Exploring physical activity and physical literacy in Canadian children: Bringing the *Build Our Kids' Success* (BOKS) program to Canada

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

In an effort to confront low levels of physical activity (PA) among children, the Build Our Kids' Success (BOKS) program was brought to Canada following its debut in the United States. The BOKS program is different from other PA programs in its timing before the start of the school day, and incorporates specific components which seek to promote long term PA and physical literacy (PL). This thesis explores preliminary data from the Canadian implementation of BOKS in order to pilot a methodology for assessment with respect to meeting the goals of the program, and to explore the range of factors that may influence the PA and PL of the participating children.

Students (n=50, of which BOKS=32) in grades 3-6 from three schools in British Columbia, and their parents (n=78, of which BOKS=59), completed an online survey that asked questions relating to PA and measures of PL. Approximately equal numbers of boys and girls participated, and more children participated from grade 3 (students=26, parents=43) compared to older grades. PA and PL scores were calculated for each individual from relevant survey items. Pedometers were worn by half of the students for nine days.

Participating in the BOKS program did not appear to have a significant effect on the PA or PL measures compared to children who did not participate. Boys reported being more active and more confident than girls, and scored significantly higher than girls on nine items, including measures of self-reported PA, motivation for PA, confidence, overall PA score, and number of steps walked. Younger students scored higher than older students on four items, including PA during school hours, overall PA score, and number of steps walked. Parents and children reported different priorities among motivating factors for PA. These findings highlight the importance of tailoring PA programs to boys and girls with sex-specific factors in mind, and of considering the motivations for PA of children, which may be different than what adults assume.

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Finally, thank you to my parents, my husband, and my children, for their encouragement, interest, and support throughout this journey.

Dedication

This thesis is dedicated in memory of my Bubby, Judith Goldberger. She was one of the most inspiring women I know, having overcome challenges of time, language, race, and war, in pursuit of education. Her determination that we should always continue to learn, and her support and encouragement in all that we do left an unquenchable thirst for knowledge in all of us.

May her memory be a blessing.

Table of Contents

List of Tables

List of Abbreviations

AHA	American Heart Association
BMI	Body Mass Index
BOKS	Build Our Kids' Success
CAPL	Canadian Assessment of Physical Literacy
CSEP	Canadian Society for Exercise Physiology
CVD	Cardiovascular Disease
IPLA	International Physical Literacy Association
MVPA	Moderate to Vigorous Intensity Physical Activity
NIOST	National Institute on Out of School Time
PA	Physical Activity
PE	Physical Education
PL	Physical Literacy
PHAC	Public Health Agency of Canada
Propel	The Propel Center for Population Health Impact, of the University of Waterloo
Report Card	The ParticipACTION Report Card on Physical Activity for Children and Youth (Canada)
SBPA	School Based Physical Activity
WHO	World Health Organization

Chapter 1: Introduction

1.1. Research Context

One of the major concerns among the global public health community today is the alarmingly low level of childhood physical activity (PA) being observed. The evidence-based and widely accepted guidelines recommend at least 60 minutes of moderate to vigorous intensity physical activity (MVPA) every day for youth (5-17 years), including three days per week of vigorous-intensity, and a different three days of bone or muscle strengthening activities (WHO 2011, CSEP 2011, and ODPHP 2008). Worldwide, however, at least 80% of adolescents (11-17 years old) are not reaching these goals (WHO, 2015).

This physical inactivity among youth is associated with the increase in childhood obesity and overweight that has been observed as well (Tremblay & Williams, 2003). Consistent with general worldwide statistics (OECD, 2014), the Public Health Agency of Canada (PHAC) estimates that 26% of Canadian children (ages 2-17 years) are overweight (PHAC, 2012), with at least 8% clinically obese (PHAC: Obesity in Canada, 2011). Overweight and obesity are serious and potentially life-threatening conditions, related to a host of chronic diseases, including Type 2 diabetes and cardiovascular disease (CVD), the rates of which are also on the rise among children (D'Adamo & Caprio, 2011, and CDC, 2015). This has led some to predict that the current generation of children may not enjoy longer life expectancies than their parents (Olshansky et al., 2005). Additionally, obesity and its consequent diseases are very expensive to treat, costing an estimated $2 trillion worldwide each year (Dobbs et al., 2014), and accounting for an estimated $7 billion of Canada's annual health care spending (PHAC: Obesity in Canada, 2011).

To shed light on the reasons for this phenomenon, a research team reviewed various sources from different countries for data on children's physical activity patterns throughout the 20th and 21st centuries. The authors concluded that children themselves still derive great pleasure from physical activity, however the children's environments have recently become "activity toxic", greatly restricting their opportunities to move and play, especially at school (Dollman, Norton, and Norton, 2005). Thus, the low levels of childhood physical activity are not necessarily due to a new generation of unmotivated children, but rather can be related to the world that some adults have created for the children – with rules and built environments planned with safety in mind, but leaving little room for spontaneous physical activity. The 2015 ParticipACTION Report Card on Physical Activity for Children and Youth identified this phenomenon as well, and even has a section titled "Get Out of the Way and Let Them Play" (ParticipACTION, 2015, page 7).

Accompanying the dearth of physical activity, a similar gap in physical literacy (PL) has been noted, as well. Physical literacy is an emerging concept in the conversation about physical activity, and is no less important in the goal of increasing PA. It is internationally defined as "the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life." (IPLA, 2015) In short, it is the *capacity* of an individual to be physically active, or, the level of self-efficacy in the realm of physical activity. While it might be assumed that children inherently know how to be active, this is not necessarily the case, as determined by recent statistics of less than half of Canadian children meeting the Canadian Assessment of Physical Literacy (CAPL) recommendations (ParticipACTION, 2016).

Many governments and private organizations are clamoring to get ahead of these worrisome trends. Canada, specifically, is addressing this issue by focusing on policies meant to support and promote physical activity. In 2010, the Federal, Provincial and Territorial Ministers of Health endorsed Curbing Childhood Obesity: A Federal, Provincial, and Territorial Framework for Action to Promote Healthy Weights. Known as the Framework, this initiative aims to promote this topic, coordinate policy changes, and assess and modify strategies as necessary (PHAC: Overview, 2011).

Within this Framework, the Public Health Agency of Canada began awarding multi-sectoral partnership grants to qualifying projects. The purpose of this funding mechanism is to invest in and support initiatives which promote healthy living and prevent chronic disease. PHAC has invested its support in 13 such projects since 2012, providing up to $5 million in funding for a duration of up to five years each (PHAC, 2015). In 2014, the Public Health Agency of Canada began funding the Build Our Kids' Success (BOKS) initiative and its goals of increasing PA among youth (Government of Canada, 2014).

The BOKS program was started in 2009 by Kathleen Tullie, after she read Spark: The Revolutionary New Science of Exercise and the Brain by John Ratey, MD (2012), and was inspired by his research. Ratey builds a convincing argument for regular exercise, addressing many of the key benefits of physical activity, especially in the morning, with a sharp focus on the effects of exercise on brain health and learning. Driven by this concept that physical activity is academically beneficial and absolutely essential for children, Tullie launched a PA program at her children's school in Massachusetts, USA. Her program grew and developed to become BOKS, facilitated by Reebok and the Reebok Foundation, and today, over 2000 schools in six countries, including Canada and Japan, are registered with the program.

The BOKS program seeks to get children excited about physical activity, and to increase their physical literacy by teaching skills and games that can be transferred to other environments. It aims to build capacity among the students, their parents, the session leaders, and the teachers, and as a cost-free program, it is open to every student.

BOKS has been successfully implemented and evaluated in the United States; however, it is now being brought to Canadian children, and there are no Canadian data about the benefits of this program. The unique diversity of landscape, cultures, and communities across Canada, encompassing a wide range of educational and transportation systems, suggests that large-scale implementation of the program may require some flexibility and adaptation. Evaluation data from the program will be essential to understanding how to most effectively deliver this program across Canada, and what short- and long-term, individual and national outcomes can be anticipated.

1.2. Research Objectives

The high levels of sedentary behaviour observed among Canadian children have worrisome health outcomes, and assertive action is necessary to combat and reverse this trend. The success of the BOKS program in the United States has attracted the attention of the Canadian government, and the program has been implemented for a five-year pilot and evaluation, with this thesis exploring the preliminary data from the fall, 2015, session. Due to the single session under analysis, and the consequently limited amount of data available, this thesis was not focused on drawing conclusions regarding the implementation and/or success of the BOKS program in Canada, and rather sought to explore this pilot program with the intent of providing

recommendations for future research, implementation, and evaluation. Accordingly, two specific objectives for this thesis were identified:

1. To pilot a systematic methodology for evaluation of the BOKS program.
2. To explore the range of factors that may influence the PA and PL of the participating children.

1.3. Thesis Outline

This thesis is organized into five chapters. This first chapter introduced the national and global problems of physical inactivity among children, and presented a program which aims to counteract this trend, and which is the focus of this thesis. The following chapter delves in to the literature to further explore the gravity of the problem, and some attempts to mitigate it at the school level. The third chapter outlines the research design and methodology, while the fourth details the quantitative results. The final chapter discusses the findings, including substantive, methodological, and theoretical contributions, as well as limitations and suggestions for future research.

Chapter 2: Literature Review

2.1. Introduction

This chapter reviews the literature that informs this thesis. First, the benefits of physical activity are emphasized, followed by current national and international trends of PA, PL, and sedentary behaviours among children and youth. Interventions that have attempted to impact PA through the school environment are explored, including barriers to realizing the recommended policies, and a review of successful programs. Finally, the details of the BOKS program, and the results of its implementation in the US, are described.

2.2. Physical activity: the answer to all our problems

If the benefits of physical activity could be bottled, we would have the best-selling drug on the market (Church and Blair, 2009). Although weight loss and cardiovascular strength are the key benefits often cited in relation to physical activity, they are not the only ones; regular exercise has been proven to bestow significant health benefits on an individual, contributing to all aspects of being, including physical, neurological, and psychological health.

Physically, exercise has been shown to improve bone density (Welten et al., 1994), lower blood pressure (Whelton et al., 2002), and affect hormonal changes (McTiernan et al., 2006). Neurologically, physical activity has a tremendous impact on the brain, increasing essential brain neurotrophins (which protect the neurons from decay) (Oliff et al., 1998, and Ratey, 2012), regulating circuitry, and generally contributing to greater neuroplasticity (the ability of the brain to form new neural connections) (Gomez-Pinilla et al., 2002, Vaynman & Gomez-Pinilla, 2005, and Ratey, 2012), not to mention reducing the onset and incidence of dementia (Andel et al., 2008). Psychologically, positive effects have also been observed, for example reduced anxiety

(De Moor et al., 2006 and Ratey, 2012) and improved concentration (Archer & Kostrzewa, 2012).

Physical inactivity, on the other hand, not only increases a person's risk for chronic diseases such as coronary heart disease, type 2 diabetes, and various cancers, but can greatly decrease life expectancy. In 2008, an estimated 9% of deaths worldwide could be attributed to premature mortality due to inactivity (Lee et al., 2012).

The effects of a sedentary versus an active lifestyle are typically seen and studied in adulthood, however many lifestyle habits are acquired in youth, and improving physical activity habits among children will be an essential component of helping to ensure a healthy future generation of adults. When researching physical activity interventions among youth, default study designs have typically looked at either correlates between two variables at a single point in time, or at the effects of an intervention among overweight or at-risk youth. As weights continue to rise, however, researchers are focusing on the benefits of physical activity among the general population of children (not specifically overweight or otherwise at risk).

2.3. The Report Card: decreased physical activity among Canadian youth

To track data regarding physical activity, and help paint the national picture, measures such as participation in organized sports, physical literacy, mode of transportation to and from school, and sedentary behaviours, are employed. Since 2005, these data have been presented in a concise and coherent manner via the ParticipACTION Report Card on Physical Activity for Children and Youth (henceforth: the Report Card), with grades awarded for each of the different areas, outcomes, or factors. Canada's scores in 2016 were not impressive, and included a B in Organized Sport, a D in Active Transportation, an F in Sedentary Behaviours, a B for the School Environment, and a B- for the Government, to name a few. Overall, the Report Card found that

only 9% of Canadian youth (5-17 years) meet the daily MVPA recommendations, earning the embarrassing overall grade of D- (ParticipACTION, 2016).

For the first time in 2016, physical literacy was evaluated by the Report Card. The CAPL was developed to assess the four domains of physical literacy among youth (8-12 years), and preliminary results show that the recommendations are met only 28% of the time in the domain of physical competence, 37% in motivation and confidence, 44% in daily behaviour, and 62% in knowledge and understanding, resulting in an overall grade of D+ (ParticipACTION, 2016). This indicator is still new and developing, with more research, initiatives, and assessments underway.

The Report Card considered many of the factors which may be contributing to this decrease in physical activity among youth, including increased screen time – television, video games, cell phones – among ever-younger children (only 24% of 5-17 year olds report less than two hours per day of screen time (ParticipACTION, 2016); 75% of children under the age of 4 have their own mobile device (Kabali et al., 2015)), increased modes of inactive transportation (58% of children are driven to school (ParticipACTION, 2016)), and the relative unimportance of physical education in the greater education framework (7 of 13 Canadian provinces/territories require only one PE credit to graduate high school (ParticipACTION, 2015); studies have found that the prioritization of academic subjects and standardized testing is a significant barrier to implementing PA policies (Amis et al., 2012, and Brown and Elliott, 2015)).

2.4. School-policies: a deterrent to physical activity

The Report Card found that daily physical education is reported at 69% of schools in Canada, and access to gymnasiums and playing fields is greater than 90% (ParticipACTION, 2016) - seemingly positive results. However, the low rates of actual physical activity attest to a need for a closer look at the implementation of school-level policies.

Many studies have looked at exactly this, by observing the levels of physical activity attained by students while at school, and/or by interviewing teachers or principals to determine the barriers and facilitators to implementing the physical activity policies in their schools. Some of the barriers that were raised include lack of awareness of the school's PA policy (Lanier, 2012), and the limited knowledge and confidence that non-PE teachers have in teaching the subject of physical activity (Belansky, 2009, People for Education, 2012). Furthermore, academic subjects are highly monitored and tested, leading teachers (and parents) to prioritize those over the PA initiatives (Langille & Rodgers, 2010, and Amis et al., 2012), stemming from a belief that there is not enough time to also include PA in their day (Lanier, 2012). The main factors that facilitated increased physical activity at a school level included strong teacher-administration collaboration, the incorporation of monitoring and evaluation components, and highly motivated teachers (Tjomsland, 2010).

A qualitative study by Kristin Brown (2013) examined the implementation of the daily physical activity (DPA) policy across schools in Ontario, and found that although the policy is standard across the province, implementation varies widely, and is strongly associated with local-level factors. The DPA policy in Ontario depends on generalist teachers to provide the space for PA, and combined with the prioritization of academic subjects by stakeholders, the result is inconsistent, often sub-par, delivery of the policy. This study advanced the notion that it is the specific school environment (i.e. teachers, resources, academic or administrative policies) which promotes or inhibits the success of PA policies or interventions (Brown and Elliott, 2015).

2.5. Case studies: school-based physical activity (SBPA) interventions

While the BOKS program cannot be strictly defined as a SBPA intervention because it does not make any changes within the existing school environment or curriculum, it is nonetheless

appropriate to compare it to SBPA interventions for a number of reasons. BOKS is not like an after-school program which runs separate to the school day, but rather aims to be a seamless addition to the school structure, and to support a more PA-friendly school. In addition, in some cases BOKS may be run during (and not before) school hours, for example during lunch, due to logistics at a specific school. The following three SBPA interventions stand out for their similarity to BOKS in age of children under assessment, their use of self-reported PA and/or pedometers, and their focus on a wider range of correlates of physical activity, including self-management.

In 2003, an initiative called Action Schools! British Columbia (AS!BC) was implemented for students in grades 4 and 5 in the Vancouver and Richmond school districts. The 16-month cluster-randomized controlled trial at 10 schools implemented a whole school/ active school model across those schools assigned to the experimental intervention, in order to increase physical activity across six Action Zones (Naylor et al., 2006). Numerous outcome measures were examined, including height and weight, cardiovascular fitness, blood pressure, and self-reported physical activity. One study evaluated the cardio-vascular fitness of the students, and observed a 20% reduction in CVD risk among children in the intervention schools (Reed et al., 2008), while a second study observed the effects on tibial bone strength, and found significantly stronger bones among the children at the intervention schools (Macdonald et al., 2007) Other researchers investigated the academic effects, concluding that the increased time spent on physical activity did not detract from academic studies, and may, in fact, have helped (Ahamed et al., 2007). Ultimately, this program was considered a success, and school-based interventions in general were recommended as a resource for improving health on a population level (Naylor et al., 2006).

An older but well-cited intervention was implemented in Poway, Calif, outside San Diego, in 1990-91. Named Sports, Play, and Active Recreation for Kids (SPARK), it engaged fourth- and fifth-grade students over two years at seven elementary schools, through re-structured physical education classes, and in-class self-management sessions. Measures collected included self-reported physical activity, accelerometers, cardio-vascular fitness, and height and weight. In addition to the individual findings for each of the measures, the study concluded that a SBPA intervention can greatly increase physical activity among students, and benefit 97% of attending children (Sallis et al., 1997).

Another 2-year intervention called LEAP (Lifestyle Education for Activity Program) took place in South Carolina in 1998-2000, focusing on high school girls. Its goal was to increase physical activity among this population by making changes to the school environment. Similar to the components of the SPARK study, the health curriculum at each school was adapted to emphasize self-regulatory behaviours (for example: goal setting and time management), and PE classes were restructured to promote non-competitive mastery of fitness skills. Studies concluded that the SBPA intervention was effective at increasing exercise among high school girls (Pate and Ward et al., 2005), and positive results could still be seen in a follow-up study a few years later (Pate and Saunders et al., 2007). An additional important finding from this study was the significance of self-efficacy on promoting physical activity among the girls, and the authors encouraged its use as a mediator variable in further studies (Dishman et al., 2004).

