EXAMINING THE INFLUENCE OF PHYSICAL AND HEALTH EDUCATION ON ONTARIO GRADE 9 STUDENTS’ PHYSICAL ACTIVITY INTENTIONS AND BEHAVIOURS

by

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ABSTRACT

Insufficient physical activity and a sedentary lifestyle are major contributors to health risks for Canadian youth. Adolescents, particularly girls, tend to experience major drop-offs in physical activity levels during high school. However, there is minimal research examining the extent to which Physical and Health Education (PHE) courses promote physical activity and mitigate against this decline. Grounded in the Theory of Planned Behaviour (TPB), the purpose of this quantitative short-term longitudinal study is two-pronged: (a) examine the effectiveness of Grade 9 PHE for 197 students’ reports of TPB constructs, physical activity intentions, and physical activity behaviour; and (b) explore the utility of TPB in predicting physical activity intentions and behaviour. For the first set of research questions, results were analyzed using 2 (time: Time Point 1 [T1], Time Point 2 [T2]) x 2 (condition: in PHE/not in PHE) x 2 (TPB status: higher or lower than the mean) MANCOVAs with boys and girls examined separately. There was no effect of PHE over time. There was no interaction among time, condition, and TPB status. There was a significant effect of condition for girls in PHE, with Attitude and Physical Activity Behaviour higher at both time points. For the second set of research questions, results were analyzed using multiple linear regressions to examine TPB in a Grade 9 setting. Findings provided support for the theoretical structure of the TPB in a Grade 9 context, with the three TPB constructs accounting for a minimum of 59% of Intentions, and a minimum of 25% of Behaviour for boys and girls. Attitude was the strongest independent predictor of Intentions with Intentions and Attitude the strongest predictors of Behaviour. PHE teachers should potentially focus attention on changing attitudes for this age group, given the importance of this construct.
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List of Abbreviations

ANCOVA = Analysis of Covariance
CSEP = Canadian Society for Exercise Physiology
DV = Dependent Variable
HBSC = Health Behaviour in School-aged Children
IV = Independent Variable
MANCOVA = Multiple Analysis of Covariance
MVPA = Moderate to Vigorous Physical Activity
OME = Ontario Ministry of Education
Partial $\eta^2$ = partial eta squared (measure of effect size)
PA = Physical Activity
PBC = Perceived Behavioural Control
PHE = Physical and Health Education
SN = Subjective Norms
TPB = Theory of Planned Behaviour
TPB constructs = Attitude, Perceived Behavioural Control, Subjective Norms
TRA = Theory of Reasoned Action
T1 = Time Point 1
T2 = Time Point 2
CHAPTER 1: INTRODUCTION

Sport and physical activity have always been central components in my life. My childhood was enriched by experiences of both individual and team-based sport as well as pick-up activities and general physical activity. I spent much of my childhood in arenas and other sporting facilities, playing or wanting to participate in whatever activity was available. I spent many of my adolescent and young adult years training for competitive rugby, hockey, soccer, and field hockey teams. In each of these avenues, I developed strong long-lasting friendships and was able to partake in physical activities that made me feel healthy and fit. Some of the greatest and most important friendships I have developed that have lasted to this point have been through sports teams. When I was not tied up in organized physical activities as a child, I was on a family pond with my brothers and parents, or outside playing tag in the fields near my house. These sports and physical activities not only contributed to my physical well-being, but also to my mental well-being. In times of stress to this day, I will go for a run or join a yoga class to relieve some of the extra tensions. Physical fitness, mental health, and well-being have been fundamental in shaping both my personal lifestyle and my interactions with others. Thus it is not a surprise that I enjoyed Physical and Health Education (PHE) classes—an opportunity in school to run around and play.

Having focused my undergraduate degree in PHE, and now as a PHE secondary school teacher and coach, sport and physical activity remain prominent foci in my life. For many individuals who were with me in PHE during my undergraduate degree, I hear similar stories about the importance of physical activity for them in feeling healthier,
providing an opportunity to de-stress, and having positive social interactions. In addition, being a coach of university and high school teams, I critically understand the central role that physical activities play in my athletes’ lives.

I have taught Grade 9 and 10 girls’ PHE classes, as well as instructed lessons in boys’, co-ed, and girls’ upper-year gym classes throughout the past three years. I believe that PHE classes could be an opportune venue to help instill in youth good values about physical activity. In my experiences as a PHE teacher, I have begun to notice large discrepancies in the amount of physical activity and enjoyment of physical activity across different individuals. One of my greatest concerns is the lack of girls in upper-year PHE courses. While many students really enjoy their time in PHE class, others struggle to actually engage in PHE class. On the other hand, when lessons are well thought-out and well-instructed and focus on different skills, students often challenge themselves to participate more. The notion of increased participation with good instruction and varying skills for increasing participation has been supported by other researchers (e.g., Gibbons, 2009). Most students are able to find something that they enjoy related to physical activity over the course of the semester. Understanding how important and central physical activities have been in my own life, I, as a coach and PHE teacher, want to be able to help provide students with similar positive PHE experiences. My goal is to make physical activities fun and enjoyable for everyone by helping each student to find some physical activity of personal interest, which can be incorporated into her or his lifestyle. Understanding the effectiveness of current PHE courses in promoting physical activities is critical to public health efforts as PHE courses are an accessible location for all youth (e.g., Sallis & McKenzie, 1991).
Purpose

The purpose of this study is to examine the effectiveness of high school PHE classes in meeting their objective of promoting students’ physical activity. As such, this study:

1. Compares changes in Theory of Planned Behaviour (TPB) constructs (Attitude, Perceived Behavioural Control, and Subjective Norms) and Physical Activity Intentions from the beginning to the end of a single high school semester between students taking Grade 9 PHE and those not taking Grade 9 PHE.

2. Compares changes in Physical Activity Behaviour from the beginning to the end of a single high school semester between students taking Grade 9 PHE and those not taking Grade 9 PHE.

3. Compares changes in Physical Activity Intentions and Behaviour from the beginning to the end of a single high school semester between those who have more and less positive reports of initial TPB constructs, and between those in PHE and those not in PHE.

In addition to examining how well high school PHE classes meet their objective of promoting physical activity, this study tests theory-predictive relationships with TPB constructs in that it:

4. Explores the utility of the TPB for predicting Physical Activity Intentions and Physical Activity Behaviour in a setting composed of Grade 9 students.

5. Explores the utility of the TPB for predicting change/no change in Physical Activity Intentions and Physical Activity Behaviour.
To accomplish these research objectives, I collected information via surveys near the beginning and the end of a high school semester from Grade 9 students in a Southeastern Ontario school board. The surveys asked students their perceptions of physical activity, in addition to how active they were over the course of the semester. Students both in PHE and not in PHE were compared across two time points to understand any potential effects of participating in Grade 9 PHE classes. Ultimately, data from this study provide critical information on whether or not current PHE classes effectively promote physical activity to Grade 9 students, in addition to providing a real-world test of the TPB in a Grade 9 context of theory-predictive relationships.

**Rationale**

With changes in technology providing ample opportunity for youth to be sedentary, and the misconceptions that predominate the world of physical activity and fitness, in combination with the ever increasing fast food options available, we are currently facing an unprecedented global obesity epidemic resulting from inactivity and poor food choices (Janiszewski & Ross, 2007; Tremblay & Willms, 2003). The resulting health implications are putting our health-care system under often unnecessary strain (Janssen, 2012).

