

Examining The Influence Of An Online Health Behaviour Support Tool For High
School Aged Youth

By

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B.A., Vancouver Island University, 2009

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Abstract

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It is well documented that the health behaviours and health status of Canadian youth are of increasing concern. This includes their inactive and sedentary lifestyle, less than recommended daily consumption of fruits and vegetables, and excessive intake of sugar sweetened beverages thought to contribute to the early development of metabolic syndrome, some cancers and certainly obesity. Strategies for reversing the declining health of Canadian youth have captured the interest of health promotion researchers. Health education in the school system has been identified as a potential vehicle of change since it is considered to be one of the last wide-scale and cost-free opportunities to motivate and educate students to be healthy and active. However, an increasing amount of research is suggesting that traditional curricula may be failing to adequately convey health information in high school youth. As a result of increasing technological literacy and exposure, a growing field of evidence suggests youth now prefer delivery of health information from electronic sources instead of traditional mediums. The majority of studies observing online

health interventions show positive results, but research involving youth, and conducted in real world settings, is still in its infancy.

Therefore, the purpose of this study was to examine the utility of an online intervention tool as part of a health education curriculum, to motivate and support grade 10 students to make healthy decisions related to physical activity, screen time, fruit and vegetable consumption and intake of sugar sweetened beverages. Research questions included: (1) How do students use the online tool to support their health behaviour changes? (2) What were students' experiences using the HPSS online tool? Are they satisfied with its function, features, look and content? (3) Was there any relationship between use of the online tool and students' behaviour change? Students in Planning 10 and PE 10 courses (N = 44) in two high schools participated in the year-long study. Pre and post intervention data collection procedures included self-report survey of health behaviours, and anthropometric measures (BMI and waist and hip measures) to more objectively capture changes in health outcomes. Focus groups were conducted with students (n = 10) and teachers (n = 6) to gather their feedback about the website and its contribution within the curriculum. Finally, web metrics captured students' use of and exposure to the online tool over the course of the intervention.

Despite evidence in the literature that youth strongly engage with electronic mediums, students' use of the website in this study was infrequent and disappointing: 52% of students did not login once, and the remainder visited the site fleetingly. No significant relationships between students' web use and behaviour change were found. Qualitative data revealed that students' appreciated the

interactive and reminder functions of the website, but teachers struggled to define its role within the curriculum as a pedagogical tool, so it failed to attract students' time and attention. The study contributes to the literature through its investigation of an online health education tool, contextualized in the real life setting of the school classroom.

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Dedication

I would like to dedicate this thesis to my family and friends for their never ending support and encouragement to reach for the stars and be the best that I can be. I share my successes with you and this thesis would not exist without you.

This thesis is in remembrance of all my grandparents who have passed on, thank you for helping shape me into the person I am today.

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Glossary

Foreman (2007), Clifton (2008) and The Web Analytics Association (2007) provide an extensive list of the terminology used in the growing field of web analytics including a list of common definitions used in Google Web Analytics. Anthropometric and SHAPES questionnaire terminology is also included below.

Authentication – Technique by which access to Internet or intranet resources requires the user to enter a username and password.

Average Page Depth – The average number of pages on a site that visitors view during a single session.

Bandwidth – The amount of data that can be transmitted along a communications channel in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits per second (bps) or bytes per second, where 1 byte = 8 bits.

Body Mass Index (BMI)- Mass (kilograms) divided by height² (meters).

Bounce Rate – Bounce rate is the percentage of single-page visits or visits in which the person left your site from the entrance (landing) page. Use this metric to measure visit quality – a high bounce rate generally indicates that site entrance pages aren't relevant to your visitors.

Browsers – A browser, or more accurately, user agent, is the software used to access a website. Examples of user agents are “Explorer” (for Microsoft Internet Explorer).

Cache – A temporary storage area that a web browser or service provider uses to store common pages and graphics that have been recently opened. The cache enables the browser to quickly reload pages and images that were recently viewed.

Cookie – A small amount of text data given to a web browser by a web server. The data is stored and returned to the specific web server each time the browser requests a page from that server. The main purpose of cookies is to pass a unique identifier to the website so that the website can keep track of the user as they step through a website.

Cost-per-click (CPC) – An advertising model in which the advertiser (sponsor) pays the publisher a certain amount each time the sponsor's ad is clicked. Also sometimes

referred to as PPC (pay-per-click).

Download – To retrieve a file or files from a remote machine to your local machine.

Encryption – The process of encoding information so that it is secure from other Internet users.

Hardware – A computer and the associated physical equipment directly involved in the performance of data-processing or communication functions.

JavaScript – Small element of code embedded on web pages and executed by the browser when the page is viewed by a visitor.

Log file – A file created by a web or proxy server which contains all of the access information regarding the activity on that server. Each line in a log file generated by web server software is a hit, or request for a file.

Moderate to Vigorous Physical Activity (MVPA)- Physical activity that is between 3.0 and 6.0 metabolic equivalents (METs). One met is defined as the energy expenditure required to sit quietly. 3 to 6 METs is approximately 3.5 to 7 Kcal/min.

Referrals – A referral occurs when any hyperlink is clicked on that takes a web surfer to any page or file in another website. If a search engine was used to obtain the link, the search engine name and any keywords used are recorded as well.

Report – A report set is a distinct Google Analytics report about one particular web site, part of a web site, or content group. A report set will have all of Google Analytics' reporting features.

Residential area- A district where people live; occupied primarily by private residences.

Robot- A program that automatically functions independent of human intervention. Usually a robot is wired with artificial intelligence to react in different situations it may encounter. A common type of robot is a spider.

Rural area- An area outside of a city or town.

Script – A short computer program written in a simplified programming language,

such as JavaScript, VBScript, or Perl.

Session – By default in Analytics, a session is defined as the period of time during which visitors are interacting with your site and there has been inactivity for less than 30 minutes. After 30 minutes of inactivity, any further page views will be treated as a new session.

Software – The programs, routines, and symbolic languages that control the functioning of the hardware and direct its operation. Written programs or procedures or rules and associated documentation pertaining to the operation of a computer system and that are stored in read/write memory.

Spider- A spider is a program that travels the Internet locating and indexing websites for search engines. Major search engines (Google, Yahoo!) use spiders to create and update their indexes.

URL – Uniform Resource Locator is a means of identifying an exact location on the Internet. For example, <http://www.googleanalytics.com/support/platforms.html>.

Unique Visitors – Unique Visitors represents the number of unduplicated (counted only once) visitors to your website over the course of a specified time period. A Unique Visitor is determined using cookies.

User – As it pertains to Google Analytics, a user is defined as a person who has specific report set access, a username and password.

Visitor – A Visitor is a construct designed to come as close as possible to defining the number of actual, distinct people who visited a website.

Waist Circumference (WC)- The measurement of the waist taken at the smallest point; testers may palpate the iliac crest if necessary to find a reference point.

Waist to Hip Ratio (WHR)- The ratio of the waist circumference to the hips (waist divided by hips)

Web Server – This is a vague term whose meaning must be determined by the context in which it's used. It will mean one of two things: The physical computer that acts as a server. This is a computer just like any other. It is called a server because its main function is to deliver web pages.

Chapter 1

Introduction

This research examined the utilization of a web based behaviour tool to support, educate and motivate high school aged adolescents' changes in health behaviour. The tool is one component of a comprehensive school health project entitled Health Promoting Secondary Schools (HPSS) implemented in five high schools in British Columbia from October 2011 through to June 2012. The HPSS study included curricula interventions in Planning and PE 10, as well as school policies and school wide events, intended to educate, motivate and support students' healthy living practices. The HPSS program specifically addressed improving physical activity levels and fruit and vegetable consumption, while decreasing screen time and the consumption of sugar sweetened beverages.

It has been well documented that the health behaviours and health status of youth is a concern (McCreary Centre Society, 2006; Ministry of Health Services, 2004), and this has created an urgent debate about how to reverse the declining health of Canadians. Health education in the school system has been identified and endorsed by public health advocates as a potential vehicle of change to combat the burgeoning numbers of unhealthy youth (Sharma, 2006; Wechsler, Devereaux, Davis, & Collins, 2006). Since health behaviours established early in life have a tendency to carry into adulthood, schools represent one of the last wide scale and monetary free opportunities to educate, motivate and encourage students in health

promotion and disease prevention. Comprehensive school health models have recently garnered attention as effective interventions for targeting health promotion since they are able to address multiple issues through diverse interventions in one setting (Deschesnes, Martin, & Jomphe-Hill, 2003). Yet, health education curricula in British Columbia high schools have diminished with students now receiving only 36 hours of classroom teaching. In recent research literature released by the provincial government, only 20% of high school senior students stated that the existing curriculum was teaching them how to lead a healthy lifestyle (British Columbia Office of the Provincial Health Officer, 2008).

Further, the school environment must enable students to integrate healthy living into their daily routines. Research by Barr-Anderson, AuYoung, Whitt-Glover, Glenn and Yancey (2011) found that interventions which integrated physical activity into a daily organizational routine demonstrated modest but consistent benefits. Adolescents' attitudes toward physical activity is an integral piece in attempting to adopt physical activity into their daily lifestyles. A study by Graham, Sirard and Neumark-Sztainer (2011) demonstrated that adolescents with positive attitudes towards exercise and sport were 30-40% more physically active 5 and 10 years later in terms of time per week than adolescents with poor attitudes. This suggests that helping youth develop long term favourable exercise attitudes may be beneficial.

Concurrent with the interest in encouraging youth to be more physically active is the amount of time they spend in sedentary pursuits, notably recreational activities tied to 'screens.' The new 2011 Canadian sedentary behaviour guidelines

for youth and children recommend no more than two hours of recreational screen time daily (Tremblay et al., 2011a). Youth who adhere to this recommendation are at much lower risk of developing health complications compared to those exceeding the guidelines. A study on American high school students found that those who reported meeting a screen time recommendation of two or less hours a day had significantly lower body mass index and systolic blood pressure compared to students who reported over two hours daily (Ullrich-French, Power, Daratha, Bindler, & Steele, 2010). This accentuates the importance of limiting sedentary behaviour in adolescent students. However, only 18% of male and 14% of female Canadian grade 6-10 students reported meeting the guidelines (Mark, Boyce, & Janssen, 2006).

Two primary concerns related to nutrition are the alarmingly high rates of sugar sweetened beverages (SSB) consumption and low fruit and vegetable (F & V) intake. It is well documented that SSB contributes to obesity and an estimated one-fifth of weight gained between 1977 and 2007 was related to its consumption (Woodward-Lopez, Kao, & Ritchie, 2010). Recent research has also displayed that very few adolescents are consuming their recommended intake of fruit and vegetables (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). Therefore, decreasing SSB, increasing F & V consumption and physical activity and decreasing screen time in the Canadian youth population are main targets of the HPSS program. The online HPSS health behaviour support tool website was designed and engineered to compliment curricula resources and school-wide policies.

Statement of Purpose

Due to the recent scholarly attention paid to adolescent health and health behaviours (e.g., Carson, Pickett, & Janssen, 2011; Mark & Janssen, 2008; Shields, 2006; Tremblay et al., 2010), the importance of healthy living for chronic disease prevention (Catford, 2007; Syme, 2002), the evidence linking environmental context to health decisions (Young & Wharf Higgins, 2010), and the intractability of health habits (McCarthy, 2007; Michie, Abraham, Whittington, McTeer, & Gupta, 2009; Nomran, 2008), understanding how to best educate, motivate and support youth to take up and sustain health practices is critical. It is evident that more research is needed to determine the effect of theory driven and interactive online health interventions targeted at youth in the school setting. Therefore, the purpose of this research was to examine the utility of an online intervention tool, framed in self-determination theory in motivating, educating and supporting high school aged students to be more physically active, reduce screen time, increase fruit and vegetable consumption and decrease consumption of sugar sweetened beverages.

The research examining the online intervention tool is part of a larger study entitled Health Promoting Secondary Schools (HPSS), a pilot project funded by the Canadian Cancer Society Prevention Initiative, in 10 BC high schools. The larger study examines the influence of PE 10 and Planning 10 curricula and resources (including the web based health behaviour change tool), as well as whole school events, on both school and student level outcomes. The four components of this whole school model are displayed in figure 1.



Figure 1. The Components of the HPSS Model

The core requirements of the HPSS intervention included curricula, opportunities for student learning, resources for schools, teachers and classrooms, and the engagement of youth. Since grade 10 curriculum contains the last mandatory health education components, PE and Planning 10 classes were selected to deliver the HPSS content. The teachers were equipped with comprehensive curricula guides that provided lesson plans, handouts, assessment tools and resource materials related to physical activity, screen time, fruit and vegetable consumption and sugar sweetened beverages. The main theoretical tenets of self-determination theory (autonomy, self-efficacy, relatedness) were integrated in the lesson plans. HPSS

provided opportunities for students to transcend their knowledge beyond the classroom by introducing school-wide events and policies with each HPSS intervention school required to introduce a minimum of two school-wide events and one new policy. Resources were provided to support the teaching and learning aspects of the HPSS project. A total of \$4,100 was provided at the start of the intervention year to the intervention schools. This monetary supplement aided in changing infrastructure or school environment and addressing individual school needs in PE and Planning 10 classes (e.g., equipment, guest speakers). An HPSS school liaison was provided to facilitate the intervention throughout the year and delivered teacher training workshops at the beginning of each semester. The HPSS website tool examined in this thesis was also developed as a resource for HPSS. The final core component of HPSS was engaging youth in the design and delivery of the delivery of school-wide events, activities and policies. The schools were asked to establish an action team (6-10 members) with 50% adult and 50% youth participation to identify areas for action regarding the current status of their school's environment for physical activity and healthy eating opportunities.

Theoretical Framework

Self-Determination theory (SDT) was chosen as the theoretical framework for the overall HPSS study, including the online HPSS website. Self-Determination theory suggests that increasing or maintaining behaviour (including health related behaviour) over time requires internalizing values and motivation. This can be facilitated by the status of three psychological markers: increased autonomy (sense

of choice), competence (self-efficacy) and relatedness (sense of meaning and belonging) (Deci & Ryan, 2000). Internalizing values (intrinsic motivation) is a result of positively perceiving the three psychological needs (autonomy, self-efficacy and relatedness). Intrinsic goals focus on personal growth, physical health and relationships which ultimately leads to acquiring the motivation to initiate healthy behaviours and maintaining them over time regardless of external influence (Ryan, Patrick, Deci, & Williams, 2008) Extrinsic goals are often centered around acquiring wealth, fame and being physically attractive. Motivation based on extrinsic principles is more likely to result in unhealthy behaviour or behaviour that is not maintained consistently over time. When autonomy, self-efficacy and relatedness needs are not met, amotivation or a lack of commitment to changing behaviour occurs (Kasser & Ryan, 1996). Deci and Ryan (2000) state that the quality of motivation (intrinsic vs extrinsic) positively influences health behaviours, including physical activity. Therefore, when implementing health based behaviour interventions at the school level, it is critical to account for the three psychological factors that inform self-determination theory. Improving health behaviour in youth will likely not be as effective without internalizing motivation or creating intrinsic self-set goals.

The larger Health Promoting Secondary Schools research study has adopted Self-Determination theory (SDT) as the underpinning theoretical framework. The application of SDT is a developmentally appropriate approach as it outlines the importance of developing self-initiated behaviour in youth. In past research, SDT has been identified as a key component of initiating and adhering to physical activity and

other healthy lifestyle behaviours. The three-part model of SDT (self-efficacy, autonomy and relatedness) will be utilized in the HPSS to observe how motivation can develop and ultimately influence behaviour (Wharf Higgins, Naylor, McKay, Gibbons, & Rhodes, 2009). The intervention tool evaluated in this specific research will follow a similar approach to the larger HPSS study. The immediate and long term success of many electronic health promoting interventions can be correlated to improvements in self-efficacy, a prominent psychological marker in SDT. Therefore, grounding this research in SDT has significant potential to yield greater statistically significant results, especially an age demographic group like high school youth. It is hoped that by, nurturing internal motivation during youth, the likelihood of continuing healthy lifestyle behaviour into adulthood is enhanced.

Self-Determination theory has been applied to a variety of other health behaviour interventions including weight loss programs, blood sugar monitoring and smoking cessation. Overall, general findings from the studies suggest that participants who were more autonomously motivated for behaviour change had more success in implementing changes recommended by health practitioners (Patrick & Canevello, 2010). Currently, no studies investigating online health interventions aimed at adolescent youth framed in self-determination theory are available in the literature.

Research Questions

There are three main questions that this research explored:

1. How do students use, if at all, the Health Promoting Secondary Schools (HPSS)

online tool to support their health behaviour changes?

a) How often do students access the site?

b) How long do they stay?

c) What is the nature of content viewed and purpose of their visit (e.g., to set and track goals, search for and/or share information etc.)?