The following table summarizes these three studies. The BOKS study as presented in this proposal is included as well (described in detail in Section 2.7).

Table 2.1. Three school-based physical activity interventions, and the BOKS program.

Study name	Study design	Population	Main intervention component	Measure	Outcome
AS!BC	Cluster-randomized controlled trial; 16 months	Children in grades 4 and 5; 10 schools in Vancouver and Richmond, BC	Generalist teachers increasing PA throughout the day	Many, including: CVD risk, Tibial bone strength, Academic scores	Successful: Lower, Stronger, Higher
SPARK	Quasi-experimental; 2 years	Children in grades 4 and 5; 7 schools outside San Diego	Re-structured PE classes, and in-class self-management sessions	Many, including: self-reported PA, accelerometers, CVF, height and weight	In general: 97% success, SBPA intervention greatly increases PA
LEAP	Group-randomized controlled field trial; 2 years	High school girls; 24 schools in South Carolina	Re-structured PE classes, and in-class self-management sessions	Self-reported PA, Height and weight	Increased PA Self-efficacy is important
BOKS	Quasi-experimental over 5 years	Children in grades 3-8; Many schools across Canada	The addition of a before-school PA program	Surveys of PA behaviours, Pedometers	Expected: more PA among children participating in BOKS

Listed above are only three of the school-based interventions that have been implemented to promote physical activity in schools, but many more have been executed and studied. Various meta-analyses have reviewed the effectiveness of a wide range of school-based physical activity interventions, with mixed results. Depending on the analysis, studies have found them to either have no or minimal effect (Harris et al., 2009), to be effective if they included both diet and activity changes (Brown and Summerbell, 2009), and to emphasize the difference between boys and girls when it comes to physical activity (Dobbins et al., 2009). In all cases, the school environment retains its importance as the easiest way to reach thousands of children.

2.6. Physical activity in and out of school

Much of a child's day is taken up by hours spent in school, lending credence to the ability of SBPA interventions to have a significant impact, however there are also pockets of PA opportunities outside of school time, which should not be overlooked. These include transportation to and from school, and leisure time before and after school.

The Report Card explores these areas as part of the overall PA picture. They find that after school, almost 50% of 5-19 year olds participate in organized PA or sports, and about 75% of the same age group engage in unorganized PA or sports, with contributing factors including age, socioeconomic status, digital screens, and concerns about safety. Regarding transportation to and from school, only 25% of 5-17 year olds regularly use active modes of transportation like walking or biking, earning Canada the low grade of D, and prompting many suggestions to increase this percentage, including implementing traffic calming measures, employing more crossing guards, and considering this factor when building new schools (ParticipACTION, 2016).

Independent studies have researched these areas as well, as in a 2006 study in the US, in which students wore pedometers for four consecutive days during recess and outside of school. The study found differences between boys and girls with regards to steps and activity time both during recess and out of school, as well as a difference in activity preference during recess. Moreover, it found that children in general were active for at least 60% of recess time, but only about 20% of after school time, leading the researchers to suggest that recess is an essential target area to achieve increased PA (Beighle et al., 2006).

With the increased emphasis on academic success in recent years, many schools have minimized physical activity, by reducing the frequency or duration of recess and/or PE classes. Some researchers have suggested that the amount of PA during school is not so important, because children will naturally seek to compensate for their restricted movement during their leisure time after school. This theory is supported by a 2003 study from England in which the activity levels of students from three schools with varying amounts of scheduled PA were compared using accelerometers, and no difference was found in the amount of PA recorded between children

from different schools. In other words, children in this study who had less time for PA in school made up for it by being more active outside of school (Mallam, et al., 2003). A different study, however, disproves this theory. Using accelerometers, and either having the children go outside for recess as usual, or keeping them indoors, the researchers analyzed the children's after-school activity, and found that they were far less active following a day of restricted movement as opposed to a day of normal, active recess. In other words, children did not seek to compensate for their earlier sedentary behaviours, but, to the contrary, showed that activity begets activity (Dale et al., 2000). With the low levels of overall physical activity that are observed on the national and global scales, for example in the Report Card, it would be wise to increase, as opposed to decrease, opportunities for PA, with scheduled PE time and recess only two of the many viable avenues to this end.

These ideas are galvanized in a 2015 position statement published by the American Heart Association (AHA) strongly in favour of school-centered interventions. The paper unequivocally recognized the importance of promoting physical activity at all levels of school, with recommendations including updating PE curriculums, integrating PA breaks throughout the day, encouraging active transportation, and disallowing PE waivers, to name a few (AHA, 2015). In a prior review of all types of physical activity interventions, a team of AHA researchers noted that SBPA interventions which include policy and environmental changes are more effective than those which are curriculum-based; that in most cases there is no increase in PA observed outside of school – no transfer to real life; and that more research needs to be done on the theoretical aspects of promoting physical activity, for example on the effects of self-efficacy as a mediating variable (Marcus et al., 2006).

Self-efficacy reflects an individual's "confidence in the ability to exert control over one's own motivation, behavior, and social environment" (Carey & Forsyth, 2015), and includes skills like time management, self-reinforcement, and accessing, understanding, and retaining information. The BOKS program incorporates self-efficacy into its goals by way of physical literacy, teaching the children lifelong fitness skills and providing health information that are relevant in the wider world, and not just within the classroom setting. It teaches nutritional information to participating children, encouraging them to make healthier food choices, and fitness skills that can be applied at any stage of life. BOKS aims to contribute to altering the current trend of childhood inactivity and obesity, however it does not focus on BMI or other anthropometric outcomes, but rather focuses on the physical activity and indicators of literacy of the children, with the aim of having a greater and longer-lasting impact.

2.7. BOKS: The intervention

The BOKS intervention consists of a number of specific and intentional components which aim to fulfill defined goals. These are related to the program content, the cost, and the timing.

The content of the BOKS program was designed to address some of the key concerns of physical inactivity, and thus consists of a running-related activity (bone-strengthening), a fitness skill (long-term healthy lifestyle), and a team-work building game (promote community), and ends with a "BOKSbit" nutrition tip (long-term healthy eating). BOKS is designed to encourage a healthy lifestyle, and incorporates the essential aspects needed for long-term success in this area, namely parental involvement, reduced inactivity, and dietary changes (Fulton et al., 2001).

BOKS is an inherently free program, utilizing parent volunteers or school staff as lead trainers to run the sessions. Training materials are provided for free once the school has enrolled in the program, including the full curriculum and assessment tools, and training seminars for the lead

trainers at intervals throughout the year, including Skype or webinar training sessions with Reebok. The school may choose to invest resources in materials (balls, hoops, whistles etc), and is encouraged to consider grants or sponsorships, to keep the program accessible to all children.

A principal component and emphasis of BOKS is its timing before the start of the school day. This specific timing aims to activate both the bodies and minds of children before learning commences, so that the effects of exercise can accompany the child throughout the school day, improving his or her physical fitness, concentration, academic performance, and self-confidence (Ratey, 2012).

2.8. BOKS: US data and Canadian implementation

In the United States, BOKS partnered with the National Institute on Out of School Time (NIOST) for program evaluation, and the initial results were very positive. Pre- and post-intervention surveys on nutrition showed increased knowledge on 94% of the items, with significant increases for 35%. The average time for a 400-meter run decreased from 2.25 minutes to 2.15 minutes, which was a significant improvement ($p<0.01$), and indicates better fitness among the children. Analysis of physical activity logs showed that children participating in the BOKS program reported more activity when out of school, primarily in the forms of exercise and jogging (NIOST, 2015), supporting the notion that this program can promote physical activity beyond the sessions themselves.

The success in the United States encouraged bringing BOKS north of the border, and in Canada it is being facilitated by the Reebok Canada Fitness Foundation, in partnership with the Public Health Agency of Canada. The Canadian Football League (CFL) is a partner as well, using their publicity and media presence to help promote BOKS, by sending football players to the schools for special events, advertising BOKS at CFL events like the Grey Cup, and using their media

presence – especially social media – to raise awareness and excitement about the project. The Propel Center for Population Health Impact (University of Waterloo) is working closely with Reebok and its partners in an evaluation capacity.

Reebok is responsible for marketing, and has attracted the attention of over 240 schools across eight of ten Canadian provinces (not PEI or Newfoundland and Labrador). Once a school registers on the website, the training materials are provided to them, and they are assumed to have begun implementing the BOKS program at their school; actual implementation data are not always available. On average, 30 children from each school sign up for BOKS, for an estimate of 7,230 students who participated in BOKS in Canada during the 2015-2016 academic year.

Propel is responsible for the overall evaluation of the BOKS program across Canada, and has set a five-year evaluation plan with three primary areas of concentration. This project will constitute *part* of the overall Propel evaluation, focusing on one aspect of the data. Pilot evaluation measures from Year 1 (2014-5), including pilot survey studies and interviews with the lead trainers at 12 schools, provided initial positive and constructive feedback for improved programming and evaluation, and thus Propel continued its evaluation in the 2015-6 school year. In the fall 2015 session, Propel conducted evaluations at three schools in British Columbia, and this research analyzed the data from these schools.

2.9. Chapter Summary

This chapter reviewed the literature on physical activity, further emphasizing its role in health, morbidity, and mortality, while the data from the ParticipACTION Report Card stressed the severity of this problem among children and youth in Canada. The school environment has been identified as a prime location to affect change, and the implementation of school- or province-specific policies, as well as previous efforts, were reviewed. Finally, this chapter discussed the

BOKS intervention, including its theoretically-informed content and timing components, its performance in the US, and the importance of its evaluation within the Canadian landscape.

Chapter 3: Methodology

3.1. Introduction

This chapter describes the study design and methodology, including participants and recruitment, the survey measures, and data analysis used to address the objectives for this research, providing:

1. A systematic methodology for evaluation of the BOKS program.
2. A method by which to explore the range of factors that may influence the PA and PL of the participating children.

3.2. Study Design

This research took shape under the umbrella of an existing and ongoing Propel evaluation project, as described in Section 2.7. As such, many parameters of the research were previously determined and not easily changed. One such parameter was the quasi-experimental design used for evaluation, whereby participants were not randomized into the different conditions; rather each individual opted in (or not) to the BOKS program and/or the evaluation component. While this is not the ideal design, it was nonetheless appropriate to work within the existing structure for the purpose of exploring the preliminary data from the BOKS program.

As part of its five-year overall evaluation of the BOKS initiative in Canada, Propel is working with a wide variety of both qualitative and quantitative tools, including online analytics, session observations, interviews with each of the stakeholders, parent surveys, student surveys, pedometers, and physical activity logs, the full list of which can be seen in Appendix A. The current study focuses on the quantitative data that pertains to PA and PL, specifically the parent- and student-surveys, and the pedometers.

3.3. Participants and Recruitment

3.3.1. *Participating Schools*

As of June, 2016, 241 Canadian schools were registered with BOKS, with the majority (84%) in the more populated areas of British Columbia, Alberta, Ontario, and Quebec. Of these 241 schools, 123 were available or eligible to participate in the BOKS evaluation, 45 were recruited, and 33 participated and completed the evaluation. To be eligible, a school must have received school-board and school-level ethics approval, and must have run the BOKS program for grades 3-6.

At the beginning of the 2015-2016 school year, in the fall of 2015, only three schools in British Columbia were available or eligible to participate in the evaluation components, and it is the analysis of that data which are presented in this study. From the three schools, data were collected from 128 surveys and 27 pedometers.

Table 3.1. Participating Schools

BOKS ID	School Name	Grades	Enrollment	Student Surveys	Parent Surveys	Pedometers
5900988	Cedar Drive Elementary	K-5	259	22	25	0
5901017	Ranch Park Elementary	K-5	219	24	49	27
5901721	Logan Lake Elementary	K-7	122	4	4	0

Cedar Drive Elementary School (CD) and Ranch Park Elementary School (RP) both serve the city of Port Coquitlam, BC (population: 56,000) (Statistics Canada, 2011), and are two of fourteen elementary schools in the city, located less than 7 km from each other. The median income of the city is slightly higher than the rest of the province (28.4K vs. 24.9K), and unemployment slightly lower (4.9% vs. 6.0%) (City Data, 2007).

Logan Lake (LL) Elementary School, along with Logan Lake Secondary School, serves the small town of Logan Lake (population <2000), just outside Kamloops, BC (Statistics Canada Census Profile, 2011). The town is quite small, with a single industry, and a small commercial and city services center. The two schools work together to adapt to the needs of the community: the elementary school building was intended to house kindergarten and grades 1-7, but since 2009, grades 5-7 have joined the higher grades in the secondary school building (Logan Lake Schools, 2014). The four children who participated in the survey were in grade 5, meaning they were physically attending classes in the secondary school building, however are registered under the BOKS ID for the elementary school.

3.3.2. *Participant Recruitment*

In the month of September, 2015, BOKS information sheets (Appendix B) were distributed to parents at each of the three participating schools, giving parents and their children the opportunity to opt in to any combination of the BOKS program and evaluation components. The three levels of participation were, therefore:

Table 3.2. Levels of participation in BOKS

Level	n-surveys	Group	Significance
BOKS program only	0	Not included	None – not included in data
BOKS program + evaluation	90	Intervention	Measure the impact of the BOKS program
Evaluation only	38	Comparison	Measure non-intervention group, for comparison

The single criterion for participating in the BOKS program was the ability to physically attend the before-school program, which may have been a limiting factor if the child was unable to arrive at school early enough, due perhaps to logistics, safety, or motivation to wake up earlier.

The single criterion for participating in the evaluation study was age – children were generally eligible join the BOKS program from grade one, however only students from grade 3 through

grade 6 were able to participate in the evaluation, due to literacy limitations that prevent younger children from being able to complete the surveys. Interestingly, far more grade 3 students participated than children or parents in the older grades, as seen in Table 3.3, below.

Ethics approval for this research was granted by the University of Waterloo, Office of Research Ethics. Every school and school-board which participated in the evaluation granted ethics approval, as well.

3.3.3. *Participants*

The 128 surveys provided information about 83 separate students, whose characteristics are shown in Table 3.3. Almost equal numbers of boys and girls completed the survey, however there were many more participants from grade 3 than older grades (4-6), and over 80% of all respondents identified as white, which is consistent with the demographics of the general population for those areas. There were more respondents from BOKS participants than from those who did not participate in BOKS.

Table 3.3. Demographic characteristics of the evaluation participants.

		Separate Individuals (n=83)			Survey Entries (n=128)		
		BOKS	Non-BOKS	Total	Students	Parents	Total
Sex	Boy	29	8	37	23	37	60
	Girl	31	15	46	27	41	68
		60	23	83	50	78	128
Grade	3	39	8	47	26	43	69
	4	12	4	16	11	16	27
	5	8	11	19	12	18	30
	6	1	0	1	1	1	2
		60	23	83	50	78	128
Ethnicity	White	46	20	66	40	62	102
	South Asian	3	0	3	3	3	6
	Chinese	3	1	4	3	3	6
	First Nation	1	1	2	2	2	4
	Other	7	1	8	2	5	7
		60	23	83	50	75*	125

** 3 parent surveys did not provide this information*

3.4. Survey Measures

3.4.1. *Survey Administration*

The surveys were administered online, as a cost-effective mechanism for distribution, and a labour-efficient way to collect the data. The information letters were emailed by Propel to the school representative, who distributed them to the parent and student bodies via the school's mailing list or other form of regular communication. The letter provided the website information for entry to the survey and additional resources about the evaluation, as well as the required school-specific access code for the survey. When parents logged on with their access code, they were asked for consent for their/ their child's participation in any or all of the evaluation components, including the parent survey, the student survey, and the pedometers, and they were able to choose any level of participation.

The survey is also formatted to be completed from a smartphone, and it is estimated that most of the population has access to either a laptop or a smartphone, even among neighborhoods of lower socio-economic status (eMarketer, 2015). However, Propel will accommodate a community where the online option is not feasible, and will mail the surveys if requested by the school (this was not necessary for this session).

Online, clear instructions outlining each of the questions were provided, and completing the survey required less than ten minutes. An incentive was offered to schools for their participation in the evaluation, in the form of an $100 honorarium, and a school-specific feedback report.

The survey was comprised of 23 (Student, S) or 28 (Parent, P) questions which gathered the individual's responses to various measures of physical activity and physical literacy, as well as demographic information, and their reaction to the BOKS program. The categorical breakdown of the survey questions is presented in Table 3.4. The analysis focused on 15 questions pertaining to physical activity and physical literacy, and the single question in the parent survey regarding the child's behavioural tendencies. The questions about the BOKS program were not analyzed in this study, due to their focus on enjoyment from BOKS, which was not relevant for this thesis.

Table 3.4. Categorical breakdown of survey questions

Category	**# of questions**		**Topics**
	Parent	**Student**	
Demographic	9	5	Gender, age, grade, marks, weight, income, parents' education
Physical Activity	6	7	Self-reported PA: activities, frequency, locations
Physical Literacy	8	8	Knowledge, motivation, attitude, competence, confidence
Behaviour	1	0	Working-memory and shift
BOKS	3	3	Custom questions: Enjoyment and experience in BOKS

The content of the surveys, including response scales, are based on items from several sources including SHAPES (Student Health Assessment Planning and Evaluation System), CHMS (Canadian Health Measures Survey), BRIEF (Behaviour Rating Inventory of Executive Function), and CAPL (Canadian Assessment of Physical Literacy), all of which are validated surveys. The BOKS' evaluation survey adapted items from these sources, to ask a specific set of questions that could assess the impact of the BOKS program. Sources for each item on the BOKS survey can be found in Appendix C.

Two versions of the survey were produced, one structured to be completed by the student (Appendix D), and the second intended for the parents to complete regarding their child (Appendix E). The goal was to obtain two sets of surveys for each individual, to allow comparison between the child's self-reported measures of physical activity and the parents' perspective. From the fall 2015 session of BOKS, 45 surveys were completed by both students and their parents, with an additional 33 surveys completed by parents but not their children, and 5 surveys completed by children but not their parents.