Insufficient physical activity and its associated health risks are particular issues for Canadian youth (Janssen, 2012). With the increasing number of individuals at risk of chronic diseases, such as cardiovascular disease, as a result of physical inactivity, the focus on health promotion efforts at this age level needs to increase (Janssen, 2012; Liebert, 2012; Tremblay & Willms, 2003). Physical activity is beneficial to children and
youth across multiple domains, including affective, physical, and cognitive (Bailey et al., 2009). With a greater physical activity level, youth are able to achieve more health benefits (Colley et al., 2011). Using accelerometer data to measure physical activity levels of Canadian youth, however, Colley et al. (2011) noted that less than 10% of boys and less than 5% of girls between the ages of 6 to 19 years were active enough to achieve health benefits, and that, regardless of age group, boys were more active than girls.

One place where physical activity can be promoted is PHE classes. PHE classes in Ontario aim to improve students’ physical health as well as their understanding of healthy activities (Ontario Ministry of Education [OME], 1999). PHE classes provide an opportunity to access the entire population of Canadian youth that constitutes a large part of the inactive population, according to Statistics Canada (Colley et al., 2011). Understanding how we can promote physical activity to this age group in a context that already exists is essential for the promotion of physical activity and health benefits. In examining the issue of physical activity promotion in PHE classes, it is beneficial to use a theoretical framework for behaviour change that has been previously established in the literature and shown to be efficacious in a PHE physical activity context.

**Theoretical Framework: Theory of Planned Behaviour (TPB)**

In examining the effectiveness of PHE, I used the Theory of Planned Behaviour (TPB: Ajzen, 1985) as my theoretical framework. TPB has been employed extensively in previous research on health behaviour change in both adult and adolescent populations (e.g., Chatzisarantis & Hagger, 2005; Mummery, Spence, & Hudec, 2000). TPB stemmed from an earlier cognitive theory called the Theory of Reasoned Action (TRA: Ajzen &
Fishbein, 1980), a theory used to predict behaviour change. TRA proposes that intentions to act on a given behaviour are influenced by Attitude and Subjective Norms. In recognition of the importance that personal volitional control can play in an individual’s behavioural changes, Perceived Behavioural Control was added to TRA to create a new model called TPB in 1985 (Ajzen, 1985; LaCaille, 2013).

TPB suggests that there are behaviours that do not occur automatically and therefore require conscious attention to complete. For behaviours requiring attentional forethought (i.e., some degree of planning), of which physical activity is often one, TPB posits that the necessary intentions to act are influenced by Attitude, Perceived Behavioural Control, and Subjective Norms. Attitude reflects people’s positive or negative feelings toward a behaviour, Perceived Behavioural Control refers to people’s perceptions of their ability to perform a given behaviour, and Subjective Norms are an individual’s perception of social normative pressures. An intention is a representation of an individual’s readiness to perform a given behaviour. TPB hypothesizes that Attitude, Subjective Norms, and Perceived Behavioural Control directly influence behavioural intentions, which then lead to actual behaviour (see Figure 1). Perceived Behavioural Control sometimes elicits its own effect on behaviour when the individual’s actual ability to control the behaviour is taken into account.
Figure 1. Model of the Theory of Planned Behaviour (Ajzen, 2006).

TPB is one of the most cited models for human social behaviour prediction (Ajzen, 2011). TPB has been found to be useful in understanding students' intentions to continue physical activity, with variations in the contribution of the three variables across grade, gender, and socioeconomic status (Ajzen, 2011; Duncan, Rivis, & Jordan, 2012; Mummery, Spence, & Hudec, 2000). Ajzen (2011) conducted a review of research that examined the predictive capability of TPB and found that there was a substantial correlation between the intention and behaviour link, showing the efficacy of using TPB as a behaviour change model. Ajzen noted that the strength of the intention and behaviour link seemed to be moderated by factors such as the amount of time that passed between the intention measurement and behaviour measurement, usually with the finding that with a longer interval between measurement times the correlation gets weaker relative to a shorter time. In addition, if anything occurs in the interim period between the intention measurement and the behaviour measurement, such as an intervention directed at changing the given behaviour, the predictive capability of TPB tends to decrease.
Mummery et al. (2000) investigated the efficacy of TPB in predicting physical activity levels in a nationwide sample \((n = 746)\) of Canadian children and youth (Grades 3, 5, 8, and 11). In their study, TPB constructs explained 47% of the variance in physical activity intention, suggesting the value of using TPB to predict physical activity intentions in this children and youth population. Perceived Behavioural Control made the largest contribution to predicting physical activity intention across the sample grades, although when grade by gender analyses were conducted, differences were observed (e.g., Attitude was the most significant predictor for boys in Grade 5 and girls in Grade 11). Perceived Behavioural Control has emerged in multiple studies as a significant predictor across all ages of physical activity behaviour intentions (e.g., Duncan et al., 2012; Mummery et al., 2000).

In a slightly different use of TPB, a quantitative study by Chatzisarantis and Hagger (2005) used an intervention in PHE class for 83 students (approximately even split of males and females) from two high schools in the UK that was done using the framework of TPB and persuasive messaging to target behavioural beliefs about leisure-time physical activity. In this study, messaging was intended to influence Attitude towards physical activity. The intervention was five weeks long and had one group of students study a message that targeted salient beliefs for five minutes, and another group of students study a message that targeted non-salient beliefs for five minutes. This second group was used as a control group. All 83 students were asked to participate in physical activities for the duration of this period. Participants in the salient belief condition had more positive Attitude and stronger intentions after the intervention than the control participants. Intentions were a good predictor of physical activity behaviour, whereas
Attitude and Perceived Behavioural Control were good indicators of predicted intentions. The results of this study show the potential influence that an intervention based on TPB principles can have in PHE settings.

In a meta-analysis exploring the efficacy of TPB, McEachan et al. (2011) found that Subjective Norms was the strongest predictor in adolescent age groups for physical activity behaviour. In conducting a multivariate regression to predict behaviour and intention, adolescent physical activity behaviours and intentions were moderately well predicted by the TPB model (22.2 percent behaviour and 49.6 percent intention). Intentions were the strongest predictor of physical activity levels. Attitude was the strongest predictor of intentions. Other researchers have emphasized the importance of the social component of TPB for adolescents when compared with the adult population (e.g., Gibbons, Houlihan, & Gerrard, 2009; Hofmann, Friese, & Wiers, 2008). Given these findings, it is important to measure all three constructs of TPB in the current study as the extant research indicates the importance of each of the variables for adolescents in this context.

Given the specific PHE context as well as the adolescent age group with which TPB has already been used, including with the Canadian youth population, it seemed a comprehensive choice for examining behaviour change within the PHE context in Ontario. While PHE classes are an accessible location for public health promotion efforts, and it has been suggested by other researchers there is a need for a focus on changing PHE classes to become more effective (e.g., Sallis & McKenzie, 1991; Sallis et al., 2012), to my knowledge, there are no studies that have examined the Ontario PHE
context to further our understanding of the efficacy of PHE classes in changing students’ perceptions of physical activity.

**Significance of Study**

The results of the current study may help to add a unique perspective to the current literature and lend insight into whether or not the standard Ontario Grade 9 PHE courses are reaching their stated aim of helping students to achieve “a personal commitment to daily vigorous physical activity and positive health behaviours” (OME, 1999, p. 2). Examining Ontario PHE courses in terms of their effectiveness in reaching their aim, to my knowledge, has not been done previously. In turn, the results of the current study may have implications for the role of PHE in public health promotion contexts because, if PHE courses are deemed useful in increasing students’ physical activity behaviours, school PHE classes are an accessible location for physical activity promotion to occur. In addition, if the courses are ineffective in certain ways, it provides PHE teachers with some context as to what might be going wrong in general and provide areas of focus for further research. Moreover, this study provides a real-world test of TPB for adolescents in a Grade 9 context with physical activity as the main focus. While previous studies have used TPB to examine adolescents in physical activity settings (e.g., Mummery et al., 2000), and examine interventions in PHE classes based on TPB principles (e.g., Chatzisarantis & Hagger, 2005), TPB has not been used to examine how effective PHE courses are doing in achieving their aims of increasing lifelong physical activity. Thus this study has a unique contribution of testing TPB in a context with a curriculum that is specifically targeted towards physical activity promotion. The review
conducted by Ajzen (2011) discusses some of the difficulties and benefits of using the TPB to measure change/no change over time. In the present study, given the two time points, there is an opportunity to use the TPB to predict intention/behaviour change over the course of the semester to add to the current literature on the predictive capability of TPB.