2. What are students' experiences using the HPSS online tool? Are they satisfied with its function, features, look and content? How well does it educate, motivate and support their decisions around health behaviours?

Hypothesis 1: Questions 1 and 2 were exploratory in nature, and thus no a priori hypotheses were generated.

3. Is there any relationship between use of the HPSS online tool and self-reported and objectively measured behaviour change? As part of the larger HPSS study, students completed a self-reported questionnaire (SHAPES) on their physical activity and screen time practices, and F & V and sugar-sweetened beverage consumption levels. To gather more objective indicators of behavior change, students' body mass index (BMI) and waist to hip ratio (WHR) were also measured.

Hypothesis 2: Students who utilized the online tool more frequently will have demonstrated greater self-reported behaviour changes on the SHAPES questionnaire and improvements in BMI and WHR.

The thesis is organized into the following chapters: Chapter 2 presents a review of the literature on the four HPSS health practices as well as the evidence gathered on web-based or online interventions for behaviour change. Chapter 3 details the methodology, including recruitment and data collection strategies used to

answer the research questions, as well as analytical procedures. Chapter 4 presents the results from students' use of the HPSS web tool, their self-reported health practices at baseline and follow-up. Finally, Chapter 5 discusses the implications of the results in terms of the literature, and recommendations for future research.

Chapter 2

Review of the Literature

This chapter presents a review of current and seminal literature related to the purpose and focus of the study. The review commences with a discussion of the relevant health behaviours in this research, followed by an overview of health promotion intervention research for adolescents, including the emerging evidence on web and online interventions. The chapter then concludes with a description of the HPSS online tool and information about current web metrics.

Obesity and Sedentary Behaviour

In North America, the rapid rise of obesity is a cause of great concern. In the United States obesity rates among youth (defined as a body mass index greater or equal to the 95th centile) have tripled since the 1970's, and Canadian figures are likely similar (Harris, Kuramoto, Schulzer, & Retallack, 2009). The current status of health in Canadian youth has become alarming. Results from the 2007-2009 Canadian Health Measures Survey found that a quarter of Canadian youth (age 12-17) are now overweight or obese (Shields, 2006; Tremblay et al., 2010). An increase in sedentary behaviour exhibited by youth is associated with metabolic disease (also referred to as metabolic syndrome) and is a main factor contributing to the increasing obesity epidemic that is now rampant in society (Active Healthy Kids Canada, 2010; Tremblay & Willms, 2003). The Canadian Health Behaviour in School-aged Children Survey (HBSC) found that grade 9-10 students spent 21 hours watching TV, 18 on the computer and 6.5 playing video games per week on average.

Grade 6-8 students displayed a similar pattern at 18, 7 and 7 hours respectively (Carson, Pickett, & Janssen, 2011). It should also be noted that revised 2011 Canadian sedentary behaviour guidelines for youth and children recommend no more than two hours of recreational screen time daily, limiting sedentary (motorized) transport and no periods of extended sitting time and time spent indoors throughout the day (Tremblay et al., 2011b). A dose response relationship between screen time and metabolic syndrome has been demonstrated (Mark & Janssen, 2008). A recent meta-analysis observing sedentary sitting and life expectancy conducted by Katzmarzyk and Lee (2012) indicated that population life expectancy in the USA would increase by two years if adults reduced their time spent sitting to less than three hours per day. This alarming prognosis may hold even more severe implications for youth. These findings suggest that any future lifestyle based interventions for adults, and especially sedentary youth, should include a specific section with a focus on decreasing screen time.

Status of Physical Activity in Youth

Over the past several decades, physical activity and fitness levels of adult and adolescent Canadians have decreased, while obesity and many of the associated co-morbidities has increased significantly (Shields et al., 2010; Tremblay et al., 2010). Partaking in habitual physical activity is widely regarded as an effective preventative measure for a variety of health risks in all age, gender, ethnic and socioeconomic subgroups (Janssen, 2007). The new 2011 Canadian Physical Activity Guidelines for youth (age 12-17) recommend at least 60 minutes of moderate to vigorous activity daily (Tremblay et al., 2011a). However, analyses from the 2007-2009 Canadian

Health Measures Survey revealed that only 9% of youth males and 4% of females reported accumulating this amount of activity (Colley et al., 2011; Tremblay et al., 2011a). Following the recommended guidelines can improve cholesterol levels, blood pressure, body composition, bone density, aspects of mental health and cardiorespiratory and musculoskeletal fitness (Tremblay et al., 2011a). Although these benefits of engaging in regular physical activity across the lifespan are well documented, this has not helped to improve the number of Canadians who meet the recommended guidelines, including youth.

Nutritional Patterns

Further worrisome are the current nutritional patterns among Canadian youth. Canada's Food Guide to healthy eating recommends 5-10 servings of fruit and vegetables daily but only 35% of adolescent males and 41% of females (aged 15-19 years) self-reported their intake met these guidelines (Riediger, Shooshtari, & Moghadasian, 2007). In a study investigating the dietary patterns of overweight Canadian youth referred for clinical weight management found adequate consumption of grains and meats but insufficient dairy and fruit and vegetable (F & V) intake for the majority of participants (Ball et al., 2008). The fruit and vegetable group is widely identified as a crucial food group in disease prevention. Johnson (2004) found a significant correlation between fruit and vegetable intake and cancer prevention, while adequate consumption of F & V is associated with reduced coronary heart disease (Dauchet, Amouyel, Hereberg, & Dallongeville, 2006; Joshipura et al., 2001). Of equal importance is the association between F & V intake and a lower risk of becoming overweight or obese (Ledikwe et al., 2006).

To compound these nutritional issues among youth even further, the consumption of sugar-sweetened beverages (SSB) has increased substantially in the past few decades. There has been a 123% increase in soft drink consumption among youth between the 1970's and the late 1990's (French, Lin, & Guthrie, 2003). Recent evidence based literature supports the hypothesis that sugar-sweetened beverages (cola, soft drinks and fruit juice with added sugar) may play an important etiologic role in obesity risk (Bray, Nielsen, & Popkin, 2004; Popkin & Nielsen, 2003).

The decrease in physical activity levels and fruit and vegetable intake, in addition to increasing recreational screen time and consumption of sugar-sweetened beverages, has significantly contributed to the obesity epidemic currently plaguing Canadian youth. Contemporary observations suggest that up to 80% of overweight adolescents will become obese as they reach adulthood (Daniels et al., 2005). Therefore, it is imperative to identify effective educational models and health interventions for this age demographic that promote healthy living and wellness across the lifespan.

Health Promotion Interventions for Adolescents

Schools have been a popular setting for delivering interventions because continuous, intensive contact can be made with students. Schools can also be considered an ideal setting for these interventions as the nutrition and physical activity environments can influence behaviour of youth through important factors, such as school policy, qualified staff and the role modeling of teachers (Wechsler, Devereaux, Davis, & Collins, 2000). However, despite the apparent advantages of addressing obesity in a school setting, a current systematic review of 38 school-

based interventions (13 high school, 25 elementary), with a focus on changing dietary intake and physical activity levels, found an overall relative lack of effectiveness in a number of major interventions (Brown & Summerbell, 2008). A similar meta-analysis observing the effect of school based physical activity interventions on the body mass index of elementary school students also found little improvement (Harris, Kuramoto, Schulzer, & Retallack, 2009). School based initiatives are failing to live up to their promise to address the prevalence of childhood obesity. This has brought into question whether using traditional curricula are a best practice in the school setting.

As discussed earlier, youth are spending vast amounts of their recreational time in front of screens. Due to recent large-scale technological advancements and marketing directed at youth, research from the Kaiser Family Foundation reported that American children and youth between the ages of 8-18 spend an average of 3 hours watching TV and 1 hour on the computer per day (Rideout, Roberts, & Foehr, 2005). Casazza and Ciccazzo (2007) state that there is a growing field of evidence indicating children and adolescents now prefer delivery of health information from computer and internet sources compared to traditional mediums such as printed materials. In light of the technological savvy of modern adolescents, computer and web-based interventions are now being recommended for use within this population (Rideout et al., 2005).

Social media is now incorporated in health care settings in response to the rapid increase in usage worldwide and predominantly North America. The Mayo

Clinic in the USA is increasingly using this social media to educate the public beyond its educational campuses, and the World Health Organization (WHO) provides twitter and youtube service to keep the world up to date on the latest news. Understanding the opportunities and potential impacts of new social media enhancements can be key for promoting health. Combining technology with behaviour change frameworks has the potential to create a new resource for health promotion and has been coined “New Social Learning” (Catford, 2011, p.133). Due to the sharp rise in computer use and the preference to obtain information through this medium, this concept of new social learning can be applied to promoting health in order to efficiently reach more people. This was evident in an Australian study investigating the effect of utilizing text messaging to increase physical activity in postnatal women. Forty-two text reminders were sent over a 13 week period and the results showed an increase in frequency of moderate to frequent physical activity (Pratt, Sarmiento, Montes, Ogilvie, Marcus, Perez, & Brownson, 2012). SMS (text) may have the potential to be a promising low cost and large scale tool for conveying health information to the public. However, Neiger, Thackeray, Van Wagenen, Hanson, West, Barnes, and Fagen (2012) warn that social media should not be viewed as a single solution to improving health outcomes and promoting behaviour change, but as an important strategy to increase communication, awareness and promotion of programs and services.

Online Intervention Research

Over the last decade the Internet has become a primary source for obtaining health related information by the general public (Brouwer, Kroeze, Crutzen, deNooijer, de Vries, Brug, & Oenema, 2011). Over 50% of internet users have identified the internet as an important source of health information (Pratt, Sarmiento, Montes, Ogilvie, Marcus, Perez, & Brownson, 2012). This strive for knowledge combined with the heavy internet usage patterns in the developed world has created an ideal medium for health behaviour research. Usage patterns illustrated by the Pew Internet and American Life Project show that almost 75% of American households have regular access to personal computers and another 75% in those households are regular internet users (Bennett & Glasgow, 2009). Online interventions can offer an engaging avenue for creating behaviour change through personal mastery techniques including self-regulatory activities like goal setting, self-assessment and problem-solving activities as well as observational learning (Thompson, Baranowski, Buday, Baranowski, Thompson, Jago, & Griffith, 2010). In recent years, an increasing amount of health promoting programs have become available on the web in an attempt to take advantage of the wide dissemination potential and address a variety of target behaviours including obesity, smoking cessation and nutrition (Verheijden, Jans, Hildebrandt, & Hopman-Rock, 2007). From 1996 to 2002, web-based therapy citations on the MEDLINE database increased from 13 to 152. Although longitudinal literature is lacking due to the relatively nascent state of electronic health behaviour interventions, evidence has already suggested that the interventions are generally beneficial (that is, provide a dose-response relationship) and contribute to knowledge acquisition, quality of life,

coping strategies and increasingly effective use of healthcare services including actively participating in healthcare decisions (Han, 2011; Strecher, 2007).

A meta-analysis conducted in 2004 observing web-based resources that intended to improve behavioural change found substantial evidence that using an online intervention improved such outcomes (Wantland et al., 2004). In a review of the effectiveness of online health behaviour change programs, Kraft and colleagues (2010) found an average weighted effect size of 0.16, or small effect size. The authors noted, however, that statistical effectiveness cannot rule out clinical and cost-effectiveness: "Given that much of the cost associated with Internet-based interventions is likely to be incurred at the design and development stage rather than in delivering individual treatments, small effects with the potential to have an impact on large numbers of people may thus be significant for patient or population health" (p. 7). Indeed enhancing the public health impact of web-based health behaviour interventions is the cost efficient scope of their dissemination (Norman et al., 2007; Saperstein, Atkinson, & Gold, 2007). A meta analysis by Cugelman, Thelwell, and Dawes (2011) that observed online health behaviour adherence factors also found a small effect (comparable to traditional print interventions), but the authors similarly stated that the lower costs and potential reach of online interventions may offer unique advantages over other health education channels.

More specifically, a systematic review evaluating the efficiency of online interventions targeting smoking cessation found positive results in general, while interventions that focused on motivated smokers yielded best results (Shahab & McEwen, 2009). A small ten study review on web-based interventions for the

management of type 2 diabetes concluded that the interventions demonstrated favourable results when complimented with strategic features such as interactive feedback, peer support groups and goal setting (Ramadas, Quek, Chan, & Oldenburg, 2011). In terms of interventions that involve targeting improvement in physical activity levels and nutrition, an online resource grounded in social cognitive theory called the “web-based guide to health” was introduced to 272 middle aged, sedentary participants and assessed after 6 months. The research demonstrated statistical improvements in both physical activity levels and nutrition levels and the majority of participants displayed improved self-efficacy and self-regulation (Anderson-Bill, Winett, Wojcik, & Winett, 2011). Further grounding online interventions in psychosocial theories promises to increase long term adherence due to improvements in self-efficacy and other related variables. Yet, while many papers discuss the potential of internet based interventions, few include the details of metrics used to fully understand how or in what ways online interventions facilitate or support behaviour change.

Despite the allure of web-based interventions in reaching larger audiences, it is troubling that participants with better baseline health characteristics and healthier lifestyles commonly receive the highest benefits from online interventions, with the exception for interventions targeting weight loss, which found that participants with higher BMI reaped the highest benefits. This finding may due to the non-stigmatizing private nature of online weight-loss programs versus clinical trials. Therefore with a few exceptions, a common issue with electronic interventions is reaching target populations that require these resources the most. It is a concern that most “free”

and “public” interventions are utilized by individuals who are already motivated to change or maintain their lifestyle while those who may require assistance even more tend to drop out or worse, do not access anything at all. In a study by Danaher, Boles, Akers, Gordon, and Severson (2006) that observed web usage patterns on a large scale web cessation program (chewfree.com), the authors observed that individuals who were least likely to make a meaningful change were likely to visit the website for a shorter duration than participants who were more interested or motivated in quitting. Further research is required to address this inequity, and using well established behavioural theories such as Prochaska and DiClemente’s (1983) Transtheoretical Model to anticipate and tailor participant usage patterns based on their stage of change may serve to address disparities of attrition, if not access.

While existing research results on cyber health interventions is promising, studies focusing on youth are rare and few programs have been specifically constructed for youth. One notable exception is the work of Thompson, Cullen, Boushey, and Konzelmann (2012) whose review of oriented online behaviour interventions found favourable evidence related to improving diet, increasing physical activity and advocating weight loss. A similar recent review of electronic interventions for preventing or treating obesity in youth conducted by Nguyen, Kornman, and Baur (2011) reported that the majority of studies found a significant change in diet and/or physical activity behaviour in participants receiving the intervention treatment. However, results should be viewed cautiously as 87% of studies did not independently evaluate the electronic tool from other intervention components.

A systematic review carried out by Hamel, Robbins and Wilbur (2010) that observed web based interventions designed to increase adolescent physical activity also found favourable results. Small but statistically significant increases were demonstrated in many of the 14 interventions observed. In a randomized controlled trial that observed the influence of an online intervention resource on decreasing adolescent dietary fat intake, positive results were shown for the majority of most participants (Haerens, Deforche, Maes, Brug, Vandelanotte, & De Bourdeaudhuij, 2007b). A Belgian randomized controlled trial study conducted by Haerens, De Bourdeaudhuij, Maes, Cardon and Deforche (2007a) observed the effect of a electronic intervention, including parental support, on youths' physical activity and nutrition and found a slight increase in PA (four additional minutes of moderate to vigorous activity per day) compared to the control group. The intervention group with no parental involvement found little improvement, thus suggesting the potential importance of family support in health promotion. Context of the intervention was also of interest in this review. School-based interventions were more effective than home-based which further suggests the strong applicability of electronic interventions in the school setting. Currently, it remains unclear whether online interventions are superior to generic classroom curriculum (De Bourdeaudhuij et al., 2010). However, research undertaken by Casazza and Ciccazzo (2007) found that computerized education was more effective than a traditional classroom education in trying to reduce body mass index (BMI) measures and increase physical activity among high school students.

A systematic review by Hamel, Robbins, and Wilbur (2010) stated that theory driven interventions are more likely to result in positive outcomes compared to those that are atheoretical. This is echoed by Webb, Joseph, Yardley and Michie (2010) who similarly suggested that the effectiveness of internet-based interventions were associated with an extensive use of theory (especially the Theory of Planned Behaviour) after conducting a systematic review on the impact of theoretical basis on internet health behaviour changes. According to Winett, Anderson, Wojcik, Winett, Moore, and Blake (2011) the recent literature has indicated that the effect, reach and impact of online health interventions is heightened when informed by theory and constructs that promote behaviour change.