The survey was required to be completed once during the length of the BOKS program. It was important that the student and parents were sufficiently familiar with BOKS before completing the survey. As evident from Table 3.5, the surveys were completed after sufficient time in BOKS.

Table 3.5. Dates and duration of BOKS at each school

School	Start Date BOKS	End Date BOKS	Student n	Student Earliest	Student Latest	Parent n	Parent Earliest	Parent Latest
CD	Oct 6 2015	Apr 21 2016	22	Nov 10 2015	Dec 13 2015	25	Nov 10 2015	Nov 27 2015
RP	Sep 8 2015	Nov 27 2015	24	Nov 4 2015	Nov 26 2015	49	Nov 4 2015	Nov 26 2015
LL	Unknown	Unknown	4	Dec 9 2015	Dec 14 2015	4	Dec 9 2015	Dec 14 2015

At Logan Lake Elementary, Propel was unsuccessful in establishing adequate communication with the school contact, and thus the dearth of information regarding the BOKS program. The four students and their parents indicated "yes" regarding being part of BOKS, and without any way of verifying that information, this research trusted the answers, and included those individuals as BOKS participants in the analysis. Because only four surveys were completed from Logan Lake Elementary during the relevant time session, they are not included in analysis comparing schools, but are included among the other comparisons.

3.4.2. *SAS: Coding and Analytical Tests*

Survey responses were uploaded and saved into Excel spreadsheets by the Propel staff, and shared for analysis. The data were formatted as necessary for compatibility with SAS, and then imported with appropriate identifiers (ID, sex, etc.), and run through the software by subject: all PA-related questions, all PL-related questions, and pedometers. Parent and student responses were entered separately, and the results were analyzed across the four groups: BOKS, sex, grade, and school.

Analyses were conducted using the SAS University Edition software, and two primary measures of analysis were employed, according to the type of data resulting from each question.

A chi-square test of independence was used to examine relationships between two categorical variables, where there were at least five counts in each of the "expected" cells. This test was run using the "freq" procedure, and specifying "chisq deviation" within "tables".

The chi-square statistic was reported to indicate the probability that the result was due to chance alone, and for this study, a 95% level of significance was adopted. As such, when viewing the results in the SAS output, a probability value greater than 0.05 would indicate that the finding of

this test is not statistically significant, and thus there is no difference between the survey answers given by the first group (e.g. BOKS) versus those given by the second group (e.g. non-BOKS), whereas a probability value less than 0.05 would indicate that the finding of this test is significant, and thus there is a statistically significant difference between the survey answer given by the first group versus those given by the second group.

The second primary analytical test used was the Mann-Whitney-U (or: Wilcoxon) test, which was utilized for questions where one of the variables was ordinal, and especially when the ordinal variable was not assumed to have a normal distribution. This test required the two groups to be independent, but from the same population.

This test was run using the "npar1way" procedure in SAS, specifying "Wilcoxon". The relevant result was found under the heading "Normal Approximation", and the two-tailed result was chosen since the directionality of the outcome could not be known, and was of interest.

As above, a 95% level of significance was adopted for the results of this test, and thus when $p>0.05$, we conclude that there is a 50% probability that a random value from the first group (e.g. boys) exceeds a random value from the second group (e.g. girls), or, in other words, that the median of the first group is statistically equal to the median of the second group. When $p<0.05$, however, we conclude that there is a statistically significant difference in the medians of the compared groups.

In some cases, the data were tested for normality to determine if Mann-Whitney-U was necessary, or if a Student's t-test would be sufficient. This was done by specifying "normalttest" within the "univariate" procedure on SAS. This procedure executes four tests on the data, each providing a statistic and a p-value. When $p>0.05$, the data set is indicated to have normal

distribution. If the four values provide different conclusions, common sense must determine the best test for analysis.

The Kruskal-Wallis test was employed in the second part of the analysis, where PA and PL scores were calculated for each participant and analyzed for comparison across a broader array of groups. This test is run automatically as an extension of the Mann-Whitney-U test, and is useful when one group being compared has more than two variables. The relevant result was the "Pr>Chi-Square" value, and the interpretation is the same as for the Mann-Whitney-U value.

3.4.3. *Analysis of the Survey Questions*

Each of the 16 relevant survey questions had a different format and thus each one required a unique approach in order to organize the data for analysis and interpretation. Table 3.6. presents questions 6-20, and 22P, in order, and describes the goal of each question, the options that were given to the respondent, how the options were organized for analysis, and the statistical test run in SAS.

Table 3.6. Survey questions and analysis

	Question and Goal	Options on Survey	Groups for SAS coding	Analytical Test(s)
6	*PL: Knowledge* How many minutes of physical activity are recommended for children to do each day?	a. 10 minutes b. 20 minutes c. 30 minutes d. 60 minutes or 1 hour	a, b, c = "30" → wrong answers d = "60" → correct answer Blank entries were not included. N=126 (students=49, parents=77)	Chi-square
7, 8	*PA: Self-reported* On how many days was your child physically active for a total of at least 60 minutes per day? (7) over the past 7 days. (8) over a typical or usual week.	a. None (zero days) b. 1 day c. 2 to 3 days d. 4 to 6 days e. Every day (7 days)	a, b, c = "3" → minimal days d = "4"→ adequate days No one chose option E N(7)= 125 (students=49, parents=76) N(8)= 125 (students=48, parents=77)	Chi-square
9	*PL: Attitude* Do you agree or disagree that movement, activities and sports are very important (a) in school? (b) at home with family? (c) with friends?	a. Strongly disagree b. Disagree c. Agree d. Strongly Agree e. I don't know	Looking for answers of C or D in at least one sub-question. 127/128 complied; bivariate analysis irrelevant. N=128 (students=50, parents=78)	NA, descriptive only
10, 11	*PL: Motivation* (10) – When I am active I… (9 options given) (11) – Would any of the following reasons stop you from being active? (10 options given)	Each sub-question had the option: a. No b. Maybe c. Yes	a = "1" / b = "2" / c = "3" A sum was calculated for each child's total score. Most motivated child: In Q10: many "yes" → high score of 27. In Q11: many "no" → low score of 10. N(10)= 126 (students=50, parents=76) N(11)= 127 (students=50, parents=77)	Mann-Whitney-U
12, 13	*PL: Motivation (12) and Competence (13)* (12) – Compared to other kids your age, how active are you? (13) – Compared to other kids your age, how good are you at sports or skills?	Survey presented a scale from: 0 (others are more or better) to 10 (I'm more active or better)	No conversion necessary; took number chosen for comparison N(12)= 121 (students=47, parents=74) N(13)= 121 (students=48, parents=73)	Normality, Mann-Whitney-U
14	*PL: Confidence* My fitness is good enough to let me do all the activities I choose.	a. Agree b. Disagree	115/ 121 chose "a"; bivariate analysis irrelevant	NA, descriptive only
15S	*PA: Self-reported* In the last 30 days, have you completed the following activities? (9 movements listed)	Each sub-question had the option: a. Yes b. No c. I don't know	a = "1"→ activity done b, c = "0" → activity not done A sum was calculated for each child's total score; most active child has a score of 9. N=50	Mann-Whitney-U

Question and Goal		Options on Survey	Groups for SAS coding	Analytical Test(s)
16S/ 15P	*PL: Competence* How good are you at doing sports and activities? (6 environments listed)	a. Never tried b. Not so good c. OK d. Very good e. Excellent	Looking for answers of D or E in at least one sub-question. 120/128 complied; bivariate analysis irrelevant. N=128 (students=50, parents=78)	NA, descriptive only
17-19S / 16-18P	*PA: Self-reported* About how many hours a week do you usually take part in physical activity that makes you out of breath or warmer than usual: (17S/16P) in free time at school, for example, at lunch? (18S/17P) in class time at school? (19S/18P) while participating in lessons or league or team sports outside of school?	a. Never b. Less than 2 hours per week c. 2 to less than 4 hours /wk d. 4 to less than 7 hours/wk e. 7 or more hours per week	a, b, c = "0" → minimal activity d, e = "1" → adequate activity N(17)= 128 (students=50, parents=78) N(18)= 123 (students=47, parents=76) N(19)= 125 (students=48, parents=77)	Chi-square
20S/ 19P	*PA: Transportation* During the past week, how did you usually get to and from school?	a. Car b. School bus c. Public bus/transportation d. Walking e. Cycling f. Other active mode g. Other inactive mode	a, b, c, g = "0"→ Inactive modes d, e, f = "1" → active modes A child with one direction "active" was given a score of 2/active. N= 127 (students=50, parents=77)	Chi-square
22P	Read the list of statements that describe children's behaviour and indicate how often your child has had a problem with the following behaviours in the last 6 months. (20 items listed from "a" to "t": 10 relating to shift, 10 relating to working memory)	Each item had the options: a. Never b. Sometimes c. Often	a = "1" / b = "2" / c = "3" Each section (shift and working memory) was approached separately; a sum was calculated for each child. No problems in either section → low score of 10. N=77	Normality, Mann-Whitney-U

Key: *PA: Physical Activity* *PL: Phyiscal Literacy* *S: Student* *P: Parent*

3.5. Analyzing the PA and PL Scores

After analyzing each question individually, two scores were created for each survey entry, one to reflect the measures of physical activity, and one to reflect the measures of physical literacy. These PA and PL scores were then used for further comparisons across other groups within the study sample.

3.5.1. *Creating the PA and PL scores*

To create the scores to assess overall Physical Activity and overall Physical Literacy, points were assigned for each of the answers, and were calculated in Excel as described in Table 3.7. The maximum score for Physical Activity was 6 for parents and 7 for students, and the maximum score for Physical Literacy was 9.

Table 3.7. Calculating the physical activity (PA) and physical literacy (PL) scores

Q#	Point	Answer	Notes
PA Scores			
7, 8	1 0	"4-6 days" Other answers	"IF" statement. Max 1 point per question, x2.
15S	1 0	Answer of "yes" for at least two of the activities Fewer than two answers of "yes"	"IF" statement. Max 1 point per question
16-18P / 17-19S	1 0	"4 to less than 7 hours/wk" OR "7 or more hours per week" Other answers	"IF/OR" Statement. Max 1 point /question, x3
19P/20S	1 0	Any active transportation Both way inactive transportation	"IF/OR" Statement. Max 1 point /question
PL Scores			
6	1 0	Correct answer Wrong answer	"IF" statement. Max 1 point per question
9	1 0	At least one answer of "Agree" or "Strongly Agree" No answers of "Agree or "Strongly Agree"	Visual check. Max 1 point per question
10	2 1	Scores above 18/27 Scores at or below 18/27	"IF" statement. Max 2 points per question.
11	1 0	Scores less than 19/30 Scores at or above 19/30	"IF" statement. Max 1 point per question
12	1 0	Answer at or above 6 Answer below 6	"IF" statement. Max 1 point per question
13	1 0	Answer at or above 6 Answer below 6	"IF" statement. Max 1 point per question
14	1 0	Answers of "Agree" Answers of "Disagree	"IF" statement. Max 1 point per question
15P/16S	1 0	At least one answer of "very good" or "excellent" No answers of "very good" or "excellent"	Visual check. Max 1 point per question

Individual scores were calculated for each survey entry (one each for PA and PL). The 45 matched parent and student scores were compared to each other to see if both parents and children rated the child in the same way. The "Means" procedure was employed for this test, and a variable was created which found the difference between the parent and student scores for each measure. A student's t-test was run on that variable, and the resulting p-value indicated whether the students and parents graded themselves similarly ($p>0.05$) or differently ($p<0.05$).

To create a single score for each individual, an average was found between each of the 45 paired student and parent scores. For the 38 un-matched surveys, SAS was instructed to keep the single score.

3.5.2. *Comparing the PA and PL scores between groups*

Once the PA and PL scores were established, the next stage of analysis compared the scores across different groups within the population: BOKS vs. non-BOKS, boys vs. girls, grade 3 vs. older, and Cedar Drive vs. Ranch Park. Then, a more in-depth analysis was undertaken, and the scores were compared to ethnicity, student marks, parental education, and household income.

For analysis of ethnicity, the population was divided into "white" and "non-white". Eight ethnic options were provided on the survey, including one option of "other," however, of the 83 represented individuals, 66 identified as white, with only 17 comprising the entire second group; thus further ethnic grouping would prohibit proper analysis. Some participants indicated two options for ethnicity, for example the same person circling both "white" and "Asian", or including accompanying text, and in this case the individual was classified as non-white.

The survey asked children and parents to describe the average marks of the child over the past year, and five options were given, splitting the grades from "mostly A" to "mostly below C" (see

Appendices D and/or E). The majority of answers chosen (n=62/83; 75%) indicated high average marks, and thus the population was split into two groups: those who meet or exceed the provincial standard (A and B), and those with marks lower than the provincial standard. Only one measure was taken for each student, and a discrepancy (of which there were four) between the student and parent survey for the same individual favoured the higher mark. SAS was coded to read the two highest brackets as "1", and all other options as "0".

The parent survey included some additional demographic questions, including the level of education the responding parent has attained, as well as annual household income. Six options were provided for parental education, from some high school through graduate degrees, and including an option of "I don't know" (see Appendix E). One answer was left blank, leaving 77 surveys for analysis of this factor. The remaining five options were combined to create three categories; the two least educated brackets (high school or less) comprised the first group (n=15), the middle brackets (College/ trade/ Bachelor's) encompassed the second (n=45), and anything including or above a graduate degree went to the final group (n=17).

For ascertaining annual household income, five options were given, from $30,000 or less to $100,000 or higher (see Appendix E). Blank answers were excluded, leaving 73 surveys for analysis of this factor. The two lowest income groups (<60K) comprised the first division (n=7), the middle brackets (60-100K) the second (n=28), and the highest bracket (>100K) served as its own (n=38).

The Mann-Whitney-U test was conducted for each of the above comparisons. The Kruskal-Wallis test was employed for parent education and household income, due to having three groups for analysis.

3.5.3. *Comparing the PA and PL scores to Behaviour*

The parent survey included a question which inquired as to the behavioural tendencies of the child, and which was included to determine if there is a relationship between participating in BOKS and positive scores on these behaviours which impact learning.

The parents read a series of 20 sentences describing various behaviours (see Appendix E), and rated their child as having done those behaviours "never", "sometimes", or "often". The first ten sentences described behaviours relating to the ability to change topics or activities (shift), while the second ten sentences related to the ability of the child to complete a task (working memory). The answers were assigned numerical values, as described in Table 3.6. (above) and two behaviour scores were thus calculated for each child, one score for each type of behaviour. The lowest possible score for each section was 10, representing ten answers of "never", and indicating a child with no problems in this area, while the highest possible score was 30, representing ten answers of "often", and indicating a child with every symptom of a problem in this area.

In the first stage of analysis, the behaviour scale results were compared between BOKS and those not participating in BOKS, boys and girls, grade 3 and older children, and CD and RP. In the second stage, the PA and PL scores were compared to the behaviour results, and to allow for this comparison, the ordinal behaviour results were categorized, as described in Table 3.8.

Table 3.8. Converting the behaviour scale results for comparison to PA/PL scores

In the:	**First Analysis**	**Second Analysis**
The behaviour scale results are:	Ordinal values (10-30)	Ordinal values (10-30)
Which are compared to:	BOKS, sex, grade, school	PA and PL scores
Which are:	Categorical values	Ordinal values as well (0-7 or 0-9)
And thus:	No change is needed: We can use the Mann-Whitney-U test to compare between one ordinal set of values and one categorical set of values.	One set of values must become categorical to allow for comparison. Because the PA/PL scores are the item of interest, they remain ordinal, and the behaviour scale results are split into categories: 10-15, 16-20, 21-30.

Due to the not-normal distribution of results with heavier representation at scores less than 20, the population was divided at scores of 15 and 20 for analysis. The first group included those who scored from 10-15 inclusive, and indicated children with no or minimal behavioural difficulties (shift n=48, working memory n=47). The second group included those who scored from 16-20 inclusive, and indicated children with minimal or average problems (shift n=27, working memory n=24). The third group included those with scores from 21-30 inclusive, and indicated children with moderate to severe behavioural difficulties (shift n=8, working memory n=12).

3.6. Pedometers

3.6.1. *General Information*

As an additional measure of PA, Propel distributed pedometers to interested participating schools (see Pedometer Information Letters in Appendix F). At Ranch Park Elementary School, 27 students received pedometers to wear from November 25, 2015, through December 3, 2015. They were sent by Propel to the school via courier, and were distributed by the classroom teacher on November 20, 2015, and were similarly returned to Propel by late December. The children wore the pedometers for nine days, and recorded their activities in an accompanying log (see

sample log in appendix G). This provided more information about the physical activity of the students, beyond the self-reported measures indicated in the surveys.

Two of the students had no steps registered to their pedometers, and were thus excluded from analysis, while twenty-four of the pedometer-wearing students also filled out surveys, providing a complete profile, and the final student did not fill out a survey but had basic information (sex, grade) provided from the main database. Therefore, there are 25 pedometers for analysis across the basic groups, but 24 pedometers for analysis with the PA and PL scores.

In addition to their basic function of counting the number of steps walked, the pedometers collected information from the students including aerobic steps (calculated when many steps were taken in a short amount of time), aerobic walking time, and "events" as indicated by the child. This research, however, only focused on the number of steps walked, and furthermore only considered days on which the child logged at least 1000 steps. This cut-off was similarly adopted by Propel, and indicates that the child was wearing the pedometer for a significant portion of the day, while a number lower than 1000 steps indicated that the child likely only wore the pedometer for a very short and insignificant portion of the day.