In addition to student health promotion, the current study provides an opportunity to explore the TPB constructs to see if there is something modifiable (e.g., Attitude) that is not working in PHE contexts, which could then be further explored. Furthermore, given the discrepancies in terms of the most useful construct when looking at TPB in adolescent contexts (e.g., Gibbons, Houlihan, & Gerrard, 2009; Hofmann, Friese, & Wiers, 2008), the current study could add to the literature our findings of which TPB constructs are the most valuable in determining physical activity behaviour when examining this population.
CHAPTER 2: LITERATURE REVIEW

Understanding Physical Activity

The Problem with Physical Inactivity

Physical inactivity is the highest of all modifiable risk factors for several illnesses including type II diabetes, obesity, and cardiovascular disease (Warburton, Nicol, & Bredin, 2006). Physical inactivity and a sedentary lifestyle have been linked to what is considered a major obesity epidemic across many developed countries including Canada and the USA (Cecchini et al., 2010; Center for Disease Control, 2013). Associated with obesity is a multitude of negative health implications closely intertwined with physical inactivity. With an increase in visceral fat that is often associated with obesity, the long-term health implications can often be dire (Janiszewski & Ross, 2007). Since 1980, the number of youth in the USA considered obese between the ages of 12 to 19 has tripled (Center For Disease Control, 2013). Canada followed a similar trend: between 1981 and 1996, there was an increase in childhood (aged 7 to 13) obesity from 5 to 15 percent (Tremblay & Willms, 2003). This drastic and rapid change indicates that the obesity epidemic is stemming from environmental factors throughout the past few decades.

Using results from the self-reported Canadian Community Health Survey, Koezuka et al. (2006) examined the relationship between the time youth (aged 12 – 19, n = 7,982) spent on sedentary activities (e.g., reading, watching television, time on computer) with physical inactivity levels. Watching television was significantly associated with physical inactivity for both males and females when researchers controlled for sociodemographic variables, health status, and body mass index.
Moreover, Janssen (2012) estimated the health care cost of physical inactivity in Canadian adults using a prevalence-based approach. The total cost to the health care system (both direct and indirect costs) due to physical inactivity in 2009 was approximately $6.8 billion, or 3.7 percent of the overall health care costs in Canada. At a time when the Canadian government is trying to increase the economy and strengthen job opportunities (Government of Canada, 2012), a large portion of our government’s money and resources are currently directed at a potentially modifiable issue (i.e., health issues due to physical inactivity; Janssen, 2012).

Thus physical inactivity is prominent for both adults and youth in Canada (Janiszewski & Ross, 2007; Janssen, 2012; Tremblay & Willms, 2003). In addition to monetary implications for our healthcare system, physical inactivity and associated obesity in children contribute risk factors for early-onset heart disease, social and psychological troubles (e.g., discrimination; low self-esteem), and increased risk of various cancer types, stroke, and early mortality rates (e.g., Center For Disease Control, 2013; Tremblay et al., 2011).

**Benefits of Physical Activity**

There is a positive relationship between physical activity and health status (Janssen & LeBlanc, 2010; Warburton et al., 2006). Not only is physical activity important for physical health, but it has benefits in the cognitive, affective, and social domains (e.g., Bailey et al., 2009; Janssen & LeBlanc, 2010). A systematic review conducted by Janssen and LeBlanc (2010) examined the relationships among physical activity, fitness, and health in school-aged children and youth. The initial search criteria provided 11,088 studies, of which 86 met rigorous inclusion criteria based on the quantity
and quality of studies, strength of effect, in addition to the volume, intensity, and type of physical activity. The researchers examined seven health indicators in both the psychological and physiological domains. There was a large body of evidence indicating that physical activity contributed to: (a) positive blood cholesterol level; (b) decreased chances of hypertension; (c) decreased blood pressure; (d) decreased chance of metabolic syndrome; (e) decreased likelihood of obesity (stronger in males than females); (f) positive contribution to bone density necessary for growth; and (g) improvements in symptoms of depression. This review is indicative of some of the positive effects that improving physical activity levels can have on both the physiological and psychological well-being of school-aged children and youth.

According to the Canadian Physical Activity Guidelines, youth aged 12 to 17 years should engage in at least 60 minutes of moderate to vigorous physical activity daily to achieve health benefits, including at least three days per week of vigorous intensity activities and activities that strengthen muscle and bone (Canadian Society for Exercise Physiology [CSEP], 2013; Janssen & LeBlanc, 2010). These guidelines were established to emphasize increased overall health and decreased health-related illnesses. This daily physical activity should be implemented in combination with reducing the time adolescents spend doing activities that are not active, such as playing computer games, surfing the Internet, and watching television, and increasing the consumption of nutritious foods (Trost, 2006).

The Canadian Physical Activity Guidelines were created by CSEP (2013) in collaboration with ParticipACTION, the Public Health Agency of Canada (PHAC), and other stakeholders (Tremblay et al., 2011). To develop the guidelines, all stakeholders
followed those set out by the Appraisal of Guidelines for Research Evaluation (AGREE) II instrument, which is an instrument that reaches an international standard. The guidelines were developed based on systematic reviews and interviews with stakeholders (Canadian and international).

Unfortunately, Canada’s Physical Activity Guidelines have had a limited reach (Cameron, Craig, Bull, & Baumen, 2007). Cameron et al. (2007), during a phone survey for adults and children (aged 12 or older, n = 8,892), found that people who were not prompted about the physical activity guidelines had very little recall of them (four percent could recall parts of the guidelines unprompted), whereas, when prompted, 37 percent were able to recall more about the guidelines. The ability to recall differed with gender, education, and socioeconomic status, with high-income females who were more educated being the most knowledgeable. The low unprompted recall of the physical activity guidelines shows the need for a coordinated and multi-stakeholder approach to both the implementation and ongoing practice of these guidelines across Canada to achieve health benefits.

In addition to this lack of knowledge regarding physical activity guidelines, Canadian youth are not meeting these recommended levels of physical activity (Guthold, Cowan, Autenrieth, Kann, & Riley, 2010; Iannotti et al., 2012). The Health Behaviour in School-aged Children (HBSC) study survey adolescents aged 11-15 across 40 countries from Europe to North America asking how many days over the past week they had participated in moderate to vigorous physical activity (MVPA) for a total of at least 60 minutes per day (Iannotti et al., 2012). MVPA was defined as any physical activity that increased their heart rate and made them out of breath some of the time. Across all
nations and age groups, boys were more likely to report higher MVPA levels than girls. For 13-year-olds (approximate average age of Grade 9 students), Ireland and the United States had the most reported participation of MVPA daily (approximately 35% for boys and 20% for girls), while Italy and Denmark had the lowest with estimates at under 10% for girls and under 15% for boys. Canada fell between the lower and higher estimates, reporting 16% of girls and 30% of boys in the 13-year-old age group reaching the MVPA daily standard. Thus while some of the target-aged youth report reached at least 60 minutes of daily MVPA, which is equivalent to the recommended standard (CSEP, 2013), more than 70% of this age group in Canada were not reaching the standard.

