AOL groups as shown in Table 5.3. Wilcoxon Sign Rank test was conducted for comparison between pretest and posttest scores for POL and AOL groups separately. The results indicated that both AOL and POL groups showed significant improvements from pretest to posttest survey (P < 0.05). We also computed difference variables for all six TPB survey constructs by subtracting mean pre scores from post scores. Then a Kolmogorov Smirnov test was conducted to compare AOL and POL groups. The results indicted
no significant difference for all constructs except behavioral beliefs which reached significance (Table 5.4).

The MANOVA results indicated grade and school level differences. Based on grade level, for pretest scores, attitude was significantly different based on grade level for POL group, with highest attitude scores for 6th grade and then 7th grade and then 8th grade. For post-scores, all six composites were significantly different based on grades for AOL group, with grade 7 having highest scores and then grade 8 and then grade 6. Based on school, for pretest scores, no significant difference was found between the two schools. However for posttest scores, significant differences were found between the two schools for intentions, behavioral belief, behavioral control and knowledge as shown in Table 5.5.

Spearman rho correlations were conducted with the TPB constructs as shown in Figure 5.1, 5.2, 5.3, and 5.4. All constructs, behavioral belief, attitude, subjective norm, perceived behavioral control and knowledge were significantly correlated with intention for pretest and posttest scores and for POL and AOL groups. For POL group, attitude and behavioral control were most strongly correlated with intention for pretest scores, and these correlations became even stronger for posttest scores. For post scores, knowledge showed the greatest improvement in correlation with intention for the POL group. For AOL group, again attitude and behavioral control showed strongest correlations with intention for pretest scores, and these correlations became even stronger for posttest scores.

For the stepwise regression analysis, significant equations were found for total intentions, for both the POL and AOL groups, and for pretest scores and posttest scores as shown in Table 5.6. For pretest scores, for POL group, 52.6% of variability in intention was predicted by (0.558) behavioral control and (0.256) attitude. For pretest scores, for AOL group, 48.2% of variability
in intention was explained by (0.348) behavioral control, (0.271) subjective norm, and (0.252) knowledge. For posttest scores, for POL group, 74.7% of variability in intention was explained by (0.527) behavioral control, (0.692) knowledge, and (0.380) behavioral belief. For posttest scores, for AOL group, 72% of variability in intention was explained by (0.281) behavioral control, (0.378) attitude, and (0.295) subjective norm. Behavioral control consistently predicted intention for all categories and was the strongest predictor for pretest scores. For posttest scores, knowledge and attitude were the strongest predictors for POL and AOL group respectively. Moreover, the predictive power of TPB constructs for intention improved significantly post intervention for both POL (52.6 vs. 74.7) and AOL groups (48.2 vs. 72).

Stepwise regression analysis results for healthy eating intentions, physical activity intentions, and diabetes intentions indicated that perceived behavioral control was the predominant predictor for all three categories of intentions (Table 5.7). Subjective norm was the predictor for healthy eating intentions and physical activity intentions for only the AOL group, suggesting that social interaction allowed in the AOL group influenced subjective norm. The predictive value improved posttest for both the POL and the AOL group, indicating the intervention improved TPB constructs. Moreover, all variables contributed to the predicting of intentions, which is suggestive of the importance of targeting TPB constructs in health behavior change interventions (Table 5.7).

5.6 Discussion:

Overall, the results of the HOT Project indicated that short-term intervention framed within the TPB for promoting healthy eating and physical activity to prevent obesity and Type 2 diabetes can have significant effects on improving TPB constructs. Similarly, Backman et al
(2002) also surmised the success of interventions with improving TPB constructs, predictive of healthy eating behavior in adolescents. Subjects in both the POL and AOL groups showed significant improvement for all six variables of interest in our study, and there were no differences between the POL and the AOL groups. These findings support our first hypothesis in that the subjects in both the POL and the AOL groups showed significant improvement in TPB constructs post intervention.

However, the results did not meet our expectations that the AOL participants would show greater improvement than the POL participants. This finding may be explained by the observational results of our study, in that some subjects in the AOL group seemed distracted by few interactive features on the website. Thus, the detrimental effects of some interactive features may have negated the positive attributes of the other features. This observation is supported by a research brief by Green and McNeese (2007), who indicated that research is needed to explore the degree of interactivity that is beneficial, neutral or detrimental for adolescent population. It has been suggested that computer games can be addicting for some students and the sounds and animations can distract from the learning process (Hostetter & Clemens, 2002; Okan, 2003). Unfortunately, this study did not evaluate each individual interactive feature, and so the negative or positive influence of each cannot be assumed.

Our results do support our second hypothesis, in that all five TPB constructs used in this intervention were predictive of intentions for healthy eating and physical activity. Additionally, in our study, the predictive power of TPB constructs for intention improved significantly post intervention, for both the POL and the AOL groups. These results are similar to a study conducted by Hewitt et al. to understand predictors of healthy eating among 10-13 year olds, which also showed that intentions were strongly predicted by TPB constructs and the TPB
constructs showed significant improvement at posttest. For the HOT Project, behavioral control consistently predicted intention for all categories and was the strongest predictor for pretest scores. Similarly, a study conducted by Rhodes et al (2006) for predicting physical activity intentions and behavior among children, indicated that behavioral control factors were important determinants of intentions. Adolescents stay committed to healthy behaviors if they have adequate control to perform the behavior by acquiring skills and feeling the sense of competence (Conteno et al, 2007). Thus, theory driven, behavioral-focused interventions have shown promise to help the adolescent subjects form intentions because they assist in building new skills and improving perceived behavioral control for the behaviors (Conteno et al, 2007). Perceived behavioral control, in addition to being a strong predictor of intentions, has a direct effect on behavior as well (Hewitt & Stephens, 2007).

In our study, for posttest scores, knowledge and attitude were the strongest predictors for POL and AOL group, respectively. The greater increase in knowledge in the POL group supports the literature that traditional pedagogy, without the use of interactive features, leads to better acquisition of knowledge (Salomon, 2002). However, increase in knowledge is not always associated with behavior change (Hewitt & Stephens, 2007). Attitude has also been found to be a stronger predictor of intention in youth by other studies, indicating that intervention must focus to improve attitude of teens for the target behaviors (Astrom & Okullo, 2004; Kassem & Lee, 2004; Lautenschlager & Smith, 2007). For assessing attitudes for healthy eating and physical activity, the HOT project questionnaire focused on importance, ease, entertainment, and outcome expectations aspects of the target behaviors, which are shown to be effective components of attitude in adolescents (Randolph & Viswanath, 2004; Wong et al, 2004; Hewitt & Stephens, 2006).
The results of the correlational analysis in our study reflect the regression analysis results. For both POL and AOL groups, attitude and behavioral control were strongly correlated with intentions at pretest, and these associations became even stronger at posttest. Similar findings were demonstrated by studies conducted to determine psychosocial predictor of healthful eating and physical activity in teens (Dennison & Shepherd et al, 1995; Backman et al, 2002; Boudreau & Godin, 2009; Wong & Mullen, 2009). In one study, attitude and perceived behavioral control were more positively correlated with intention than subjective norm (Backman et al, 2002). According to Ajzen, the greater the relative contribution of a construct to influencing intentions, the greater the probability of change in that construct will influence intentions and behavior (Gollwitzer, 1999). Thus, from a practical perspective, educational messages aimed at improving healthy habits for obesity and Type 2 diabetes preventions may become more effective when targeting attitude and perceived behavioral control in teens. Perceived behavioral control not only helps with improving intention but also bridges the gap between intention and behavior (Kothe, Mullan & Amaratunga, 2011). Additionally, the correlation of knowledge with intention was greater for control group than treatment group. However, continued research is needed to quantify the effects of increased knowledge on behavior change (McClain et al, 2009).

Our results suggest differences between grades for the TPB constructs. At pretest, grade 6 students had the highest attitude scores for healthy eating and physical activity, followed by grade 7 and then grade 8, suggesting that younger adolescents have more positive attitudes for health behavior change. Similar finding have also been observed in a study conducted by Thunfors et al (2009) to determine factors that may influence adolescents’ interest in various health behaviors, where again younger adolescents showed more interest than older adolescents. The older adolescents develop their own personal belief systems and gain autonomy over their
behaviors, making them less amenable to health behavior perspectives and recommendations imposed upon them by adult authority figures. A study conducted by Eto et al (2011) to determine TPB constructs predictive of eating meals with family also indicated that students in the younger grades (grade 5 and 6) showed more improvement in the TPB constructs and the behavior than older adolescents. At posttest for our study, grade 7 had the highest scores for all constructs, and then grade 8 and then grade 6. This result indicates that the web-based intervention was most aligned with the reading and comprehension capability of 7th graders, thus suggesting tailoring information separately to the individual grades than using the same intervention for all middle school students. Moreover, study by Eto et al (2011) suggests that interventions for older adolescents need to focus on emphasizing the short-term benefits and also help to remove time constraint barriers for healthy behaviors to improve results.