3.6.2. *Analyzing the pedometer data*

The average steps per day for each child was used for comparison across the groups (BOKS vs. non-BOKS, boys vs. girls, and grade 3 vs. older children). Values less than 1000 had to be excluded from the average, and thus the data were first calculated in Excel: each of the pedometers were worn for nine days, producing nine steps/day values, which were each manually checked to determine if they were above 1000, and values that passed the threshold were used to calculate an average steps/day value for that child. That average value was then

entered into SAS along with the relevant demographic data, and was analyzed with the Mann-Whitney-U test.

To compare the PA and PL scores with the pedometer results, the pedometer data were categorized to represent those with lower or higher than average steps per day, as described in Table 3.9.

Table 3.9. Converting the pedometer results for comparison to PA/PL scores

In the:	**First Analysis**	**Second Analysis**
The pedometer results are:	Count data (3480-15829)	Count data (3480-15829)
Which are compared to:	BOKS, Sex, Grade, School	PA and PL scores
Which are:	Categorical values	Ordinal values (0-7 or 0-9)
And thus:	No change is needed: We can use the Mann-Whitney-U test to compare between one set of count data and one categorical set of values.	One set of values must become categorical to allow for comparison. Because the PA/PL scores are the item of interest, they remain ordinal, and the pedometer results are split into categories: 3480-9739 (average), and 9740-15829.

3.7. Chapter Summary

This chapter outlined the research design and methodology for this thesis, including school and student-level participants, the quantitative data measures employed, and the procedures for data analysis of each of the various components. The following chapter will present the results of this analysis.

Chapter 4: Results

4.1. Introduction

This chapter presents the results from the survey (n=128) and pedometer data (n=27) that were part of the BOKS evaluation during the fall, 2015, session. These data provide information regarding:

1. The pilot of a systematic methodology for evaluation of the BOKS program.
2. The range of factors that may influence the PA and PL of the participating children.

First, the student and parent surveys are analyzed in depth, according to measures of physical activity, then physical literacy, and finally behaviour scale results. The PA and PL scores follow, with the pedometer data completing the chapter.

4.2. Survey Measures

4.2.1. *General Overview*

The answers to each question on the survey were compared between four primary groups: BOKS vs. non-BOKS, boys vs. girls, grade 3 vs. older children, and (children from) Cedar Drive vs. Ranch Park. Of the 16 included survey questions, bivariate analysis was not carried out for three of them (9, 14, and 16S/15P, see section 4.2.2.) due to virtually zero variability in the answers. The analysis of the remaining 13 questions (11 questions common to students and parents, one for students only, and one with two-parts for parents only), indicated that approximately 11% of all answers showed a statistically significant difference between the two groups being compared ($p<0.05$). The distribution of results indicate that in general, among this population, there were few differences in the responses between those in BOKS vs. those not in BOKS; between boys and girls; between those in grade 3 vs. those in older grades; and between those attending Cedar

Drive Elementary vs. those at Ranch Park Elementary, on the measures of PA and PL as presented in the survey.

4.2.2. *Results of the physical activity measures from the survey questions*

Seven survey questions pertained to the physical activity of the children, five of which asked the respondent to quantify hours or time spent being active in a specific setting, one which asked the student to report on types of PA, and the final one asked about the method of transportation to and from school. The results from these questions are presented in Table 4.1.

Six of the seven PA questions were analyzed using a chi-square test of independence (refer to Table 3.6); Table 4.1. presents the percentage from each group who answered the question "correctly", and the resultant p-value. For example, the first square in the table can be read as follows: "On question 7, 78% of BOKS children, and 76% of non-BOKS children indicated that they spent at least four days being active last week. When these groups were compared, the chi-square analysis revealed a p-value of 0.89, indicating that there is no significant difference between the answers of BOKS and non-BOKS for this question."

For the one PA question that was analyzed with a Mann-Whitney-U test (Q15S), the table reflects the mean score of each group, and the resulting probability value. For example, the first square for Q15S would read, "On the topic of various fitness skills, the mean score for BOKS participants was 28, and for non-BOKS participants was 20. When these groups were compared, the Mann-Whitney-U analysis revealed a p-value of 0.10 (two-tailed), indicating that there is no significant difference between the answers of BOKS and non-BOKS for this question."

Percentages and mean scores were rounded to whole numbers, and p-values were rounded to 2 decimal places.

Table 4.1. Physical activity measures on the survey by question and group comparison

		Student				Parent			
		BOKS	**Sex**	**Grade**	**School**	**BOKS**	**Sex**	**Grade**	**School**
Q#	**Value**	(BOKS, non)	(boy, girl)	(Gr3, older)	(CD, RP)	(BOKS, non)	(boy, girl)	(Gr3, older)	(CD, RP)
7 Self-report,>4d	*%*	(78, 76)	(91, 65)	(84, 70)	(71, 83)	(78, 67)	(84, 67)	(81, 67)	(79, 75)
	p-value	0.89	**0.03***	0.27	0.34	0.35	0.09	0.14	0.69
8 Self-report, >4d	*%*	(75, 62)	(86, 58)	(76, 65)	(67, 74)	(76, 67)	(84, 65)	(79, 68)	(75, 76)
	p-value	0.37	**0.03***	0.41	0.60	0.42	0.06	0.26	0.96
15S Fitness skills	*Mean score*	(28, 20)	(26, 25)	(28, 23)	(19, 27)	-	-	-	-
	p-value	0.10	0.67	0.23	0.05				
17S/ 16P Free time, >4hrs	*%*	(56, 44)	(65, 40)	(60, 44)	(54, 50)	(49, 37)	(59, 34)	(58, 31)	(40, 49)
	p-value	0.42	0.08	0.26	0.76	0.35	**0.03***	**0.02***	0.46
18S/ 17P Class time, >4hrs	*%*	(13, 25)	(32, 4)	(16, 18)	(14, 17)	(18, 26)	(19, 20)	(31, 6)	(16, 21)
	p-value	0.30	**0.01***	0.84	0.83	0.41	0.95	**0.01***	0.59
19S/ 18P Not school, >4hrs	*%*	(53, 50)	(60, 44)	(48, 56)	(52, 50)	(43, 42)	(46, 40)	(49, 35)	(40, 46)
	p-value	0.84	0.24	0.55	0.87	0.94	0.60	0.23	0.63
20S/ 19P Transportation, active	*%*	(38, 50)	(43, 41)	(40, 44)	(59, 25)	*(33, 58)*	(40, 37)	(35, 44)	(28, 46)
	p-value	0.43	0.85	0.77	**0.02***	**0.05***	0.78	0.41	0.14

Key: % = the % who answered the question "correctly", chi-square p-value = the p-value for the comparison within that group
Mean score = The mean score from the Mann-Whitney-U analysis **n*** = $p<0.05$.

There was one significant difference when comparing the BOKS and non-BOKS groups, while four differences were found when comparing by sex, two when by grade, and one when by school. Overall, these results indicate that while the BOKS program did not have any impact on the physical activity of the children, the sex of the child is a significant factor in overall physical activity, grade is an important factor in levels of physical activity especially during school hours, and how the child gets to and from school differs according to school.

Qs 7 and 8: Self-reported activity, general

As a measure of self-reported physical activity, questions 7 and 8 asked how much time the student spent being active over the past week or in a usual week, and in both cases boys indicated significantly higher levels of activity than girls. Although the parents did report greater activity for boys compared to girls, these results were not statistically significantly different.

About three-quarters of all respondents marked that they were active for at least 60 minutes per day, 4-6 days per week. There were no differences in reported activity between the other groups.

Q 15S: Fitness skills

Question 15 asked the students about the types of PA movements they have encountered and performed, and every child (n=50) scored one point for running, and all but two also scored one point for jumping. Thirty-seven (74%) and 35 children (70%) reported that they did push-ups and squats, respectively, with burpees (62%), crunches (58%), and planks (52%) following in popularity. The least-performed activities were donkey kicks (46%) and walking lunges (44%). When these answers were added together, almost half of the children (23/50) attained scores of 7/9 or above. None of the group comparisons were statistically significantly different for this question.

It is important to note that this question refers only to diversity, or the number of different types of PA, and the children who scored only one point for running, without having done any other type of PA may, in fact, be very active children; they may have been running every day, while a child with a score of "9" may have done all 9 activities during one 20-minute gym class and then not moved at all for the rest of the month. Due to the young age of the children (and the responses from questions 7 and 8), it is likely that most of the children were generally quite active, but technically this question does not provide information on the quantity of each type of PA, and the high or low score for diversity of PA represents only the number of different activities, and not the amount of PA.

Qs 17-19S, 16-18P: Self-reported activity, in and out of school

Three questions on each survey asked about PA during and outside of school, with the result of interest being physical activity equal to or greater than four hours per week. Parent answers indicated a significant difference in PA in free time at school, with their sons and younger children having more activity than their daughters and older children. For class-time PA, parents again indicated that their children in younger grades have more PA than those in older grades, but the students did not report this difference, instead indicating a split by sex, with boys responding that they have more class-time PA than girls.

These findings are curious. How do the parents know what is happening during free time at school? Do they assume that their sons (59%) are running around more than their daughters (34%) at recess or during other free time ($p=0.03$)? Did they perhaps complete the survey while consulting with their child, for example asking "What do you do at recess every day?", and then mark their answer based on that? And, why did the boys (65%) and girls (41%) themselves not find a difference for this question ($p=0.08$)? The same questions follow for the difference found between older and younger children: how did the parents (31 and 58%, respectively, $p=0.02$) come to the conclusion that their younger children are more active, especially when the students (44 and 60%, respectively, $p=0.26$) do not agree?

These questions rely on self-reporting, which may lie at the crux of these differences. The questions asked to sum up activity over the course of a week, and with blocks of ten or twenty minutes worth of breaks or recess, it might have been challenging for some children to have arrived at an accurate number. Alternately, the parents may have been inaccurate in their answers, due to them not being present during the school day, and having to guess at the level of

activity of their children. This raises the important issue of the validity of self-reporting, of children on themselves, and of parents on their children.

Regarding physical activity outside of school, there were no differences between any of the comparisons. Among the parents, 43% reported at least four hours of activity per week outside of school, while among the students 52% reported that amount.

Q 20S/19P: Transportation

The final PA question (20S/19P) asked how the students travel to and from school, and the results are relevant in three different ways. First, for this analysis, active and inactive transportation can be compared and counted as another measure of the student's overall PA. Second, a difference in modes of transportation between BOKS and non-BOKS, or a conspicuous absence of any mode of transportation, would help inform changes to the accessibility of the BOKS program at schools across Canada. Finally, transportation to and from school is one of the seven indicative behaviours measured on the annual Report Card, and is thus informative on a national scale.

Just over 60% of all respondents indicated that they/ their children are driven to and from school each day, while about 33% indicated walking as their regular transportation, with the remaining few respondents indicating either general active or inactive modes of transportation. One respondent, from Cedar Drive Elementary, indicated that he takes the school bus, which is interesting because there is no school bus program at that school. Most likely he meant to indicate "public bus", or else perhaps he gets to school by a private transport, and the closest option among the survey choices was "school bus."

When comparing the answers of students from CD and RP, there is a statistically significant difference, with children from CD indicating they were more likely to walk to school. The

schools are located very close together, however no obvious difference between the schools arises from the data, for example related to enrollment (219 vs. 259 students) or bus programs (no program at either school). The schools are situated in slightly different neighborhoods of the city, which may ultimately account for this difference. These results would indicate that it is the school the children attend which has the greatest impact on their transportation to and from school.

Parent answers when comparing BOKS and non-BOKS groups were statistically significantly different, with parents of non-BOKS students indicating that their children were more likely to use active transportation to get to or from school. This finding is likely not due to participation (or not) in the BOKS program, and rather is more likely due to the specific neighborhood demographics surrounding each school. It is interesting to note that students differed by school, whereas parents differed by BOKS. Due to the differences in the size of each sample (50 students vs 78 parents), and the overall small sample size, it would be difficult to draw conclusions from these data alone.

Active transportation is a critical component of a healthy lifestyle, with the literature finding that it can add as much as 45 minutes of MVPA per day, and positively influence cardiovascular fitness and cholesterol levels. In the 2016 Report Card, Canada's grade remained a D in this area, with the finding that 58% of children use inactive modes to get to and from school, 25% use only active modes, and 17% use a combination (ParticipACTION, 2016). These data are very similar to the findings from this study, and only serve to reinforce the necessity to increase opportunities for active transportation, especially to and from school.

4.2.3. *Results of the physical literacy measures from the survey questions*

Eight survey questions pertained to physical literacy, asking questions of confidence, competence, knowledge, motivation, or attitude. Four significant results were found among measures of physical literacy, three for differences between boys and girls, and one between parents from different schools, on questions of self-ranking among peers.

The results from these questions are presented in Table 4.2. One PL question was analyzed using a chi-square analysis, four were analyzed with a Mann-Whitney-U analysis, and three physical literacy questions were answered with almost no variability among the responses, and are not included in the table.

Table 4.2. Physical literacy measures on the survey by question and group comparison

		Student				Parent			
		BOKS	**Sex**	**Grade**	**School**	**BOKS**	**Sex**	**Grade**	**School**
Q#	**value**	(BOKS, non)	(boy, girl)	(Gr3, older)	(CD, RP)	(BOKS, non)	(boy, girl)	(Gr3, older)	(CD, RP)
6 Knowledge, 60m	*%*	(68, 67)	(74, 62)	(71, 64)	(57, 79)	(70, 85)	(69, 78)	(71, 77)	(75, 76)
	p-value	0.94	0.36	0.61	0.11	0.19	0.39	0.57	0.96
10 Motivation	*Mean score*	(25, 28)	(26, 25)	(27, 24)	(22, 25)	(40, 38)	(40, 39)	(39, 42)	(37, 38)
	p-value	0.93	0.75	0.58	0.59	0.73	0.84	0.47	0.81
11 Motivation	*Mean score*	(28, 24)	(24, 27)	(25, 26)	(25, 23)	(37, 45)	(39, 40)	(40, 39)	(44, 34)
	p-value	0.33	0.58	0.93	0.60	0.17	0.79	0.97	**0.05***
12 Motivation	*Mean score*	(26, 21)	(29, 20)	(26, 23)	(22, 22)	(38, 36)	(45, 31)	(38, 37)	(38, 36)
	p-value	0.29	**0.04***	0.45	0.85	0.66	**0.01***	0.83	0.66
13 Competence	*Mean score*	(26, 22)	(30, 20)	(25, 24)	(22, 24)	(36, 39)	(40, 34)	(36, 39)	(41, 33)
	p-value	0.42	**0.01***	0.66	0.70	0.68	0.23	0.58	0.10

Key: % = the % who answered the question "correctly", chi-square p-value = the p-value for the comparison within that group
Mean score = The mean score from the Mann-Whitney-U analysis **n*** = $p<0.05$.

Q6: Knowledge

To ascertain knowledge, question 6 asked if the individual recognizes PA guidelines, specifically regarding the recommended number of minutes one should be active each day. Thirty-three students (67%), and 57 parents (74%) answered this question correctly. There were no

significant differences found between the answers when comparing across the different groups in either population, indicating that both students and parents have similar levels of knowledge.

Q9: Motivation, importance of PA

A positive attitude is an important aspect of physical literacy, as it can help maintain interest in physical activity over time, and so question 9 measured the individual's attitude towards PA, in the sense of recognizing PA as important in at least one area of life: at school, with family, or among friends. All 50 students, and all but one parent (n=77/78), agreed or strongly agreed that PA was important in at least one of those areas, with most respondents from both populations choosing at least two, if not all three areas. The importance of PA at school was agreed upon by 94% of students and 97% of parents; with family by 90% of students and 97% of parents; and with friends by 92% of students and 96% of parents. These data point to an extremely positive attitude towards PA among both students and their parents, which is the first step towards a long-term commitment to a healthy lifestyle.

Qs 10 and 11: Motivation, push and pull factors

Questions 10 and 11 asked about some motivating factors: what would motivate an individual to be active, and what might prevent that individual from engaging in physical activity. There was one significant result in the comparisons for this question, between the parents of students from different schools, with parents from CD indicating overall higher scores than parents from RP.

Regarding factors that encourage physical activity (Q10), the lowest score measured was 17 (of a possible 27 points) among students, and 13 among parents, with 78% of students and 54% of parents scoring at least 23 (85%) or above. All parents (n=76) and all but one student (n=49/50) found at least one motivating factor for physical activity.

The most common reasons chosen by the students to be active were: feeling happier, having more fun, getting stronger, and getting in better shape, (86% of students said each of these were reasons for them to be active), followed by feeling healthier (82%). Having more energy and making friends were significant motivating factors (68% and 64%, respectively), while looking better and liking myself more were the least common or popular factors (42%).

Parents were asked to indicate reasons why their children might be active, and the uncontested top answer was having fun (96% of parents said this was a reason for their child to be active). Second-tier factors included feeling happier (79%), feeling healthier (68%) and getting stronger (67%), followed by having more energy and getting in better shape (55%). Making friends was rated low by parents (42%), while feeling more like him/herself (38%), and looking better (20%) were scored even lower.

What is especially interesting about the parent answers is how different they are from their children's. Table 4.3. compares the percentage of students and parents who agreed with each motivating factor, and with the exception of "having fun", parents scored lower on every other factor, with significantly lower scores on four of the other eight options, indicating five areas where students and parents do not agree about the importance of that factor as it relates to physical activity.

Table 4.3. Parent and student comparisons for Q10 options

	Look better	More energy	Feel happier	Have more fun	Make friends	Get stronger	Like myself more	Get in better shape	Feel healthier
Students	42%	68%	86%	86%	64%	86%	42%	86%	82%
Parents	20%	55%	79%	96%	42%	67%	38%	55%	68%
P	**0.01***	0.15	0.32	**0.04***	**0.02***	**0.02***	0.67	**<0.001***	0.09

Regarding factors which would prevent an individual from being active (Q11), the highest score (most easily swayed from activity) was 26/30 among students, and 30/30 among parents, with seven parents scoring from 27-30, i.e. higher than any of the students. Sixty percent of students but only 31% of parents scored 15 or below (not easily swayed from activity), with 4/50 students and 2/77 parents answering "no" to all the options, representing five individuals who claim that they wouldn't stop being active for any reason.