This lack of physical activity in our Canadian youth is prevalent worldwide, including in developing countries. A study conducted by Guthold et al. (2010) analyzed the Global School-based Student Health Survey (GSHS) data for 72,845 children (aged 13 to 15) from 34 countries, with a focus on developing countries. The data were collected between 2003 and 2007. This survey was distributed by the World Health Organization (WHO), and included five questions regarding physical activity including overall physical activity (at least 60 minutes per day), sedentary behaviour, and active transport to and from school. The questionnaire was modified for each country to provide examples of what physical activity meant. Very few students were meeting the physical activity recommendations, and there were high levels of sedentary behaviours among this age group. Therefore, a world-wide need for physical activity promotion for health in school-aged children exists, not just in Canada.
As students enter high school, there is a marked decrease in physical activity levels, which is more prominent in girls than in boys (Biddle, Gorley, & Stensel, 2004; Koezuka et al., 2006). In a similar vein, girls and boys tend to have different physical activity levels and feelings toward physical activity (e.g., Gibbons, 2009; Huhmen et al., 2005). For example, Kelder, Perry, and Klepp (1993) explored the efficacy of a school-based health promotion program, embedded in a larger program aiming to reduce cardiovascular disease in the community. Female students in Grades 8 through 11 who were in the intervention group had significantly higher levels of physical activity than those not in the intervention group. Additionally, there was a decreasing trend for both male and female adolescents in the amount of time spent in physical activity outside of school as they went up in grade level.

In a slightly different study, Huhman et al. (2005) conducted longitudinal research to survey a USA nationally representative sample of children and youth ages 9 to 13 ($n = 3120$), while doing a mass media campaign to promote physical activity levels amongst this age group. This mass media campaign sought to improve youths’ daily physical activity through daily messaging and advertisements via schools, communities, television, and Internet. For both girls and children who were considered low active at baseline, the campaign had the greatest effect. Thus targeting the low active children in addition to girls (e.g., Iannotti et al., 2012; Kelder et al., 1993) for physical activity promotion could be important. Similarly, in a systematic review of sedentary behaviour in youth and school-aged children, Tremblay et al. (2011) found a large body of evidence indicating that decreasing any type of sedentary time is associated with lower health risk.
in youth. Youth who go from sedentary lifestyles to some, even minimal, physical activity have the potential to achieve health benefits.

One review noted the plethora of research that acknowledges the significant decline in adolescents’ physical activity levels (Dumith, Gigante, Domingues, & Kohl, 2011). Of the 26 studies that matched the researchers’ criteria of at least two physical activity measures throughout adolescence, or a first measurement of physical activity during childhood with the second during adolescence, there was a decline across both boys and girls in physical activity levels, especially during the 13-16 year old age range. Some of the more recent studies showed significant declines in physical activity levels for girls relative to earlier studies that showed a greater decline for boys. Moreover, girls tended to have drop-offs in physical activity levels at a younger age (9-12) relative to boys, where the decline tended to happen at an older age (13-16). This stage of students’ lives also coincides with the time when students enter secondary school in Canada and the USA. Understanding the health implications of physical activity (e.g., Janiszewski & Ross, 2007) and the large decline in physical activity levels with the adolescent age group focuses attention on this age group.

Furthermore, with the link between health and physical activity, longitudinal tracking studies that follow adolescents’ physical activity levels through to adulthood indicate a strong relationship between those people who participated in physical activity during adolescence and continuing that physical activity into adulthood (Trost, 2006). This trend is the same for adolescents with low physical activity levels—they are less likely to continue physical activity into adulthood. This physical activity link is not strongly established between younger children and adulthood. Understanding that
adolescents’ physical activity levels can be predictive of adulthood physical activity levels points to a need for focused physical activity promotion efforts with the adolescent portion of our population. Moreover, within this adolescent age group in particular, past physical activity behaviour is the greatest predictor of future physical activity behaviour (Craggs, Corder, Esther, Sluijs, & Griffin, 2011).

Given the strong link among sedentary lifestyles, obesity, and increased all-cause mortality, and the body of knowledge showing the benefits of physical activity for health status, physical activity has the potential to play a crucial role in reducing the chances of morbidity due to inactivity (e.g., Janiszewski & Ross, 2007; Warburton et al., 2006). With the knowledge that sedentary lifestyle choices can lead to the development of chronic diseases, health promotion efforts should focus heavily on adolescents, especially females and those youth who are currently sedentary.

**Adolescents’ Perceived Barriers to Physical Activity**

Research has shown a variety of perceived barriers to regular physical activity engagement exist that are often unique to the adolescent age group (e.g., Moore et al., 2010; Robbins, Pender, & Kazanis, 2003). For example, when a population of urban and rural youth and parents were included in focus groups examining the barriers and facilitators for physical activity \((n = 41\) youth, \(n = 50\) parents) in North Carolina, distance, cost, crime/danger, and television were the primary barriers that parents mentioned for youth. While some factors may have been location-specific, distance, access to facilities, and cost have often been noted as barriers to physical activity. For example, Sallis et al. (2000) conducted a systematic literature review that sought to
understand the factors that affected physical activity levels in adolescents. Factors most associated with barriers to physical activity included access to programs and facilities.

In a study conducted by Robbins et al. (2003) specifically exploring adolescent girls’ (age 11-14) perceptions of barriers to physical activity ($n = 77$), a questionnaire was used to examine potential barriers to physical activity participation. The barriers to physical activity that emerged from this study included feelings of self-consciousness while exercising, and a lack of motivation to be active. While some barriers to physical activity may be applicable for both boys and girls, they may need to be looked at as unique populations that have independent perceived barriers to physical activity.

**Physical and Health Education’s Role in Public Health**

With the understanding that physical inactivity is associated with health-related illness (e.g., Warburton et al. 2006) and that decreasing time spent participating in sedentary activities and increasing time spent on physical activities could help youth—especially youth who have low initial physical activity—to achieve greater health benefit (e.g., Huhmen et al., 2005; Janiszewski & Ross, 2007; Koezuka et al., 2006), it is essential that we find ways to help youth establish healthy activity patterns. One avenue to become physically active is through Physical and Health Education (PHE) classes.

Challenging the way we think about and approach physical activity as an entire population requires a well-coordinated approach (Center for Disease Control, 2013). Due to the nature of the Canadian education system, youth spend a large portion of their lives interacting with peers and teachers in a school setting. Thus schools, and in particular PHE classes, have the potential to elicit changes in students’ perceptions of and
participation in physical activity (e.g., Bailey et al., 2009; Center for Disease Control, 2013). While some students are able to find the time to participate in school sports, community sports, or other physical activities, often the only time students have access to physical activity is during high school PHE classes (Sallis, Prochaska, & Taylor, 2000).

There have been a multitude of studies that have examined the positive effects of PHE and sport (e.g., Bailey et al., 2009; Hofmann, Friese, & Wiers, 2008; Tassitano et al., 2010). Improving PHE contexts where all students have both facilities and instruction and providing mandated PHE course options by educated health and physical activity teachers throughout high school can help alleviate access-related barriers to physical activity participation (e.g., Moore et al., 2010; Robbins, Pender, & Kazanis, 2003).