Pretest scores did not show any significant differences between the two schools for all six TPB questionnaire categories. However, at posttest, the school where the intervention was implemented in a health class setting showed significantly more improvement than the other school where the intervention was implemented in physical education class for knowledge, behavioral belief, perceived behavioral control, and intentions. These results suggest that the venue with the more structured learning was more effective in improving posttest scores. Similar results have been demonstrated in the HOT Project first intervention, where participants in the health class setting improved more than physical education class or afterschool participants (Castelli et al, 2011). Sierens et al conducted a study to determine the synergistic relationship of teacher support and provision of structure in the prediction of self-regulated learning in adolescents. The results of this study indicated that both teacher support and provision of structure were positively correlated with learning, but structure yielded a main effect on self-
regulated learning (Sierens et al, 2009). Research suggests that structure promotes student engagement instead of less passive and avoidant academic behavior (Patrick, 2003)

The HOT Project study was limited in that the intervention was brief, only one week long, and we did not include robust measures of behavior. Although behavior change is the ultimate target of the intervention, in the brief intervention period of one week it is hard to change long ingrained habits; and thus change in the variables leading to behavior is an appropriate outcome to measure for short-term interventions (Mauriello et al, 2007). A review by Stice et al to (2006) identify intervention features that produce larger effects, suggested that short term interventions produce more significant effects than longer term interventions. The HOT intervention could have been strengthened by including forming implementation intentions. Implementation intentions which specify where, when and how the behaviors will be performed, fill the gap between intentions and behaviors, and this may help to improve the predictive power of behavior in short term interventions (Gravel et al, 2010). Secondly the posttest was administered very close in time to pretest and no follow up tests were done. A follow-up test at a later date may have helped to assess the long term impact of the intervention (Gratton, Povey & Carter, 2007).

In conclusion, this study extends the prior literature concerning the use of TPB to predict healthy eating, physical activity and increase in knowledge about diabetes in adolescents. The most promising conclusion of this study is that a brief web-based intervention improved knowledge and the TPB constructs scores for the targeted behaviors, healthy eating and physical activity, for prevention of obesity and Type 2 diabetes for both AOL and POL groups. Additionally, we can conclude that the TPB constructs were predictive of intentions in our study, and the predictive power of the constructs for intentions improved post intervention. Perceived
behavioral control and attitude were the strongest predictors for both AOL and POL. Subjective norm was a significant predictor for healthy eating intentions and physical activity intentions for only the AOL participants.
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Wong F, Huhman M, Heitzler C et al. VERB- a social marketing campaign to increase physical activity among youth. Preventing Chronic Disease 2004; 3(1): A10-A16.
Table 5.1: Cronbach Alpha for All Theory of Planned Behavior Constructs

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cronbach alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Belief</td>
<td>0.765</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.771</td>
</tr>
<tr>
<td>Subjective Norm</td>
<td>0.850</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>0.741</td>
</tr>
<tr>
<td>Intentions</td>
<td>0.867</td>
</tr>
<tr>
<td>Knowledge</td>
<td>0.871</td>
</tr>
</tbody>
</table>

Substantial (0.61- 0.81); Perfect (0.81- 1.0)
Landis and Koch, 1977
Table 5.2: Cronbach Alpha for Healthy Eating, Physical Activity and Diabetes Categories Within the Theory of Planned Behavior Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Category</th>
<th>Pre/Post</th>
<th>Cronbach Alpha</th>
<th>n of items</th>
</tr>
</thead>
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<tr>
<td>Behavioral belief</td>
<td>Healthy eating</td>
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<tr>
<td></td>
<td></td>
<td>pre</td>
<td>0.629</td>
<td>5</td>
</tr>
<tr>
<td>Physical activity</td>
<td>pre</td>
<td>0.633</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>post</td>
<td>0.777</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>pre</td>
<td>0.256</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>post</td>
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<td>Healthy eating</td>
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<tr>
<td></td>
<td>post</td>
<td>0.685</td>
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<tr>
<td>Physical activity</td>
<td>pre</td>
<td>0.672</td>
<td>5</td>
<td></td>
</tr>
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<td></td>
<td>post</td>
<td>0.762</td>
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<tr>
<td></td>
<td>post</td>
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<td>Subjective norm</td>
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<td></td>
<td>post</td>
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<td></td>
<td>post</td>
<td>0.871</td>
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<td></td>
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<td>post</td>
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<td>Physical activity</td>
<td>pre</td>
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<td></td>
<td>post</td>
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<tr>
<td></td>
<td>post</td>
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<tr>
<td>Knowledge</td>
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<td>Physical activity</td>
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<tr>
<td></td>
<td>post</td>
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Table 5.3: Descriptive Statistics; Comparison Between POL Group and AOL Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre/Post</th>
<th>Control/Treatment</th>
<th>n</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Median</th>
<th>25, 75 percentiles</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Belief composite</td>
<td>Pre</td>
<td>Control</td>
<td>74</td>
<td>42.95</td>
<td>5.79</td>
<td>43</td>
<td>40/46.25</td>
<td>.823</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Treatment</td>
<td>111</td>
<td>43</td>
<td>3.95</td>
<td>43</td>
<td>40/46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Control</td>
<td>73</td>
<td>46.99</td>
<td>5.58</td>
<td>48</td>
<td>43/51</td>
<td>.062</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Treatment</td>
<td>105</td>
<td>45.43</td>
<td>5.45</td>
<td>46</td>
<td>42/49.5</td>
<td></td>
</tr>
<tr>
<td>Attitude composite</td>
<td>Pre</td>
<td>Control</td>
<td>79</td>
<td>43.37</td>
<td>4.45</td>
<td>44</td>
<td>40/46</td>
<td>.223</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Treatment</td>
<td>115</td>
<td>42.31</td>
<td>5.03</td>
<td>43</td>
<td>39/45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Control</td>
<td>76</td>
<td>45.62</td>
<td>5.91</td>
<td>46</td>
<td>40.25/50</td>
<td>.435</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Treatment</td>
<td>105</td>
<td>44.93</td>
<td>6.10</td>
<td>45</td>
<td>41/49</td>
<td></td>
</tr>
<tr>
<td>Subjective norm composite</td>
<td>Pre</td>
<td>Control</td>
<td>74</td>
<td>40.38</td>
<td>6.26</td>
<td>41</td>
<td>37/43</td>
<td>.204</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Treatment</td>
<td>103</td>
<td>39.39</td>
<td>5.85</td>
<td>39</td>
<td>35/43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Control</td>
<td>77</td>
<td>43.55</td>
<td>6.69</td>
<td>44</td>
<td>39/48</td>
<td>.714</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Treatment</td>
<td>99</td>
<td>42.81</td>
<td>7.53</td>
<td>43</td>
<td>39/48</td>
<td></td>
</tr>
<tr>
<td>Behavioral control composite</td>
<td>Pre</td>
<td>Control</td>
<td>79</td>
<td>43.24</td>
<td>6.19</td>
<td>41</td>
<td>41/47</td>
<td>.044</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Treatment</td>
<td>120</td>
<td>42.29</td>
<td>4.28</td>
<td>39</td>
<td>40/45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Control</td>
<td>81</td>
<td>45.14</td>
<td>5.85</td>
<td>46</td>
<td>41/49</td>
<td>.291</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Treatment</td>
<td>108</td>
<td>44.14</td>
<td>5.82</td>
<td>45</td>
<td>39/49</td>
<td></td>
</tr>
<tr>
<td>Intentions composite</td>
<td>Pre</td>
<td>Control</td>
<td>80</td>
<td>38.26</td>
<td>6.49</td>
<td>38</td>
<td>34.25/43</td>
<td>.041</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Treatment</td>
<td>117</td>
<td>36.76</td>
<td>5.30</td>
<td>37</td>
<td>34/40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Control</td>
<td>78</td>
<td>41.54</td>
<td>5.99</td>
<td>42</td>
<td>38.5/46</td>
<td>.105</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Treatment</td>
<td>106</td>
<td>40.08</td>
<td>6.35</td>
<td>40</td>
<td>37/44.25</td>
<td></td>
</tr>
<tr>
<td>Knowledge composite</td>
<td>Pre</td>
<td>Control</td>
<td>73</td>
<td>57.90</td>
<td>6.88</td>
<td>57</td>
<td>54/62</td>
<td>.284</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Treatment</td>
<td>108</td>
<td>56.88</td>
<td>5.98</td>
<td>57</td>
<td>52/60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Control</td>
<td>76</td>
<td>62.51</td>
<td>8.88</td>
<td>63.5</td>
<td>57.25/70.75</td>
<td>.191</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>Treatment</td>
<td>102</td>
<td>61.39</td>
<td>7.42</td>
<td>60.5</td>
<td>56/67</td>
<td></td>
</tr>
</tbody>
</table>

Mann Whitney Test; P-value < 0.05
AOL=Active Online Learning; POL= Passive Online Learning
Table 5.4: Comparison Between POL and AOL Groups for Difference Variables of Survey Constructs

<table>
<thead>
<tr>
<th>Difference Variable</th>
<th>Mean</th>
<th>n</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The distribution of intentions difference is the same across categories of treatment</td>
<td>0.309</td>
<td>203</td>
<td>0.154</td>
</tr>
<tr>
<td>The distribution of behavioral belief difference is the same across categories of treatment</td>
<td>0.272</td>
<td>203</td>
<td>0.054</td>
</tr>
<tr>
<td>The distribution of attitude difference is the same across categories of treatment</td>
<td>0.208</td>
<td>204</td>
<td>0.893</td>
</tr>
<tr>
<td>The distribution of subjective norm difference is the same across categories of treatment</td>
<td>0.263</td>
<td>204</td>
<td>0.447</td>
</tr>
<tr>
<td>The distribution of behavioral control difference is the same across categories of treatment</td>
<td>0.147</td>
<td>203</td>
<td>0.997</td>
</tr>
<tr>
<td>The distribution of knowledge difference is the same across categories of treatment</td>
<td>0.279</td>
<td>204</td>
<td>0.731</td>
</tr>
</tbody>
</table>

Asymptotic significances are displayed. The significance level is .05; AOL= Active Online Learning, POL= Passive Online Learning.