The most significant reasons for students not to be active were bad weather (44% answered that bad weather would *not* prevent them from being active), not having the right equipment (50%), having too much homework (54%), and not knowing how to the do the activity (58%). Not having someone to be active with (66%), and not having enough time (68%) were less compelling reasons to abstain from PA, while having too many chores, not having a good place, and not having the right clothes or shoes were apparently less sufficient reasons to stop being active, with 74% of students claiming each of these reasons would not stop them. Most interestingly, 80% of students responded that not liking physical activity would not stop them from doing it anyway.

Parents, on the other hand, had a very different opinion of which factors would prevent their children from being active. According to parents, bad weather (21% answered that this would *not* prevent their child from doing PA), not having someone to be active with (22%), and not having enough time (25%) were convincing reasons why their children would not be active, as were not knowing how to do the activity (31%), not having the right equipment (35%), and no good place to be active (38%). Less credible reasons, according to the parents, included not liking physical activity (52%), and having too much homework (57%) while factors like not

having the right clothes or shoes (60%), and having too many chores (65%) were not as likely to prevent their children from being active.

Parents and children were not statistically significantly different in their answers regarding the relevance of homework (p=0.73), chores (p=0.28), clothing (p=0.1) and/or equipment (p=0.09) preventing physical activity, however, they had very different opinions regarding the remaining six factors (p<0.05). Parents felt that their children were more likely to stop being active, while children were more optimistic about their physical activity.

As observed above in some of the physical activity reporting, there is sometimes a difference between how or what a child reports about him or herself, versus the parent's perception, and this difference is quite evident in these questions regarding motivating factors.

Table 4.4. Parent and student comparisons for Q11 options

	No Time	Chores	No Place	Bad Weather	No clothes/ shoes	Don't know	No equipment	Home-work	No partner	Don't like it
Student	68%	74%	74%	44%	74%	58%	50%	54%	66%	80%
Parent	25%	65%	38%	21%	60%	31%	35%	57%	22%	52%
P	**<0.0001***	0.28	**<0.0001***	**0.01***	0.1	**0.003***	0.09	0.73	**<0.0001***	**0.001***

Qs 12 and 13: Motivation and Competence

Questions 12 and 13 sought to determine the competence level of the child, and asked the individual to rate themselves/ their child with a score from 0-10, with a higher score indicating a child who is more active (Q12) or better at sports and skills (Q13) than his or her peers. The distribution of answers was not normal across the range of options, with 86% (67/78 parents) or 87% (41/47 students) of answers equal to or above a score of 5.

Three significant results were found among the comparisons for these questions, all when comparing results between boys and girls. On question 12, both boys (p=0.03) and parents of

boys (p=0.01) answered that they (their sons) were more active than their female counterparts, and on question 13 boys responded that they were more skilled than the girls in their class (p=0.01). Similarly, parents of boys indicated higher skill for their child than parents of girls, however this difference was not significant (p=0.23).

On both time spent being active, and level of skill, girls rated themselves lower than the boys in their peer group. In a co-ed class, it is reasonable to assume that even if the boys are not actually more active or more skilled, they would nonetheless appear to be so to the casual female classmate, due perhaps to the natural male confidence, or their tendency to play sports at every recess while girls might be socially "required" to engage in less active activities (Brustad, 1993, Babic, 2014, and Seabra, 2013). It would be informative to compare the results from a girls-only school, or to ask the girls to compare themselves only to the other girls in their class; the results would likely have a different distribution.

Q14: Confidence

On a measure of confidence, however, (Q14) there was no gender difference. In fact, there was nearly 100% agreement with the statement that their (their child's) fitness is good enough to allow them to do all the activities they choose, with 47/49 students, and 68/72 parents in agreement. The dissenters among the population did not belong to any particular demographic, and were equally represented by boys and girls, older and younger grades, both schools, and were equally BOKS and non-BOKS participants.

This result points to a ceiling effect in this question, whereby the question is not specific enough to allow for differentiation. We do not know, for example, if the agreement to the statement was strong or weak, or represented "most of the time" versus "some of the time". While this format

allows for a certain measure of confidence, a more detailed question would permit greater understanding of this element.

Q 16S/15P: Competence

The final measure of physical literacy (Q16S/15P) sought to determine the child's competence at sports and activities in each of six different environments. A child need not be an all-around athlete, but if there is at least one area in which he or she feels physically competent, that would be enough to encourage adequate physical activity. With these criteria, there was nearly 100% positive responses, with only 2/50 students and 6/78 parents not meeting the requirements. As above, the dissenters among the population did not belong to any particular demographic, and were equally represented by all groups.

The three environments with the highest percentage of competent children were found to be outdoors, on the playground and in the gym, with at least one answer of "very good" or "excellent" from an average of 77% (74-82%) of students, and 74% (63-82%) of parents. Looking back at the survey itself (Appendices D and E), it is easy to confuse these three options, and there may be overlap in how they were understood. The example for "gym" was "playing sports", but "playing soccer" was listed as an example under "outdoors" and thus there may have been a difference in perceptions between students and parents particularly in what was meant by gym, outdoors, and/or playground, leading to the difference in distribution of answers between parents and students.

Sixty percent of students and parents answered that they/ their child felt competent on the water, while the numbers dropped significantly for winter environments: only 32% of students and 26% of parents answered that they/ their child was "very good" or "excellent" on ice, while those numbers dropped to 24% for each in snow. Since the entire population from this study was

located in British Columbia, it would be interesting to contrast these numbers with a similar population in a different province or area.

4.2.4. *Results of the behaviour scale measure from the survey*

Question 22 on the parent survey assessed some measures of child behaviour and executive functioning. The question had two parts, one measuring the ability of the child to transition between activities (shift), and the other measuring the ability of the child to stay with an activity until it is complete (working memory). Seventy-seven parents filled out this question, and a total of six answers (of 1540: 20 sentences * 77 surveys) were left blank, belonging to four people. Instead of assigning a code of "0" to blank answers, which would lower the score of the child, or excluding the entire entry from analysis, the mode of the other answers was determined for that child, and the blank answer was filled in with the mode. Thus, the following adjustments were made:

ID	**1639**	left blank option:	**S**	which was filled in with:	**1**
ID	**1641**	left blank options:	**L, N, R**	which were each filled in with:	**2**
ID	**1667**	left blank option:	**F**	which was filled in with:	**1**
ID	**1685**	left blank option:	**S**	which was filled in with:	**1**

For both shift and working memory, the majority of all scores came in at or below 20 (possible range: 10-30), indicating a minimally symptomatic, or average, child. For shift, 90% of entries were low, with the most common scores shown at 13 (n=10) and 20 (n=8). For working memory, 84% of entries were low, with the most common scores shown at 11 (n=9), 15 (n=8), and 20 (n=8). For both shift and working memory, the range of scores was not normally distributed, and so the Mann-Whitney-U test was used for analysis.

The behaviour scale results were compared by BOKS participation, sex, grade, and school. The PA and PL scores were then compared against the behaviour scale results, to determine if there was a difference in PA/PL scores according to low, medium, or high behaviour scale results.

Table 4.5. Behaviour scale results by group comparison

Measure	Value	BOKS (BOKS, non)	Sex (boy, girl)	Grade (Gr3, older)	School (CD, RP)	PA (Low, med, high)	PL (Low, med, high)
Shift	*Mean score*	(36, 47)	(37, 41)	(35, 44)	(42, 34)	(45, 38, 35)	(52, 30, 27)
	p-value	**0.04***	0.39	0.08	0.11	0.29	**0.0001***
Working Memory	*Mean score*	(40, 37)	(34, 44)	(41, 37)	(34, 38)	(41, 42, 44)	(46, 37, 38)
	p-value	0.63	0.06	0.46	0.41	0.92	0.29

Key: Mean score = The mean score from the Mann-Whitney-U analysis

p-value = the p-value for the comparison within that group

n* = $p<0.05$.

For the comparison between children who participated in BOKS and those who did not, there was a statistically significant difference in their answers on the shift scale, ($p=0.04$) with an overall lower score found for BOKS participants. The comparisons between the groups of sex, grade, and school, did not produce statistically significant results for either measure.

There was no difference found in the PA scores between those with higher or lower scores in shift or working memory, indicating that all children rate equally in their physical activity, regardless of any difficulty with transitioning or completing a task. Similarly, working memory did not appear to affect the PL scores, however there was quite a significant difference in PL scores when split by shift ($p=0.0001$), with higher PL scores attributed to children with lower shift scores. However, due to the inequality in the sizes of the high, medium, or low-scoring groups, it would be hard to determine any conclusions from this result, and should be re-evaluated with more equally distributed representation.

4.2.5. *Summary of the results from the survey measures*

The two significant differences when comparing survey answers between BOKS and non-BOKS groups were found among parent answers on the transportation question, and on one part of the behavioural scale question. None of the questions pertaining to physical activity or physical literacy differed between the groups, indicating that in this preliminary study, participating in the BOKS program did not achieve different results in the PA or PL outcomes measured than those found for the non-BOKS participants.

When comparing survey items between boys and girls (students), five (n=12, 42%) comparisons showed significantly different answers. These differences were specific to questions related to time spent being active, and ranking among peers. Interestingly, parents only noted two significant differences when asked about their sons or daughters, on a question of free time at school, and on ranking among peers.

Fewer differences were found when comparing the other groups, with two significant survey results between the parents when comparing older and younger children (two measures of time spent being active), and two significant results between participants from different schools (children on transportation, parents on ranking among peers).

Having two sample populations complete the same evaluation allowed for some comparison between their answers, and it was interesting to note where they differed. For example, male students reported higher levels of activity than females, but parent results did not note the same difference. On the questions of motivators and barriers, there were significant differences in the priorities of students compared to their parents.

4.3. PA and PL Scores

4.3.1. *General Overview*

After reviewing the data on each survey question individually, two overall summary scores were created from the relevant items on each survey, to reflect the Physical Activity and Physical Literacy of each child. These scores were then used for further analysis.

On the physical literacy score, both students (n=50) and parents (n=78) could score up to 9 points, and their average scores were 7.6 and 7.28, respectively, indicating high levels of PL for both groups. Forty-five of the surveys were matched between students and parents, and of those surveys, the PL mean score was 7.64 for students, and 7.42 for parents, with no statistically significant difference between those values (Pr>t; 0.29). Once parent and student scores were combined, that is, once an average was calculated for each of the 45 matched parent-student scores, the average score was 7.34 across all 83 entries, with a range from 4-9. The distribution of scores was not normal, with the weight of the scores between values 7-9.

On the physical activity scale, parents could score a maximum of six points, while students were able to score up to seven points, due to question 15 which was only asked on the student survey. An adjustment then had to be made to account for this extra point, and because 48/50 students received one point for this question, it was essentially removed from the calculation: one point was subtracted from the students' score before any further analysis with or comparison to the parents' score. This calculation was not made for the two students who scored "0" on question 15.

The average PA score for parents (n=78) was 2.92 while the average PA score for students (n=50) was 3.04 after the adjustment, indicating intermediate levels of PA. Of the 45 matched

surveys, the PA mean score was 3.02 for the parents, and 3.13 for the students, with no statistically significant difference between those values (Pr>t; 0.61). Once the 45 matched parent and student scores were combined, the average score was 2.91 across all 83 entries, with a range from 0-5.5. The distribution of scores was not normal, with the weight of the scores between values 3-5.

4.3.2. *Results of the analysis of the PA and PL scores*

The PA and PL scores were compared between the various groups of interest.

Table 4.6. PA and PL scores by group comparison

		BOKS (BOKS, non)	**Sex** (boy, girl)	**Grade** (Gr3, older)	**School** (CD, RP)	**Ethnicity** (white, non)	**Marks** (high, low)	**Parental Education** (low, med, high)	**Household Income** (low, med, high)
PA	*Mean score*	(43, 40)	(50, 35)	(47, 35)	(40, 40)	(43, 37)	(44, 37)	(43, 39, 35)	(27, 37, 38)
	p-value	0.68	**0.004***	**0.03***	0.93	0.32	0.28	0.61	0.43
PL	*Mean score*	(43, 40)	(45, 39)	(42, 44)	(39, 41)	(45, 31)	(46, 32)	(44, 37, 41)	(21, 40, 38)
	p-value	0.56	0.24	0.86	0.78	**0.04***	**0.02***	0.48	0.11

Key: Mean score = The mean score from the Mann-Whitney-U analysis p-value = the p-value for the comparison within that group
n* = $p<0.05$.

Boys and grade-3 students achieved significantly higher PA scores than girls and grades 4-6 students, while no difference was found between BOKS and non-BOKS, or between children at different schools. There were no statistically significant differences found in PL scores between any of the first four groups.

There was no significant difference in PA scores between children of different ethnicities, children with higher or lower average marks, children of parents with varying degrees of education, or children from households with a range of annual income. These results are positive, as they indicate that children in this study from all walks of life are equally physically active.

Regarding the PL scores, the parents' education or income did not appear to influence the outcome, however the ethnicity and the marks of child were found to be significant, with white

children scoring higher than ethnic children, and those with higher marks similarly scoring higher than those with lower marks. The difference in ethnicity is interesting, however with only 17 non-white respondents and 66 white respondents, it would be difficult to draw any conclusions. Indeed, almost 90% of non-white respondents have completed at least an undergraduate degree or college program, indicating well-educated households, and as such the discrepancy in results is less likely due to a cultural disadvantage among children of ethnicities, but rather due to the unequal distribution of the population in this sample. The difference found between children with lower and higher class grades requires further investigation, however, and may be an indication that those with higher grades are also more confident in themselves, and therefore score higher in the measures of physical literacy. This is something that BOKS is actively trying to influence, and so data from a larger population would be helpful in exploring this further.

4.4. Pedometers

4.4.1. *General Overview*

Of the 225 days' worth of pedometer data collected, 47 days (21%) reflected 16 (of 25) children with fewer than 1000 steps that day, of which 27 days (12% of total) reflected 11 children with zero steps, both phenomena likely due to the child forgetting to put on the pedometer for a significant amount of time, or at all, that day. Once the data were cleaned of those 47 days, and only values greater than 1000 steps per day were accounted for, the average steps per day was found to be 9740 steps per day, which is actually quite close to the popular but only vaguely founded (Tudor-Locke, 2008) recommendation to walk 10,000 steps per day. The maximum value recorded was 25,802 steps per day.

It should be noted that the pedometer can only effectively measure physical activity when it is being worn. While some children wore their pedometer overnight, or from early in the morning (as recorded by the pedometer), other children seem to have only put theirs on at 9 or 10 am – likely when they were reminded by their teacher. One thousand steps can easily be attained while preparing for school, and even more steps may be gained by walking to school, none of which would be counted if the pedometer was only worn from when the child arrived at school. Furthermore, swimming and contact sports require the removal of the pedometer, resulting in additional "lost" steps. Thus, while the pedometer data are interesting, it can only reflect the physical activity of the children when they were wearing the device.

4.4.2. *Results of the analysis of the pedometer data*

The pedometer results were compared by BOKS, sex, and grade, to determine if there was a difference in steps per day according to each group. The PA and PL scores were compared against the pedometer data, to determine if there was a difference in scores according to more or fewer steps per day.

Table 4.7. Pedometer data results by group comparison

		BOKS (BOKS, non)	**Sex** (boy, girl)	**Grade** (3, older)	**PA** (<9740, >9740)	**PL** (<9740, >9740)
Pedometers	*Mean score*	(15, 6)	(17, 9)	(15, 9)	(9.92, 15.55)	(9.62, 15.91)
	p-value	**0.02***	**0.00***	**0.05***	**0.05***	**0.03***

Key: Mean score = The mean score from the Mann-Whitney-U analysis
p-value = the p-value for the comparison within that group
n* = $p<0.05$.

There was a statistically significant difference found between the number of steps per day between students in BOKS (n=20) versus those not in BOKS (n=5), with BOKS participants showing more average steps per day. The discrepancy in the comparative sizes of the group,

however, must be taken in to account, and populations of more equal size should be compared before interpreting this result.

There were also statistically significant differences found between the number of steps per day between boys (n=12) and girls (n=13), and between children in grade 3 (n=14) and children in older grades (n=11), with boys and younger children showing more average steps per day than girls and older children.

The difference in scores between those with lower or higher steps per day was significant for both PA and PL scores, with those having more steps per day also having higher PA and PL scores.

Regarding physical literacy, this might be a case of the PL score affecting the amount of steps taken – a child who is more knowledgeable about physical activity (a higher PL score) may have made sure to take more steps, or may have been more interested or more careful about wearing the device all day.

4.5. Chapter Summary

This chapter reviewed the results from the survey measures, resulting PA and PL scores, and pedometer data. From these results, it appears that the BOKS program did not have any effect on the physical activity outcomes, or factors that influence physical literacy, of the children who participated. A difference in some measures was observed between boys and girls, specifically relating to time spent being active, and perception. Finally, the data uncovered some interesting points of difference between the motivating PA factors for children and adults.

Chapter 5: Discussion

5.1. Introduction

This chapter will summarize the key findings from the initial evaluation of BOKS in Canada, and will contextualize these findings within current research, to address the objectives of this thesis:

1. To pilot a systematic methodology for evaluation of the BOKS program.
2. To explore the range of factors that may influence the PA and PL of the participating children.

This chapter will further discuss the limitations of this work, as well as its substantive, methodological, and theoretical contributions, and will make recommendations for future research.

5.2. Summary of Key Findings

Fall, 2015, marked the first year that the BOKS program was implemented in schools across Canada. This research reviewed the data from three schools in British Columbia during this initial session, and while it did not, in general, find BOKS to have a statistically significant effect on the measures of the physical activity or physical literacy of the children in this session, it did provide some evidence that boys score higher in some measures of PA and PL than girls, and that students and parents approach physical activity differently, findings which are echoed in the Report Card, and which have implications for future iterations of PA programs.