However, to what extent are PHE courses influencing positive changes in youth, and, if so, what are the mechanisms of change? While PHE courses have a well sought-after aim of students achieving lifelong physical activity adoption, according to Corbin (2002) and Gibbons (2009), there are some critical components to creating a positive atmosphere in PHE class to promote physical activity effectively to youth. To achieve the benefits of healthy physical activity adoption, Corbin (2002) believes that: (a) youth have unique physical activity needs; (b) girls have different physical activity needs than boys; (c) there is a need for a focus shift from ‘fitness’ to ‘physical activity’; (d) youths’ feelings of competence and self-esteem need to be primary foci; and (e) self-management skills need to be promoted for long-term physical activity adoption. Similarly, Gibbons (2009) conducted interviews with teachers and used student questionnaires from 32 senior PHE courses from 22 districts in British Columbia (Canada). Several themes emerged: (a) lifetime physical activities rather than fitness to promote physical activity;
(b) the necessity of a focus on gender in course design; (c) authentic and appropriate assessment; (d) student involvement in course development; and (e) a focus on a respectful and positive class environment. However, while there is research on what components make a PHE course that keep students wanting to go back, we still do not know what the underlying internal mechanisms of change are in this adolescent population regarding PHE courses. The Theory of Planned Behaviour constructs (Attitude, Subjective Norms, Perceived Behavioural Control, and intentions), which are being used in the current study, begin to explore the mechanisms of change to see if there are specific areas that PHE teachers need to target in their instruction to help create positive physical activity behaviour change.

PHE classes can best contribute to public health by providing frequent exposure to enjoyable and age-appropriate physical activity as well as through helping students to prepare for a lifetime of regular physical activity (Gibbons, 2009; Trost, 2006). PHE classes can be structured to focus on student behaviour change, and teacher instruction strategies can be modified to increase student participation in physical activity (e.g., Stone, McKenzie, Welk, & Booth, 1998; Trost, 2006). Stone et al. conducted a review of 22 elementary PHE class intervention studies, finding that, across all interventions, there was an increase in physical activity level during school hours, as well as more positive attitudes and knowledge regarding physical activity. Additionally, Ringuet and Trost (2003: as cited by Trost, 2006) examined school-based physical activity interventions for both elementary and secondary school students using effect sizes. Across all studies, the mean effect size was 0.47; physical activity interventions at the school level produced moderate but significant changes in physical activity levels. Furthermore, interventions
targeting physical activity levels in PHE class had a greater effect size than interventions targeting overall physical activity.

Sallis et al. (2012) described a review paper they wrote in 1991 (Sallis & McKenzie, 1991) discussing future steps that PHE courses needed to take in the USA to achieve benefit to public health (e.g., adopt a public health goal for school PHE; prioritize highly active classes; prepare youth for a lifetime of physical activity). During this review they noted that, despite the 1991 paper being one of the most commonly cited papers for PHE in a public health context, the USA had not made further progress in terms of how the country had done in actually achieving the goals of the paper. Research dissemination to PHE teachers and other pertinent stakeholders of the importance of PHE in a public health capacity might be more difficult than generally thought.

Unfortunately, most of the studies looking at PHE class effectiveness only have a focus on intervention studies rather than the effectiveness of regular everyday PHE classes. We already know that there is a direct link between physical activity and health status (e.g., Warburton et al., 2006), and we know that there is a strong link between adolescent physical activity levels and their physical activity levels in adulthood (see Trost, 2006). However, Trost (2006) also suggested that it is difficult to track children’s physical activity levels through to adulthood, and studies that have done so have not shown a strong link between childhood and adulthood physical activity levels, perhaps due to the extended time period. While there is a wealth of research that investigates PHE classes as a means of increasing public health, most of the focus of these studies is on elementary school physical education classes (Chow, McKenzie, & Louie, 2009; Trost, 2006). While physical activity is important for children at the elementary school level,
with the clearly defined link between adolescence and adulthood physical activity, it is critical that research and health promotion efforts focus on secondary school-aged students as well.

**Context**

Students in Ontario secondary schools are currently only required to take one PHE credit (one, single-semester course) to receive their high school diploma (Ontario Ministry of Education [OME], 2011). The Ontario Health and Physical Education curriculum was “designed to provide learning experiences that will help students realize their potential in life” (OME, 1999, p. 2). The document outlines expectations related to students’ personal fitness, competence, skills, attitude, and knowledge around health and physical activity. There are two major components to the Ontario courses: (a) promotion of healthy active living; (b) regular participation in physical activity.

To achieve these components, each of the Grade 9 and 10 courses within the same document contain four strands: physical activity, active living, healthy living, and living skills. These courses are open courses, which means they have expectations that are appropriate to all students and there are no prerequisite courses necessary to take them. Students are allowed to take more than one PHE credit in any given year should they wish to do so. However, logistically, with many post-secondary requirements for specific programs, as well as many students in Ontario graduating within four years, it is often difficult for students to take PHE as an elective credit more than once within that four-year timeline. Thus students may not receive the necessary amount of guidance in healthy
physical activity strategies to make positive changes in their lifestyles (Sallis, Prochaska, & Taylor, 2000).

The importance of healthy active living is beginning to be recognized in Ontario schools with some of the newer policies, such as the elementary school-based Daily Physical Activity Policy (DPA: OME, 2005). While this is a worthwhile policy, currently there is no policy in place that requires Ontario secondary school students to get a certain amount of physical activity per day. It would seem necessary that real-world health promotion efforts be focused in the one place where all young people in Ontario are mandated to attend. If these efforts are effective, then the lack of physical activity affecting our youth’s health might be remedied by a nation-wide focus on the benefits of PHE (Sallis et al., 2000; Tasitano et al., 2010). To know if PHE is beneficial, we need data, which is what the present study begins to explore.

PHE classes are unique in that students must attend high school until graduation or the age of 18 in Ontario, whichever comes first (OME, 2011). Most students who enter high school in Ontario are automatically enrolled in their single mandated PHE credit in Grade 9. School-based intervention studies have shown PHE to be a beneficial place to improve physical activity levels of children and adolescents (e.g., Kelder et al., 1993; Trost, 2006), and consequently may be an effective location to focus our health promotion efforts in Canada and Ontario. Moreover, while intervention studies focus on implementing some sort of an external program or changing the normal routine, what we do not know is how standard PHE classes in Ontario are doing in promoting physical activity.
Given our knowledge that there are large drop-offs in physical activity level as students enter high school (e.g., Biddle, Gorley, & Stensel, 2004; Koezuka et al., 2006), that there is a link between adolescent physical activity levels and physical activity levels in adulthood (e.g., Trost, 2006), and that most students in Ontario take the required PHE credit in Grade 9, the focus for the current research was on Grade 9 students. The Grade 9 Ontario PHE course is designed to help students gain an understanding of the “importance of physical fitness, health, and well-being,” to develop a “personal commitment to daily vigorous physical activity,” in addition to acquiring the “skills and knowledge they require to participate in physical activities throughout their lives” (OME, 1999, p. 2). This course is meant to be implemented in such a way that students should develop lifelong healthy active habits and engage in a number of activities from which they can choose to incorporate into their lives.

The primary purpose of this study was to evaluate how well Grade 9 PHE classes in one school board were promoting students’ physical activity. The research was guided by three physical activity components: (1) comparing changes in physical activity TPB constructs and intentions from the beginning to the end of a high school semester between students taking Grade 9 PHE and those not taking PHE, (2) comparing changes in physical activity behaviour from the beginning to the end of a high school semester between students taking Grade 9 PHE and those not taking Grade 9 PHE, and (3) comparing changes in physical activity behaviour from the beginning to the end of a high school semester between those who have more and less positive reports of initial TPB constructs, and are in PHE/not in PHE. In addition, the research was guided by two theory-predictive components: (4) exploring the utility of the TPB for predicting Physical
Activity Intentions and Physical Activity Behaviours in a setting composed of Grade 9 students, and (5) exploring the utility of the TPB for predicting change/no change in physical activity intentions and behaviour. Through a deeper understanding of PHE effectiveness, successful health promotion efforts through PHE classes could be made.
CHAPTER 3: METHODOLOGY

Research Design

The design for this study was a pre-test/post-test, quasi-experimental research design that examined differences between a control (not in Physical and Health Education [PHE]) and an experimental group (in PHE). Students in PHE and not in PHE were compared from near the beginning to the end of an Ontario secondary school semester (September to January). As students were previously assigned to classes according to their school’s scheduling format, the distinction between students in PHE and those not in PHE was naturally occurring (as opposed to randomly assigned) and therefore quasi-experimental in design. In Grade 9, students are assigned to PHE class for either first or second semester. The students who were not in PHE served as a control group for the students who were in PHE. In addition, the students who completed both time points served as their own control as they were subjected to a ‘treatment’ over time, and I was able to examine changes in students’ individual scores (Tabachnick & Fidell, 2007).