Independent-Samples Kolmogorov-Smirnov test
Table 5.5: Results Based on Two Schools

<table>
<thead>
<tr>
<th>Variable</th>
<th>School (physical education class)</th>
<th>School (health class)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>3.89</td>
<td>4.21</td>
<td>0.047</td>
</tr>
<tr>
<td>Behavioral Belief</td>
<td>4.00</td>
<td>4.20</td>
<td>0.022</td>
</tr>
<tr>
<td>Behavioral Control</td>
<td>3.86</td>
<td>4.09</td>
<td>0.049</td>
</tr>
<tr>
<td>Knowledge</td>
<td>3.93</td>
<td>4.17</td>
<td>0.035</td>
</tr>
</tbody>
</table>

MANOVA; P < 0.05
Mean for each Theory of Planned Behavior construct.
Table 5.6: Stepwise Regression Analysis for Intentions

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Pre/post scores</th>
<th>Treatment</th>
<th>n</th>
<th>Equation</th>
<th>$R^2$</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>Pre scores</td>
<td>POL</td>
<td>45</td>
<td>Behavioral control (0.558) + Attitude (0.256)</td>
<td>0.526</td>
<td>23.829</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intention</td>
<td>Pre scores</td>
<td>AOL</td>
<td>68</td>
<td>Behavioral control (0.348) + Subjective norm (0.271) + Knowledge (0.252)</td>
<td>0.482</td>
<td>20.133</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intention</td>
<td>Post scores</td>
<td>POL</td>
<td>46</td>
<td>Behavioral control (0.527) + Knowledge (0.692) – Behavioral belief (0.380)</td>
<td>0.747</td>
<td>42.223</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intention</td>
<td>Post scores</td>
<td>AOL</td>
<td>57</td>
<td>Behavioral control (0.281) + Attitude (0.378) + Subjective norm (0.295)</td>
<td>0.720</td>
<td>46.239</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

POL: passive online learning; AOL: active online learning
Stepwise Regression Analysis: Significance at < 0.01. Behavioral control and attitude predict 53% of variance in intention pre scores for control group. Behavioral control, subjective norm, and knowledge predict 48% of variance in intention pre scores for treatment group. Behavioral control, knowledge, and behavioral belief predict 75% variance in intention post scores for control group. Behavioral control, attitude, and subjective norm predict 72% variance in intention post scores for treatment group.
Table 5.7: Stepwise Regression Analysis for Intentions Healthy Eating, Intentions Physical Activity and Intentions Type 2 Diabetes

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Pre/Post scores</th>
<th>Treatment</th>
<th>n</th>
<th>Equation</th>
<th>R²</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentions Healthy eating</td>
<td>Pre</td>
<td>POL</td>
<td>46</td>
<td>Behavioral control (0.501)</td>
<td>0.252</td>
<td>15.120</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>AOL</td>
<td>70</td>
<td>Attitude (0.334) + Subjective norm (0.325)</td>
<td>0.343</td>
<td>17.770</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>POL</td>
<td>48</td>
<td>Behavioral control (0.659)</td>
<td>0.434</td>
<td>36.082</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>AOL</td>
<td>58</td>
<td>Subjective norm (0.449) + Behavioral control (0.409)</td>
<td>0.586</td>
<td>51.738</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intentions Physical activity</td>
<td>Pre</td>
<td>POL</td>
<td>45</td>
<td>Behavioral control (0.637)</td>
<td>0.406</td>
<td>30.022</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>AOL</td>
<td>70</td>
<td>Behavioral control (0.379) + Knowledge (0.332)</td>
<td>0.353</td>
<td>18.514</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>POL</td>
<td>47</td>
<td>Knowledge (0.471) + Behavioral control (0.375)</td>
<td>0.635</td>
<td>39.201</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>AOL</td>
<td>60</td>
<td>Behavioral control (0.271) + Attitude (0.413) + Subjective norm (0.259)</td>
<td>0.704</td>
<td>45.163</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Intentions Diabetes</td>
<td>Pre</td>
<td>POL</td>
<td>46</td>
<td>Attitude (0.535)</td>
<td>0.286</td>
<td>18.057</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>AOL</td>
<td>70</td>
<td>Knowledge</td>
<td>0.402</td>
<td>22.828</td>
<td>&lt; 0.001</td>
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Table 5.7 continued

<table>
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<tr>
<th></th>
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<th>Behavioral control (0.378) + Knowledge (0.522) + Behavioral control (0.336)</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>POL</td>
<td>49</td>
<td>Knowledge (0.522) + Behavioral control (0.336)</td>
<td>0.654</td>
<td>44.481</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th>Behavioral control (0.352) + Attitude (0.367)</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>AOL</td>
<td>61</td>
<td>Behavioral control (0.352) + Attitude (0.367)</td>
<td>0.452</td>
<td>24.303</td>
</tr>
</tbody>
</table>

POL= Passive Online Learning; AOL= Active Online Learning

Stepwise Regression Analysis: Significance at < 0.01. Behavioral control predicts 25% variance in intentions healthy eating pre scores for control group. Attitude and subjective norm predict 34% of variance in intentions healthy eating pre scores for treatment group. Behavioral control predicts 43% of variance in intentions healthy eating post scores for control group. Subjective norm and behavioral control predict 59% of variance in intentions healthy eating post scores for treatment group. Behavioral control predicts 41% variance in intentions physical activity pre scores for control group. Behavioral control and knowledge predict 35% variance in intentions physical activity pre scores for treatment group. Knowledge and behavioral control predict 64% variance in intentions physical activity post scores for control group. Behavioral control, attitude and subjective norm predict 70% variance in intentions physical activity post scores for treatment group. Attitude predicts 29% variance in diabetes intentions pre scores for control group. Knowledge and behavioral control predict 40% variance in diabetes intentions pre scores for treatment group. Knowledge and behavioral control predict 65% variance in diabetes intentions post scores for control group.
Figure 5.1: Correlational Analysis for Pre Scores for POL Group:

Figure 1: Correlations between TPB constructs and intention. Significant at 0.01 level (2-tailed); Spearman’s rho.
Figure 5.2: Correlational Analysis for Pre Scores for AOL Group

Figure 2: Correlations between TPB constructs and intention. Significant at 0.01 level (2-tailed); Spearman's rho.
Figure 5.3: Correlational Analysis for Post Scores for POL Group

Behavioral Belief

Attitude

Subjective Norm

Behavioral Control

Knowledge

Intention

.556*

.724**

.619**

.813**

.782**

Fig 3: Correlation between TPB constructs and intentions. Significant at 0.01 level (2-tailed); Spearman’s rho.
Figure 5.4: Correlational Analysis for Post Scores for AOL Group

Figure 4: Correlations between TPB constructs and intention. Significant at 0.01 level (2-tailed); Spearman's rho.
CHAPTER 6

EVALUATING INTERACTIVE FEATURES IN HOT (HEALTHY OUTCOME FOR TEENS) PROJECT WEBSITE USING FOCUS GROUPS WITH THE STUDY PARTICIPANTS

6.1 Introduction:

Overweight and obesity incidence is increasing in the youth population (Contento et al., 2007). There is a strong association between overweight and cardiovascular disease risk and Type 2 diabetes, beginning in childhood (Muntner et al., 2004; Jago et al., 2006). This association has public health and economic implications because the longer the individuals have these conditions, the greater the risk of complications, ill health, lost days from school and medical visits (Contento et al., 2007; Lightwood et al., 2008). Surprisingly, few studies in the past have targeted the adolescents for healthy weight interventions (Contento et al., 2007; Gellar et al., 2012). Improved eating patterns and increased physical activity are both important for maintaining a healthy weight (Doak et al., 2006; Flynn et al., 2006). More research is needed to determine how best to assist the teens to adopt these healthful behaviors and to maintain a healthy weight (Institute of Medicine, 2006).

Like with adults, Internet use for seeking health information is becoming popular in the adolescent population, thus making the Internet a well-suited medium to provide a variety of resources (Schiffman et al., 2008). More than 25 million kids age 2-17 years are online in the U.S., both from home and school; and they are more likely to be on the internet in school (Parlove et al., 2003). Brown, Teufel, & Birch, (2006) suggested adolescents learn the most about health from the school and the Internet. Indeed, school-based programs are better received by adolescents than community-based programs (Gordon et al., 2011). Internet interventions for healthy behaviors, developed within a theoretical framework, have shown success with
improving physical activity behavior, as indicated in a review by Vandelanotte et al (2007). Elements of interactivity such as pictures, videos, & games in web based interventions are appealing to middle school children and can be useful in reaching students with varied learning styles. A study conducted with children aged 7 to 8 years concluded that even young students valued fun in educational software (Sim, MacFarlane, & Read, 2006). However, learning was not always correlated with fun, and usability was important (Sim, MacFarlane, & Read, 2006). Consequently, to enhance the impact of health-related websites, social and entertainment features must be incorporated, with learning and usability remaining as the primary focus.