5.2.1. *The BOKS program and the national picture*

When comparing the findings between those who participated in BOKS versus those who did not, only three results were found to be statistically significant, although each of those results would require further data and research for a more firm conclusion.

Non-BOKS students were found to be more likely to walk to school than BOKS students (according to the parents), possibly due to the later start time (BOKS participants must get to school early), when it is more likely to be light outside, and when there are more safety features available like crossing guards and reduced-speed traffic zones. Students did not note this difference, however, instead indicating that "school" was significant in determining a mode of transportation to and from school. A larger sample size would be necessary to determine if BOKS is perhaps hindering children from walking to school.

In contrast to the transportation results, it was found that BOKS students walked more steps per day, as indicated by the pedometer data, than non-BOKS students, however this comparison was based on a very small sample, and there was a significant size difference between the two groups, with 20 BOKS students compared to only five non-BOKS students. Other than the unequal size of the groups, having only five participants on one side is not sufficient to show an effect unless said effect was tremendous, and thus it would be ill-advised to draw conclusions from this result without more equally represented populations, and greater power to detect an effect if one exists.

Finally, BOKS participants were found to score lower on the shift scale than their non-BOKS counterparts, however there is no assessment from before the start of the BOKS program to provide a baseline, and thus no definitive conclusions can be drawn from this single result regarding the BOKS program and its correlation to shift.

Thus, this study found that in the initial session, the BOKS program did not have any significant effect on the measures of physical activity or physical literacy of the participating children. As a whole, however, the survey and pedometer results do seem to indicate relatively higher PA than what is reported on the ParticipACTION Report Card (2016), with almost 75% of BOKS

evaluation participants reporting that they were active for the recommended 60 minutes per day, at least 4-6 days (although not 7 days) in the past week or in a usual week (BOKS: 77%, non-BOKS: 68%). These results are significantly higher than the finding from the Report Card that only 9% of 5-17 year olds achieve the recommended level every day, indicating the effect that BOKS can, potentially, have.

The BOKS program provides an opportunity for children to participate in PA, and to build their capacity in PA, teaching skills in a fun way designed to increase competence and confidence. Furthermore, it is unique in its approach, due to its theoretically informed content and timing before school, and its adaptive potential on a national scale. Analysis of a larger sample size would be necessary for more substantial conclusions about its effectiveness and correlation with any of the observed measures.

5.2.2. *Physical Activity and Physical Literacy: sex is an important factor*

To address the second objective, that is to explore the measures of physical activity and physical literacy among Canadian school-aged children, this study carried out secondary comparisons between other sub-groups, including sex, age, and school. Although a larger sample size is necessary to definitively determine the effect of each factor, there were some interesting findings specifically related to differences between boys and girls.

Significant differences were found between the answers of boys versus girls in one third of the comparisons between the sexes, including ratings by students and parents, as well as the pedometer data. In every instance, the boys indicated a more active response than the girls, either more time being active, higher motivation to be active, better confidence, or greater levels of activity.

The Report Card (2016) echoes these findings, and expands on gender disparities across Canada, reporting that boys take more daily steps than girls (11,862 vs. 10,536 steps), and are more likely to achieve a full 60 minutes of daily MVPA (13% vs. 6%), with a greater proportion of boys taking part in unorganized after-school physical activities (78% vs. 72%). These data are not unique to Canada, with an international study from ten countries finding that boys are more physically active than girls at all ages. In physical literacy, as well, the Report Card finds boys more likely to meet the recommendations. In the sub-domain of knowledge, the proportion of boys and girls is similar (60% of boys vs. 64% of girls), however in the other three, the proportion of boys meeting the recommendation is higher than that of girls: physical competence (32% of boys vs. 23% girls), daily behaviours (47% of boys vs. 41% girls), and motivation and confidence (41% of boys vs. 32% girls) (ParticipACTION, 2016).

The confluence of childhood, adolescence, and physical activity is a tangled junction, and there are many elements to consider when analyzing disparities in PA. For example, when considering the sex-specific variation in physical activity, it is important to note the biological difference between males and females, with the former having more muscle-building testosterone, which would influence the choice and duration of desired activity. Maturity and the onset of puberty come at different times for each sex, and menstruation and constant hormonal changes can impact a girl's ability to exercise regularly throughout every stage of her life (Dwyer, 2006, and Ratey, 2012). Few studies account for this difference in their results, however a team from Canada has shown that objectively measured pedometer data may be confounded by differences in physical maturity, and that there is no difference in PA when the data are aligned by maturity (Sherar, 2007).

Notwithstanding the underlying biology, many studies have sought to investigate and understand the myriad of complex factors which may influence the physical activity of boys and girls. A cross-sectional study from Portugal, for example, assessed various correlates of physical activity, and found that boys *enjoyed* being physically active more than girls, and also *perceived* themselves as being more physically competent than girls. The researchers noted a difference in attitude between the sexes, with girls tending to shy away from competitive, skill-based activities. They proposed some of the possible reasons for this finding, including the social and cultural expectations of boys to be active while girls are expected to focus on body image (Seabra et al., 2013). Noteworthy studies on the matter of gender differences and physical activity have explored the relationship between entrenched social and cultural notions of gender roles, and children's subsequent attraction to physical activity, finding that parental encouragement was more instrumental for boys' attraction to PA than for girls, and that vigorous-PA is seen as more appropriate for boys, across all socio-economic levels, and perhaps from a very young age (Brustad, 1996).

When considering how to engage children in physical activity, then, it is imperative to understand the background context and the many influencing factors at play, including parental involvement, religious and cultural background, and extending to social cues and peer pressure. To successfully engage girls in physical activity, programs need to be tailored to address the underlying issues of enjoyment from PA, perception of confidence, and focus on body image, and should promote non-competitive activities.

Using accelerometers, some studies have differentiated between vigorous physical activity and moderate physical activity, finding girls engaging far less in the vigorous type, but performing relatively equal amounts of moderate activity (Trost et al., 2001). The nature of this finding from

an objective measure emphasizes two important points. First, that the nature of physical activity that girls prefer is inherently different than their male counterparts: they tend to engage in moderate physical activity, not vigorous, and this speaks to the importance of moderate-PA in programs designed for girls. On a national scale, boys are also not as active as recommended, and this finding is relevant to them as well: PA programs for boys should include vigorous-PA wherever possible, to keep them interested and engaged.

The second important point regarding measuring PA is that the extent of agreement between subjective (self-reporting) and objective (accelerometers, time stamped pedometers) measures of PA is not always consistent. This was demonstrated in a systematic review of self-reported versus directly measured PA among adults, which found that self-report methods may alternately be either higher or lower than direct measures, the correlation between these measures is generally low to moderate, and there is no clear method for correction (Prince et al., 2008). Child self-reporting may be even less valid, due to cognitive limitation which prevents them from accurate recall and/or estimation of time or frequency of activity (Sallis, 1991). Thus, although it seems to appear from the BOKS survey data that the girls were less active, the reliability of the self-reporting measures is in question. The difference in self-reporting between girls and boys, but the possibility that their actual levels of (moderate) activity may be closer to equal, returns the discussion to the matter of entrenched social norms: are the girls actually less active, or simply more modest in their reporting?

In the present BOKS study, the objective pedometer data agreed with the self-reported data from the survey measures that girls are less active than boys, however the sample population size was very small (n=25), and is only one example of these BOKS-specific measures (there will be more sample populations as the program expands across Canada). In larger studies of pedometer data,

for example in in Japan (n=691), or as brought by the Report Card, this finding is repeated, with boys logging more steps per day, and being more likely to achieve daily guidelines than girls (Ishii, 2015, ParticipACTION, 2016), indicating that while there may still be errors in self-reporting, the present finding is consistent, and likely accurate.

A meta-analysis of various physical activity interventions explored studies (n=64) with outcomes of physical self-concept (perception of physical abilities), and found sex to be a moderating factor, with a stronger association found for boys; that is boys were more likely to be more physically active, and have a better perception of their physical abilities than girls (the directionality of this relationship is debated) (Babic et al., 2014). This finding further highlights an underlying concept related to physical activity and physical literacy: perceived competence. Before addressing the physical activity components of a girls-oriented PA program, the issues of perceived competence, motivation, and willingness to engage must be addressed and presented in a way as to encourage female participation.

Interventions aimed specifically at girls have been implemented (for example the LEAP program described in section 2.4), and a recent meta-analysis of the effectiveness of sex-specific interventions analyzed 22 studies which promoted physical activity for girls aged 5-11 years. The most effective interventions seemed to include multiple components, for example PA plus diet changes, or educational plus environmental changes, since they reinforced each other and thus had a stronger impact. Factors that limited behaviour change included the culture of increased rules and supervision, academic pressure, and attractive sedentary options. In general, a small but significant success was found, especially for interventions which targeted only girls, encouraging the continuation of such initiatives (Biddle, 2014). Looking at the existing infrastructure with regards to the overall activity levels of boys and girls revealed a strong relationship for girls with

the relative contribution of structured physical activity (PE classes and/or sports teams), indicating that they are an important source of PA, without which girls would be even less active (Lenhart, 2012). This finding speaks to the nature of girls not to voluntarily or spontaneously engage in physical activity, thus reducing the amount of their naturally-active leisure time.

Low levels of PA are observed for both sexes, pleading the case for more opportunities to engage in PA in general, however the challenges for each sex are different, with the findings from this research on BOKS, in conjunction with similar findings from other studies, clearly outlining the distinction. Boys appear to engage more spontaneously in physical activity, and prefer activity which is competitive in nature, and which involves vigorous exertion. Girls, on the other hand, rely more heavily on structured forms of PA, such as PE classes, and prefer non-competitive activity which is moderate in nature. In addition, girls face the additional challenge of having lower perception of and confidence in their PA skills. These differences have implications regarding the desired format of a PA program for either sex, and highlight the areas which require a little extra thought, for example, a girls' program with an emphasis on vigorous PA.

5.2.3. *Parent and student comparisons*

The BOKS evaluation research is uncommon in that it affords the opportunity to compare perspectives between two sample populations, with answers from a student population (n=50) and a parent population (n=78), and matched surveys between them (n=45). The two populations were kept separate for the analysis, but for some questions there was a note-worthy difference between how parents and students responded.

Some of these differences occurred on questions of self-reported physical activity or ability, indicating a possible discrepancy among reporting consistency, with children noting higher levels of activity for boys, for example, but parents not indicating this difference. This

discrepancy between parents and children has been shown in a study reporting on children's dietary behaviours, for example, with only very weak agreement found between parent and children answers (van de Gaar et al., 2016). These results open the question of the validity of self-reporting. On one hand, children may not be reliable due to their younger age and less-developed memory skills when it comes to recall of frequency, intensity, and duration of activity. On the other hand, adults, as proxy respondents, are not necessarily reliable reporters of their child's activity, due to them not being present with the child at all times (Sallis, 1991). Thus, in the case of differences in answers between students and parents on questions of activity recall, it is advised to draw only hesitant conclusions, and augment with objective measures where possible.

In addition to differences in self-reporting, some interesting data arose from the analysis done specifically on questions 10 and 11 from the surveys, which spoke to the motivation of the individual (the child, or the parent on behalf of the child) to partake in or avoid physical activity. A breakdown of the motivations or barriers presented in each question showed that students and parents indicated different priorities among the options. Children, for example, considered making friends and getting in better shape important factors in a physical activity program, while their parents rated those factors far less important. While some of these differences may be explained by childish optimism at odds with parental realism and/or cynicism, this result is nonetheless worth noting, as it clearly shows that children approach and engage in physical activity for reasons that are quite different than what their parents might think.

While quantitative studies comparing the motives behind physical activity between children and parents were not found in the literature, comparison between child and parent populations in other subjects does exist. In one such comparison between multiple populations, the researchers

wanted to explore differing perspectives on the definitions and motives of cyberbullying. The researchers spoke to teachers, parents, and students, and found very different perspectives among the three groups, with teachers identifying "ease" as the main motivation, parents saying "anonymity", and students reporting "avoid retaliation", as their main motive. Understanding these different motives has significant ramifications for policy-makers regarding how to approach and combat this phenomenon (Compton, Campbell, and Mergler, 2014). Another example is found in a study comparing emotion management between students and parents from five large US cities, with the results showing significant differences in many areas between how the students said they would react versus how the parents thought their children would react (MacCann et al., 2010).

These studies, among others, affirm and reinforce the finding that children and adults differ not only in their reporting of various measures, but also in their perspectives on a range of topics, including motivations for and attitudes towards physical activity. To properly uncover the depth or breadth of these differences, further analytical techniques, such as a more detailed questionnaire, or cognitive interviewing, would be necessary. Addressing these differences between the population creating the programs (adults), and the population for which the programs are intended (children), is essential for creating physical activity initiatives which actively and successfully engage children, by speaking to their specific motivating factors.

5.2.4. *Summary*

As the BOKS program expands across Canada, more data will be collected, and a more comprehensive picture will emerge regarding the effect of this initiative on the physical activity and physical literacy of Canadian school-aged children. It is the aim, that results on this, and other initiatives, will be reflected in the annual Report Card, and perhaps eventually in national

statistics of child obesity and overweight. In the meantime, this research supports the notion that there is a difference in sex with regards to physical activity, with boys tending to engage more wholly, and girls tending to shy away, further advocating the necessity of building PA programs for both boys and girls with these differences in mind. Additionally, this research brings to light the difference between students and parents in their reporting of participation in physical activity, and encourages child-participation in the creation or adaption of physical activity programs.

5.3. Limitations

Three primary limitations presented themselves when working on this research.

The populations represented in this survey are small, with 78 parents comprising one group, and 50 students comprising the other. When comparing between sub-groups and their different answers, the populations were further divided, often leaving only a few individuals in a given category, and presenting a significant barrier to extrapolating conclusions from the data. Furthermore, the population was quite homogeneous, with all but four respondents living in the same city and attending one of two neighbouring schools. Besides the small size, this population is also not representative of the wide and varied population across Canada, and thus generalizing conclusions on a national scale are not possible. This limitation is overcome in subsequent research that is already underway by Propel.

The second limitation pertains to the BOKS intervention itself. To sign up for BOKS, a school registers on the website, and then gains access to all the relevant materials necessary for running the program. There is no oversight, however, to determine how many of the schools are actually implementing the BOKS program after registration, and, more relevant to this research, there is only minimal oversight to determine if the implementation of the program at the schools is as described in the materials – and likely, there is variation, as each school adapts the program to fit

their specific needs. This would apply to the program length (meant to be 12 weeks, but might be either shorter or longer), when during the day the program runs (meant to take place in the morning, before school, but might be during lunch or after school), who is running the program (meant to be a parent volunteer, but might be a PE teacher, a general teacher, or a Reebok staff member), and how closely the curriculum is followed. That is to say, the fidelity of the BOKS program implementation between schools cannot be determined, and therefore "BOKS" children from different schools are, in all likelihood, exposed to different versions of the program.

This limitation is more difficult to overcome, as it requires constant physical oversight at each of the participating schools, which translates to significant amounts of human and financial resources, an unrealistic and improbable undertaking. Measures such as lead trainer surveys and on-site observations are employed by Propel, however they are limited in their scope, and cannot fully assess the extent or nature of the implementation of BOKS at each school. However, with many different schools involved in the evaluation, many variations of the implementation of BOKS will be represented, and grouping them all together under "BOKS" provides a *comprehensive* picture of the effect that BOKS – in all its forms and adaptations – has on the PA and PL of children across the country. Thus, although the fidelity of the BOKS intervention at different schools remains in question, the existing structure does provide a very realistic picture of how the intervention plays out in the real world, and that is valuable information as well.

A final limitation arises from the quasi-experimental design of the intervention, and cross-sectional nature of the analysis. Participants were not randomized in to BOKS or non-BOKS, rather each child (and his or her parent) made the decision to opt in to the program, and/or to take part in the evaluation. With this design, there may be selection bias among those who participated versus those who did not; it is not random sampling. Moreover, the participants were

asked to fill out the survey at one point during the course of the BOKS program, generally after about four to six weeks. Without a baseline assessment from before the commencement of BOKS, however, it becomes difficult to interpret the results. For example, this study found almost no differences in the answers between children who were participating in BOKS versus those who did not. Does this mean that BOKS is not being effective in relating its intended messages or goals (and the groups were similar from before the intervention, and remained so)? Or were the children who signed up to BOKS coming from a less-educated and/or less-active background, and BOKS succeeded in having an impact on them (indicating that the groups were different before the intervention, and BOKS bridged the gap)? Due to the quasi-experimental, cross-sectional design of this study, this cannot be determined.

The quasi-experimental design cannot be changed, as the program is part of a large-scale, national, initiative. With many evaluation participants, however, this limitation will be minimized. Propel is aware of the cross-sectional analysis limitation, and moving forward, will conduct time-staggered assessments before the intervention, at the end of the session, and perhaps at six months follow up.

5.4. Contributions and Future Research

This research is a preliminary study in an ongoing national project, and while direct policy implications cannot be provided from these data, the present analysis nonetheless contributes substantively, methodologically, and theoretically to the scientific body of knowledge, and raises directions for future research and implementation of the BOKS program.

Substantively, this research provides a look at the data from the initial fall, 2015, session of BOKS. It identifies a strong difference in the way each sex approaches physical activity, and further reinforces the finding that girls feel less confident in their abilities, and engage less

frequently and vigorously in physical activity, lending credence to the importance of creating PA programs which are specifically built to address these issues. This research fills a gap in the literature by including both student and parent perspectives on physical activity and physical literacy, a comparison which is otherwise virtually absent from the scientific discourse. This new dimension of the conversation will enable and encourage the creation or adaption of programs that are more in tune with the needs and perspectives of the children, not the adults, and are thus more successful in achieving their goals.

Methodologically, this research has contributed to the BOKS program by piloting a scientifically sound method of assessment. The specific quantitative analysis put forth here is intended to be used as a template as the BOKS program expands across Canada, and can be replicated to ensure rigorous analysis of the data.