The dependent variables (DVs) for the first portion of the study were adolescents’ physical activity intentions, their actual physical activity behaviour, and the three Theory of Planned Behaviour (TPB) constructs (Attitude, Subjective Norms, and Perceived Behavioural Control). In TPB, Attitude, Subjective Norms, and Perceived Behavioural Control are predicted to influence intentions to be physically active, which, in turn, are predictive of actual physical activity behaviour (Mummery et al., 2000). The between-subjects independent variables (IVs) were TPB status (above the mean versus at or below the mean) and condition (Grade 9 students in the PHE class versus Grade 9 students not
in PHE class first semester). The within-subjects IV was time. Males and females were run independently as initial comparisons show differences in composition of the two gender groups (see Results section for further details).

The IVs for the second theory-predictive portion of the study were the three TPB constructs (Attitude, Perceived Behavioural Control, and Subjective Norms), as well as Physical Activity Intentions. The DVs for the second portion of the study were Physical Activity Intentions (both time points) and Physical Activity Behaviour (both time points).

**Data Collection**

**Participants**

The participants in this study were selected from pre-assigned Grade 9 classes from 6 of 11 public high schools from a single school board in a mid-sized city and surrounding area in South-eastern Ontario. Of the five schools that did not participate, one school principal indicated that their school only had Grade 9 PHE in the second semester and thus were unable to participate, two school principals indicated that their schools were too busy to participate in a study at this time, and two school principals did not respond to the requests to conduct research. Of the six schools that were able to participate, a total of 252 of a possible 837 Grade 9 students (30.1%) returned their signed consent forms and were therefore eligible to participate in the study. The final sample consisted of 252 Grade 9 students (52% female): 197 students (55.3% female) completed surveys at both time points; 27 students (25.9% female) completed only Time Point 1; and 28 students (53.6% female) completed only Time Point 2. Students who completed Time Point 1 but not Time Point 2 were either absent or had changed schools.
at the time I came in for the second round of data collection. Students who completed Time Point 2 but not Time Point 1 had brought in their consent forms too late for Time Point 1 to be considered; hence they were excluded from portions of the analyses.

Students in the sample came from 40 English-instruction classes across the six different schools. Of the 197 students who completed both time points, 113 students (57.4%) were taking Grade 9 PHE first semester (47.8% female), and 84 students (42.6%) were not taking Grade 9 PHE the first semester (65.5% female). For all schools included in this study, Grade 9 PHE classes were single-gendered.

**Procedure**

After receiving ethics clearance by both Queen’s University (June 2013; see Appendix A) and the district school board (July 2013), the readability of the questions was tested in August 2013 by providing four teachers of Grade 9 students with the questionnaires and asking them to look at clarity of the questions as well as to see if they thought Grade 9 students would comprehend questions in the way they were worded. Questions were adapted for clarity and appropriateness for the Grade 9 group based on the teachers’ feedback. At the beginning of August I sent out a brief recruitment email (see Appendix B: including the Letter of Information and Consent Form that would go out to parents) to each of the principals in the school board from which I had received clearance, informing them of the details of my study and requesting their school’s participation. All principals except two provided a response by the end of September. For the six principals who agreed to have me conduct research in the schools, I provided a recruitment script (see Appendix C) for them to email out to the Grade 9 home form teachers, who were initially selected to avoid overlap of students between the classes.
Home form, for the purposes of this study, is defined as the first period of the instructional day at each of the given schools. Once home form teachers had responded, the recruitment was opened to any Grade 9 teacher to provide the opportunity for participation from the maximum number of Grade 9 students. Teachers were directed to email me if they were interested in participating, and I provided consent forms and letters of information to be handed out to the students in their classes. All students were made aware that those who participated would be entered into a draw among individuals at their own school for a 25 dollar gift certificate to either SportChek or Cineplex (movies).

Teachers were directed to return signed consent forms to the same envelope I had originally provided with letters of information and consent forms. I then scheduled times with each classroom teacher who agreed to participate to come into her or his class and administer the questionnaire to the students who had returned their consent forms for the first time point in September and October, 2013. Students who did not have their consent forms filled in were asked to do independent written work based on their teacher’s suggestion.

All questionnaires were administered in the students’ regular classroom to provide a non-influential setting to the students (McMillan & Schumacher, 2010), and were administered in English at two time points in the Fall of 2013. Before filling in the questionnaire, all students were provided verbally with the same instructions that were written on the questionnaire:

Please answer each of the following questions by circling the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues. When filling in the questionnaire, please
remember to answer all items; never circle more than one number on a single scale.

I also reminded the students to be as honest as possible and that they would not be graded on this task, and that all the information collected from the questionnaires would be completely anonymous. Students were informed that, if they had any questions or needed to seek clarification, they could do so by asking the classroom teacher or me. In addition, all students at a given school were reminded that they would be entered into a draw to win a 25 dollar gift certificate to SportChek or Cineplex (movies) after the second time point was completed. During the administration of the questionnaire, the classroom teacher and I wandered around the classroom and answered questions for clarification. In addition, there were three occasions where teachers indicated that a few of the students had limited reading skills. For these students, they sat with me in the hallway where I dictated the questions to them and ensured they understood the content before responding on their own paper. Questionnaires took between 10 and 20 minutes for students to complete.

In the interim time period between the two data collection points, the students taking PHE classes continued to attend their classes regularly and participated in activities. The students not in PHE class continued to attend their classes regularly, but without the daily physical activity and PHE instruction. Towards the end of the semester (between December 9\textsuperscript{th} to 20\textsuperscript{th}, 2013), but before the 2-week holiday break, I returned to the schools and re-administered the questionnaire to the control group and the experimental group. I chose to do this administration in December 2013 instead of the end of the semester (mid-January 2014) because I wanted to get the students’ regular
physical activity and feelings about physical activity prior to a two-week holiday followed by the exam session. During this time (December 2013), the region experienced a major snowstorm that interfered with my data collection as many students were absent from school. I tried to reschedule with as many teachers as possible prior to the holiday.

Students were matched using a unique code consisting of the students’ birthday, the last four digits of their cell phone number, and a school code that I assigned (e.g., 11-4698-1). Students were told if they did not have a cell phone to utilize the last four digits of their home phone number instead. This information was assigned to ensure that the same individuals were responding at the two time points, and to ensure that there were no missing data. The students’ names were not associated with the questionnaire in any way to ensure confidentiality of information. The students’ names only appeared on the consent/assent form, which was signed by both the parent (consent) and student (under the age of 18, therefore giving assent: McMillan & Schumacher, 2010). Of the 252 participating students, 178 students were matched from Time Point 1 to Time Point 2 by their unique code. There was a small portion of individuals who could not remember which phone number they had used in the early Fall, and, for these individuals, students were matched from Time Point 1 to Time Point 2 using their birthday, school code, gender, if they were taking PHE class first semester, as well as their hand-writing (if necessary). Through this process, an additional 19 students were matched between the two time points. The remaining 56 students completed only one time point (either Time Point 1 or Time Point 2).
**Questionnaires**

TPB questionnaires are widely used for health behaviour change research and were the best way to access a large portion of the Grade 9 student population in this particular school board to further our understanding of students’ changing physical activity behaviours and intentions after taking a PHE class. There are many methods that can be used to understand physical activity levels and health behaviour change (e.g., accelerometer data, pedometer data, physical testing; Colley et al., 2011). However, while understanding exact amounts of physical activity was important for this study, the central component of this study sought to examine how students’ base-level perceptions of physical activity changed over the course of the semester between those who were taking PHE and those who were not taking PHE. Saying that, a short self-report of physical activity behaviour was incorporated into the questionnaire and given to both the PHE and no PHE groups at both time points. By using the same TPB and physical activity survey at two time points, students were able to act as their own control, and thus changes that students made over the course of the semester were changes made relative to themselves (Tabachnick & Fidell, 2007). In addition, using the TPB questionnaires provided an opportunity to directly answer the research questions, which involved comparing changes in physical activity behaviour and physical activity intentions over the course of a high school semester between students taking Grade 9 PHE and those not taking Grade 9 PHE.