The success of online health interventions is further influenced by the nature of the online tool itself and the features included in its design. Participants have reported that individually tailored (personalized) web-based interventions are easier to read and remember, more relevant and ultimately more effective than generic ones (Skinner, Campbell, Rimer, & Curry, 1999). Neville, O'Hara and Milat (2009) found that controlled program delivery, using incentives, interactive and dynamic web components, ease of access to the intervention, prompts through another medium (e.g., telephone) and individualized tailoring may be important intervention characteristics in enhancing participant retention of educational material. Other advantages of computer-based interventions include a more confidential, non-stigmatized and convenient environment for participants, better cost-effectiveness compared to traditional interventions, and potential to advance

knowledge translation (Patrick & Canevello, 2010). Gaps in the literature include assessments of online sites in serving the needs of users, and an understanding of participants' perspectives of technology-mediated interventions (Bee, Lovell, Lidbetter, Easton, & Gask, 2010; Ritterband et al., 2009; Saperstein, Atkinson, & Gold, 2007).

Website Components And Measuring Exposure In Online Health Interventions

The success of an online health intervention cannot solely be measured by time spent online and subsequent health behaviour change; observing web metrics and structural intervention components are just as critical. Measuring website "exposure" data is necessary to go beyond just the conventional approach of explaining the utility of website in terms of dose and response, and into a holistic perspective where additional analyses are required to observe the specific processes by which participants locate data and what benefits are acquired (Han, 2011). It is important to note that usage data is a construction of how the user interacts with the website and cannot always be compared to other data at face value. As Han (2011) has noted, a 'one size fits all' principle is still employed when considering 'amount of use' even though, in reality, users have demonstrated a variety of usage behaviour and patterns. On interactive and content rich websites, users have active roles in creating their learning experiences through information they search, sending/receiving messages and choosing what they view based on personal preferences. According to Binks and van Mierlo (2010), internet based research has primarily focused on treatment outcomes, attrition rates, site log-in frequency and behaviour change tracking without giving thought to how the intervention itself was

presented (e.g., support groups, assessments, content). Effective internet based interventions must ensure that core elements are delivered and components that can improve utilization must be considered. Research in which more data regarding actual user needs is gathered will help elucidate these phenomena while concurrently reporting any strategies that can successfully increase engagement to the intervention (Fleisher et al., 2012). Trying to detect causation or tease out correlations between participation and behaviour change does not always address the most salient questions such as what website features are related to increased/decreased adherence? Or of equal importance how can the website measure exposure to these web features and demonstrate that specific components are correlated to success or failure of an intervention? The ability to use inferential statistics is necessary to comprehensively review a more effective and efficient web resource.

Selecting appropriate web components can be critical in determining how much exposure an intervention can potentially receive and even more importantly, the quality of exposure participants will experience. Strategic design can increase utilization, decrease attrition and cater to a variety of users. Despite the increasing research in the online health intervention field, detailed methodology about which component “mixture” is the most effective in promoting adherence and success is largely absent from the literature. Presently there is still no “gold standard” when selecting specific components for a website (Ferney & Marshall, 2006). This holds true for both “ad libitum” (free at will) public studies and randomized controlled trials with specific participation criteria.

Even though there is no “gold standard,” there is a general consensus about several components deemed critical to a successful website intervention. Findings by Binks and van Mierlo (2010) and Ferney and Marshall (2006) stated that interactive design and personally tailored feedback were consistently linked to increased long term adherence, decreased attrition and statistically significant changes in health behaviours. Interactive self-assessments with personalized relevant feedback was particularly appealing to users. Many studies that compare a basic site versus an enhanced interactive site observe that having an engaging and tailored interactive resource led to more visits, time spent on the site and overall exposure. Funk et al. (2010) postulate that the development of engaging and attractive internet based programs are currently a priority, but further assessment of what components encourage long term engagement is necessary to maximize effectiveness and minimize cost. The challenge that remains is selecting among the many resources that are commonly used in the literature. An array of components ranging from baseline information quizzes, self assessment quizzes, goal setting, web forums, email or phone reminders, counseling, resources/links, progress tracking and incentives have all been utilized. Focus groups can be an effective strategy in determining what website elements are most beneficial to behaviour change. For example, a qualitative study by Thompson, Cullen, Boushey, and Konzelmann (2012) asked youth participants to offer their opinions during the design of a web intervention and while this is a usual practice in health promotion programming, seems less so for electronic initiatives.

A meta-analysis reviewing web-based weight loss interventions conducted by Arem and Irwin (2010) found that drawing definitive conclusions about effectiveness was difficult due to the highly variable study methods, inconsistent control group utilization and generally low adherence to the interventions, as were highly diverse web components. Similar findings are likely true for other online health behaviour change efforts. It can also be difficult to draw consistent conclusions due to a reliance on self reported measures and exposure. For example, Fleisher et al. (2012) conducted a study measuring participant exposure through web tracking software and self report. Significant discrepancies were found between the two measures. Close to 40% reported using the intervention when in reality there was no use, while conversely, 20% who claimed to not use the intervention in reality logged on. This bias raises questions about the validity of self reported data, and illustrates the importance of utilizing software to objectively capture exposure related data. Finally, research that compares two phase interventions (a face to face clinical program plus a following supplementary online program) versus standard online programs is another recommended area for future study and development in the discipline as both modalities are common place in the literature.

The study by Fleisher et al. (2012) on self report bias illustrates one of many reasons why objectively measuring exposure to the intervention and its components is critical. Data on participant exposure to web based interventions has become an expected ingredient in published reports (Danaher et al., 2006). It is a necessary measure to create the “bigger picture” in determining how effective a study is and can have important implications for future research. Software that can track site

visits, duration of the visit and number of pages viewed gives rise to data that documents participant engagement, usage patterns and characteristics of attrition (when participants stop using the site). However, to fully understand how effective the site is as a whole, specific page visits and utilization of site components are also critical to track. In doing so, researchers can observe relationships between specific components and overall success of the intervention to determine what “ingredients” may be beneficial for future study. This is vital for ongoing research since the field does not have any standard practices and can shed light on to what components are useful, or are archaic and should be abandoned, as well as how components and functions can best serve different types of interventions. For example, an internet mediated walking program found less attrition in participants who engaged on the web forum where individuals could interact with each other (Richardson et al., 2010).

Yet, similar to web intervention components there is no universally accepted measure for assessing participant exposure. It is problematic that there is no definition of standard use metrics because of the potential for significant variation in methodology and different exposure measures. Since there is empirical evidence that participant website utilization predicts positive outcomes across a variety of health conditions, uniform website exposure methodology would enhance comparability between studies and significantly increase the external (Bennett & Glasgow, 2009) or ecological (Han, 2011) validity. This lack of a standard measure may also be due to the dearth of literature comparing the various monitoring software or just the sheer vast number of options available presently. A challenging

(and potentially rewarding) area of future research lies in determining appropriate website components that will address adequate exposure to relevant content while also ensuring maximum participation and engagement. Measuring participant exposure can not only aid researchers in determining what content is viewed, these data can also provide insight into website design and information layout. If regions of the website are not accessed frequently, one must assume that this content is not beneficial in contributing to desired outcomes. However, it can be difficult to measure exposure in certain circumstances due to the information architecture of web interventions where viewing segments of a website have to be achieved in a predefined order. For example, on the Chew Free smokeless tobacco cessation program one must access the quitting strategies page to further link to the alternatives section. Therefore, exposure to certain areas of the website can be a product of informational layout and structural design of an intervention (Danaher & Seeley, 2009). Even with a few limitations, correlating specific areas of website traffic with behavioural change outcomes can still identify “active” components that can be vital to the intervention or archaic while enabling a better understanding of program utilization patterns to help accommodate different participant interests, needs and learning styles by adapting structure and/or content (Danaher et al., 2006).

The Different Modes Of Measuring Website Exposure

Peterson (2005) offers a number of potentially appropriate modes of measuring exposure including cookies, web beacons, session identifiers and server log files. There are also a large number of commercial products utilized on the web including pay per click, average revenue per order, top products and customer segment analysis. However, this review is limited to strategies appropriate for measuring exposure in health behaviour interventions. The two type of analytics used to measure exposure on the HPSS website were Google and Caorda (the web design team) Web Analytics. Google utilizes page tag analysis to measure a variety of variables including total number of website visits and unique visits, duration of time spent on the site and the number of website pages viewed. According to Clifton (2008), there are two main methodologies for collecting data on website exposure: page tags and server logfiles. A logfile is data collected by a web server independent of a visitor's browser. This technique is known as server-side data collection and captures all data requested to a web server including pages, images and PDF's. Page tags collect data via a user's web browser and this information is commonly recorded by JavaScript code placed on each page of a website. This is referred to as client-side data collection. Google Web Analytics utilizes page tag techniques to capture exposure because implementation is easier from a technical point and the data are collected by external servers which can save time and money by avoiding maintenance of running software to capture and store information. Web server logfiles have become outdated since they are too basic when measuring exposure, however they remain as an easy technique for beginners to use and access as most

Internet service providers supply free log analyzing equipment with their web hosting accounts (Clifton). However, both methods have their strengths and limitations as summarized in Table 1.

Table 1. Page Tag and Logfile Analysis Evaluation.

Methodology	Advantages	Disadvantages
Page Tags	Break through caching servers (Increased accuracy) Track clients side events (e.g. JavaScript) Collect and process data in nearly real time Allows data storage to be performed by vendors Captures client side e-commerce data	Set up errors lead to data loss Firewall can mangle or restrict tags Cannot track bandwidth or completed downloads Cannot track search engine spiders
Logfile Analysis	Historical data can be reprocessed easily No firewall issues Can track bandwidth and completed downloads Tracks search engine spiders by default	Proxy and caching inaccuracies No event tracking (e.g., JavaScript, Flash) Requires manual program updates/data storage Robots multiply visit counts

In Google Web Analytics, page tags track visitor traffic by using cookies.

Cookies are small text messages that are located in a web server and transferred to a browser window to keep track of activity and exposure on a website. The web user's browser stores cookie data on the local hard drive as name value-pairs. In the context of web analytics, cookies are used to identify website users for later use, most commonly with an anonymous ID. Cookies can be used for a plethora of uses but are frequently used to determine how many visitors (or repeat visitors) a website has received, how many times a visitor returns in a specific time frame and the amount of time surpassed between visits. (Clifton, 2008).

Summary

The health status of youth is declining. The current literature suggests that youth are inactive, sedentary and are not getting proper nutrition. The environments in which our youth learn, play and live do not support a healthy lifestyle, which can contribute to the early development of diabetes and metabolic syndrome and increase the risk of certain cancers and heart disease. There is a growing amount of evidence that suggesting that traditional school-based health curriculum is becoming ineffective. The growing research field of online interventions that provide health based information has been in response to the increase in technological literacy and widespread internet use, especially in youth. Early results have displayed early success and great potential in future study. However, structural design ingredients and measuring web exposure still have no "gold standards" and more research is needed to determine if these interventions are effective across a diverse range of settings and contexts.

Chapter 3

Methodology

Research Design

In keeping with the design of the larger HPSS study, a mixed-method prospective design, following students over the course of one full school year, was utilized, gathering both quantitative and qualitative data to address and answer the three research questions. A mixed-methods approach is defined as “The collection and analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involves the integration of the data at one or more stages in the process of research” (Cresswell, Plano Clark, Gutmann, & Hanson, 2003, p. 212).

A multi-method approach allowed our research team to take a “pragmatic” philosophical perspective, which draws on the use of several diverse approaches and values both objective and subjective knowledge (Tashakkori & Teddlie, 2003; Greene & Caracelli, 2003). One of the benefits of using multiple methods within a single research study is that it capitalizes on the objective strengths of quantitative findings as well as the richness and depth of qualitative findings (Tarrow, 2004). The combination of these two methods provided a means of approaching the research question from different angles, increasing inferential leverage (Mertens, 2003). Thus, a mixed-method approach allowed us to triangulate data sources and types to take advantage of both the representativeness and generalizability of

quantitative findings, and the rich contextual contributions of qualitative data (Punch, 1998).

Mixed method research can generate a superior understanding of social phenomena (Collins, Onwuegbuzie, & Johnson, 2012; Greene, 2012) due to an emphasis on pragmatism, reliance on a mixture of quantitative and qualitative data to interpret research questions, and paradigmatic outlook. Using data components and sources that have complementary strengths and non-overlapping weaknesses, mixed method research strengthens the validity and reliability of findings (Hesse-Biber, 2010) contributing to an understanding of how the intervention may contribute to the outcomes united with knowledge of what the outcome is; findings that are greater than the sum of their parts (Bazeley, 2012, p. 817)

Participants

Participants were consenting grade 10 high school students in Planning and Physical Education (PE) courses in two of the five HPSS schools in Greater Victoria receiving the HPSS intervention over the 2011-2012 school year. Grade 10 students were recruited for the HPSS study and the online intervention study because these are the final two mandatory courses specifically addressing health behaviours. Planning 10 contains the only mandatory health education curriculum taught in BC high schools in which students are offered learning opportunities to think critically about health in four areas: healthy living, health information, healthy relationships, and health decisions.

Recruitment

For the purpose of this study, two Greater Victoria high schools were visited

from the larger HPSS sample. Participants were recruited prior to the T1 baseline (September/October) phases of data collection for the HPSS study. As students were completing questionnaires, anthropometric measurements and other testing protocols for HPSS, consent forms for this study were circulated among the students and collected by the end of the testing period. In the consent form, it was noted that every student had the choice to withdraw from the study at any time, and their data would be destroyed upon request. Participants were told that participation was voluntary and that they have the right to refuse to participate in the study. They were also told that they did not have to answer any questions that they did not wish to and that there was no penalty from not participating or withdrawing from the study.

The HPSS Web Support Tool

The online tool developed for HPSS by Caorda Web Solutions (www.caorda.com) supports PE 10 and Planning 10 curricula, and school-wide events for Grade 10 students. In keeping with the theoretical tenets of SDT, the tool has been designed to include the following features: self-assessment quizzes on each of the four behaviours of interest (PA, screen time, F & V intake, consumption of sweet and sugar beverages); goal-setting information and goal statement choices for students to select based on their self-assessment results; goal tracking; and, ability to 'earn' trophies for meeting goals and/or participating in school-wide challenges while providing access to health promotion tips and links to resources as part of the interactive features on the website. Students were able to personalize their page with a customized profile, use text and email to link to the tool, and share their

information through Twitter and Facebook.

Logging Into/Navigating The HPSS Website

All grade 10 students received a unique log-in identification (ID) in the fall of 2011. Each student was added to the website database manually and given a unique email address and temporary password that could be used to access the HPSS site. To gain access to the website, students logged onto www.healthyactiveschools.ca. The website home landing page had some brief information about the HPSS study as well as username and password boxes that were required to access website features. Each user entered in the log-in information provided by the webpage administration, and were then required to change their temporary password and accept the terms of use disclaimer upon their initial log-in. Once students accepted the terms of use, access to the site was granted and the website then asked the user to complete their own personalized profile. It should be noted that at this point, the user had the option to choose a “not right now” function that bypassed the profile and rerouted to each student’s respective school dashboard. Each following time a student successfully logged in after the initial process, they were taken immediately to their dashboard, which acted as the “central” page where user profiles, self-assessment quizzes, goal setting, challenges and resource functions could be accessed. The user profile allowed each student to input customized information including an image of their choice, specific cell phone and email information and an option to share information about their HPSS website experience on facebook and twitter. See Figure 2 for an example of a dashboard.

The dashboard features a top navigation bar with the following tabs: MY PROFILE, SELF ASSESS, GOALS, CHALLENGES, and RESOURCES. On the right side of this bar, the user's name "Connor Malbon" is displayed along with "Admin Logout" and a profile icon.

The main content area is divided into several sections:

- MY GOALS:** A dark header with "Edit/Set My Goals" on the right. Below it, a notification states: "My recreational screen time will be less than 4 hours on my weekends for this next month. - I COMPLETED THIS GOAL!"
- YOU HAVE 1 TROPHY:** A section with a trophy icon and the text "YOU HAVE 1 TROPHY" and "Earn more trophies with [Challenges](#)".
- ? QUIZ STATS:** A section with a question mark icon, containing four quiz categories:
 - Physical Activity:** Two sub-items. The first is "Physical Activity and Daily Life" with a score of "B" and a "Retake Quiz" button. The second is "Amount of Physical Activity" with a score of "C A B" and a "Retake Quiz" button.
 - Screen Time:** Two sub-items. The first is "Time in front of the screen" with a score of "C" and a "Retake Quiz" button. The second is "Screen time motivation" with a score of "NA" and a "Retake Quiz" button.
 - Fruits and Vegetables:** Two sub-items. The first is "Fruit and Vegetable Knowledge" with a score of "A" and a "Retake Quiz" button. The second is "Fruit and Vegetable Consumption" with a score of "A" and a "Retake Quiz" button.
 - Sugar Sweetened Beverages:** Two sub-items. The first is "Sugar Knowledge" with a score of "D" and a "Retake Quiz" button. The second is "SSB Consumption" with a score of "B" and a "Retake Quiz" button.