Finally, this research took a theoretically informed approach to combatting the low rates of physical activity, by introducing a new program with specific components. Based on the research of Dr. Ratey describing how physical activity can boost brain activity, BOKS is designed to run before the start of the school day, instilling both mental and physical energy into the students from the morning. The program itself is theoretically informed as well, incorporating very specific components with explicit goals in mind, including bone strength, a long-term active life-style, and long-term healthy eating. Furthermore, the program's primary objective is not to assess changes in BMI, but rather to determine if there was any impact on the physical activity or physical literacy of the child, both of which are better indicators of long-term engagement with and commitment to a healthy lifestyle. The results of the large-scale BOKS evaluation, of which this thesis is part, will support this theoretical approach to physical activity.

Future research will more thoroughly explore some of the differences that were noted in this thesis. Why and how are children attracted to physical activity: what are the most important motivating factors, or the most prohibitive barriers to PA from the perspective of the child, and are they different from what their parents believe? Self-reporting should be examined for its validity, particularly as it concerns the difference between boys and girls: does each sex account for their physical activity in a similar fashion? Similarly, the level of agreement between the self-reporting of children and parents should be analyzed.

The difference between boys and girls regarding affinity for different types of PA, their likelihood to engage with and meet daily recommendations, and their levels of perception, motivation, and confidence have been well corroborated. Future implementations of PA programs would do well to take these differences in to account, to successfully engage each sex in physical activity.

5.5. Conclusion

The current trend of physical inactivity among youth is worrying to parents and governments alike, due to its link to chronic disease and obesity. With less unsupervised time to play, and the now ubiquitous digital screens, there seems to be fewer *opportunities* for physical activity, as well as *low motivation* to get up and get moving. These have resulted in a generation of children who, as a whole, do not engage in physical activity on a regular basis, and who are not equipped to participate even when the opportunity presents itself. There are dire consequences to extended sedentary behaviours, for the children themselves as well as for parents and society. Reversing this trend is a major undertaking, and requires cooperation and support from every level – from changing family patterns at home to the highest level of legislature.

Reebok, the CFL, and Propel, with financial help from the PHAC, have brought the BOKS physical activity program to Canada for a five-year duration, as one stone on the path to greater overall health. The concept behind BOKS is based on the book by Dr. Ratey which links exercise to greater brain health, and as such the program contains specific, theoretically-informed components, including its timing before school and emphasis on long-term fitness skills.

The current research piloted a systematic methodology for the evaluation of the BOKS program, and explored the range of factors that may have influenced the physical activity and physical literacy of the participating children. While sample sizes were small, this thesis nonetheless uncovered interesting findings regarding the differences between boys and girls on measures of self-reported activity, perception, and ranking among peers, and regarding the difference between children and their parents on motivating factors for PA.

As the BOKS program expands across Canada, with an increasing number of participating schools and children, these data will be further explored, and will inform future iterations and adaptions of the program, thereby maximizing its potential to achieve its goals of enhanced physical activity and physical literacy in Canadian children.

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Appendix A: All Data Collection Tools in the Full Propel Evaluation

The following table shows all the measures that will be evaluated by Propel over the course of its five year evaluation of the BOKS program in Canada.

Data collection procedure	Year 1-2	Year 3	Year 4	Year 5
Google analytics and registration information	✓	✓	✓	✓
Implementation tracking (e.g., number of students enrolled, attendance etc.)	✓ Up to 100 schools	✓ Up to 180 schools	✓ Up to 270 schools	✓ Up to 360 schools
Site/session observations	✓ Up to 10 schools	✓ Up to 10 schools	✓ Up to 10 schools	
Administrator interview	✓ Up to 15 schools	✓ Up to 10 schools	✓ Up to 10 schools	✓ Up to 10 schools
Student surveys (pilot testing August 2015)	✓ Up to 55 schools	✓ Up to 45 schools	✓ Up to 45 schools	✓ Up to 20 schools
Time stamped pedometers worn for 9 days (pilot testing July 2015)	✓ Up to 15 schools	✓ Up to 10 schools	✓ Up to 10 schools	✓ Up to 10 schools
Physical activity log	✓ Up to 15 schools	✓ Up to 10 schools	✓ Up to 10 schools	✓ Up to 10 schools
Healthy School Planner (School level survey)	✓ Up to 100 schools	✓ Up to 180 schools	✓ Up to 270 schools	✓ Up to 360 schools
Parent Questionnaire (pilot testing August 2015)	✓ Up to 55 schools	✓ Up to 45 schools	✓ Up to 45 schools	✓ Up to 20 schools
Lead trainer interviews	✓ Up to 25 schools			
Lead trainer survey	✓ Up to 45 schools	✓ Up to 45 schools	✓ Up to 45 schools	✓ Up to 20 schools
Student focus groups	✓ Up to 10 schools	✓ Up to 10 schools	✓ Up to 10 schools	
Link to student report cards (Learning skills and work habits)	✓	up to 5 schools (if possible)	TBD	TBD

Appendix B: Permission Form / Survey Access Information letter

<Propel Logo> <BOKS logo>

Dear Parent/Guardian:
Your child's school is taking part in the Build Our Kids' Success (BOKS) Program. As part of this program, the Propel Centre for Population Health Impact at the University of Waterloo is evaluating the program to help understand the impact of the BOKS Program and improve the program. This BOKS Evaluation Project has been approved by the school board and the school and is in partnership with the Reebok Canada Fitness Foundation, the Public Health Agency of Canada and the Canadian Football League.
Both families enrolled and not enrolled in the BOKS program are invited to participate in different parts of the BOKS Evaluation Project.

What is involved in the evaluation?

Parent/Guardian

- Parents are invited to complete a **10-minute** online questionnaire that asks questions about their child's physical activity. *If you would like to participate, please complete the questionnaire online using the code provided to you on the attached postcard.*

Student/Child

- Students are invited to complete a **10-minute** online questionnaire that asks questions about their physical activity. *If your child would like to participate, please ask them to complete the questionnaire online using the code provided to them on the attached postcard. Please provide support (if needed) but do not help them answer the questions.*
- [if enhanced] Randomly selected students will be invited to wear a pedometer for 9-days and complete an activity log at home. Students will receive a small token of appreciation for their participation.
- [if enhanced] Randomly selected students will be invited to participate in a group discussion about their participation in the BOKS program. This group discussion will be 30-40 minutes during the school day. Students will receive a small token of appreciation for their participation

Permission/Consent

You are asked to go to the link below to complete the online permission form if you **DO or DO NOT** want you and/or your child to take part in this evaluation.

Steps to give permission/refuse participation:

1. Go to: www.uwaterloo.ca/boks
2. Click on: **Access Code** (top right hand corner of webpage)
3. Enter this Access Code: **[insert code]**
4. Give decision on participation
5. If permission given, you and your child can begin to complete the questionnaire online.

You and your child are the only ones who can decide to take part in the BOKS Evaluation Project. Only students who consent and have parent permission can participate. Your participation is voluntary. You or your child can refuse to take part at any time. You or your child can also choose to skip any questions on the questionnaires that you do not wish to answer. There are no known or anticipated risks from participation in this evaluation. Please keep this letter for your records.

Complete the online permission form if you DO or DO NOT want to participate.

Confidentiality and Privacy

All of your and your child's responses are confidential. Students and parents are given an ID number to maintain confidentiality and so that parent and student data responses can be linked.

The results of the survey will only be reported in group form in reports. There will be reports summarizing our findings to the school and to our partners and funders.

Electronic data we gather from the BOKS Evaluation Project will be kept for a minimum of 5 years. All paper data will be stored at a University of Waterloo storage facility for no more than 5 years and then confidentially shredded.

Contact Information

This project has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. If you or your child have any concerns about the survey, contact Dr. Maureen Nummelin, Chief Ethics Officer at (519) 888-4567 x 36005 or maureen.nummelin@uwaterloo.ca.

Thank you for taking the time to read this information. To view further project details and samples of the questionnaires, visit the BOKS Evaluation Project on the web at **uwaterloo.ca/boks** or contact Anne Horst.
If you have questions please contact us via email or phone.
Sincerely,

Anne Horst, Project Coordinator
Propel Centre for Population Health Impact
University of Waterloo
[1-800 number]
ahorst@uwaterloo.ca

Jennifer Yessis, Principal Investigator
Propel Centre for Population Health Impact
University of Waterloo
[1-800 number]
jyessis@uwaterloo.ca

BOKS evaluation

The Propel Centre for Population Health Impact at the University of Waterloo is evaluating the BOKS program in partnership with the Reebok Canada Fitness Foundation, the Public Health Agency of Canada and the Canadian Football League. The evaluation will assess the theory and impact of the program and the extent to which it has been implemented in schools.

Schools have been invited to participate in the BOKS Evaluation Project alongside their participation in the BOKS program.

» You are asked to follow the steps to the right, and indicate if you want you and/or your child to take part in this evaluation. For more information about the components of the evaluation, please visit us at **www.uwaterloo.ca/boks**.

Steps to give permission/refuse participation:

1. Go to: **www.uwaterloo.ca/boks**

2. Click on: **Access Code** (top right hand corner of webpage)

3. Enter this Access Code:

PROPEL
CENTRE FOR POPULATION HEALTH IMPACT™

This project has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. If you have any questions about the Evaluation Project, contact:

Dr. Jennifer Yessis, Scientist
Propel Centre for Population Health Impact, University of Waterloo
519-888-4567, ext.32860 | jyessis@uwaterloo.ca

C009472

Appendix C: Sources of Survey Items

The following table shows the source for each item on the surveys. "S" refers to question numbers specific to the Student survey, while "P" references the same on the Parent survey. All questions here are written for the student ("you"); questions on the parent survey are appropriately edited ("your child").

Q	Item	Source
1-5	Demographics: Gender / Age / Grade / Ethnicity / Grades (marks in school)	SHAPES (2007)
6	Comprehension about physical activity guidelines for children: How many minutes of physical activity are recommended for children to do each day?	Adapted from CAPL (2013)
7-8	Self-reported physical activity questions: - Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? - Over a typical or usual week, on how many days were you physically active for a total of at least 60 minutes per day?	CHMS (2012)
9-11	9 – is being active important (attitude) 10 – facilitators to being active (motivation) 11 – barriers to being active (motivation)	Garcia et al., (1995) CAPL (2013)
12	Compared to others your age, how active are you (motivation)	CAPL (2013)
13	Compared to others your age, how good are you at sports or skills (confidence)	CAPL (2013)
14	My fitness is good enough to let me do all the activities I choose. (competence)	CAPL (2013)
15S	Student only: In the last 30 days, have you completed the following activities?	Fundamental movement skills
15P / 16S	How good are you at doing sports and activities? (Confidence and competence)	PLAY self (2013)
16-18P / 17-19S	About how many hours a week do you usually take part in physical activity that makes you out of breath or warmer than usual in (a) free time at school, for example, at lunch? (b) class time at school? (c) while participating in lessons or league or team sports outside of school?	CHMS (2012)
19P / 20S	During the past week, how did you usually get to and from school? (Choose only one option for "To School" and one option for "From School") Car / school bus / public bus, streetcar, or subway / walking / cycling / other active mode / other inactive mode	Custom question developed with input from G. Faulkner of UofT; adapted from his survey of Active Transportation.
20-21P	Parent only: Height and Weight for BMI	SHAPES (2007)
22P	Parent only: Read the list of statements that describe children's behaviour and indicate how often your child has had a problem with the following behaviours in the last 6 months: Never / sometimes / often	BRIEF (2000)

Appendix D: Student Survey

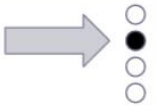
ID# _____

boks
build our kids' success

Student Survey

Thank you for taking the time to complete this questionnaire today. This questionnaire will help the researchers better understand physical activity behaviours of students. We value your help today.

Please mark all your answers with full, dark marks like this:



- This is NOT a test. All of your answers are confidential. No one, not even your parents or teachers, will ever know what you answered. Please be honest when you answer the questions.
- Mark only one option per question unless the instructions tell you to do something else.
- If you do not understand a question, or do not wish to answer a question, leave it blank and continue to the next question.
- Choose the option that is the closest to what you think/feel is true for you.

1. Are you a boy or a girl?

- ○ a boy
- ○ a girl

2. How old are you today?

- ○ 8 years or younger
- ○ 9 years
- ○ 10 years
- ○ 11 years
- ○ 12 years
- ○ 13 years or older

3. What grade are you in?

- ○ Grade 3
- ○ Grade 4
- ○ Grade 5
- ○ Grade 6
- ○ Grade 7
- ○ Grade 8

4. How would you describe yourself? *(Mark all that apply)*

- ○ White
- ○ Black
- ○ West Asian / Arab
- ○ South Asian (Indian, ...)
- ○ East / Southeast Asia (Chinese, ...)
- ○ Latin American / Hispanic
- ○ Aboriginal (First Nations, Métis, Inuit, ...)
- ○ Other

5. Which of the following best describes your marks during the past year?

- ○ Mostly A's / above 85% / level 4
- ○ Mostly A's and B's / 70 – 84% / level 3-4
- ○ Mostly B's and C's / 60 – 69% / level 3
- ○ Mostly C's / 50 – 59% / level 2
- ○ Mostly letter grades below C's / below 50% / level 1

6. How many minutes of physical activity are recommended for children to do each day?

- ○ 10 minutes
- ○ 20 minutes
- ○ 30 minutes
- ○ 60 minutes or 1 hour

The next few questions are about your physical activity. Physical activity is any activity that increases the heart rate and causes someone to be out of breath. Physical activity can take place while playing sports, doing school activities, playing with friends, or walking to school.

Some examples of physical activity are running, brisk walking, dancing, swimming, rollerblading, skateboarding, biking, soccer, basketball and football. For these next two questions, add up all the time you spent in physical activity each day.

7. Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?

- ○ None (zero days)
- ○ 1 day
- ○ 2 or 3 days
- ○ 4 days or more

8. Over a typical or usual week, on how many days were you physically active for a total of at least 60 minutes per day?

- ○ None (zero days)
- ○ 1 day
- ○ 2 or 3 days
- ○ 4 days or more

9. Do you agree or disagree that movement, activities and sports are very important…

	Strongly disagree	Disagree	Agree	Strongly agree	I do not know
a) ... in school?	○	○	○	○	○
b) ... at home with family?	○	○	○	○	○
c) ... with friends?	○	○	○	○	○

Kids say there are many different reasons that they like to be active or play sports. Being active is anything that you do when you are moving, exercising or not sitting still. Below are some reasons that other kids have told us why they like to be active. For each reason, tell us what you think.

10. When I am active ...	No	Maybe	Yes
a) ...I look better	○	○	○
b) ...I have more energy	○	○	○
c) ...I feel happier	○	○	○
d) ...I have fun	○	○	○
e) ...I make more friends	○	○	○
f) ...I get stronger	○	○	○
g) ...I like myself more	○	○	○
h) ...I get in better shape	○	○	○
i) ...I feel healthier	○	○	○

Kids say there are also reasons that make it hard for them to be active. For each reason, tell us what you think.

11. Would any of the following reasons stop you from being active?	No	Maybe	Yes
a) Not enough time to be active	○	○	○
b) Too many chores	○	○	○
c) No good place to be active	○	○	○
d) Bad weather	○	○	○
e) Not having the right clothes / shoes	○	○	○
f) Not knowing how to do the activity	○	○	○
g) Not having the right equipment	○	○	○
h) Too much homework	○	○	○
i) No one to be active with	○	○	○
j) Don't like to be active	○	○	○

12. Compared to other kids your age, how active are you?

Others are more active				Same					I'm more active
○	○	○	○	○	○	○	○	○	○
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

13. Compared to other kids your age, how good are you at sports or skills?

Others are better				Same					I'm a lot better
○	○	○	○	○	○	○	○	○	○
1	2	3	4	5	6	7	8	9	10

14. My fitness is good enough to let me do all the activities I choose.

- ○ Disagree
- ○ Agree

15. In the last 30 days, have you completed the following activities?

	Yes	No	I don't know
a) Planks	○	○	○
b) Running	○	○	○
c) Crunches	○	○	○
d) Push-ups	○	○	○
e) Squats (for example, wall squats)	○	○	○
f) Burpees	○	○	○
g) Jumps (for example, tuck jumps, squat jumps, broad jumps, jumping jacks)	○	○	○
h) Walking lunges	○	○	○
i) Donkey kicks	○	○	○

16. How good are you at doing sports and activities?

	Never tried	Not so good	OK	Very good	Excellent
a) In the gym (for example, playing sports)?	○	○	○	○	○
b) In and on the water (for example, swimming, canoeing, water skiing)?	○	○	○	○	○
c) On the ice (for example, skating, playing hockey)?	○	○	○	○	○
d) On snow (for example, skiing, snowshoeing)?	○	○	○	○	○
e) Outdoors (for example, playing soccer, hiking, bike riding)?	○	○	○	○	○
f) On the playground (for example, climbing, skipping, hopscotch)?	○	○	○	○	○

17. About how many hours a week do you usually take part in physical activity that makes you out of breath or warmer than usual <u>in free time at school</u>, for example, at lunch?

- ○ Never
- ○ Less than 2 hours per week
- ○ 2 to less than 4 hours per week
- ○ 4 to less than 7 hours per week
- ○ 7 or more hours per week

18. About how many hours a week do you usually take part in physical activity that makes you out of breath or warmer than usual in class time at school?

- ○ Never
- ○ Less than 2 hours per week
- ○ 2 to less than 4 hours per week
- ○ 4 to less than 7 hours per week
- ○ 7 or more hours per week

19. About how many hours a week do you usually take part in physical activity that makes you out of breath or warmer than usual while participating in lessons or league or team sports outside of school?