Literature both supports and also discourages the use of “edutainment” in teaching. Baranich and Currie, in their research, supported the use of edutainment, specifically games, in training and educational settings (Baranich & Curie, 2006). Okan (2003) critically examined the educational potential of edutainment software. He suggested positive effects of games included that they challenged the students, aroused their curiosity, developed their creativity and brought a pleasure and a sense of accomplishment. Children were willing to pay attention and participate enthusiastically when they were having fun. Students also got a chance to interact with their peers, friends and strangers when playing games and that helped them learn to work in teams and to work with each other (Okan, 2003). On the other hand, Okan (2003) also presented debates to discourage the use of edutainment for teaching. According to him, one of the most detrimental effect of using technology to teach is that it can have an unintended effect of suppressing serious learning by teaching the students that learning does not require perseverance and that reading critically, making connections with new information and what is already known is outdated and unnecessary (Okan, 2003). In addition to discouraging serious learning, computer games can be addicting for some students and the animation and sound can distract them from the actual
educational content (Hostetter & Clemens, 2002). Moreover, McDonald and Hannafin suggested that gain in student achievement attributed to the computer should be attributed to the novelty effect of using a new medium, which will wear off in time (McDonald & Hannafin, 2003; Green & McNeese, 2007). The Centers for Disease Control and Prevention (CDC) has issued a statement suggesting that an interactive, computer-based method of health education is a relevant and socially appropriate method of learning for adolescents (CDC, 2003; Long et al, 2006). However, at this point, further information is needed to explore the degree of edutainment that is beneficial, neutral, or detrimental.

Literature in this area suggests that boys are more interested in games/activity in modules, whereas girls are more engaged and concerned about reading the material. In a study conducted to evaluate the effectiveness of edutainment software ‘MyEdutale’; most subjects perceived the web-based intervention was easy to use and was effective in delivering the intended information through narrative content reinforced with interactive features. The researchers observed that girls were more engaged and concentrated with the narrative content whereas the boys were more interested in the games/activity modules (Zin & Nasir, 2008). In fact, statistics indicate that boys play substantially more games than girls in all age groups (Kaiser, 2002).

Focus groups have been used successfully with the adolescent population to obtain qualitative information from relatively homogenous populations about attitudes, perceptions and opinions that can influence their behavior (Kubik, Lytle & Fulkerson, 2005). They have also been used successfully with the teens to assess the acceptability and appeal of web-based interventions (Parlove, Cowdery & Hoerauf, 2003). Focus groups give the opportunity for exchange of ideas among the participants, to assess the degree of consensus and diversity of
opinion, and to promote responses with depth and complexity (Ott et al, 2009). Focus groups are conducted using a general format of open-ended questions and the data are analyzed qualitatively to determine appropriate codes, themes and patterns (Weinger, O’Donnell, & Ritholz, 2001; Kubik, Lytle & Fulkerson, 2005; Ott et al, 2009).

**HOT (Healthy Outcome for Teens) Project**

The HOT Project was a six-phase intervention. First, the website was adapted from an adult website to use with the middle school students by recruiting a teen council for their opinions (Herrejon et al, 2009). Second, the intervention framed within Social Cognitive Theory (SCT) was implemented in three schools in the Midwest (Castelli et al, 2011). Third, focus groups were conducted with the participants of the SCT intervention to assess their acceptability of the intervention (Muzaffar et al, 2011). Fourth, the website was adjusted based on the results of the two studies. Fifth, the intervention was again implemented in two schools and this time framed within the Theory of Planned Behavior (TPB). Sixth, focus groups were conducted to explore the observational findings of the TPB intervention.

In the second pilot study of the HOT Project, it was observed that the increased interactivity kept the audience in the AOL group better engaged with the website, but some seemed to spend less time reading the actual material. The primary purpose of the focus groups was to explore observational findings of the HOT Project second intervention for formative evaluation. The objective was to conduct focus groups to identify the adolescents’ perceived usefulness of incorporating different interactive features in terms of supportive or distracting to the content in the HOT Project; and also to assess any gender differences for preference of interactive features on the intervention website.
6.2 Methods:

The questions for the focus groups were developed following the guidelines of Krueger, 1994 (Krueger, 1994). The website development team formed questions in the categories of opening questions, introductory questions, transition questions, key questions and ending questions (Appendix 4). The questions went through several rounds of revisions till consensus was reached that focused and concise questions were developed to obtain information required to answer the research question. The questions focused on internet use, ease of using the intervention site, general content/language, preference for interactive features, and preference for reading. A checklist was also developed to use with the subjects to determine if they remembered the interactive features and if they found them helpful or distracting (Appendix 4).

After approval from the University Institutional Review Board and obtaining parental consent and child assent, subjects were recruited from two school districts that participated in the treatment component of the HOT Project. A total of 37 subjects, 19 boys and 18 girls, participated in 9 focus groups. Focus groups were conducted in small private rooms, where one investigator led the focus groups and a co-moderator took notes to record the dialogue and nonverbal cues. Topic saturation in responses indicated that enough subjects had participated to provide robust findings. The discussion took between 30 and 45 minutes to complete. To protect their anonymity, participants used pseudonyms during the sessions. Subjects were compensated with a ten dollar gift card at the end of the study. The investigators debriefed each other immediately after the focus group interviews to capture the first impressions and then highlight and contrast findings from earlier focus groups. These discussions were collected in formal observational notes as well as the fidelity-to-treatment logs. Additionally, each researcher recorded any unique demographics (i.e., gender, race) and situational events that took place.
during the focus groups. The focus group interviews were audiotaped and then transcribed verbatim. If there were any recording difficulties in the interviews, detailed notes were used to capture the data.

6.3 Data Analysis:

The focus group data was analyzed using content analysis (Christensen, Griffiths KM & Korten, 2002). Content analysis involves identifying coherent and important examples, themes and patterns in the data. First, these data were analyzed inductively, without regard to theory, by coding discrete statements and identifying patterns and themes, according to inductive category development methods (Mayring, 2000). Three researchers analyzed the transcribed focus group data separately to develop a list of categories and frequencies. The three then met to discuss findings, and build consensus to achieve agreement on coding of statements.

A negative case analysis was conducted to ensure that all ideas had been accounted within the act of coding (Lincoln & Guba, 1985). Negative cases were single or a collection of discrete statements that did not fall within the established defined codes. In this study, one negative case appeared suggesting that there may be a gender difference in the preference of interactive features. Given the potential effects of this finding, these data were again analyzed to determine if there was a difference in the responses of participants between genders.

For the checklist statements, number of similar responses were tallied and divided by the total number of respondents for each question. These frequencies were determined for all the subjects, and also for males and females separately, to identify the most helpful, least helpful, distracting and least remembered interactive features on the HOT project website.
6.4 Results:

From the categories and frequency counts, four overarching themes emerged. The results from the focus group data analysis will first be presented according to the categories of questions and then four emerging themes will be discussed.

*Opening questions.* Most (89%) subjects reported using Internet on a daily basis, with 50% of the subjects spending 1-3 hours a day. Facebook was the most popular site, followed by playing games, then visiting YouTube and sending emails. To the subjects, health and nutrition meant exercising and being active, and some aspect of both healthy eating and exercise.

*Introductory questions.* The website taught the students about how to eat healthy (69%), diabetes and how to stay healthy (24%), and exercise (14%). All subjects liked to use the website to learn about healthy eating and physical activity. Main reasons for liking the website were that it was better than learning in a classroom, more fun because of interactive features, they liked the voiceover feature, and could learn at their own pace.

*Transition questions.* The majority (81%) of the subjects thought the website was easy to use in terms of wording, information and navigation; while 19% of the subjects thought some words were complex, these students did not make use of the glossary section on the website. All the subjects appreciated the assistance from the HOT Project staff.

*Key questions.* The preference of the interactive features for being helpful was in the following order: videos (68%), games (62%), pictures (41%) and voiceovers (20%). The majority (70%) of the subjects thought nothing was distracting, but 16% found seeing rating of friends as distracting and 22% found Google maps as distracting.

*Final questions.* Some subjects thought that seeing the ratings of friends (19%), Google maps (35%), and crosswords and review game (19%) added least to the overall objective of
learning about healthy eating and physical activity. About 60% of the subjects said they would not spend more time reading the material if there were less interactive features. On the other hand, 68% of subjects would log in at home if given access to the intervention website. To design an ultimate website for learning, the participants suggested adding games (43%), videos (32%), pictures (19%), being same as HOT Project (14%), not having too many difficult words (14%), and providing for social interaction like Facebook (11%).

Negative case analysis indicated that there were no gender differences between the subjects for Internet use, intervention website use and material, and preference of interactive features. However, we did see a gender difference for preference of reading the intervention material, with more females (39%) willing to read if there were less interactive features on the website than boys (16%). Moreover, more females (89%) showed interest in reading the information at home if given access to the website than boys (63%).