Figure 2. HPSS Dashboard

Self-Assessment Quizzes

The HPSS research team developed eight self-assessment quizzes for participants to take to help them select goals and track their adherence to the key areas of the HPSS program. The quizzes represented the four main goal areas of the HPSS initiative (physical activity, screen time, sugar sweetened beverages, fruits and vegetables) offering two quizzes within each area. Following completion of each quiz, students received a grade (A+, A, B, C, D) and text feedback was presented to the user. For example, after completing the “time in front of screen” quiz the following feedback was given to students:

Your Score: C

You are spending too much time in front of a screen. Research shows that for every hour of screen time you accumulate, you spend 1/3 of an hour less being physically active! Make a goal to trade 30 minutes of screen time for physical activity! Did you know that in 2010, the ‘Active Healthy Kids Canada’ Report Card gave Canadian children and youth an ‘F’ for screen time? Youth are spending too much time in front of the TV and in front of a screen! The report card says that in 2005/2006 youth accumulated more than 6 hours of screen time on weekdays and more than 7 hours per day on weekends. Ideally, we need to spend no more than 2 hours for recreation or entertainment each day in front of screens.

A record of the number of quizzes taken, and the subsequent grade for each student, was stored on the Caorda server. The quizzes are summarized below.

Physical Activity Quiz

Quiz #1 – “Physical Activity and Daily Life” asked students questions about how they moved about their community from place to place in the last seven days with a focus on active transportation (e.g. bike, walk).

Quiz #2 – “Amount of Physical Activity” asked students questions about their physical activity habits and fitness level. This included questions about flexibility, muscular strength and cardiovascular endurance.

Fruits and Vegetables Quiz

Quiz #1 – “Fruit and Vegetable Knowledge” queried students about their understanding regarding the importance of fruits and vegetables to good health. This included questions about nutritional benefits and serving size.

Quiz #2 – “Fruit and Vegetable Consumption” asked students to report the number of fruits and vegetables they were consuming daily.

Sugar Sweetened Beverages Quiz

Quiz #1 – “Sugar Knowledge” asked students questions about their understanding regarding sugar and sugary beverages and their impact on health. This included questions about recommended sugar consumption and nutrition.

Quiz #2 – “Sugar Sweetened Beverages Consumption” posed questions on the type and amount of drinks students consumed throughout an average day.

Screen Time Quiz

Quiz #1 – “Time in Front of the Screen” measured how much time per day that students spend in front of screens. Questions took weekdays and weekends into account.

Quiz #2 – “Screen Time Motivation” assessed reasons why students participated in screen time activities. Potential moderators of screen time (e.g., influence of friends) was addressed.

All quizzes were prefaced with instructions for completing each specific quiz.

The multiple choice or true and false answers had a corresponding algorithm to calculate a five level grading system (A+, A, B, C, D). All users received uniform

general feedback and individual feedback based on the quiz grade if applicable. The two exceptions were the amount of physical activity quiz, which provided three letter grades (one each for flexibility, aerobic activity and muscle strengthening activity) and the screen time motivation quiz, which was not scored or graded and rather served to increase students critical awareness of their screen time habits.

Each student was able to check their self-assessment quiz status by looking in the “quiz stats area” on the dashboard and self-assessment pages respectively, which displayed the grade for each quiz. If a quiz had been completed, the grade was displayed above the quiz name. If the quiz had not been taken, no grade was shown. If the quiz had never been taken and the quiz was active, there was a “Take Quiz” button available to access the quiz for completion. If the quiz was not active, the “Take Quiz” button was grayed out. If the quiz had already been taken, the “Take Quiz” button was replaced with “Retake Quiz.” The Retake Quiz button could be active or inactive depending on when the user last took that specific quiz. The system compared the date that the quiz was last taken to the current date; if that value was more than 30 days, the button became active again and the quiz could be retaken. If the number of days was less than 30, the button was grayed out and inactive. On the self assessment page, each student was able to see the progress of their quiz scores by selecting the “compare to me” tab which tracked the dates and subsequent grades of each quiz taken. This information was also used to compare scores against the school average by selecting the “compare to my school” tab. The HPSS website team was able to manage the quizzes in the school features area of the administration area of the site. This was a default setting created by the HPSS

research team designed to be compatible with the Planning 10 goal setting lesson plan, which had students set goals over the period of one month. Past the 30 day time period, students were then able to re-take the quiz and see if their score improved. Figure 3 depicts a sample self-assessment page.

« Return to Dashboard

View Quizzes Compare to Me Compare to My School

Physical Activity

- B Physical Activity and Daily Life Retake Quiz
- C A B Amount of Physical Activity Retake Quiz

Screen Time

- C Time in front of the screen Retake Quiz
- NA Screen time motivation Retake Quiz

Fruits and Vegetables

- A Fruit and Vegetable Knowledge Retake Quiz
- A Fruit and Vegetable Consumption Retake Quiz

Sugar Sweetened Beverages

- D Sugar Knowledge Retake Quiz
- B SSB Consumption Retake Quiz

Figure 3. Self-Assessment page.

Challenges

Teachers were provided with administrative privileges enabling them to create school (or class) wide challenges either weekly or monthly. Each student had the choice of accepting or declining any existing challenges. If the student selected to partake in the challenge, the HPSS website enabled them to track their progress over the duration of a challenge. Students tracked their adherence to the challenge on a daily basis by selecting one of the following tabs on their challenges webpage: 'I met the challenge! Or I missed the challenge but I'm motivated to achieve it next time.'

The system tracked if a given user met the challenge for that day. If no answer was provided for a given day, the day was considered as missed. The "success rate" metric developed by Caorda represented the percentage of days that a student answered that they met a challenge over the duration of the challenge. The number ranged from 0-100. It was also possible for students to accept more than one challenge at any given time and track both of them simultaneously. Participants had the option to set automated reminders to help achieve their challenge completion on the challenge page. Students could send themselves reminders via email or SMS (text) and select morning (7 a.m.) or evening (6 p.m.) as the time that the reminder was delivered. Similar to the self-assessment quizzes, the challenge results of each user could be compared against school averages.

As well, students had the opportunity to earn 'Trophies' for successfully meeting an accepted challenge. Trophies earned were indicated on the school

dashboard of each user which displayed the total number of trophies earned to date and a graphic of a trophy to accompany it.

Personal Goals

Another element to engage students in the program was the ability to set personal goals and track their subsequent success in meeting them. Goals were set within the four main categories and for each category a selection of predetermined goals were available to choose from. Participants also had the option to create a goal of their own if desired and to share their goals with others. Similar to the self-assessment quizzes, information about current goal information was available on the main dashboard webpage. Website users were able to create a goal on the goal setting page of the HPSS website. The students could select their goal, define the start date (month long) and track performance by answering 'I achieved my goal this week' tab or the 'I missed my goal this week but am motivated to achieve it next week' tab. The system tracked each week the given student met or missed their goal. If no answer was provided for a given week, it was considered as a miss. Once an answer was provided, the participant could not answer again until the next week. The voting buttons were disabled following an answer and a note popped up showing the new date that the users could update their goal tracking. The dates were calculated based on seven-day increments from the start date for the month.

A goal was considered to be successful if the student met their goal for three of the four weeks that the goal was active. Each student that successfully completed their goal received a trophy as a result. Similar to the quiz and challenge results,

goal setting results of each user could be compared to their other goals completed on HPSS and to other users who completed a goal in their respective school. Similar to challenges, participants also had the option to set reminders to aid in reaching their goals. The ability to set reminders was executed the same way as outlined in the challenges section. Another special feature of the goal setting page was the ability of the user to share goals in social media via facebook and twitter. Each time a new goal was created an option to share the goal on social media was available. When the user elected to push updates to the social media site for the first time, a simple process where they provided the HPSS application the right to publish data to their account popped up. As part of the process, the user was redirected to the social media site where they log in and grant this access. The social media site authenticated the users and then responded with a key that was stored in the HPSS application database for the individual user (the token). From then on, updates were posted to the approved social media site using this token value and the sign-in process was not necessary. Figure 4 displays an example of a student dashboard on the goal tab.

Table 2 summarizes of the interactive features on the HPSS website.

« Return to Dashboard

Current Goals Compare Goals Create New Personal Goal

PERSONAL GOALS

My recreational screen time will be less than 4 hours on my weekends for this next month.

I completed this Goal!

I would like automated reminders for this Personal Goal Yes No

I will reduce my recreational screen time by 1 hour each week for this next month.

I completed this Personal Goal.

I missed the Personal Goal but I'm motivated to complete it next time!

I would like automated reminders for this Personal Goal Yes No

Reminder Method Email Text Both

Time of Reminder Morning Evening

Day to be reminded Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Figure 4. Goal setting page.

Table 2. Interactive Features of the HPSS Website.

Student Dashboard	Self- Assessment Quizzes	Goal Setting	Challenges	Reminders	Trophies
Create a profile and upload an avatar	Eight quizzes that upon completion, provide a grade and feedback for improving or maintaining physical activity or healthy eating practices	Select from pre-set goals or create a personalized goal	Accept and track class or school-wide challenges	Track goals and challenges via email or SMS	Rewards for successfully meeting goals or challenges

Administration Role On HPSS

A variety of administration privileges were available on the HPSS website. Only an administrator was able enter or modify user login-in ID (email and password) in the website database. Teachers and action team members were granted some administration privileges in addition to the HPSS research team. Any situation where a student could not remember their password or wanted to change their password required an administrator to make these particular changes. There was a help link on the main landing page of HPSS (info@healthyactiveschools.ca) that could be accessed without needing to successfully log-in. This link automatically redirected to the researcher's email address.

HPSS administrators had the capability to modify the dropdown list of goal options for users by creating, deleting or editing goals. This could have been in response to satisfying a specific school curriculum component or just as an opportunity to give the students different perspectives to choose from.

HPSS administrators were also able to create announcements that would show up on the main dashboard of each user. The intention of setting an announcement was to provide any news or events happening in the school or surrounding community. Only one active announcement was permitted at a time, however new ones could be set-up in advance by date in anticipation of an upcoming event. An announcement could also be modified in the case of wrong information or any other issue.

The last main feature of the HPSS website was the resources page. This area contained links to a variety of websites including the Canada Food Guide and other important health promotion documents. The HPSS administrators were able to access a function that could change or modify links by inputting the website URL and a description of what each site offers.

Collecting HPSS Website Usage Data Through Caorda Web Metrics

Caorda Web Metrics tracked all activity on the HPSS website and summarized the data into nine specific excel spreadsheet reports, described in detail below: class list report, goal summary report, goal detail report, challenge report, social media sharing report, goal setting summary report, student visits report, trophy report and self-assessment report.

The class list report presented all the students registered on the website for a given PE or Planning 10 class, including each student's name, gender, grade, email address, cell phone number and the date of their last log in. The goal summary report listed all aggregate goal information for a specific school. Data including goal category, specific goals, start/end date, total number of days for each specific goal, total number of answers possible for each goal (total days x participating students) and the number of days the goal was met or not met were included in this report.

The goal detail report itemized goals by each specific school. Outputs included the goal category, goal, start/end date, a column for each day of the goal, a sequentially numbered row to represent students, and a cell that indicates yes or no for each day that the goal was available. The challenge report itemized the challenge

information for each school. This information included the specific challenges offered, the start/end date, the number of students accepting or not accepting a challenge and the number of days each challenge was met or not met by the students. The social media sharing report presented goals that were shared by individual students on social media outlets (twitter or facebook). The name of each student who shared a goal via social media was displayed, including their school, grade, gender, the goal category and the start/end date of the goal. The student visits report displayed the frequency of user visits. Every student that has visited the HPSS website was recorded, including their school, the date of log-in and the length of that log-in. The goal setting summary report summarized the goal setting and tracking practices of each student using the HPSS website. Every student that set a goal was listed along with the number of goals set and the number that have a email or text reminder. The trophy report displayed a summary of trophies earned by each HPSS student. Outputs included school, name and the number of trophies earned overall. Finally, the self-assessment scores report summarized the grades achieved by students on the self-assessment quizzes. Any student who completed at least one quiz was recorded, along with the quiz category, quiz name, completion date and grade.

To further understand how each webpage on the HPSS site contributed to the accrument of web metrics, Table 3 describes the metrics collected on each page by Caorda and Google Analytics, describes the function of each page in the study, and the research questions addressed in this study.

Table 3. Summary of the HPSS Website Components, Metrics and their Functions.

HPSS Web Page	Metric (s)	Interpretation	Research Question
Home Landing Page	Number of visitors, number of unique visitors, bounce rate, geographical location of log-in, method of finding the website and type of browser used	The home page described how many visitors accessed the HPSS site (including return visitors), who further explored the site versus users who left immediately (bounce rate), where the user logged in from geographically, what browser was used and the method used to find the website	1 and 3
Student Dashboard/User Profile	None	The student dashboard was essentially the main page of the HPSS where all the tabs to goals, quizzes, resources etc were located and provided a link to the user profile.	1 and 3
Self-Assessment Quizzes	Number of quizzes taken, score on the quizzes taken and the date of each quiz taken	This section was used to take quizzes every month and following trends in progress (via letter grades). Metrics identified how many quizzes each user took and resulting grades.	1 and 3

Table 3 Continued

HPSS Web Page	Metric (s)	Interpretation	Research Question
Goal Setting/ Tracking	Number of goals set and the number/percentage of goals completed	This section was used to set and achieve goals. Metrics included how many goals were set as a school and how many were achieved in total and percentage	1 and 3
School Challenges	Number of challenges accepted and the number of challenges completed	This section was used to follow how many students that accepted and achieved school challenges created by teachers or HPSS administrators	1 and 3
Trophies	Number of trophies obtained	Trophies were given when a user successfully completed a goal or challenge. Web metrics measured how many trophies each student had and identified if it was earned through a goal or a challenge.	1 and 3
Resources	None	The resource page provided links to health promoting websites that related to the main themes of the HPSS study (e.g., Canadian physical activity guidelines to compliment the theme of increasing PA.	None

Summary reports on website usage were generated by Caorda Web Analytics and were cleaned to include only those students who consented to having their online usage tracked for the purposes of this study. Descriptive statistics were generated for goal-setting and goal tracking practices, scores earned on self-assessment quizzes, tracking social media and ‘trophies’ earned for meeting goals and participating in school-wide challenge events. Google Web Analytics were used to determine web traffic measures on the HPSS homepage including the number of visitors, the number of website pages viewed and the average duration website visit. In addition, through Google analytics other interesting metrics were tracked, such as the type of browser used, information about geographical location of each log-in and bounce rate.

SHAPES Questionnaire

To determine if there was any relationship between student exposure to the website and self-reported health outcomes related to the four goal areas of the HPSS intervention, the SHAPES questionnaire (University of Waterloo) was administered to students in a pre-post design. The questionnaire was given to students in September/October 2011 as part of the HPSS protocol to establish baseline data, and again at T2 in June 2012. Students completed the paper and pencil questionnaire during the main HPSS testing session at which time anthropometric measures and The Leger’s 20 meter shuttle run¹ were also completed. This took place in each school’s gymnasium. The SHAPES questionnaire gathered self-report data on height, weight;

¹ Shuttle run data were not used for the purposes of this study as a UBC research team member was responsible for inputting and analyzing these data which were not ready in time to include as part of this thesis.

physical activity levels, types and context including active transport (cycling, walking) to and from school, and students' perceived support from their parents to be active; type and level of sedentary activities; and healthy eating practices including fruit, vegetable, beverage and breakfast consumption. The SHAPES questionnaire has been recognized as having strong validity and acceptable reliability (Biddle, Gorely, Pearson, & Bull, 2011).

Anthropometric Data Collection

In addition to selected questions from the SHAPES questionnaire, body mass index ($\text{height}/\text{weight}^2$) and hip and waist girth circumference provided objective health measures as proxies for student behaviour change. There were two testers – one who served as the primary measurement person, and the second served as the assistant who confirmed each measurement and recorded the numbers. A screen separated the student and the two testers from others present in the room. The measurement protocols are summarized below.