All scale items that were negatively worded were reverse coded so that they would be on the same scale as all other items. For the measures, the higher scores indicated a more positive response (e.g., extremely difficult or extremely easy). All
questions in the Physical Activity portion of the questionnaire were standardized using z-
scores as all items for physical activity were on different scales. The TPB questions were
not standardized as they were all on a 7-point Likert-type scale. Each scale was created
from the average of individuals’ responses for a given construct.

Background Characteristics

Included in the questionnaire were questions about the background characteristics
of the students including questions regarding sex, participation in school PHE first
semester, participation in school sports, and participation in physical activities (e.g.,
sports, gyms) outside of school and during school hours (for specific questions, see
Appendix D). The question about whether or not they participated in organized physical
activity in school was removed prior to the analyses as the interpretation of the question
varied between students; some students thought that PHE was included in this question
and others did not.

TPB Constructs

Like Mummery et al. (2000), I created a quantitative questionnaire that was
developed in a manner consistent with the detailed validity recommendations of Ajzen
(1985) (see Appendix D for TPB questions). This procedure has been followed for a
number of studies and is common practice for the study of physical activity behaviour
using TPB (Hagger, Chatzisarantis, & Biddle, 2002; Kerner & Kalinski, 2002; Raudsepp,
Viira, & Hannus, 2010). Questions were designed to measure the TPB constructs
(Attitude, Subjective Norms, and Perceived Behavioural Control plus Physical Activity
Intentions). Each scale was created by running a Principal Component Analysis on all
related items for both the TPB questions, as well as the questions from the Physical
Activity Questionnaire, selecting variables with a factor loading greater than 0.5. I then ran a reliability analysis and removed items until the internal reliability was maximized. In a review, Ajzen (2011) indicated that well-designed TPB measures rarely exhibited reliabilities in excess of 0.75 or 0.80.

**Attitude Scale.** The Attitude Scale was constructed from six variables ($\alpha = .88$). The variables were answered on a 7-point Likert-type scale anchored with bipolar adjectives. The variables included in the scale for Attitude included the following questions: ‘For me to be physically active on a regular basis is … [extremely good] [extremely bad]’; ‘For me to be physically active on a regular basis is … [extremely valuable] [extremely worthless]’; For me to be physically active on a regular basis is … [extremely pleasant] [extremely unpleasant]’; ‘For me to be physically active on a regular basis is … [interesting] [boring]’; ‘Doing physical activity for the next few weeks would be … [relaxing] [stressful]’; ‘Doing physical activity is generally … [beneficial] [harmful].’

**Perceived Behavioural Control Scale.** The Perceived Behavioural Control Scale was constructed from three variables ($\alpha = .78$). The variables were answered on a 7-point Likert-type scale anchored with bipolar adjectives. The variables included in the scale for Perceived Behavioural Control included the following: ‘For me to be physically active on a regular basis is … [extremely easy] [extremely difficult]’; ‘I am confident that if I wanted to I could be physically active on a regular basis … [definitely true] [definitely false]’; ‘For me to be physically active on a regular basis is … [impossible] [possible].’ Two items were removed after the factor analysis as they seemed to be measuring a different component of Perceived Behavioural Control and were loading onto a different
component in the factor analysis. The questions that were removed were the following:

‘It is completely up to me whether or not I am physically active … [strongly agree]
[strongly disagree]’; ‘Whether or not I am physically active on a regular basis is up to me … [strongly agree] [strongly disagree].’

**Subjective Norms Scale.** The Subjective Norms Scale was constructed from four variables (α=.65). One item was removed to maximize reliability. The lower reliability of this scale should be taken into consideration when looking at the results. Subjective Norms are often the least well predicted of the TPB constructs (Armitage & Conner, 2001). The variables were answered on a 7-point Likert-type scale anchored with bipolar adjectives. The variables included in the scale for Subjective Norms included the following questions: ‘Most people who are important to me hope that I am physically active … [absolutely true] [definitely false]’; ‘It is expected of me that I am physically active on a regular basis … [definitely true] [definitely false]’; ‘Most people whose opinions I value would approve of my being physically active on a regular basis … [strongly agree] [strongly disagree]’; ‘Most people that are important to me think that I should be physically active … [strongly agree] [strongly disagree].’ The item that was removed was ‘Most of the students that I know in my Grade 9 class are physically active on a regular basis … [definitely true] [definitely false].’ Anecdotally, students seemed to be confused by this question as they did not feel they were a good judge of other students’ physical activity levels, and they did not know many of the other Grade 9 students, especially at the first time point. This issue was not one of the factors raised by Grade 9 teachers who read through the questionnaires for comprehension and readability.
Thus it made sense to remove this item from the Subjective Norms Scale, especially as it lowered the scale’s reliability, a reliability that, even with its removal, was low.

**Physical Activity Intentions Scale.** The Physical Activity Intentions Scale was constructed from four variables ($\alpha = .90$). The variables were answered on a 7-point Likert-type scale anchored with bipolar adjectives. The following items were included in the scale for physical activity intention: ‘I plan to be physically active on a regular basis … [extremely likely] [extremely unlikely]’; ‘I will make an effort to be physically active on a regular basis … [I definitely will] [I definitely will not]’; ‘I intend to be physically active on a regular basis … [strongly agree] [strongly disagree]’; ‘I plan to be physically active over the next two weeks … [strongly agree] [strongly disagree].’

**Physical Activity Behaviour**

The Health Behaviour in School-aged Children (HBSC: Freeman, King, & Pickett, 2011) physical activity questions were used to assess the actual level of physical activity for both the experimental and control group (see Appendix D). HBSC is used to collect information on students in Grades 6 to 10 in Canada and worldwide. The use of the HBSC survey for sampling has been established in the literature and validated as a measurement (Biddle, Gorley, Pearson, & Bull, 2011; Currie et al., 2012). Asking questions related to a specific time of day is meant to elicit a more accurate self-report of physical activity (Shephard, 2003); the questions from the HBSC survey do so by asking about “in-school hours” and “outside school hours” physical activity. ‘Physical activity’ was defined for students on the questionnaire to ensure similar interpretation across students, which can help improve the accuracy of self-reported measures. The definition
given at the top of the Physical Activity portion of the questionnaire was the same one used in the validated and reliable HBSC questionnaire and was stated as follows:

Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, school activities, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, inline skating, biking, dancing, skateboarding, swimming, soccer, basketball, and football.

By describing physical activity as anything that “increases your heart rate and makes you get out of breath some of the time,” the survey increases the likelihood that students were thinking about moderate-to-vigorous physical activity, which is needed to achieve health benefit (Canadian Society for Exercise Physiology [CSEP], 2013).

Two separate scales were created for physical activity: the first scale was created to measure students’ perceived summer time physical activity level, and the second scale was used to measure students’ physical activity level during the school semester. The first scale, the Summer Physical Activity Behaviour Scale, provided an opportunity to examine pre-existing differences between students who were taking PHE and those not taking PHE, as well as between boys and girls.