Checklist results. The results from the checklist indicated that videos, pictures, and voiceovers were most helpful (80%). Navigating routes on Google maps was least helpful (14%). Seeing how your friends were rating different things was most distracting (16%). And two features, serving size pictures and seeing rating of friends, were least remembered (22%). Negative case analysis indicated only one difference between genders; more boys found seeing rating of friends as distracting than girls (26% vs. 6%).

Themes. Four themes emerged in our focus group data analysis. The first theme was ‘preference for computer over classical classroom’ with subcategories familiarity, fun, and learn at your own pace. Our adolescent population was familiar with the online venue as they spend on average 1-3 hours a day on the computer. They visited social networking website (Facebook), played games, watched videos, sent emails and even sought health information on the computer.
Middle school students’ perceived learning was fun from our interactive HOT Project, because of the novelty effect of using a new medium, and the engaging interactive features on the website. Our subjects appreciated being able to learn at their own pace; which is only achievable in an online format.

The second theme was ‘reinforcements’. Subjects perceived the interactive features helpful in reinforcing the narrative content presented on the website. The interactive features in the order of preference in HOT Project website were videos, games, picture, and voiceovers. When asked how they would design an ultimate website, the subjects suggested adding games, videos, pictures, same as HOT Project, and providing for social interaction like Facebook.

The third theme was ‘distractions’. The majority of the subjects did not find anything distracting on the website. However, Google maps and seeing rating of friends distracted some subjects because they spent a lot of time navigating routes on Google maps and did not appreciate the competition between peers when seeing their friends’ scores or rating for different opinions. Some interactive features were considered least helpful to the overall objective of the study, which included seeing rating of friends, Google maps, and crosswords and review games.

The fourth theme was ‘gender evaluations’ which highlight gender differences. More females said that they would be willing to read intervention material if there were less interactive features on the website. Additionally, more females were interested in reading the information at home if given access to the HOT Project website at home. Another gender difference was that more boys found seeing rating of friends as distracting than girls.
6.5  **Discussion:**

This qualitative study explored the usefulness of incorporating interactive features in the HOT Project website by conducting focus groups with the participants of the second intervention of the HOT Project. The website was well received by our target audience in terms of wording, information and navigation. The students correctly recalled that they learned information about exercise, healthy eating, diabetes, and how to stay healthy from the intervention website. The subjects indicated that they preferred learning from an interactive website about healthy eating and physical activity than learning in a traditional classroom. Similar results were seen in a study conducted by Bensley et al (2011) to compare internet and traditional classroom instruction for promoting fruit and vegetable intake. The results suggested that internet nutrition education group did better on post evaluation measures than traditional classroom group and also expressed more satisfaction with the intervention.

Importantly, our subjects indicated that interactive features were important to keep them engaged with the intervention content, as the majority of the subjects said that they would not spend more time reading the intervention material if there were less interactive features. Videos, games, pictures and voiceovers were perceived as helpful for better engagement with the intervention material. Allison and Rehm (2007) indicated that middle school students needed visual aids such as pictures, maps, videos, games, and other multimedia resources to enhance learning by engaging different senses and presenting information in alternative formats. Subjects in our HOT Project study liked that the videos had teens acting in them, which led to increased acceptance of behavior. Similarly, peer modeling was perceived effective by a focus group study, which was conducted by Thomas et al (1997) to assess interactive computer game for safer sex
negotiations. This study also indicated that voiceover feature was received favorably by the teen population (Thomas et al., 1997).

Support for an attractive and interactive learning website is also indicated by a study conducted by Hightow-Weidman et al. (2011) to evaluate a theory-based HIV prevention website. The subjects indicated that they liked the attractive look and feel of the intervention website, easy navigation features, and the incorporation of interactive features such as videos and pictures. However, this study also recognized that it was hard to determine how much interactivity is needed to keep the target audience engaged and motivated to return to the site more than once.

Our focus groups identified that Google maps and seeing ratings of their friends’ choices were distracting and least helpful to some of the HOT Project participants. Google maps feature was distracting to the subjects because the subjects kept on putting more and more addresses to map their routes. This has also been observed in a study conducted by Hostetter & Clemens (2002) which detailed many positive effects of using games to teach, but also recognized that the games on the entertainment website were addicting to the adolescent students. On the other hand, seeing the ratings of friends’ choices and their scores for games was distracting to some of the subjects as they said it created an atmosphere of competition. This finding was surprising, as the participants of our focus groups for the first intervention of HOT Project suggested adding social interaction features (Muzaffar et al., 2011). The social interaction features were added to the HOT Project website to accommodate these suggestions. Research literature also suggests that adolescents like to compete and collaborate with their peers for problem solving tasks and other activities (Allison & Rehm, 2007). In fact, another study determining factors that predict digital game play indicated the positive effects of players competing with each other, which promoted
social gratification (Green & McNeese, 2008). Similarly, in a study using web-based intervention to prevent diabetes in adolescents suggested that the competitive games on the intervention website were received well by the adolescent target audience (Long et al, 2006)

Our subjects indicated that they will likely log onto the HOT Project website from home if given access to the intervention website. The participants expressed interest to share the intervention content with their parents and siblings when logged on to the website at home. This was actually observed for the first phase of the HOT Project study participants, where subjects visited the website on their own time in the evenings and the weekends (Castelli et al, 2011). Thus, giving subjects opportunity to log in at home will not only reinforce the material learnt but also disseminate the information to their family members. The students in this study were on the Internet for 1-3 hours; Madden and Gross have reported that youth spend 40 minutes or more online per day (Ybarra et al, 2006)

The main gender difference highlighted in this study was that girls showed more preference to read from the website if there were less interactive features and were more willing to log on to the HOT Project website from home to read. There is a dearth of research conducted determining gender differences concerning learning and motivational factors (Lautenschlager & Smith, 2007). This area needs further exploration to appropriately disseminate youth education curriculum. Youth are more receptive to learning if they have the intrinsic motivation to change health behaviors. Since females are more interested in learning about health and nutrition, it explains their increased preference for reading intervention material than boys in our study (Lautenschlager & Smith, 2007). This gender difference has also been seen in other studies where girls indicate more interest in healthy behaviors and males give less importance to health and nutrition (Eto et al, 2011). Girls show greater concern for weight control and are 50% more
likely to avoid high fat foods. This leads to girls being more apt to read information about preventive health behaviors and disease prevention (Wardle et al, 2004). Another gender difference observed in our study was that more boys perceived seeing rating of their friends as distracting than girls, although this represented only a few boys.

One limitation in using focus groups is that there are no standardized assessment tools. The type of questions are tailored to the particular intervention and are only valid to be used for the particular setting for which they are designed. However, qualitative data obtained from focus groups still has been found useful for evaluating interventions (Schneider et al, 2009). Secondly, focus group subjects may give socially desirable responses due to face-to-face interaction (Schneider et al, 2009). This was minimized by telling the subjects that there was no right and wrong answers and that we wanted honest feedback to improve the website. We also supplemented the focus group interview with a checklist to get a more accurate evaluation of the website by the study subjects. Thirdly, we did not conduct separate focus groups with girls and boys. It is possible that participants’ responses were influenced by male/female interaction within the focus groups. Lastly, focus group moderators were the same as those who implemented the intervention that may have led to more desirable responses.

In conclusion, these focus groups shed some light on approaches that youth perceived as most acceptable. Internet based interventions were perceived more favorably by the adolescents population that traditional classroom instruction. The majority of the interactive features (videos, games, pictures, voiceovers) were perceived as reinforcements except Google maps and seeing rating of friends. There were no gender differences for preference of interactive features. However we did see a gender difference for preference of reading the intervention content, with girls being more apt to read the narrative on the website. The findings from this study must be
extended with caution because the sample size was limited to one geographic area and narrow age range of middle school students.
REFERENCES


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Schiffman, JD, Csongradi E & Suzuki LK. Internet use among adolescent and young adults (AYA) with cancer. Pediatric Blood & Cancer 2008; 51: 410-415.


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CHAPTER 7
CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions:

The HOT project expands current knowledge of the efficacy of adolescent obesity and Type 2 diabetes prevention programs by demonstrating an understanding of adolescents’ preference for and acceptability of the Internet in the delivery of an intervention framed within a behavioral theory framework. The HOT Project was successful in improving knowledge acquisition about healthy eating, physical activity and Type 2 diabetes prevention and management in both the first and the second intervention. In the first intervention, knowledge in the treatment group with active online learning (AOL) improved significantly more than the control group with passive online learning (POL) for all individual modules as well as overall knowledge. Web-based interventions have shown promise for improving knowledge for weight loss, diabetes self-management, healthy eating, HIV prevention, eating disorders, smoking cessation and alcohol abuse in adolescents (Ybarra et al, 2006). However, a study conducted by Kroeze et al (2008) for reducing fat intake compared print vs. interactive web-based intervention. The results suggested that interactive and print delivered computer-tailored interventions can have similar short-term effects on fat intake but the effects of print-delivered intervention are maintained in the longer term.