Stretched height (head in Frankfort plane) was recorded to nearest 0.1 cm. The first tester stretched the student's head, the second tester observed the student's heels to ensure they remain grounded and put headpiece in place. The student then ducked their head and walked away. The first tester read measure aloud using whole numbers (132.2 cm, would be "one three two point two"). The second tester repeated this number to measurer to confirm and recorded on the anthropometric form. This process was repeated twice ensuring no difference greater than 0.4 cm. If the difference was greater, repeated measurements were conducted until the difference

was within 0.4 cm. Students' weights were measured in light indoor clothing (e.g., shorts and T-shirt; students are asked to remove sweatshirt, sweat pants if possible). The weight scale was placed on a solid surface (lino, wood or concrete, not carpet). Students stepped on the scale and their weight was recorded to nearest .1 kg. Testers followed established protocol to not announce out loud the weight, but rather used eye contact with each other to confirm the number. Two measures were taken ensuring no difference greater than 0.2 kg. If the difference was greater, repeated measurements were conducted until the difference was within 0.2 kg. Hip and waist girth measurements were conducted over students' light indoor clothing.

Measurements were annotated if the clothing was bulky. Testers were respectful and careful of students' personal space, so that they stood to the right of the student and did not wrap their arms around them. The measurement of the waist was taken at the smallest point; testers palpated the iliac crest if necessary. Students stood with their feet together, arms out of the way. The measurement was taken at the end of a normal exhale, with the tape level. The measurement of the hips was taken at the greatest gluteal protuberance, with students' feet together and the tape level. Testers maintained a constant tension on the tape measure; that is, no indentation of the skin was made. The first tester squatted so that their eyes were at the same level as the tape, while the second tester ensured that the tape was level (always parallel to the floor), correctly placed and not indented. Girths were recorded to nearest 0.1 cm. Two measures (waist 1, hip 1; waist 2, hip 2) were taken ensuring no difference greater

than 0.2 cm. If the difference was greater, repeated measurements were conducted until the difference was within 0.2 cm.

Focus Group Data

Focus groups were conducted in the spring of 2012 during lunch hour of the T2 testing days at School A and B with both planning 10 students ($n = 10$) and teachers ($n = 6$). This provided an opportunity to gather additional in-depth information about experiences with the online tool and as a venue to express their opinions on the resource including strengths and limitations, content and any reasons why the tool was used/not used. The focus groups with the students and teachers were audio-recorded and transcribed into a word document.

The purpose of a focus group is to record information regarding the opinions of a population of interest or homogenous group. It can be an efficient way to understand how individuals feel or think about an issue or product, or for the purpose of this study, gathering information from participants that cannot be directly observed (Cresswell, 2003). Krueger and Casey (2008) refer to focus groups as carefully planned discussions that are designed to obtain perceptions on an identified area of interest in a permissive non-threatening environment where discussions are relaxed and participants enjoy sharing their opinions and ideas. Another advantage of focus groups involve utilizing the researcher(s) as a group moderator. Morgan (1997) states that having primary researchers facilitate the focus group can lead to the production of concentrated amounts of data precisely on the topic of interest. By directly targeting the researchers interests and the relative efficiency of collecting data

compared to participant observation, focus groups have acquired a reputation of being quick and easy.

On the other hand, researchers that take part in the interviewing process may introduce personal bias that may unintentionally skew results. Thus, it is important that a certain rigour of “trustworthiness” is introduced to address the issues of validity and reliability (such as personal bias), two of the foundational principles of carrying out sound and accurate research. Trustworthiness includes four criteria considered essential in a thorough qualitative study: credibility (similar to internal validity), transferability (external validity), dependability (reliability) and confirmability (objectivity) (Guba, 1981). Credibility is one of the key criteria addressed by positivist researchers in which they seek to ensure that their study measures or tests what is actually intended (Shenton, 2004). Merriam (1998) stated that credibility deals with the question of how congruent research findings are to reality. According to Shenton (2004) the issue of dependability relates to the positivist criterion and reliability. Transferability is concerned with the extent of which results of specific studies can be applied to other populations and other settings (Merriam, 1998). Lastly, the concept of confirmability, describes that findings are the result of participant experience and not from the agenda of the researchers (Shenton, 2004).

In this specific study, triangulation will be used to address credibility, dependability and confirmability. In the context of qualitative research, Patton (1999) refers to triangulation as a means to verify findings by utilizing other sources. One type identified by Patton used is multiple analyst triangulation. This method involves

having more than one researcher analyze the data to ensure that information from participants has been interpreted correctly and potentially minimize researcher bias. Establishing confirmability requires the researcher(s) to acknowledge their role in the research and admitting to their own specific predispositions (values, assumptions, expectations) (Miles and Huberman, 1994). This includes being transparent in methods and decisions selected in the research process along with an adequate explanation for utilizing that specific approach. In terms of transferability, a rich and thick description of the study, including the methodological process in explicit detail is vital to include in the written summary. The detail needs to be sufficient enough to reproduce (or adopt specific components of) the study in a similar context (Cresswell, 2003).

Data Analysis

The Wilcoxon signed-rank test was conducted to detect any differences on students' measures of self-reported health behaviours and anthropometric indicators from T1 to T2. The relationship between students' usage of the web tool and self-reported changes in nutrition and physical activity behaviours, and anthropometric measures were examined using nonparametric Spearman rank correlation test. It is important to note that due to the nature of the study, cause and effect cannot be established, however correlations exploring relationships among the variables are suitable statistical analyses. It will be assumed that student self reported data from the questionnaire is accurate. Content and thematic analyses, using SDT as an orientational framework, was conducted with the focus group data. Transcripts were

reviewed and key quotes were colour coded and grouped for interpretation. It was assumed that student responses from focus groups were honest and open.

Chapter 4

Results

This chapter begins with an overview of the schools and students who participated in this study, including a summary of the political climate during the year of HPSS intervention, and the challenges with launching the HPSS website. An overview and discussion of HPSS web use overall, and then consenting students' usage is presented, followed by a summary of SHAPES and anthropometry descriptive statistics at T1 and T2. Results from the Wilcoxon and correlational procedures are then discussed. The chapter concludes with the presentation of focus group findings.

Demographics

The grade 10 populations of school A and school B were 262 and 162 respectively. Out of this number of students, only those enrolled in both PE and Planning 10 were qualified to partake in the study. A total of forty-four students were recruited from school A (N = 26) and school B (N = 18). Out of the 44 website consenting students, 52% (n = 23) were female and 48% (n = 21) were male. In school A 54% (n = 14) were female and 46% (n = 12) were male. While in school B the gender distribution was more even with 50% for each gender with 9 females and 9 males. School A was set in a semi-residential and rural area and school B was set in a rural and residential setting. Table 4 presents selected demographic information for School A and School B.

Table 4. HPSS Intervention School Demographics.

School	Grade 10 Population (number partaking in the HPSS online tool intervention study)	Total Visible Minorities (%)	Aboriginal Grade 10 Population (%)	School District Average Family Income	Prevalence Of Low Income After Tax (%)	Semester Or Linear System	School Setting
A	262 (26)	7.5%	11.1%	\$ 96,013	5.6%	Semester	Semi-Residential/Rural
B	162 (18)	5.0%	20.4%	\$ 80,556	6.0%	Semester	Rural/Residential

The Teachers' Labour Action

Beginning in October of 2011 and through to the end of the 2012 school year, the BC Teachers' Union initiated labour action as part of their negotiations for renewing their contract with the provincial government. This meant that teachers refrained from engaging in administrative duties – such as report cards and communicating with parents – as well as extracurricular activities (coaching etc.) as part of the work-to-rule tactics. Implementation data from the larger HPSS study revealed that this had a negative impact on the extent to which the Action team committee was able to meet and plan school-wide activities and policies. In School B, for instance, the intervention monies were intended to be spent on erecting permanent water filling stations with

an agreement that the school district would match HPSS funds to purchase them for the school. Because of the labour action however, this was never realized. In fact, School B's HPSS intervention money was never spent until toward the end of the school year. More importantly, for this study the teachers' strike prevented instructors from providing the HPSS research team with class lists and email addresses, requiring student log in IDs and passwords to be manually entered and delaying access to the website during the early classes of Planning 10 in the fall of 2011.

HPSS Homepage Web Metrics

Google web analytics summarized website traffic throughout the school year. Overall, the website was usually visited just a single time for only a short duration. Throughout the school year (September 2011 to June 2012) 1,438 users accessed the HPSS website, 855 of which were unique users. A unique user is defined as any user who visits the webpage once. This figure, combined with a bounce rate (number of users who leave after viewing the one page) of 44.78% suggests that a solid portion of website user traffic only visited the webpage once and did not navigate through the site. However, this is not surprising given that the majority of the website was inaccessible without a password and ID. The average time spent per visit was 6 minutes and 23 seconds which suggests that the average user spent time reading the HPSS background information available on this portion of the website. Tables 5 and 6 present web traffic for both first and second semester of the school year, including number of users (including unique), bounce rate, the type of browser used, traffic

source, geographical information, number of pages viewed and duration on the website by visit.

Table 5. Website Metrics from the HPSS Home Landing Page for the First Semester (September 2011-January 2012).

Number Of Unique Visitors	Bounce Rate	Browser	Traffic Source	Geographical Location	Pages Viewed (Average Per Visit)	Average Duration Of Visit
827 (439) Unique Visitors	46.07%	Safari 329 visits (39.78%)	18.38% Search	Canada 793 visits (95.89%)	3123 (3.78 per visit)	00:06:30
53.08% Returning Visitors		Internet Explorer 316 visits (38.21%)	14.63% Referral	Other 34 visits (4.11%)		
46.92% Returning Visitors		Firefox 106 visits (12.82%)	66.99% Direct	Top 5 Regions: Vancouver 331 visits (40.02%) Victoria 235 visits (28.42%) Brentwood Bay 104 visits (12.58%) Nanaimo 59 visits (7.13%) Surrey 45 visits (5.44%)		
		Chrome 53 visits (6.41%)				
		Other 23 visits (1.81%)				

Table 6. Website Metrics from the HPSS Home Landing Page for the Second Semester (February 2011-June 2012).

Number Of Unique Visitors	Bounce Rate	Browser	Traffic Source	Geographical Location	Pages Viewed (Average Per Visit)	Average Duration Of Visit
611 (416)	43.04%	Firefox 214 visits (35.02%)	38.79% Search	Canada 571 (93.45%)	2243 (3.67 per visit)	00:06:14
62.36% Unique Visitors		Safari 178 visits (29.13%)	19.48% Referral	Other 40 (6.55%)		
37.64% Returning Visitors		Internet Explorer 139 visits (22.75%)	41.73% Direct	Top 5 Regions: Brentwood Bay 191 visits (31.26%) Vancouver 171 visits (27.99%) Victoria 80 visits (13.09%) Surrey 50 visits (8.18%) Nanaimo 28 visits (4.58%)		
		Chrome 71 visits (11.62%)				
		Other 9 visits (1.48%)				

Objective HPSS Website Exposure Measures

The amount of student website usage was minimal over the course of the school year. Only 21 HPSS online intervention consenting students logged on to the website at least once and the number that used the website twice or more dropped to 11. Due

to the low numbers of log-ins, a measure was created to utilize additional web metric data to determine the amount of exposure for each student and whether or not each student was below or above the mean exposure. The web exposure variable was created by multiplying each student's number of website log-ins and the cumulative number of minutes spent on the website. The total number of self-assessment quizzes was added to this value to create the web exposure measure. Subsequently, the mean of web exposure scores was used to create a cut point of above or below average use. Similar to the low number of student log-ins and overall web usage, only 12 of the 44 consenting students ranked above the average exposure score. The mean web exposure score was 23.73 with a standard deviation of 46.37. The scores ranged from 0 to 243.

Moreover, 23 of the 44 students did not log-in or take a self-assessment quiz once. The majority of student web activity was condensed to a small frame with only six students logging on to the website in multiple months. This finding gives rise to the problem of insignificant long term website usage since no student accessed the website more than 2 different months out of a possible 10. The web exposure data are presented in Table 7.

Table 7. Consenting Participant Website Exposure for School A and B (N = 44).

Number Of Students	Number Of Times Logged In	Number Of Months Logged In	Total Length Of Log-Ins (min)	Number Of Quizzes Completed	Web Exposure (Line 2 x 4 + 5)	Above/ Below Average
23	0	0	0	0	0	Below
1	1	1	1	0	1	Below
1	1	1	9	1	10	Below
1	1	1	9	2	11	Below
1	1	1	9	4	13	Below
3	1	1	9	8	17	Below
1	1	1	17	4	21	Below
1	1	1	13	8	21	Below
1	1	1	16	8	24	Above
1	2	2	18	0	36	Above
1	2	1	15	6	36	Above
1	2	1	15	8	38	Above
1	2	1	18	4	40	Above
1	2	1	18	8	44	Above
1	2	2	18	9	45	Above
1	2	1	27	5	59	Above
1	2	2	27	8	62	Above
1	3	2	36	8	116	Above
1	3	2	52	17	173	Above
1	5	2	47	8	243	Above

HPSS Self Assessment Quizzes

Goal setting data were captured and stored by Caorda Analytics over the course of the school year and results were displayed on an excel spreadsheet. One hundred and seventeen quizzes were taken during the course of the school year by 19 students. The average scores were moderately successful and varied by the four quiz categories. The quiz scores on sugar sweetened beverage consumption were the most successful

at 4.5 (knowledge) and 4.6 (consumption). Fruit and vegetable intake quiz scores on knowledge and consumption were lower at 3.4 and 3.5 respectively. Physical activity and daily life scored 3.3 with the amount of physical activity quiz (out of 15) scoring 7.3. The quiz on screen time was the lowest at 2.6. Overall, the general trend of scores indicated a strong comprehension of sugar knowledge and consumption, a moderate understanding of fruit and vegetable intake and consumption and poor scores for physical activity and screen time variables. The overindulgence of time in front of a screen and low physical activity levels are of great concern and consistent with present research literature. It was clear that the self-assessment quizzes were the most popular and utilized interactive component of the HPSS website.

Table 8. Scores on Self-Assessment Quizzes for Schools A and B.

Quiz	Number Completed	Mean Score (out of 5)	Minimum Score	Max Score	Standard Deviation
Physical activity and daily life	20	3.3	2	5	0.80
Amount of physical activity	18	7.3*	4	14	2.87
Fruit and vegetable knowledge	19	3.4	2	5	0.83
Fruit and vegetable consumption	16	3.5	1	5	1.41
Sugar knowledge	14	4.5	3	5	0.85
Sugar sweetened beverage consumption	13	4.6	4	5	0.51
Screen time	17	2.6	1	4	0.79

* Amount of physical activity quiz is out of 15

HPSS Goal Setting

Goal setting data were captured and stored by Caorda Analytics over the course of the school year and results were downloaded from the site on an excel spreadsheet. During the year, 39 different goals were set by HPSS students across the 4 different

main health categories. However, results suggested that students were generally unsuccessful in achieving their goals. Overall, the success rate was only 11% during the months that goals were set and tracked by HPSS students. Goals in the “reducing sugar sweetened beverages” category were ultimately the most successful at 15% with screen time, physical activity and fruit and vegetable consumption goals coming in at 12%, 9% and 8% respectively. Only 7 online intervention consenting students set a goal with 12 total goals set between them. The goal reminder function of the website was similarly underused, with only 1 SMS (text) reminder and 2 email reminders created out of the 12 overall goals. No goals set by the students were shared on to the social media platforms of facebook and twitter. Thus, no trophies were subsequently earned as a result. The one encouraging component of the goal setting website function may have been the self-created goal option. Numerous specific goals were created and participated in by the students although it should be noted that the success rate of each goal was similar to self-set goals created by the website developer. Tables 9-12 summarize how many students participated in each specific goal, a description of the goal category and the percentage of weeks that the students successfully reached their goals.

Table 9. Sugar Sweetened Beverage Goals Set (including self- created) and Achieved by HPSS Students.

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Reduce sugar sweetened beverage consumption	I choose to limit drinking sugar sweetened beverages to 3 each week for the next month	10	12.5%
	I will choose to drink water when I am studying rather than an energy or soft drink for the next month	1	0%
	I will choose to have a glass of water over a sugar sweetened beverage each weekday morning for the next month	16	12.5%
	Lower pop consumption	15	25%
	Rather than buying a bottle of water, I will choose to bring a reusable water bottle to school for the next month	4	0%

Table 10. Physical Activity Goals Set (including self-created) and Achieved by HPSS Students.