- ○ Never
- ○ Less than 2 hours per week
- ○ 2 to less than 4 hours per week
- ○ 4 to less than 7 hours per week
- ○ 7 or more hours per week

20. During the past week, how did you usually get to and from school?
(Choose only one option for "To School" and one option for "From School")

To School

- ○ Car
- ○ School bus
- ○ Public bus, subway or street car
- ○ Walking
- ○ Cycling
- ○ Other active mode
- ○ Other inactive mode

From School

- ○ Car
- ○ School bus
- ○ Public bus, subway or street car
- ○ Walking
- ○ Cycling
- ○ Other active mode
- ○ Other inactive mode

Only students who participated in the BOKS program are to complete the next 3 questions:

21. If the choice was up to you, would you sign up for BOKS again?

- ○ Yes
- ○ No
- ○ I don't know

22. Have you had fun with BOKS?

- ○ Yes – lots of fun
- ○ Yes – a little fun
- ○ No – no fun
- ○ I don't know

23. On days when you have BOKS, how excited for school are you?

- ○ Very excited
- ○ A little excited
- ○ Not excited at all
- ○ I don't know

Appendix E: Parent Survey

ID#

Parent Survey

Thank you for taking the time to complete this questionnaire today. Please complete this questionnaire about your child's physical activity. The objective of this questionnaire is to understand the preference and behaviours of your child, not to judge you or your child. Parents observe a lot about their child's behaviour that cannot be measured in other ways. Your responses will help us better understand your child's behaviours and how they are influenced.

eport 4

We value your help today.

- **This is NOT a test. All of your answers are confidential. Please be honest when you answer the questionnaire.**
- **Mark only one option per question unless the instructions tell you to do something else.**
- **If you do not understand a question, or do not wish to answer a question, leave it blank and continue to the next question.**

1. Is your child a boy or a girl?

- ◯ a boy
- ◯ a girl

2. How old is your child today?

- ◯ 8 years or younger
- ◯ 9 years
- ◯ 10 years
- ◯ 11 years
- ◯ 12 years
- ◯ 13 years or older

3: Report 4

3. What grade is your child in?

- ◯ Grade 3
- ◯ Grade 4
- ◯ Grade 5
- ◯ Grade 6
- ◯ Grade 7
- ◯ Grade 8

4. How would you describe your child? *(Mark all that apply)*

- ○ White
- ○ Black
- ○ West Asian / Arab
- ○ South Asian (Indian, ...)
- ○ East / Southeast Asia (Chinese, ...)
- ○ Latin American / Hispanic
- ○ Aboriginal (First Nations, Métis, Inuit, ...)
- ○ Other

5. Which of the following best describes your child's marks during the past year?

- ○ Mostly A's / above 85% / level 4
- ○ Mostly A's and B's / 70 – 84% / level 3-4
- ○ Mostly B's and C's / 60 – 69% / level 3
- ○ Mostly C's / 50 – 59% / level 2
- ○ Mostly letter grades below C's / below 50% / level 1

6. How many minutes of physical activity are recommended for children to do each day?

Report 4

- ○ 10 minutes
- ○ 20 minutes
- ○ 30 minutes
- ○ 60 minutes or 1 hour

The next few questions are about your child's physical activity. Physical activity is any activity that increases the heart rate and causes someone to be out of breath. Physical activity can take place while playing sports, doing school activities, playing with friends, or walking to school.

Some examples of physical activity are running, brisk walking, dancing, swimming, rollerblading, skateboarding, biking, soccer, basketball and football. For these next two questions, add up all the time your child spent in physical activity each day.

7. Over the past 7 days, on how many days was your child physically active for a total of at least 60 minutes per day?

- ○ None (zero days)
- ○ 1 day
- ○ 2 or 3 days
- ○ 4 days or more

8. Over a typical or usual week, on how many days is your child physically active for a total of at least 60 minutes per day?

Report 4

- ○ None (zero days)
- ○ 1 day
- ○ 2 or 3 days
- ○ 4 days or more

9. Do you agree or disagree that movement, activities and sports are very important…

	Strongly disagree	Disagree	Agree	Strongly agree	I do not know
a) ... in school?	○	○	○	○	○
b) ... at home with family?	○	○	○	○	○
c) ... with friends?	○	○	○	○	○

Kids say there are many different reasons that they like to be active or play sports. Being active is anything that your child does when moving, exercising or not sitting still. Below are some reasons that other kids have told us why they like to be active. For each reason, tell us how you think your child would feel about the items below.

10. A reason that your child might be active is because when your child is active…	No	Maybe	Yes
a) ... he/she feels they have more energy	○	○	○
b) ... he/she feels happier	○	○	○
c) ... he/she feels they have fun	○	○	○
d) ... he/she feels they look better	○	○	○
e) ... he/she feels they make more friends	○	○	○
f) ... he/she feels they get stronger	○	○	○
g) ... he/she feels more like himself/herself	○	○	○
h) ... he/she feels they get in better shape	○	○	○
i) ... he/she feels they are healthier	○	○	○

Kids say there are also reasons that make it hard for them to be active. For each reason, tell us how you think your child would feel about the items below.

11. Your child might <u>not</u> be active if...	No	Maybe	Yes
a) …he/she didn't have enough time to be active	○	○	○
b) …he/she had too many chores to do	○	○	○
c) …he/she didn't have a good place to be active	○	○	○
d) …the weather was too bad	○	○	○
e) …he/she didn't have the right clothes / shoes	○	○	○
f) …he/she didn't know how to do the activity	○	○	○
g) …he/she didn't have the right equipment	○	○	○
h) …he/she had too much homework	○	○	○
i) …he/she didn't have anyone to be active with	○	○	○
j) …he/she didn't like to be active	○	○	○

12. Compared to other kids your child's age, how active is your child?

Others are more active — Same — My child is more active

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

13. Compared to other kids your child's age, how good is your child at sports or skills?

Others are better — Same — My child is a lot better

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

14. Your child's fitness is good enough to do all the activities he/she chooses.

- ○ Disagree
- ○ Agree

15. How good is your child at doing sports and activities?

	Never tried	Not so good	OK	Very good	Excellent
a) In the gym?	○	○	○	○	○
b) In and on the water?	○	○	○	○	○
c) On the ice?	○	○	○	○	○
d) On snow?	○	○	○	○	○
e) Outdoors?	○	○	○	○	○
f) On the playground?	○	○	○	○	○

Please answer the following question to the best of your knowledge. We recognize that you may not always be aware of how much physical activity your child is doing while at school or other during activities where you are not present.

16. About how many hours a week does your child usually take part in physical activity that makes him/her out of breath or warmer than usual <u>in free time at school</u>, for example, at lunch?

- ○ Never
- ○ Less than 2 hours per week
- ○ 2 to less than 4 hours per week
- ○ 4 to less than 7 hours per week
- ○ 7 or more hours per week

17. About how many hours a week does your child usually take part in physical activity that makes him/her out of breath or warmer than usual <u>in class time at school</u>?

- ○ Never
- ○ Less than 2 hours per week
- ○ 2 to less than 4 hours per week
- ○ 4 to less than 7 hours per week
- ○ 7 or more hours per week

18. About how many hours a week does your child usually take part in physical activity that makes him/her out of breath or warmer than usual <u>while participating in lessons or league or team sports outside of school</u>?

- ○ Never
- ○ Less than 2 hours per week
- ○ 2 to less than 4 hours per week
- ○ 4 to less than 7 hours per week
- ○ 7 or more hours per week

19. During the past 7 days, how did your child usually get to and from school? (If your child used two or more modes of travel, choose the one that your child spent the most time doing)

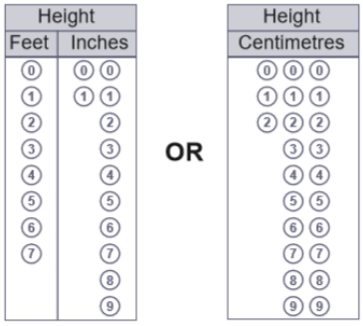
<u>To School</u>	**<u>From School</u>**
○ Car	○ Car
○ School bus	○ School bus
○ Public bus, subway or street car	○ Public bus, subway or street car
○ Walking	○ Walking
○ Cycling	○ Cycling
○ Other active mode	○ Other active mode
○ Other inactive mode	○ Other inactive mode

20. Please provide us with your child's approximate height. (Write your child's height in feet and inches **<u>OR</u>** in centimetres, and then fill in the appropriate numbers for your child's height.)

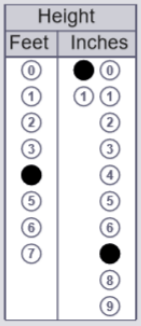
"My child's height is ____feet ____ inches"

OR

"My child's height is _____centimetres"



***Example*:**
My child's height is <u>4 ft 7 in</u>

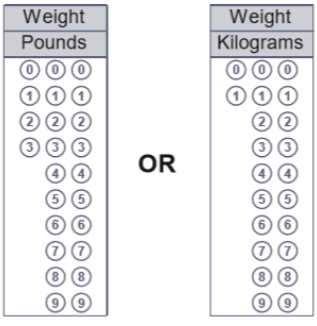


21. Please provide us with your child's approximate weight. (Write your weight in pounds **<u>OR</u>** in kilograms, and then fill in the appropriate numbers for your weight.)

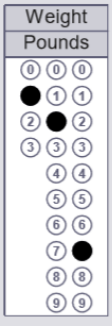
"My child's weight is _____pounds"

OR

"My child's weight is _____kilograms"



***Example*:**
My child's weight is <u>127 lbs</u>



22. Read the list of statements that describe children's behaviour and indicate how often your child has had a problem with the following behaviours in the last 6 months….If your child has never had a problem with this behaviour, fill in "never"; if they have sometimes had a problem fill in "sometimes" and if they have often had a problem, fill in "often".

	Never	Sometimes	Often
a) Cannot get a disappointment, scolding, or insult off his/her mind	○	○	○
b) Resists or has trouble accepting a different way to solve a problem with schoolwork, friends, chores, etc.	○	○	○
c) Becomes upset with new situations	○	○	○
d) Acts upset by a change in plans	○	○	○
e) Is disturbed by change of teacher or class	○	○	○
f) Resists change of routine, foods, places, etc.	○	○	○
g) Has trouble getting used to new situations (classes, groups, friends)	○	○	○
h) Thinks too much about the same topic	○	○	○
i) Gets stuck on one topic or activity	○	○	○
j) After having a problem, will stay disappointed for a long time	○	○	○
k) When given three things to do, remembers only the first or last	○	○	○
l) Has a short attention span	○	○	○
m) Has trouble concentrating on chores, schoolwork, etc.	○	○	○
n) Is easily distracted by noises, activity, sights, etc.	○	○	○
o) Has trouble with chores or tasks that have more than one step	○	○	○
p) Needs help from adult to stay on task	○	○	○
q) Forgets what he/she was doing	○	○	○
r) When sent to get something, forgets what he/she is supposed to get	○	○	○
s) Has trouble finishing tasks (chores, homework)	○	○	○
t) Has trouble remembering things, even for a few minutes	○	○	○

23. What is your highest level of education? (Choose only one)

- ◯ Some high school or less
- ◯ High school diploma or graduate equivalency
- ◯ College/trade/vocational certificate
- ◯ University Bachelor's degree
- ◯ University Master's/PhD/law school/medical school/teacher's college degree
- ◯ I don't know

24. What was your annual household income?

- ◯ $30,000 or less
- ◯ $40,000 to less than $60,000
- ◯ $60,000 to less than $80,000
- ◯ $80,000 to less than $100,000
- ◯ $100,000 and over

If your child participated in the BOKS program, please answer the following three questions:

25. If the choice was up to your child, would he/she want to sign up for BOKS again?

- ◯ Yes
- ◯ No
- ◯ I don't know

26. Has your child had fun with BOKS?

- ◯ Yes - lots of fun
- ◯ Yes - a little fun
- ◯ No - no fun
- ◯ I don't know

23. On days when your child has BOKS, how excited for school is your child?

- ◯ Very excited
- ◯ A little excited
- ◯ Not excited at all
- ◯ I don't know

Appendix F: Pedometer Information Letters for Parents and Students

<Propel Logo> <BOKS Logo>

Dear Parent/Guardian,

Re: Pedometer Instructions for Parent/Guardian

Thank you for allowing your child to participate in the BOKS Evaluation Project. Your child was given a pedometer today that is ready to use with no set up necessary. It will be used to measure your child's physical activity by counting their steps. This is part of research project to see how effective pedometers are in measuring physical activity in kids. We have also provided an *Activity Log* for your child to fill out each day with your help. **Both the pedometer and the activity log are to be returned after 9 days.**

Step 1: Child is asked to wear the Pedometer every day for 9 days

- We ask that your child start wearing the pedometer tomorrow when they wake up in the morning.
- The pedometer can be clipped on to your child's waistband or belt, or placed in a pant pocket. Please also attach the strap to your child's clothing.
- Have your child place the pedometer beside their bed at the end of the day and put it back on first thing in the morning when they wake up.
- If the pedometer is not worn, record the amount of time it was not worn on the *Activity Log*.
- Please ensure that the pedometer does not get wet as it is not water resistant.
- See reverse for Frequently Asked Questions.

Step 2: Complete Activity Log Daily

- Be as thorough as possible at completing the *Activity Log* with your child.
- Record the number of steps taken and any times your child was moderately or vigorously active on the Activity Log.
- The pedometer will automatically reset at midnight. You do not have to push any buttons.

Step 3: Return Pedometer and Log

- After 9 days of wearing the pedometer, return the pedometer and the Activity Log to project staff.

Thank you so much for your participation in this work. If you have any questions or concerns, please call Anne Horst or Dr. Jennifer Yessis.

Thank you,

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University of Waterloo
1-800-667-1804
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Frequently Asked Questions

Question	Response
Can my child wear the pedometer when playing a hockey/ soccer match (or other contact sports)?	We want your child to wear the pedometer as often as they can, so try and have them wear it during all sports team practices and games. If the coach asks your child to take the pedometer off, explain that they are participating in a physical literacy test and are supposed to wear it as much as possible. If the coach says your child has to take it off, take the pedometer off and record the time it was off and what your child did while it was off on the log sheet.
Can my child wear the pedometer during dance and gymnastics?	The pedometer can be worn on a belt or shorts that your child wears over dance/gymnastics clothes. Make sure that it is positioned in the right place (over the hip) and that the belt is on tightly. If the instructor asks your child to take the pedometer off, explain that they are participating in a physical literacy test and are supposed to wear it as much as possible. If the instructor says they have to take it off, take the pedometer off and record the time it was off and what your child did while it was off on the log sheet.
Can my child wear the pedometer when swimming?	The pedometer is not waterproof, so do not have your child wear it if they are going to get wet. Your child should take it off just before taking a shower, a bath, or going swimming and then put it back on immediately after they get out of the water. Record how long the pedometer was off and what your child did while it was off on the log sheet.
What if my child press the reset button accidentally?	If for some reason the pedometer does reset to zero, write this on the log sheet, alongside how long your child had worn the pedometer that day and any activities that they participated in.
Will the pedometer hurt my child?	The pedometer will not hurt your child and will not break if they fall on it.
What if my child forgets to put the pedometer on in the morning? Can he/she put it on half way through the day?	Have your child place the pedometer by their bedside at night so it is the first thing that they see when they get up in the morning. If your child does forget to put it on first thing, have them put it on as soon as they remember and record on *Activity Log* how long the pedometer was off for.
What if the pedometer stops working or breaks?	If the pedometer stops working or breaks, please return it to the school along with the completed *Activity Log*. We understand that pedometers do stop working or break – your child will not be responsible for damaged pedometers, but please be as careful as possible.

<Propel Logo> <BOKS Logo>

Student Instructions

General Instructions

1. Wear the pedometer for 9 full days in a row.
2. Take the pedometer off when you get into bed at night and place it on your bedside table. Put it back on as soon as you get out of bed in the morning.
3. Never wear the pedometer in water (bath, shower, swimming pool, etc.)
4. If you take the pedometer off for any reason, record the length of time that it was off on your *Activity Log*.

What is a pedometer?

A pedometer is a step counter, so every time you walk or run it counts the number of steps you take. To count the steps accurately, it is important to wear it correctly.

How do I wear a pedometer?

- Clip it to your waistband or belt, at the front of your clothing. Place it on, or as near as possible, to your hipbone. It should be in line with your foot when you're standing.
- In your front pant pocket.
- If you are wearing clothes that do not have a waistband or pocket (e.g., a dress), the pedometer can be worn under your clothes attached to your underwear.
- Please also clip the strap to your waistband or belt to help ensure you don't lose it.

How do I read and reset the pedometer at the end of the day?

- The display will show the number of steps you have taken during the day.
- The pedometer automatically resets at midnight, so it is ready to go every morning.

What do I do with the Activity Log?

- Please complete the *Activity Log* provided every day at bedtime.
- Write down the number of steps (look on your pedometer for the number) and any activities you did during the day that made your heart beat faster and make you out of breath.
- Ask your parent for help to complete the *Activity Log,* if you need help.

Tips for using the pedometer

- Wear the pedometer during waking hours-but not in water.
- If you change clothes during the day remember to put your pedometer back on.
- Put the pedometer by your bed at the end of the day so you remember to put it on the next day.

Appendix G: Activity Log

BOKS Evaluation Activity Log

Student ID:	Pedometer Number:
School:	
Date Range:	

Date	Was the pedometer worn all day?	Number of steps taken	What times were you moderately or vigorously active? Definition below.
Example ***November 13, 2015***	***√ Yes, I never took it off*** ***☐ No. How many hours missing?___***	***8426***	***Played soccer - 11:30-12:00*** ***Bike ride - 6:00-6:45pm***
Day 1	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 2	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 3	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 4	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 5	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 6	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 7	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 8	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time
Day 9	☐ Yes, I never took it off ☐ No. How many hours missing? ___		Activity – Time Activity – Time Activity – Time

Definition: *Moderately and/or Vigorously Active* is when you are doing physical activities that make your heart beat faster and make you breathe faster, like walking fast or running? This could include activities like skating, bike riding, running, rollerblading, and other activities.