In the first intervention, the participants in the AOL group acquired skills for planning a meal whereas the subjects in the POL group did not. This suggests that for skill acquisition, an interactive online learning venue is more effective. Research evidence also supports this finding, as it is suggested that technology intensive classroom improve skill acquisition, hypothesis generation, and solving new problems (Green & McNeese, 2007).
For the first intervention based on Social Cognitive Theory (SCT), and employing self-efficacy and outcome expectations; the subjects in AOL improved outcome expectation for exercise, and outcome expectations for nutrition related to fat intake only in girls. The AOL subjects showed some improved in weight efficacy by improving for eating under social pressure and stress. Subjects did not show improvement in self-efficacy related to exercise and healthy eating. Moreover, the behavior-focused survey indicated no change in behavior except some improvement in fat, fruit and vegetable intake. The modest improvement in SCT psychosocial variables may be explained by the short length of intervention, which did not give the subjects enough time to internalize information and bring about a change in these variables and behavior (Nahm et al, 2010). Research evidence suggests that theory of planned behavior (TPB) is more appropriate to use with the adolescent population and also the constructs of TPB show more rapid changes that SCT constructs (Webb et al, 2010). Thus, we framed our second intervention within the TPB.

In the second intervention, the participants in both AOL and POL improved their knowledge significantly and there was no difference between AOL and POL. This result can be explained by the observational findings and the results of the focus groups with the participants of the second intervention that indicate that some new interactive features in the website, such as Google maps and seeing friends scores and rating, was distracting from the educational content for a small proportion of students. The task of developing effective web-based interventions requires the use of educational psychology to achieve a balance between entertainment and learning, as animation and sound in some interventions can distract from the learning process (Green & McNeese, 2007).
For the second intervention, both POL and AOL group subjects showed significant improvement from pretest to posttest survey for improvement in all TPB psychosocial variables targeted in the HOT intervention. Perceived behavioral control (PBC) and attitude were the strongest predictors of intentions for healthy eating, physical activity, and Type 2 diabetes management; suggesting using these psychosocial variables with the adolescent populations. A study conducted by Backman et al (2002) also supports our findings in that the results indicated that PBC and attitude were stronger predictors of healthful dietary behavior in adolescents.

The results of the second intervention of the HOT Project indicated that grade 6 students had the highest attitude scores, suggesting that younger adolescents had more positive attitudes to learn about healthy eating, physical activity, and Type 2 diabetes prevention. Both the first and the second intervention results indicated that subjects in the setting with the most structure (health class) produced strongest results (Castelli et al, 2011).

The focus groups with the participants of the first intervention indicated that the website was well perceived in terms of design, information and entertainment. However, the subjects gave specific suggestion for improvement, which included increased fun, options for social interaction, and broader health coverage for topics (Muzaffar et al, 2011). The website was then updated by adding more interactive features, more information, and some degree of social interaction.

The focus groups with the participants of the second intervention suggested that majority of the participants liked the HOT Project website because they perceived it was better than learning in a classroom setting, more fun, they liked the voiceover feature, and appreciated being able to learn at their own pace. Videos, games, pictures, voiceovers and animations were
perceived as helpful by the study subjects. On the other hand, Google maps activity and seeing rating of their friends and their friends’ scores were distracting for a small proportion of students. Certain gender differences were also highlighted in the study, as the girls showed an increased preference for reading the intervention content, if there were less interactive features and if they were allowed to log on from home.

Keeping the results of the first and the second intervention of HOT Project in mind, the TPB will continue to be used to guide the implementation of the intervention. The constructs of the TPB showed more significant improvements than constructs of the SCT for the HOT Project. Research evidence suggests that TPB is more suitable to be used in short-term interventions and with adolescent population (Webb et al, 2010).

7.2 Recommendations for Future Directions:

The website will be adjusted based on the results of the second intervention of the HOT Project and the associated focus groups. The interactive features perceived as distracting and least helpful by our focus group participants will be removed. These included Google maps activity and seeing rating of friends and their games scores. Collaboration with study participants for formative evaluation takes advantage of and maximizes the existing interests of adolescents and assists in determining favorable features of Internet based interventions for this population (Thunfors et al, 2009). Decisive knowledge tests will be added to the website, as the teachers indicated that they need scores that can be used as grades, in order to implement the intervention in the health class.

Separate versions of the HOT Project website will be made for different grades, as the results of the second intervention suggested differences based on grade level, with respect to
attitudes about healthy eating and physical activity. Specifically, the reading level, complexity of information presented and difficulty level of games will be adjusted. Moreover, website for 8th graders will focus more on short term benefits and improving perceived behavioral control. A study conducted by Thunfors et al (2009) also suggested that grade was an important predictor of all health interest parameters, with 7th grade expressing more interest than 11th graders.

Thirdly, the website development team will conduct interviews with school teachers to determine their perspective concerning both the content (healthy eating and physical activity) and the venue (Internet). The results from the HEALTHY study suggest that engaging teachers and seeking their input for intervention updates, increase their commitment to the intervention, and gives the teachers a feeling of ownership to the project (Hall et al, 2011). Similarly a study conducted by Gorely et al (2011) to assess the GreatFun2Run physical activity intervention at follow up, indicated that teachers perceived that talking to the program developers was helpful to stay committed to the program. Emphasis on the outcomes of the strategies and phased support may provide one avenue to ongoing intervention success.

Fourthly, the HOT Project team may implement a pilot study to assess the intervention with behaviorally challenged/attention deficit children to compare whether they perform better with active online learning or passive online learning. In our second intervention, teachers informally advised the investigators that one class was behaviorally challenged students, who were assigned to the control condition. Although the observation that they performed well with the passive online version of HOT Project, this is a potentially confounding variable for which we did not control. It may, however, be an important area to explore for future implementation.
Fifthly, survey items for the SCT-based intervention were not developed specifically for the adolescent population. The self-efficacy and exercise outcome expectancies surveys were developed for the adult population and the nutrition outcome expectancies survey was developed for children. Future research may focus on developing SCT surveys specific for our teen study population and also aligned specifically with the HOT Project content.

Sixthly, surprisingly, for the planning a meal survey, subjects in the control group had negative scores for the starch category at posttest. Additional research in this area may look into the food choices, pictures, or the way the text was worded in the HOT Project to find an explanation for this unexpected finding.

Lastly, the HOT Project intervention website has been made public. The intervention will be implemented in school settings with the assistance of school health teachers instead of our research team running the intervention. A teachers’ guide has been developed for the HOT project website to give the teachers a resource to use in assisting with the project implementation. These steps will enhance the sustainability of the HOT Project intervention.
REFERENCES


HOT Project
Outcome Expectations for Exercise Scale

Please review the following outcomes and indicate your level of agreement using the scale provided. Please circle only one answer for each statement.

I believe that being physically active on a regular basis will result in the following outcomes:

1. Stay in shape.

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2. Make me feel better in general.

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3. Good health.

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5. Improve appearance.

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I believe that being physically active on a regular basis will result in the following outcomes:


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8. Reduce stress and relax.

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11. Lose weight.

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12. Companionship.

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HOT Project
Outcomes Expectations for Nutrition

Directions: We want to know what you think will happen if you eat fruit and vegetables and low fat foods every day. There are no right or wrong answers, just your opinion. Please select the response that best describes how much you agree or disagree with each of the below sentences.

If I ate five servings of fruit and vegetables every day...

1. I would have more energy.

A Strongly Agree
B Agree a Little
C Unsure, Don’t know
D Disagree a Little
E Strongly Disagree

2. I would be able to keep my weight where I want it.

A Strongly Agree
B Agree a Little
C Unsure, Don’t know
D Disagree a Little
E Strongly Disagree

3. I would feel that I am being good to myself by eating healthy.

A Strongly Agree
B Agree a Little
C Unsure, Don’t know
D Disagree a Little
E Strongly Disagree

4. Other people would think I am healthy.

A Strongly Agree
B Agree a Little
C Unsure, Don’t know
D Disagree a Little
E Strongly Disagree

5. I would not enjoy eating.

A Strongly Agree
B Agree a Little
C Unsure, Don’t know
D Disagree a Little
E Strongly Disagree

6. I would have an upset stomach.

A Strongly Agree
B Agree a Little
C Unsure, Don’t know
D Disagree a Little
E Strongly Disagree

7. My food would cost too much.

144
8. My family would not enjoy eating it.

9. I would be less likely to get cancer or heart disease.

10. I would be a good example for my friends and family.

If I ate foods low in fat every day…

1. I would more energy.

2. I would be able to keep my weight where I want it.

3. I would feel that I am being good to myself by eating healthy.
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4. Other people would think I am healthy.

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5. I would enjoy eating.

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6. I would have an upset stomach.

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7. My food would cost too much.

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<th>Unsure, Don’t know</th>
<th>Disagree a Little</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

8. My family would not enjoy eating it.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree a Little</th>
<th>Unsure, Don’t know</th>
<th>Disagree a Little</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

9. I would be less likely to get cancer or heart disease.

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<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree a Little</th>
<th>Unsure, Don’t know</th>
<th>Disagree a Little</th>
<th>Strongly Disagree</th>
</tr>
</thead>
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146
10. I would be a good example for my friends and family.

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<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
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<tr>
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<td>Agree a Little</td>
<td>Unsure, Don’t know</td>
<td>Disagree a Little</td>
<td>Strongly Disagree</td>
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</tbody>
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147
HOT Project
Rapid Eating Assessment

Please check the box that best describes your habits.