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Increase physical activity levels	Do 30 minutes of exercise or more 4-5 days a week	15	0%
	Exercise 3+ times a week	15	25%
	Go for runs on weekends. Go swimming after school. Continue with rugby and do not miss practices.	15	0%
	Go for a walk everyday	15	0%
	Add at least 15 minutes of stretching to my physical activity routine each week throughout the next month	12	12.5%
	I will bike or walk to school (active transportation) at least 2 times each week for the rest of the next month	15	25%
	I will do a new type of exercise or physical activity each week for the next month	14	12.5%
	I will get at least 6 hours of sleep every week night	15	0%
	I will go for a 15 minute run at least twice a week	15	0%

Table 10 Continued

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Increase physical activity levels	I will increase my step count by 100 steps each week for the next month (increasing step count by 400 by the end of the month)	4	37.5%
	I will increase the amount of aerobic activity I do to total 60 minutes 5 days of the week for the next month	18	12.5%
	I will increase the amount of muscle strengthening activity I do to a total of 60 minutes 3 days of each week for the next month	1	0%
	I will meet the daily physical activity recommendations each week (at least 150 minutes) for the next month	6	12.5%
	I will run 5 times a week and swim lengths 3 times a week	15	0%
	To work on abs and arms for a total of 2 and 1/2 hours a week	15	0%
	Watch Jersey Shore every Thursday at 7 pm. Then rofl lots about Snooki	15	0%

Table 11. Screen Time Goals Set (including self-created) and Achieved by HPSS

Students.

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Reduce screen time	After school, I will keep my recreational screen time down to 2 hours or less for 3 days each week for this next month	8	0%
	For each hour (60 minutes) that I am in front of my computer screen or TV on weekends, I will get up and move around for 5 minutes for the next month	38	12.5%
	For the next month, I will choose to help cook/prepare one meal for my family instead of spending time on the computer each week this month	14	12.5%
	I will choose to be physically active instead of doing my usual recreational screen time activity at least once each week for the next month	27	25%
	I will participate in a social activity with my friends outdoors instead in front of the TV or computer once each week for the next month	14	12.5%
	I will reduce my recreational screen time by 1 hour each week for this next month	24	12.5%

Table 11 Continued

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Reduce screen time	I will reduce my screen time to one hour a day	15	0%
	My recreational screen time will be less than 4 hours on my weekends for this next month	12	12.5%
	Reduce social media, read instead for 20 minutes a night, spend time with family for at least an hour. Look through homework and complete it. DON'T SPEND ALL YOUR TIME ON ALL ELECTRONICS	15	0%

Table 12. Fruit and Vegetable Goals Set (including self-created) and Achieved by HPSS

Students.

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Increase fruit and vegetable consumption	Add at least one serving of fruit in every meal	15	25%
	Have two pieces of fruit a day	15	0%
	I will consume a fruit smoothie at least 3 days a week for the next month	15	0%
	I will eat 1 more serving of fruit or vegetable than I normally eat on each weekend day (Saturday and Sunday) for the next month	16	12.5%
	I will eat 1 serving of vegetables cooked or prepared in a new way once a week for the next month	1	0%
	I will eat more than my recommended amount of daily fruits and vegetables each week (at least a total of 8 servings each day for girls, at least a total of 9 servings each day for boys) for the next month	1	0%
	I will eat my recommended amount of daily fruits and vegetables each week (a total of 7 servings each day for girls, and total of 8 servings each day for boys) for the next month	9	0%

Table 12 Continued

Category	Goal Category	Number Of Participating Students	Percentage Achieved
Increase fruit and vegetable consumption	I will replace my usual junk food snack with at least 1 piece of fruit at least once a week for the next month	1	0%
	I will try 1 new fruit or vegetable at least each week for this month	5	25%

Challenges

There was just one challenge created during the HPSS intervention by School A. The challenge was to drink less than two energy drinks per week over a two week time period. Thirty-five students accepted to participate in this challenge, however, web metrics indicated that none were successful in achieving this goal.

Self-Reported SHAPES Questionnaire Results

Fifty-two percent of HPSS students met the Canadian physical activity guidelines at T1 compared to only 30% at T2. The new guidelines state that children and youth should have at least 60 minutes of moderate to vigorous physical activity daily (Tremblay et al., 2011a). The physical activity data were further calculated to reflect the amount of moderate to vigorous physical activity (MVPA) the students accumulated on average per day. At T1 students averaged over 159 minutes but only 108.70 at T2; this was a significant decline ($Z = -3.511, p < .000$). When comparing MVPA averages during the week and on the weekend, students engaged in

significantly ($Z = -4.499, p < .000$) higher amounts of activity during the week at T1 (167.80 compared to 142.29) but this was reversed at T2 with 130.88 minutes of MVPA on the weekend compared to 104.81 at T1. This undoubtedly reflected the scheduling of PE 10 during the first semester which students attend daily over the course of five months (September through to January), and then not at all during the second semester. Overall physical activity results suggest that the amount of MVPA was considerably lower at T2 despite students having access to the online tool as part of the Planning 10 curricula. Their tendency to be more active on the weekends at T2, however, may be an expression of goal setting activities during the second semester when attending Planning 10 (as presented in Table 13).

The amount of mean sedentary activity per day (measured in hours) dropped from 8.36 at T1 to 7.79 at T2, although this was not a significant decline. Despite the small improvement post intervention, results were still far from the recommended two hours of daily recreational screen time that the revised 2011 Canadian sedentary guidelines for youth and children recommend (Tremblay et al., 2011b). At T1 only 5.1% students met these guidelines, while T2 results slightly improved at 9.7%, which is an encouraging although non-significant rise ($Z = -1.633, p = .102$). The different mediums of sedentary behaviour (e.g., TV) are compared from T1 to T2 in Table 5 and most displayed slight improvements, but none were significantly changed. Mean sugar sweetened beverage consumption (SSB) showed a slight, albeit non-significant improvement dropping from 2.97 at T1 to 2.39 at T2 ($Z = -1.305, p = .192$). However, the amount of fruit and vegetable intake (including fruit juice) declined from 4.03 to

3.78 at T1 and T2 respectively. Both values are well below the recommended 7-8 servings that the Canadian food guide recommends for teenagers aged 14-18 (Health Canada, 2012). Overall findings demonstrate inconsistent scores from T1 to T2. There was very little improvement in any of the behaviours and a number of the self-reported measures show unhealthier behaviour practices at T2 than T1 despite being exposed to the HPSS online intervention tool. SHAPES questionnaire results are presented in Table 13. To answer the third research question exploring any relationship between students' use of the HPSS online tool and self-reported and objectively measured behaviour change, bivariate correlations using spearman's Rho were performed. There were no significant differences found between students' web exposure and their intake of fruits and vegetables, sugar sweetened beverages or measures of sedentary practices. There was a negative association between students' minutes of weekday MVPA and web use that approached significance ($r^2(59) = -.232$, $p = .072$). Finally, there was a significant positive correlation found between students' WHR (but not BMI) at T2 and their web scores ($r^2(59) = .260$, $p < .05$).

Table 13. Students' Self-Reported Health Practices at T1 and T2.

	T1	T2
Percentage Meeting MVPA Guidelines	52.00	30.00
MVPA average minutes/day	159.37	108.70
MVPA average minutes/weekday	167.80	104.81
MVPA average minutes/weekend	142.29	130.88
Percentage Meeting Sedentary Guidelines	5.10	9.70
Sedentary activity average hours/day	8.36	7.79
TV average hours/day	2.47	2.27
Video Games average hours/day	0.57	0.63
Computer average hours/day	0.65	0.56
Talking On Phone average hours/day	0.65	0.46
Internet average hours/day	2.24	2.14
Texting average hours/day	1.78	1.74
SSB consumption/day	2.97	2.39
Fruit & Vegetable servings/day	4.03	3.78

Anthropometric Measurements

Anthropometric results demonstrated that BMI rose for both male and female students at T2. Mean BMI for females increased from 22.3 to 22.9 and from 21.8 to 22.1 for males. All four BMI scores were approximately around the 75th percentile according to the Centers for Disease Control and Prevention (2012) BMI growth chart for youth aged 15 and 16. The 75th percentile is in the upper range of the healthy

weight category. Katzmarzyk et al. (2004) found that the threshold for cardiovascular disease risk factors started at a BMI of 22.1 for both male and females aged 16. This value places the average male and female at the beginning of the threshold for cardiovascular health risks. Waist circumference data saw similar trends to BMI. The mean for females increased from 71.0cm to 71.7cm, and the male mean increased from 74.5cm to 75.0cm. The female mean was between the 25th and 50th percentile while the male mean was approximately around the 50th percentile (Cook, Auinger, & Huang, 2009). Both percentiles fell well within the normal values of the growth curve for health risk according to the latter researchers. Katzmarzyk and colleagues (2004) determined that the cardiovascular disease threshold for waist circumference is 71.3 in females and 79.0 in males. In this study, the average female score places them at the beginning of the cardiovascular risk threshold while the male mean was well below. Waist hip ratio displayed a slightly different trend than BMI and WC. The female mean score was identical at T1 and T2 (0.75) while the male mean score increased slightly from 0.79 to 0.80. Overall results illustrated that there was little or no change between any of the three anthropometric measures between T1 and T2. Table 14 summarizes the anthropometric results.

Table 14. Mean Anthropometric Participant Characteristics from T1 and T2.

Gender	Mean Waist		Mean Waist Hip		Mean Body Mass	
	Circumference		Ratio (WHR)		Index (BMI)	
	(WC)					
	T1	T2	T1	T2	T1	T2
Females Participants	71.0	71.7	0.75	0.75	22.3	22.9
Male Participants	74.5	75.0	0.80	0.79	21.8	22.1

*15 students did not have full anthropometric data to calculate WC WHR or BMI.

Focus Group Findings

Focus groups were conducted at lunch time during T2 measurements in the two schools. A total of ten students (n = 10) and six teachers (n = 6) were interviewed to obtain subjective feedback including opinions and reflections about the website. Some students appreciated the reminders function that the website offered to keep them accountable and maintaining their motivation to utilize the website. Students stated that “the reminders really helped” and “if you are reminded it makes you not forget about it; if you are reminded constantly like it’s nice, cause like you are reminded to do it, then it makes you want to do it, you have more motivation for it.” According to self-determination theory (SDT), intrinsic motivation is required to stimulate and maintain behaviour change. By providing the option of reminders, one of the three markers of SDT (autonomy) was satisfied and increased the likelihood of students

adhering to behaviour change. The students were subsequently asked about anything that could improve their experience and further support reaching their health goals through the use of the website. Two students suggested including games as an interactive component that would make the site more interesting and appealing perhaps because of their familiarity with and experience using video games that may also drive students to the website as a form of extrinsic motivation. Another student suggested having more information about nutrition regarding specific foods and a list of muscle strengthening exercises that students could use to tailor their own workouts; aspects that would have enhanced students' competence for changing their eating or physical activity practices and satisfy the self-determination theory marker of self-efficacy to further facilitate behaviour change.

Not surprisingly, students cited the teachers' labour action (strike) during fall 2011 as a significant issue for the implementation of the HPSS intervention overall, including limiting their use of the website. One student explained that the it "would have been better if the teachers strike wasn't happening" as it detracted considerably from the implementation of the HPSS components, particularly in School B. Another student similarly mentioned that teachers had told the students that "the strike wasn't going to affect us but that's exactly the opposite of what's happening."

The teachers were also asked about their experiences with the website, including integrating the use of the website in the Planning 10 curriculum and the results were mixed. One teacher stated that the website was "good" but then described the challenges of accessing the computer lab, "We only have three labs and

it's just impossible to get in there." Teachers also expressed that completing assignments online only took about 15-20 minutes to complete and this made it difficult to logistically plan their classes. Such feedback suggests that student web use and exposure may have been influenced by the amount of access students had to their school computer rooms. Overall teachers' feedback revealed that the website was not a successful pedagogical tool as implemented during the 2011-2012 school experience. Noted one teacher in particular,

The website was not a very successful experience for these kids. Keep in mind that these kids are at an age and generation that they are technology savvy and faced with a statically dynamic website, they lose interest. First, it was not developed on time and it was developed with some glitches and these are all the little things that turn off this type of students away from even getting into it cause they have the first impression that this website is not good for me.

Teachers went on to comment that the website design lacked in sufficient interactive components that would maintain the interest of the students, and that students became bored with the functionality of the website. According to one teacher, "I think they mostly got bored with having to track stuff. I think that is what got mostly frustrating. They want the information they want to do an assignment on it, but they don't want to actually track stuff." Indeed, the web metrics supported this sentiment, suggesting that students lost interest in having to continually track their progress on the website. It seems that students lacked the intrinsic motivation to

change health practices on their own – as evidenced by the SHAPES data – and the website did not function sufficiently to externally motivate their efforts, despite the appreciation of reminders.

The reality that the website was constructed and launched behind schedule, combined with the numerous glitches and technical issues that plagued the first few months, including the delay in importing students' email addresses associated with teachers' administrative labour action, undoubtedly contributed to the low website used experienced in this study. Teachers' labour action hampered the overall implementation of school-wide activities and administration aspects of the HPSS intervention, affecting teachers' own motivation to learn how to use the website, find time in the curriculum to book a computer lab and introduce it to students:

“Teachers feel inundated anyways with our normal tasks that we have to do each day. Right now we are all feeling a little overworked so adding more to it was difficult. Had this been in a different year maybe the staff would have been into all the extras. I mean you kind of lose your motivation because there's nothing we can do until the district starts moving on it [strike], so we sort of feel like our hands are tied and then you're not as motivated.”

Summary

The findings from the web metrics, self-reported behaviours of students, anthropometric data and focus groups consistently point to the inadequacy of the HPSS web tool in motivating students' behaviour change. However, the context within which the website was delivered underlines the importance of a supportive school

and political environment in contributing to the use of the website. These findings are discussed in light of others' experience with web based interventions in the following chapter, as well as recommendations for future research.

Chapter 5

Discussion

The findings of this study suggest that students in the HPSS schools underutilized the intervention website and no statistically significant changes in both objective and self-reported health behaviours were found. These results confirm others' experiences in the literature, including Bennett and Glasgow (2009) who suggest that although the potential of internet based health intervention dissemination is substantial, the existing (and limited) evidence based research has shown low reach and website utilization. Similarly, Crutzen et al. (2011) note that "exposure to interventions is low, especially when they are implemented in real life ... true exposure, that is, accessing the intervention website and actually using it, is necessary for an intervention to induce behavior changes" (pp. 49-50).

Even with its interactive features and functions (self assessment quizzes, tailored feedback, goal setting and tracking) and theoretically grounded design, which were both recommended in the literature as strategies to induce higher exposure, retention (Crutzen et al., 2011), and success (Pratt et al., 2012; Winett et al., 2011), and that it was designed specifically for grade 10 students (Thompson, Cullen, Boushey, & Konzelmann, 2012), the HPSS website was under used. Indeed, no student took advantage of the social media sharing feature, and none earned trophies. It may be that the content of the site needed to more fully address the barriers and facilitators to behaviour change for youth in order to be perceived as relevant and meaningful (Thompson et al., 2012). Even with glowing sanctions in the literature

about the promise of web and technology-based healthy living interventions (Hamels, Robbins, & Wilbur, 2010; Haerens et al., 2007; Wantland et al., 2004) “they certainly need additional insight and improvement” (Pratt et al., 2012, p. 291). The experience from the HPSS study suggests that website interventions delivered in a school context may be reliant on the capacity of teachers and school administration to adequately educate, motivate and support students accessing the website. Future research may need to provide solutions to the common barriers that limit website exposure. For example, the lack of computer room access during the school year was mentioned in the focus groups as a barrier to website exposure. This alone may have contributed to the under utilization of the website resource by students.

Despite the disappointing results demonstrating the advantage of using the HPSS website as a behaviour change tool, the study contributes to the literature in terms of its use of and reporting on multiple measures of objective web exposure metrics and both self-reported and objective measures of health-related outcomes. In doing so, the results add to our understanding of Type 3 evidence and the need to tend to the context of implementation in order to improve the delivery of such interventions (Pratt et al., 2012). Notably in the HPSS study, the BC teacher political and labour negotiations process defined a large part of the context in which implementation of the initiative occurred. In September 2011 (which was also the first month that the HPSS website was introduced to the intervention schools), the B.C. teachers began “limited job action” which involved teacher non-compliance towards administrative duties, preparing reports cards, supervising playground

activities and coaching or facilitating extra curricular activities after school. This may have contributed to the discouraging study results since the implementation of the HPSS website was largely based on the teachers' ability to incorporate the website into the Planning 10 curriculum and encouraging students to utilize the site on their own time. Observing the utility and effectiveness of the HPSS online intervention in a school environment context may have also led to less than desirable results. There is a common notion that the school setting can exert a powerful influence on shaping youth health behaviours, however the reduced role of physical education and health curriculum may limit the effectiveness of interventions conducted in this environment (Rowland, 2012).

Website Exposure Of Users

The first research question addressed the students' use of the HPSS website, specifically, "how often did the student users access the site" and "how long did they stay per visit." Through the utilization of Google and Caorda web metrics, this information was accrued and analyzed. The findings suggest that only a small percentage of the users that accessed the HPSS online resource received adequate exposure to the website as a whole and its interactive components. Current research has shown similar trends to the study results. Crutzen, de Nooijer, Brouwer, Oenema, Brug, and de Vries (2008) stated that in practice, many online intervention studies promoting changes in health behaviour have demonstrated low levels of exposure by users and the HPSS results followed this trend. Crutzen and colleagues identified multiple visits to an intervention as a key component to increasing exposure and

having an attractive home landing page is considered critical.

The low student use of the HPSS website may have been a reflection of the interactive material that the website offered. Danaher and Seeley (2009) state that research has suggested that engagement with a resource decreased as program requirements for the participants increased. That is, as more was asked of the user (e.g., setting and tracking goals) in an intervention, the chance of attrition and decreasing adherence became more prominent. This may have been the case in the HPSS website study despite teachers suggesting that students seek high interactivity from their online experiences, setting and tracking goals failed to captivate their interests. Adding a gaming component may address this flaw (Primack et al., 2012), but care needs to be taken so that such online engagement does not counter the purpose of motivating students to manage their screen time. Furthermore, offering many functions in an online intervention may trigger usability issues for the participants accessing the material. Early in its development and prior to the intervention year, a beta version of the HPSS website was tested with a class of grade 10 students at School B (N = 16). In pairs, students were asked to review the site and provide written feedback about the look, language, features and function of the site. All students commented positively on the organization of the site, its interactive quizzes and their ability to navigate through the site. Yet, the promise of the site's use as indicated by the beta testing group failed to be realized during the implementation year. According to Ahern (2007), one of the advantages of web interventions is their twenty-four hour, seven day access and the ability to be used from any 'wired' setting,

placing a great deal of control in the hands of the users “that in turn can be very empowering, and that may become an important aspect of interventions designed to enhance self-efficacy and self management, among other objectives” (p. S80).

However, he further notes that the cultural, literacy and learning styles of users must be reflected in the online intervention. It will be important in future website development to engage youth earlier in the design phases and usability testing to identify the optimal balance of interactivity, and to test for learning suitability (Glasgow, 2007).

During the intervention year, the HPSS research team further attempted to increase website comprehension by offering support through email and presentations to each intervention school throughout the year. However an attempt to reach all participants in a one on one setting in the study proved difficult due to accessibility issues of scheduling and competing priorities in the classroom. A reliance on the school teachers to introduce the website to students in sufficient detail, may have been ill guided. Another reason for the low website use may simply have been that participating students were not interested in health behaviour change. In future studies, the motivational levels of participants and their willingness to improve the health behaviour(s) that the intervention targets may be a necessary prerequisite when observing the effectiveness of online health interventions (Verheijden, Jans, Hildebrandt, & Hopman-Rock, 2007). While the goal areas of the HPSS intervention aligned with provincial learning outcomes for PE and Planning 10, and certainly address health issues prevalent in the literature, students were not engaged in

selecting them. Further research is necessary to determine how internet centered interventions can encourage greater participant engagement, notably through involving youth earlier in the intervention design.

The interactive components of the HPSS website proved to have little allure. Other than the moderately used self-assessment quizzes, goal setting, challenges and reminders were rarely utilized by students to shape their health behaviours over the course of the year. Further, trophies could be earned by successfully adhering to goal setting or challenges over a given time period, yet over the course of the intervention not a single trophy was earned. According to Kavanagh, Oakley, Harden, Trouton, and Powell (2011), a systematic review observing the effect of incentive schemes in changing youth behaviour found no impact in educational studies that used incentives. Kavanagh and colleagues suggest that while incentives can be successful in certain single non complex behaviour contexts, the long term behaviour changes relating to attendance and effort on school work in an educational setting may need more complex multi-component incentive schemes that provide students with increased support to elicit desired behaviour outcomes. The recent call for incentivizing behaviour change among adults (Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011; Volpp, Asch, Glavin, & Loewenstein, 2012), may simply be irrelevant to youth. Future incentive driven research needs to eliminate the focus on short-term and one dimensional strategies and develop multi-component comprehensive strategies that continuously address individual motivation and are adaptive to the dynamically and constantly changing nature of long term interventions.

The low amount of website use found in this study was supported by Crutzen et al. (2011). In their meta-analysis observing the different strategies incorporated to increase website exposure, frequently used components (e.g., discussion boards, ask the expert) were moderately or even seldom used by adolescents even though they are encouraged by experts. Future research should describe the strategies used to increase attention to the intervention and how to make using and revisiting the website attractive to participants, including determining an appropriate blend of interactive website components. Danaher, Boles, Akers, Gordon, and Severson (2006) echo this view by stating that challenging (and potentially fruitful) future research lies in determining the ideal mix of program ingredients that provides sufficient exposure to the intervention while simultaneously encouraging long term participation and engagement. Again, this speaks to the importance of engaging youth as web designers early and often throughout an intervention.

One interactive component that seems to be returning favourable results in the literature and has high future potential is the use of texting messaging to deliver health information. In the HPSS study, students had the option of using text messaging to deliver reminders but further research needs to explore using text as a tool for delivering detailed information. Cole-Lewis and Kershaw (2010) state that text messaging should not be applied as a stand alone strategy for promoting health behaviour but instead as a strategic resource by which behaviour change interventions can be administered. There is growing evidence that text messages can be an effective medium for enhancing clinical results and behaviour modifications.

The relatively low cost and high dissemination potential of text messaging appears promising for future health initiatives (Wei, Hollin, & Kachnowski, 2011). These successes in the literature are based on short term and non complex health behaviours however, and more research is needed to observe the effectiveness of text messaging as a strategy in complex behaviour change. Evidence from the website metrics in this study determined that only a small population of students utilized text messaging to deliver health behaviour reminders. Perhaps if tailored and informative health behaviour messages were also available via text, student usage patterns could have been higher. The single function of the text as a reminder tool may not have been sufficient in supporting student health behaviour change. Instead of just reminding students about completing goal setting or other tasks, additional information that offers strategy or support mechanisms may not only increase the effectiveness of the intervention but also create a larger percentage of students that are consistently using text messaging as a tool to shape their health behaviours. In the future, web-based health intervention studies need to determine the utility of text messaging as a health promoting resource across a range of outcomes due to the large dissemination and potential to enhance intervention effectiveness.

Another interactive component that deserves further observation is the use of video games to elicit behaviour change in online health interventions. A literature review discussing the utility of 25 video games that focused on promoting health-related behaviour was observed by Baranowski, Buday, Thompson, and Baranowski (2008). Results demonstrated that most of these games led to health related changes,

including increased knowledge and improvements in attitude. The authors note that two strategies were associated with the most success. Behaviour was positively influenced by integrating goal setting practices into the video game or through the use of story telling and blending behavioural concepts into the story. Findings suggest that more intensive analysis is warranted, including the application of video games in different health contexts and environments. Incorporating interactive games in the HPSS website design may have led to increased web utilization results and is a promising resource that should be included in future research, especially given the prevalence of adolescents and young adults that play video games on a regular basis.

Consistent with the recommendations by Crutzen et al. (2011) to employ multi-web measures, both Google and Caorda web analytics were used to determine website exposure. It is clear that no gold standard exists for measuring and capturing web exposure of an intervention. In fact, if this study had relied solely on Google analytics to interpret web exposure, it would have overestimated actual student use. However, Danaher, Boles, Akers, Gordon, and Severson (2006) warn that there is a risk of accruing so much web metric data that the ability to analyze and interpret findings can become paralyzing. Theory driven and pragmatically oriented studies can overcome this challenge. Certainly, objectively measuring web metrics reflects the nature of content viewed, and theoretically informed content can be expected to elicit changes in health behaviour outcomes. Web metrics can further inform process evaluations and whether program structure or content needs to be tailored to meet individual differences in learner needs, interests and learning styles and can

ultimately measure how each website component or feature contributed to study findings (Danaher, Boles, Akers, Gordon, & Severson, 2006).

Students' Health Behaviours

The student health behaviour results documented through the SHAPES questionnaire is disappointing, but consistent with the physical activity and sedentary levels of Canadian children and youth (Active Healthy Kids Canada, 2012). The recently released 2012 report card gave an “F” grade for both physical activity levels and screen based sedentary behaviours. We know information from the 2007-2009 Canadian Health Measures surveys found that only 7% of youth are meeting the new physical activity guidelines of at least one hour of moderate to vigorous physical activity every day of the week. Recent statistics of sedentary behaviour is similarly worrisome with the average Canadian teenager averaging 7 hours and 48 minutes of time related to screen time pursuits. HPSS students reported similar results with approximately 8 hours of daily screen time reported in the SHAPES questionnaire at both T1 and T2 testing and only 30% of students meeting the new physical activity guidelines at T2.

Even though the HPSS website had hyperlinks to information that provided students with resources (e.g., sedentary guidelines for youth and the Canadian food guide), their self-reported health behaviours at T2 suggest that this information was inadequate to elicit complex behaviour change. Future website based interventions in the school context may need to include tailored strategies and personalized interventions to overcome potential barriers that may limit behaviour change. Passive

health education in the form of stand alone text cannot be expected to provide students with an adequate knowledge and critical thinking base required to cope with the complex phenomena of behaviour change adherence (Active Healthy Kids Canada, 2012). Ideally, access to credible, trustworthy and understandable information is part of a layered and multi prong strategy such as whole school approaches.

Implications for Future Research

It is evident that more in-depth knowledge may be required to understand the reach and dissemination of internet interventions. According to Bennett and Glasgow (2009), one critical component may be identifying and characterizing the representativeness of study samples. Research should report the size of the target population, the population exposed to the recruitment process, the number of individuals who are eligible to partake, and the number that actually do. This may be particularly important since many of the existing online intervention studies conducted (this one included) use small and select participant samples.

Bennett and Glasgow (2009) also argue for the standardization of web metric measures. To date there is no standardized method of collecting web usage information, which can potentially lead to variation and heterogeneity in the web metric tools used to track website traffic. Therefore, website utilization rates in individual studies can not be directly compared and thus limit the capacity to generalize findings. Since research based evidence suggests that participant website utilization can predict favourable outcomes over a wide range of conditions, a uniform standardized methodology can increase comparability across the research field when

reporting individual and aggregate web site use. Bennett and Glasgow ultimately determined that developing a consensus regarding the analysis of web usage is an important evolutionary step towards understanding how website use shapes intervention outcomes. The analytic products offered by Google (used for the HPSS study), Yahoo and Microsoft are sophisticated, free and widely used but each offer different web metric reports. A fruitful future research area may be the development of standardized analytic software products that can be applied over a variety of health outcomes and study designs.

Website exposure has been identified as a critical measure for determining the success of an online website intervention. However, Danaher, Boles, Akers, Gordon, and Severson (2006) view exposure as just one of many complementary measures that determines the broader context of website engagement. In the future additional measures including participant comprehension, participant self-efficacy and practice of the content (outside of just website interaction) offer important perspectives to fully understand how effective a website intervention is as a whole. In this study, the self-reported SHAPES questionnaire, anthropometric measures and focus group content contributed to assessing the utility of the HPSS website in facilitating behaviour change, in addition to multiple web metrics.

Another future endeavour that may help advance the field of study is developing and applying theories to increasing website exposure. According to Crutzen et al. (2011) many studies use theory to guide interventions, however, these theories were limited to behaviour change theories (including the use of self-determination theory

in this study) rather than a framework designed for internet delivered interventions.

Ritterband, Thorndike, Cox, Kovatchev, and Gonder-Frederick (2009) offer such a model that considers the integration of the web context (e.g., features, functions, delivery mechanisms etc.) with traditional health concepts (e.g. , knowledge, attitudes, motivation) to influence behaviour change. This model is depicted in Figure 5, and the HPSS website is considered with regards to the model.

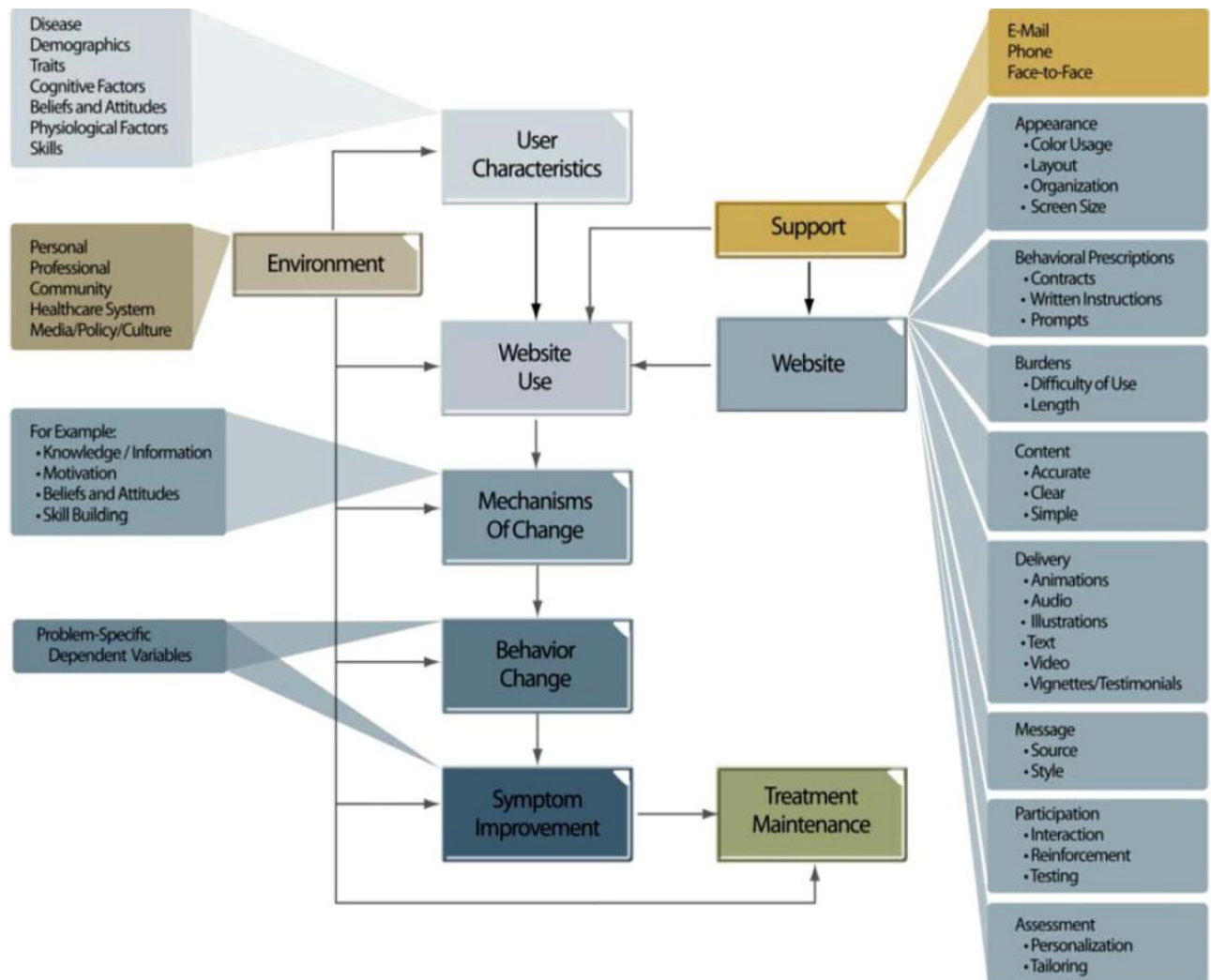


Figure 5. Ritterband's (2009) Online Health Behaviour Model.

If we interpret the HPSS web experience through the Ritterband et al. (2009) model, we find several areas for improvement. The components of the model are summarized here in terms of the HPSS experience, and are indicated on the model itself. *User characteristics* – male and female students with an average age of 15.5 years attending PE 10 and Planning 10. The 'disease' of concern is prevention of cancer and other chronic conditions through four primary lifestyle practices:

increasing physical activity and decreasing sedentary screen based activities, increasing consumption of fruit and vegetables, and decreasing intake of sugar sweetened beverages. HPSS did not assess other user characteristics such as personality traits and cognitive factors. The *environment* for the delivery of HPSS was the school environment and classroom, integrated as part of the Planning 10 curriculum. The *mechanisms of change* included supporting students' increased knowledge, motivation, skills and attitudes through classroom learnings, and their school wide activities by participating in challenges and offering supportive physical and social environments. The website represented one aspect of intervention delivery, but aspects of its *appearance, behavioural prescriptions, burdens, content, delivery, message, user engagement* and *assessment* are clearly relevant. Although the dashboard and school site pages were amenable to colour, uploading pictures etc., little tailoring by the Action Teams and students was done. Behavioural prescriptions in HPSS emphasized choice of goals rather than directing student learning. However, prompts in the form of text or email reminders were available for students to access. Burdens refer to intervention content rather than barriers to accessing the site; in terms of the HPSS experience, the primary burden to engaging students in the content was perhaps the content itself which may have not been interesting to students to drive them to the site. Despite the content related to the four goals of HPSS being accurate, up to date and credible, teachers did note in other schools' focus groups that "students have learned about health behaviours before and are bored by it." It is in the delivery component of the HPSS website that may account for its lack of appeal.