Date:  

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>In an average week, how often do you:</th>
<th>Usually/Often</th>
<th>Sometimes</th>
<th>Rarely/Never</th>
<th>Does not apply to me</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEALS</td>
<td>1. Skip Breakfast?</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<td></td>
<td>2. Eat 4 of more meals from sit-down or take out restaurants?</td>
<td>O</td>
<td>O</td>
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<tr>
<td>GRAINS</td>
<td>3. Eat less than 3 servings of whole grain products a day? Serving = 1 slice of 100% whole grain bread; 1 cup whole grain cereal like Shredded Wheat, Wheaties, Grape Nuts, high fiber cereals, oatmeal, 3-4 whole grain crackers, ½ cup brown rice or whole wheat pasta</td>
<td>O</td>
<td>O</td>
<td>O</td>
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</tr>
<tr>
<td>FRUITS &amp; VEGETABLES</td>
<td>4. Eat less than 2-3 servings of fruit a day? Serving = ½ cup or 1 med. fruit or 4 oz. 100% fruit juice</td>
<td>O</td>
<td>O</td>
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<td></td>
<td>5. Eat less than 3-4 servings of vegetables/potatoes a day? Serving = ½ cup vegetables/potatoes, or 1 cup leafy raw vegetables</td>
<td>O</td>
<td>O</td>
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<tr>
<td>DAIRY</td>
<td>6. Eat or drink less than 2-3 servings of milk, yogurt, or cheese a day? Serving = 1 cup milk or yogurt, 1 ½ - 2 ounces cheese</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>Rarely use milk O</td>
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<td></td>
<td>7. Use 2% (reduced fat) or whole milk instead of skim (non-fat) or 1% (low-fat) milk?</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>Rarely eat cheese O</td>
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<td></td>
<td>8. Use regular cheese (like American, cheddar, Swiss, Monetery jack) instead of low fat or part skim cheeses as a snack, on sandwiches, pizza, etc.?</td>
<td>O</td>
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<tr>
<td>MEATS / CHEESE / CHICKEN / TURKEY</td>
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<td>9. Eat beef, pork, or dark meat chicken more than 2 times a week?</td>
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<td>○</td>
<td>○</td>
<td>Rarely eat meat, chicken, turkey or fish</td>
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<tr>
<td>10. Eat more than 6 ounces (see sizes below) of meat, chicken, turkey or fish per day? Note: 3 ounces of meat or chicken is the size of a deck of cards or ONE of the following: 1 regular hamburger, 1 chicken breast or leg (thigh &amp; drumstick), or 1 pork chop.</td>
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<td>11. Choose higher fat red meats like prime rib, T-bone steak, hamburger, ribs, etc. instead of lean red meats.</td>
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<td>○</td>
<td>○</td>
<td>Rarely eat meat</td>
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<td>12. Eat the skin on chicken and turkey or the fat on meat?</td>
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<td>○</td>
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<td>Rarely eat processed meats</td>
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<td>13. Use regular processed meats (like bologna, salami, corned beef, hotdogs, sausage or bacon) instead of low fat processed meats (like roast beef, turkey, lean ham; low-fat cold cuts/hotdogs)?</td>
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<th>FRIED FOODS</th>
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<td>14. Eat fried foods such as fried chicken, fried fish or French fries.</td>
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<th>TOPIC</th>
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<td>In an average week, how often do you:</td>
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<td>Usually/ Often</td>
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<th>SNACKS</th>
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<tr>
<td>15. Eat regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts instead of pretzels, low fat-fat chips or low-fat crackers, air-popped popcorn?</td>
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<tr>
<td>FATS AND OILS</td>
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<tr>
<td>17. Add butter, margarine or oil to bread, potatoes, rice or vegetables at the table?</td>
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<tr>
<td>18. Cook with oil, butter or margarine instead of using non-stick sprays like Pam or cooking without fat?</td>
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<tr>
<td>SWEETS</td>
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<tr>
<td>20. Eat regular ice cream instead of sherbet, sorbet, low fat or fat-free ice cream, frozen yogurt, etc.?</td>
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<tr>
<td>21. Eat sweets like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day.</td>
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<td>SOFT DRINKS</td>
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<td>Note: 1 can of soda = 12 ounces</td>
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<td>SODIUM</td>
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<td>24. Add salt to foods during cooking or at the table?</td>
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<td>ACTIVITY</td>
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<td>26. Watch more than 2 hours of television or videos a day?</td>
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### HOT Project

**Exercise Self-Efficacy Scale**

The items listed below are designed to assess your beliefs in your ability to continue exercising on a five time per week basis at moderate or higher intensities (activities include: jogging, running, swimming, cycling, or a brisk walk, hard enough to raise your heart rate and make you perspire), for 40+ minutes per session in the future. Using the scales listed below please indicate how confident you are that you will be able to continue to exercise in the future. Please remember to answer honestly and accurately. There is no right or wrong answers.

For example:
If you have complete confidence that you could exercise five times per week at moderate or higher intensity for 40+ minutes for the next four months without quitting, you would circle **100%**. However, if you had no confidence at all that you could exercise at five times a week at this intensity for the next four months without quitting, (that is, confidence you would not exercise), you would circle **0%**.

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1. I am able to continue to exercise five times per week at moderate or higher intensity, for **40+ minutes** without quitting for the **NEXT MONTH**.

2. I am able to continue to exercise five times per week at moderate or higher intensity, for **40+ minutes** without quitting for the **NEXT TWO MONTHS**.

3. I am able to continue to exercise five times per week at moderate or higher intensity, for **40+ minutes** without quitting for the **NEXT THREE MONTHS**.

4. I am able to continue to exercise five times per week at moderate or higher intensity, for **40+ minutes** without quitting for the **NEXT FOUR MONTHS**.
5. I am able to continue to exercise five times per week at moderate or higher intensity, for 40+ minutes without quitting for the **NEXT FIVE MONTHS**.

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6. I am able to continue to exercise five times per week at moderate or higher intensity, for 40+ minutes without quitting for the **NEXT SIX MONTHS**.

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<td>Not at all</td>
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HOT Project
Weight Efficacy Lifestyle Questionnaire Scale

Listed below are a number of situations that lead some people to eat. We would like to know how confident you are that you would not eat in each situation. Circle the number that best describes your feelings of confidence to not eat food in each situation according to the following scale:

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<td>Not confident</td>
<td>Very confident</td>
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1. I can resist eating when I am anxious (nervous)

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2. I can control my eating on the weekends

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3. I can resist eating when I have to say “NO” to others

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4. I can resist eating when I feel physically run down

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5. I can resist eating when I am watching TV

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6. I can resist eating when I am depressed (or down)

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7. I can resist eating when there are many different kinds of food available

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8. I can resist eating when I feel it’s impolite to refuse a second helping
   0 1 2 3 4 5 6 7 8 9
   Not confident Very confident

9. I can resist eating when I have a headache
   0 1 2 3 4 5 6 7 8 9
   Not confident Very confident

10. I can resist eating when I am reading
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident

11. I can resist eating when I am angry (or irritable)
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident

12. I can resist eating when I am at a party
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident

13. I can resist eating even when others are pressuring me to eat
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident

14. I can resist eating when I am in pain
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident

15. I can resist eating just before going to bed
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident

16. I can resist eating when I have experienced failure
    0 1 2 3 4 5 6 7 8 9
    Not confident Very confident
17. I can resist eating even when high-calorie foods are available

0 1 2 3 4 5 6 7 8 9
Not confident Very confident

18. I can resist eating even when I think others will be upset if I don’t eat

0 1 2 3 4 5 6 7 8 9
Not confident Very confident

19. I can resist eating when I feel uncomfortable

0 1 2 3 4 5 6 7 8 9
Not confident Very confident

20. I can resist eating when I am happy

0 1 2 3 4 5 6 7 8 9
Not confident Very confident
APPENDIX 2

FOCUS GROUP SCRIPT FOR CHAPTER 4
Focus group Questions for first focus group study

1. Do you use internet?

2. What is your favorite website?

3. Why is it your favorite website?

4. Define healthy outcomes?

5. How can you get to Healthy Outcomes?

6. Define Diabetes.

7. Do you have any family members who have diabetes?

8. Who?

9. How long have they had it?

10. How does it affect their lives?

11. What is your favorite part of the HOT website?

12. How can we make the HOT website better for you?

13. What is most important to you? (text, images, videos, games)

14. Any advice to make the website better?

15. What should people remember when developing the website?

16. Other comments
APPENDIX 3

SURVEY USED IN HOT PROJECT STUDY DETAILED IN CHAPTER 5
HOT PROJECT QUESTIONNAIRE FOR SECOND INTERVENTION

Please click on the number which best describes your answer

Behavioral Belief
Please answer these questions on a scale of 1 to 5 with 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree.