There were no animations, audio, video, vignettes, or additional graphics even though the Action Team and teachers had administrative privileges to upload pictures and youtube videos. It is unknown how well students accepted the message sources – the University of Victoria HPSS research team and the Canadian Cancer Society – but even if both were well received, the style of the message may have not grasped their attention. Engaging students earlier in the design and style seems warranted.

The use of the elements such the self assessment quizzes, goal setting and tracking, providing tailored feedback and offering rewards (trophy) are seen as important mechanisms for inviting participation by Ritterband and colleagues, yet proved ineffective for the HPSS experience. Support for using the website was provided through orientations to teachers and students, and through the use of the HPSS help email. Yet, no behaviour change resulted. “Determining which characteristics, variables and elements are necessary or even ideal for the success of different treatment programs is an important endeavor; and one in which the research has only just begun” (Ritterband et al., 2009, p. 22).

Crutzen and his colleagues (2011) determined that there were no studies in their meta-analysis on strategies to increase web exposure that focused on exposure solely. This may be a fruitful area for future study, especially if standardized methodology and strategies to increase web-based exposure can be determined. Although this may be challenging since it is unclear whether certain methodology, strategies and theories that work on one type of intervention may work for others in different health contexts. Further research should focus on conducting randomized

controlled trial studies that contain both intervention and control groups. The lack of a control group in this study limits the strength of the study findings. Future studies may also benefit by recruiting larger and more diverse participants. The HPSS study sample size was relatively small ($N = 44$) and featured predominantly rural and semi-residential students that were middle class and Caucasian. The low demographic diversity limits the external validity of the study findings. Finding diverse populations to study may be more feasible in community and recreational based research instead of focusing on a school context.

As well, online intervention studies in future research should focus on isolating resources, strategies and incentives that increase engagement to the website. The present literature has still not identified a standardized methodology and research designs that maximize student participation and limit attrition rates. Finding a “gold standard” for both web exposure metrics and website component design remains a challenge and is critical in advancing the field of online health behaviour intervention research. The lack of homogenous research methodology has limited the capacity to compare existing literature and determine any “best practices.” Finally, any research that is conducted in a school setting context needs to also identify barriers that may impede implementation of the intervention in the classroom. A continuous and frequent rapport with the teacher(s) might be a prerequisite to ensure successful results in this setting.

Limitations

There are a few limitations of note for this particular research study that may need to be addressed in future research endeavours. The SHAPES questionnaire consisted of self-reported data, so there was potential for social desirability and recall bias. Further, only some of the web use data could be identified with each individual student; Caorda analytics were not structured to link the goal setting data to each student limiting the interpretation of some of the web findings. As well, because focus groups asked about the HPSS intervention overall, and did not solely focus on the website, there was limited time to fully explore student and teacher experiences within this aspect of the intervention. The Google web metrics used to generate statistics for this study was limited to the homepage only. Gathering future web metrics that represents the entire site may aid in determining correlation between specific website use and behaviour change.

The community-based nature of this study demanded that schools and consenting participants were self-selected, which eliminated the possibility of employing an experimental research design. Imputing student log-in data into the website database was done manually, and was time sensitive, delaying access for students which may have led to lower utilization rates. Even though the HPSS website intervention study launched in September, some students did not have proper log-in credentials until October which may have lost potential website users. The website was also full of technical glitches during the first few months of the intervention, which may have further led to decreased use of the website. This included the

teachers action job strike in the fall of 2011, which likely affected the administration of the HPSS website in the school and classroom context. Finally, the schools sampled in this study were from rural and semi-residential areas in the Greater Victoria area of British Columbia, which limited the external validity and generalizability of the findings to other regions and populations. The small sample size and lack of control groups further contributed to the generalizability of the research.

Summary

The purpose of this study was to determine the utility of an online intervention tool grounded in self-determination theory and as part of a health education curriculum, to motivate and support grade 10 students to make healthy decisions related to physical activity, screen time, fruit and vegetable consumption and intake of sugar sweetened beverages. The research objectives in this study were threefold: how, and to what extent did the students use the intervention, understanding, student experiences with the website including function and content, and determining if there was any correlational relationships between website use and self-reported and objectively measured health behaviour changes. Despite the encouraging literature of youth centered online health behaviour change interventions, student website use was sporadic with over half not accessing the HPSS website at all. Focus group findings revealed that while students appreciated the interactive website components, there was no “hook” that led to long term web site use. According to teachers, integrating the website intervention into the Planning 10 curriculum was not as seamless as the HPSS architects had hoped. There were no statistically significant

relationships found between web use, objective anthropometric measurements and self reported SHAPES questionnaire findings.

Despite a lack of positive results, this study contributes to existing literature by investigating the use of online health interventions in the classroom context, reporting on objective website exposure and measuring health behaviour related outcomes using both self-reported and objective modes of measurement. Future research needs to further explore the utility of online health behaviour interventions in the school context, using larger and more diverse study populations and determining standardized measures for both website exposure metrics and website components to maximize participant to the intervention. Another line of fruitful research may be determining resources and incentives that promote utilization of the website in complex behaviour change processes. It needs to be remembered that online health interventions are contextual. A study like HPSS is conducted in a certain setting that has different supports, demands, constraints and policies than other web-based health behaviour research. Future literature needs to account for these varying contexts and provide intensive detail on how the intervention has adapted so future research has a framework to follow. To summarize, online health behaviour tools are complex, contextual and constantly evolving, which must be taken into account when comparing and generalizing existing literature or applying successful research designs in new settings, populations or situations (Glasgow, 2007).

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Appendices

Appendix A: Ethics Certificate of Approval



Human Research Ethics Board
Office of Research Services
Administrative Services Building
PO Box 1700 STN CSC
Victoria British Columbia V8W 2Y2 Canada
Tel 250-472-4545, Fax 250-721-8960
Email ethics@uvic.ca Web www.research.uvic.ca


Certificate of Approval

PRINCIPAL INVESTIGATOR: Connor Malbon	ETHICS PROTOCOL NUMBER: 11-302
UVic STATUS: Master's Student	ORIGINAL APPROVAL DATE: 29-Jul-11
UVic DEPARTMENT: EPHE	APPROVED ON: 29-Jul-11
SUPERVISOR: Joan Wharf Higgins	APPROVAL EXPIRY DATE: 28-Jul-12
PROJECT TITLE: Examining The influence Of An Online Health Behaviour Support Tool For High School Youth	
RESEARCH TEAM MEMBERS: Research Coordinators: Karen Strange (UVic), Sandra Courtall (UVic) Co-Investigators: Heather McKay (UBC), Sandra Gibbons (UVic), PJ Naylor (UVic), Ryan Rhodes (UVic), Heather MacDonald (UBC) Research Assistant: Lauren Sulz	
DECLARED PROJECT FUNDING: Canadian Cancer Society: Prevention Initiative	
CONDITIONS OF APPROVAL	
This Certificate of Approval is valid for the above term provided there is no change in the protocol.	
Modifications To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.	
Renewals Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.	
Project Closures When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.	
Certification	
This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.	
 Dr. Rachael Scarth Associate Vice-President, Research	

Certificate Issued On: 29-Jul-11

11-302 Malbon, Connor

Appendix B: SHAPES Questionnaire



HEALTH PROMOTING SECONDARY SCHOOLS


To all students:

Thousands of students, just like you, have been asked to take part in this survey. This important survey will help us to better understand health behaviour lifestyles (i.e., physical activity and healthy eating) among young people. Your responses will be added with the responses from other students to help us identify what can be done to encourage health among youth. Your help today is very important.

This is **NOT** a test. All of your answers will be kept **confidential**. No one, not even your parents or teachers, will ever know what you answered. So, please be honest when you answer the questions.

Thank you!

Please, use an HB pencil



● ○ ○ ○ ○

Proper Mark

⊗ ⊗ ● ●

Improper Marks

Office use only


Date: _____

Checked by: T1 _____

T2 _____

Office use only

0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9



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About You

1. What grade are you in?

- Grade 9
- Grade 10
- Grade 11
- Grade 12

2. How old are you today?

- 14 years or younger
- 15 years
- 16 years
- 17 years
- 18 years or older

3. Are you...

- Female?
- Male?

Physical Activity

HARD physical activities are jogging, team sports, fast dancing, jump-rope and any other physical activities that increase your heart rate and make you breathe hard and sweat.

4. Mark how many minutes of **HARD** physical activity you did on each of the last 7 days. This includes physical activity during physical education class, lunch, recess, after school, evenings, and spare time.

For example: If you did 45 minutes of hard physical activity on Monday, you will need to fill in the 0 hour circle and the 45 minute circle, as shown below:

	Hours					Minutes			
Monday	●	1	2	3	4	0	15	30	●

	Hours					Minutes			
Monday	0	1	2	3	4	0	15	30	45
Tuesday	0	1	2	3	4	0	15	30	45
Wednesday	0	1	2	3	4	0	15	30	45
Thursday	0	1	2	3	4	0	15	30	45
Friday	0	1	2	3	4	0	15	30	45
Saturday	0	1	2	3	4	0	15	30	45
Sunday	0	1	2	3	4	0	15	30	45

MODERATE physical activities are lower intensity activities such as walking, biking to school, and recreational swimming.

5. Mark how many minutes of **MODERATE** physical activity you did on each of the last 7 days. This includes physical activity during physical education class, lunch, recess, after school, evenings, and spare time. **Do not** include time spent doing hard physical activities.

For example: If you did 1 hour and 30 minutes of moderate physical activity on Monday, you will need to fill in the 1 hour circle and the 30 minute circle, as shown below:

	Hours					Minutes			
Monday	0	●	2	3	4	0	15	●	45

	Hours					Minutes			
Monday	0	1	2	3	4	0	15	30	45
Tuesday	0	1	2	3	4	0	15	30	45
Wednesday	0	1	2	3	4	0	15	30	45
Thursday	0	1	2	3	4	0	15	30	45
Friday	0	1	2	3	4	0	15	30	45
Saturday	0	1	2	3	4	0	15	30	45
Sunday	0	1	2	3	4	0	15	30	45

6. Do you participate in competitive or non-competitive sports or clubs not organized by your school?

- Yes
 No

7. Do you do individual physical activities outside of school (e.g., jogging, biking)?

- Yes
 No

8. Your closest friends are the friends you like to spend the most time with. How many of your closest friends are physically active?

- None
 1
 2
 3
 4
 5 or more

9. Outside of classes (e.g., phys ed) do you have any other chances to be physically active at school?

- Yes
 No

10. Do you participate in before-school, noon hour, or after-school physical activities organized by your school (e.g., intramurals, non-competitive clubs)?

- Yes
 No
 None offered

11. Do you participate in competitive school sports teams that compete against other schools (e.g., junior varsity or varsity sports)?

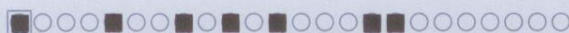
- Yes
 No
 None offered

12. In the last 7 days, how did you *usually* get to and from school?

- Actively (e.g., walk, bike, skateboard)
 Inactively (e.g., car, bus, public transit)
 Mixed (actively and inactively)

13. How long does it *usually* take you to get to school? (Select the closest amount of time from the list below)

- Less than 15 minutes
 15-30 minutes
 31-45 minutes
 More than 45 minutes



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14. In an average week, **how many days** do you use the following ways to get to and from school? (For example: If you always ride the bus to and from school, you would fill in the "5" circle for the "Go by car or bus" option in both columns)

Days per week <u>TO</u> school						Days per week <u>FROM</u> school							
a) Walk	0	1	2	3	4	5	a) Walk	0	1	2	3	4	5
b) Bike	0	1	2	3	4	5	b) Bike	0	1	2	3	4	5
c) Go by car or bus	0	1	2	3	4	5	c) Go by car or bus	0	1	2	3	4	5
d) Combination ($\frac{1}{2}$ walk & $\frac{1}{2}$ bus, or $\frac{1}{2}$ cycle & $\frac{1}{2}$ bus, etc.)	0	1	2	3	4	5	d) Combination ($\frac{1}{2}$ walk & $\frac{1}{2}$ bus, or $\frac{1}{2}$ cycle & $\frac{1}{2}$ bus, etc.)	0	1	2	3	4	5

15. How much do your parents, step-parents, or guardians encourage you to be physically active?

- Strongly encourage
- Encourage
- Do not encourage or discourage
- Discourage
- Strongly discourage

16. How much do your parents, step-parents, or guardians support you in being physically active? (e.g., driving you to team games, buying you sporting equipment, etc.)

- Very supportive
- Supportive
- Unsupportive
- Very unsupportive

17. In the **last 7 days**, how much time per day did you *usually* spend doing the following activities?

For example: If you spent about 3 hours watching TV each day, you will need to fill in the 3 hour circle, and 0 minute circle as shown below:

a) Watching TV/movies Hours: 0 1 2 ● 4 5 6 7 8 Minutes: ● 15 30 45

	Hours								Minutes				
a) Watching TV/movies	0	1	2	3	4	5	6	7	8	0	15	30	45
b) Playing video games	0	1	2	3	4	5	6	7	8	0	15	30	45
c) Playing computer games	0	1	2	3	4	5	6	7	8	0	15	30	45
d) Talking on the phone	0	1	2	3	4	5	6	7	8	0	15	30	45
e) Surfing the internet	0	1	2	3	4	5	6	7	8	0	15	30	45
f) Texting	0	1	2	3	4	5	6	7	8	0	15	30	45

22. In a usual school week (*Monday to Friday*), how many times do you do the following?

	None	Less than once a week	1 time	2 times	3 times	4 times	5+ times
a) eat breakfast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) eat lunch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) buy lunch at school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) eat foods purchased at a fast food place or restaurant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) eat snacks purchased from a vending machine, corner store, snack bar, or canteen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) eat as part of a breakfast and/or snack program at school, where food is supplied to you	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) eat meals while watching television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h) eat meals with at least one adult family member	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. On a usual weekend (*Saturday and Sunday*), how many times do you do the following?

	None	1 time	2 times	3+ times
a) eat breakfast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) eat foods purchased at a fast food place or restaurant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) eat snacks purchased from a vending machine, corner store, snack bar, or canteen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) eat meals while watching television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) eat meals with at least one adult family member	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. If you do not eat breakfast every day, why do you skip breakfast? (*Mark all that apply*)

- I eat breakfast every day
- I don't have time for breakfast
- The bus comes too early
- I sleep in
- I'm not hungry in the morning
- I feel sick when I eat breakfast
- I'm trying to lose weight
- There is nothing to eat at home
- Other _____

25. Over the past week, how many times did you drink a serving of 100% fruit juice such as orange, apple, grape, or grapefruit juice? **A serving is $\frac{1}{2}$ cup.** (*Do not count fruit drinks like Kool-Aid, lemonade, Hi-C, iced tea, cranberry juice drink, or Tang*)

- Never
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 times per day
- 3 times per day
- 4 times per day
- 5+ times per day

26. Over the past week, how many times did you eat a serving of fruit? A fruit serving is ½ cup of chopped, canned, frozen, or a piece of whole fruit.

- Never
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 times per day
- 3 times per day
- 4 times per day
- 5+ times per day

27. Over the past week, how many times did you eat a serving of vegetables? A vegetable serving is ½ cup of chopped, canned, or frozen vegetables, or one cup of leafy green vegetables.

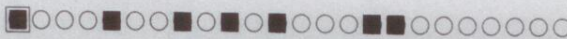
- Never
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 times per day
- 3 times per day
- 4 times per day
- 5+ times per day

28. YESTERDAY, from the time you woke up until the time you went to bed, how many **SERVINGS** (½ cup per serving or one cup of leafy green vegetables) of the following foods did you eat/drink?

Number of servings						
0	1	2	3	4	5	6+

a) Fruit, not including juice (for example, fresh, dried, canned, or frozen fruit)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) Dark green vegetables (for example, lettuce, broccoli, green beans)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) Dark orange vegetables (for example, carrots, squash, sweet potatoes/yams)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) Other vegetables (for example, other raw or cooked vegetables, like corn)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) French fries or other fried potatoes (for example, wedges, hash browns, poutine)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) 100% fruit juice (Do not count fruit drinks like Kool-Aid, lemonade, Hi-C, iced tea, cranberry juice drink, or Tang)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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