1. Reading Nutrition Facts labels will help me choose healthy foods.
   1  2  3  4  5

2. Foods high in fat are also high in calories because fats provide 9 calories per gram.
   1  2  3  4  5

3. To have a healthy diet you should choose foods from all the food groups.
   1  2  3  4  5

4. A dessert can be part of a healthy diet.
   1  2  3  4  5

5. Balancing the calories I eat with physically activity will help keep me healthy.
   1  2  3  4  5

6. Exercising regularly will help me have a healthy weight.
   1  2  3  4  5

7. Exercising regularly will help keep me healthy.
   1  2  3  4  5

8. Physical activity helps with weight and improved fitness.
   1  2  3  4  5

9. Eating 3 meals and possibly 1 to 2 snacks at about the same time each day helps to maintain target blood glucose levels in people with diabetes.
   1  2  3  4  5

10. Eating carbohydrates gives me glucose which is used for energy.
    1  2  3  4  5

11. Exercising regularly will increase my energy level.
    1  2  3  4  5

12. The prevalence of type II diabetes can be decreased by eating a healthy diet and by being physically active.
    1  2  3  4  5
Attitude

Please circle one response per statement.

1. For me, it is _________ to pay attention to “calories in” and “calories out” to stay in balance.
   Extremely unimportant unimportant neutral important extremely important

2. It is _________ for me to make healthier food choices such as eating popcorn without butter instead of chips for snack to maintain a healthy weight.
   Very unimportant unimportant neutral important very important

3. It is ________ for me to look at the serving size and calories on the Nutrition Facts label of food to monitor caloric intake.
   Very unimportant unimportant neutral important very important

4. For me to eat a healthy diet every day for the next seven days it would be ____________.
   Very difficult difficult neutral easy very easy

5. Doing physical activity every day for the next 3 months would be _________ for me.
   Extremely boring boring neutral fun extreme fun

6. Doing physical activity every day for the next 3 months would be ________ for me.
   Extremely unenjoyable unenjoyable neutral enjoyable extremely enjoyable

7. Doing physical activity every day for the next 3 months would be ______ for me.
   Very bad bad neutral good very good

8. Insulin is _________ for people with type I diabetes to control blood sugar.
   Extremely unimportant unimportant neutral important extremely important

9. It is _________ for people with diabetes to engage in exercise.
   Extremely harmful harmful neutral beneficial extremely beneficial

10. It is __________ to talk to health care practitioner before starting a new exercise routine to prevent any complications.
    Very unimportant unimportant neutral important very important

11. Balance is ____________ part of performing exercises and will help me build my core strength.
    Very unimportant unimportant neutral important very important
Subjective Norm
Please answer these questions on a scale of 1 to 5 with 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree.

1. My friends want me to eat a healthy diet from all the food groups over the next 3 months.
   1 2 3 4 5

2. My teachers want me to be physically active every day over the next 3 months.
   1 2 3 4 5

3. My family wants me to be physically active every day over the next 3 months.
   1 2 3 4 5

4. My friends want me to be physically active everyday over the next 3 months.
   1 2 3 4 5

5. The American Diabetes Association recommends walking as a good form of exercise for people with diabetes.
   1 2 3 4 5

6. Healthcare providers advise people with diabetes to incorporate the grams of carbohydrate in a sweet food as part of their total carbohydrate for that meal.
   1 2 3 4 5

7. Healthcare providers encourage people with diabetes to monitor their food and carbohydrate intake.
   1 2 3 4 5

8. Healthcare providers advise people with Type I diabetes to regularly take insulin to control blood sugar.
   1 2 3 4 5

9. My parents want me to balance “calories in” with calories out” over the next 3 months.
   1 2 3 4 5

10. My friends think we should all balance “calories in” with calories out”.
    1 2 3 4 5

11. My teachers think balancing “calories in” with calories out” is important.
    1 2 3 4 5

Perceived Behavioral Control
Please answer these questions on a scale of 1 to 5 with 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree.
1. I know I can eat at least five portions of fruit and vegetables daily.
   1 2 3 4 5

2. If I wanted to I could eat a healthy diet every day.
   1 2 3 4 5

3. I can make healthier food choices such as choosing water more often than regular soda/pop to prevent weight gain.
   1 2 3 4 5

4. I can find calories, serving size and macronutrient information on the food labels.
   1 2 3 4 5

5. I know how to do aerobic, strength and stretching exercises.
   1 2 3 4 5

6. I have the time to be physically active every day over the next 3 months if I wanted to.
   1 2 3 4 5

7. I have a place to be physically active every day over the next 3 months if I wanted to.
   1 2 3 4 5

8. I could be physically active every day over the next 3 months if I really wanted to.
   1 2 3 4 5

9. In stress, I find it hard to eat healthy
   1 2 3 4 5

10. In stress, I find exercise helps relieves stress for me
    1 2 3 4 5

Intention
Please answer these questions on a scale of 1 to 5 with 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree.

1. I can monitor my carbohydrate intake by looking for grams of carbohydrate on the food label.
   1 2 3 4 5

2. I can monitor my carbohydrate intake by looking for grams of carbohydrate on the food label.
   1 2 3 4 5

3. I will make healthy food choices.
   1 2 3 4 5
4. I will look at the food label for serving size and calories to monitor intake.
   1  2  3  4  5

5. I intend to be physically active every day in the next week.
   1  2  3  4  5

6. I will pay attention to calories in = calories out.
   1  2  3  4  5

7. I will engage in at least 30 minutes of cardiovascular activity most days of the week.
   1  2  3  4  5

8. I intend to be physically active every day over the next 3 months.
   1  2  3  4  5

9. I will eat healthy and be physically active to prevent type II diabetes.
   1  2  3  4  5

10. I will eat recommended servings from each food group daily.
    1  2  3  4  5

11. I will engage in aerobic activity to burn calories.
    1  2  3  4  5

12. I will use exercise balls to build my core strength.
    1  2  3  4  5

Knowledge
Please answer these questions on a scale of 1 to 5 with 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree.

1. In people with diabetes, weight gain can lead to higher blood glucose levels.
   1  2  3  4  5

2. Stress is harmful to the body as it causes physical, mental and emotional reaction.
   1  2  3  4  5

3. For people with diabetes, it is better to eat a dessert with a meal than to eat dessert without other food so that the blood glucose levels rise more slowly.
   1  2  3  4  5

4. Eating carbohydrates gives me glucose which is used for energy.
   1  2  3  4  5

5. Diabetes is a disease where glucose in the blood is higher than normal.
   1  2  3  4  5
6. In type 1 diabetes, there is not enough insulin.

7. In type 2 diabetes, insulin does not work well.

8. For people with diabetes, exercise is important to improve glucose control.

9. Macronutrients are needed in large amounts to provide us energy, for growing, digestion and other body functions.

10. Foods high in fat are calorie dense because fats provide 9 calories per gram.

11. If calories in are greater than calories out, you will gain weight.

12. Weight machines, free weights and exercise bands are used to build strong muscles.


14. A proper exercise regime would consist of warm up, exercise, cool down and stretching.

15. Physical activity goals are 60 minutes of activity most days.
APPENDIX 4

FOCUS GROUP SCRIPT FOR CHAPTER 6
Focus Group Questions for Treatment Group

Hypothesis: Online interactivity in the treatment group website detracted the intervention group from the module objectives depending on the content and individual child characteristics.

Focus groups will be conducted with the treatment group participants from Rantoul and Champaign schools with 5 to 6 subjects per focus group and 3 focus groups per school or until there is a response saturation.

Introductory speech: Hello guys, it is good to see you again. This time around, we are not going to the computer labs; we will just sit and discuss your experience with the intervention in a classroom. I will ask several questions and feel free to share your opinions. If you don’t feel like talking you don’t have to, as it says in your assent form. If you want to share your thoughts with just me after the discussion group, that is okay too. You will also be asked to complete a checklist for the interactive features on the website. It will take us about 30-45 minutes to complete the session and all your responses will be kept confidential. We are recording this, so don’t use your real name when talking.

Opening Questions
1. How much time do you spend online?

2. What are your thoughts about health and nutrition in general?

Introductory Questions
1. You were part of the HOT project a few months ago. What new information did you learn from the website or what information did the website reinforce?

2. What it was like to use the website?

Transition Questions
1. What was easy/hard to use the website, for example wording, information, navigation etc.?

2. As being part of the intervention, did you feel like you got adequate assistance from the HOT project staff?
Key Questions: Checklist

You may not remember all the interactive features on the website and there is no right and wrong answer. We want to know how helpful/or not helpful you found these features or if you remember them. Please circle one.

1. Videos on the website to encourage healthy eating and increase in physical activity.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

2. Having someone read the material (the voiceovers).
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

3. Blast Off game teaching food groups and recommended servings of healthy foods.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

4. Serving size pictures on the website for example the dice, mouse etc.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

5. Navigating routes on Google maps to increase physical activity.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

6. Pictures and videos teaching how to do different exercises.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

7. Identifying food within the food groups when playing the food matching game.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

8. HOT review games and crosswords.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember

9. Seeing how your friends were rating different things and how much they were scoring in the HOT review game.
   - Helpful
   - Not helpful
   - Distracting
   - Not distracting
   - Don’t remember
Now that everyone has finished the checklist, I have a couple more questions:

1. Did you have anything on the list that you thought was helpful? What was that? Let’s talk about it.

2. Did you have anything on the list that you thought was distracting? Let’s talk about those.

Ending Questions

1. Which interactive features added \textbf{least} to the overall objectives for healthy eating and physical activity?

2. Would you have spent more time reading the material if there were less interactive features?

3. Would you have spent more time reading the material if you could log-on at home?

4. If you were to design the ultimate website for learning, what would it look like?"