**Summer Physical Activity Behaviour Scale.** The Summer Physical Activity Behaviour Scale was constructed from two variables (α = .77). The variables were answered on an 8-point and a 9-point scale; thus the z-scores were used to standardize the items. The variables included in the scale for summer physical activity behaviour included the following questions: ‘During this past summer (summer 2013) over a typical or usual week, on how many days were you physically active for a total of at least 60
minutes per day?’ with answers ranging from “0 days” to “7 days”; ‘Over this past summer (summer 2013), about how many hours a week did you usually take part in physical activity that made you out of breath or warmer than usual?’ with answers ranging from “none at all” to “about 7 or more hours.”

**Physical Activity Behaviour Scale.** The Physical Activity Behaviour Scale was constructed from five variables (α = .84). The items were measured on scales ranging from 1-6 and 1-9; thus standardized z-scores were used to create the scale. One variable was removed as it decreased the reliability of the scale. The variables included were:

‘Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?’ [0 days] to [7 days]; ‘Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?’ [0 days] to [7 days]; ‘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 your free time (for example, lunch or school sports) at school?’ [none at all] to [about 7 or more hours]; ‘Outside school hours: How often do you usually exercise in your free time so much that you get out of breath or sweat?’ [every day] to [never]; ‘Outside school hours: how many hours a week do you usually exercise in your free time so much that you get out of breath or sweat?’ [none] to [about 7 hours or more].

**Data Analysis**

**Preliminary Data Analysis**

The student questionnaire responses were entered into the Statistical Package for Social Sciences (SPSS, version 22: IBM Corporation, 2013). Prior to data analysis, cases
were scanned for missing data and outliers. There were two cases of students with more than two pages of missing values, and these individuals were removed from the analysis entirely as there were insufficient usable data from either case. Due to the inherent differences between boys and girls of this age group as examined in previous TPB (e.g., Craig, Goldberg, & Dietz, 1996; McEachan et al., 2011) and physical activity studies (e.g., Lim & Wang, 2009; Prusak et al., 2004), these two groups were compared at Time Point 1 using independent samples t-tests to see if further analyses would need to be conducted with boys and girls separately. Chi-square tests were conducted for categorical variables examining potential differences between boys and girls.

To examine any pre-existing differences between the 197 treatment and control participants who completed the questionnaire at both time points, independent samples t-tests were run for students who were taking PHE versus students who were not taking PHE using all Time Point 1 continuous variables (i.e., TPB and physical activity scales: Vogt, 2007) with boys and girls separated due to initial differences found. Chi-square tests were completed for all non-continuous categorical variables (i.e., whether or not students participate in organized physical activity outside of school, and whether or not students have gym memberships outside of school). The question “I participate in organized physical activity in school” was removed from all analyses as, anecdotally, there was confusion from participants on whether or not this question encompassed PHE class, thus decreasing the validity and reliability of the question. There was a difference found for the Summer Physical Activity Behaviour scale, so it was treated as a covariate to ensure that the pre-existing differences on the given variables were adjusted for in the analyses (Tabachnick & Fidell, 2007).
Descriptive Statistics

Like Mummery et al. (2000), quantitative data were analyzed using descriptive statistics (means and standard deviations). The alpha (α) for the inferential statistics was set at 0.05. Correlation tables were created for all variables used in the analyses to examine the relationship amongst variables (Vogt, 2007). Negatively worded questions were recoded to ensure the higher number was the more positive response for all questions (Volk et al., 2006). Scales were created for TPB constructs, Physical Activity Intentions, Physical Activity Behaviour, and Summer Physical Activity Behaviour.

Multiple Analysis of Covariance (MANCOVA)

After checking for violations of normality on all variables, analyses were used to determine if the response variables (TPB constructs, Physical Activity Intentions, and Physical Activity Behaviour) had altered between the students who were taking PHE class versus the students who did not take PHE class during the first semester for girls and boys separately. The data were analyzed in two stages. A MANCOVA was used due to the initial differences between those students in PHE and not in PHE on the Summer Physical Activity Scale (Vogt, 2007). Using the MANCOVA helped to compensate statistically for differences found between the PHE and no PHE groups in the Time Point 1 data. By comparing all DVs together, there is a greater chance of figuring out which of the DVs contribute most based on the different groupings and their interactions (Tabachnick & Fidell, 2007). In addition, by using a MANCOVA instead of multiple ANCOVAs, the chances of Type I error (i.e., rejection of a true null hypothesis: Vogt, 2007) are reduced.
I used a 2 (condition: in PHE / not in PHE) x 2 (time: Time Point 1 / Time Point 2) x 2 (TPB status: above the mean / below the mean) mixed between-within-subjects MANCOVA, where condition (in PHE or not in PHE) and TPB status (above and below the mean) were the between-subjects factors, and time (Time Point 1 and Time Point 2) was a within-subject factor (Tabachnick & Fidell, 2007). Follow-up univariate ANCOVAs were then examined. The time, condition, and TPB status factors allowed me to address research questions 1, 2, and 3, while analyzing the genders separately allowed me to address differences between boys and girls of this age group.

**Multiple Regression Analyses**

In addition, to answer research questions 4 and 5, I used multiple linear regression analyses within both conditions (PHE and no PHE) to investigate the predictive effects of the TPB constructs on both Physical Activity Intentions as well as Physical Activity Behaviour in a Grade 9 context and to investigate the change/no change in Physical Activity Intentions and Physical Activity Behaviour.
CHAPTER 4: RESULTS

To analyze the data from this study, I went through several procedures. First I went through preliminary data analysis to ensure that missing data were dealt with appropriately (examining frequency and patterns of missing data to ensure that there were no systematic biases in non-response; Tabachnick & Fidell, 2007), no data were entered incorrectly, and there were no initial differences between boys and girls and between those students taking PHE and not taking PHE. Following this preliminary analysis, I reported the descriptive statistics for all students to paint a picture of the population examined, in addition to reporting the correlations for all variables to check initial relationships between variables. To examine how effective Grade 9 PHE classes were promoting students’ physical activity levels, I used Multivariate Analyses of Covariance (MANCOVA) to compare students who took PHE and students who did not take PHE between the two time points in a single high school semester. To use a MANCOVA, there are certain initial assumptions that must be met to ensure robustness of the findings and thus meaningful interpretation of the data (Tabachnick & Fidell, 2007). Therefore, MANCOVA assumptions are discussed followed by results from the MANCOVAs for boys and girls independently.

To further understanding of predictive relationships within the Theory of Planned Behaviour (TPB), multiple regression analyses were used to examine the TPB in a context specific to Grade 9 students, in addition to looking at the predictive ability of the TPB for predicting change/no change in Physical Activity Intentions and Physical Activity Behaviour. Similar to MANCOVA, there are assumptions that must be met for
multiple regression analyses to ensure robustness of the findings and thus meaningful
interpretation of the data (Vogt, 2007). Assumptions for the multiple regression analyses
are discussed, followed by results from the multiple regression analyses for boys and girls
separately.

Thus the structure of the results section is as follows: (a) preliminary data analysis
including assessment of missing data, comparisons between boys and girls, and
comparisons between students in PHE/not in PHE; (b) descriptive statistics; (c)
MANCOVA, which presents assumptions and results, the latter of which addresses
research questions 1 through 3 (comparing changes in TPB constructs and Physical
Activity Intentions, Physical Activity Behaviour, and individuals who have more or less
positive reports of initial TPB constructs over the course of a high school semester); and
(d) Multiple regression analyses, which again present assumptions and results, the latter
of which addresses the fourth and fifth research questions that explore the utility of TPB
for predicting Physical Activity Intentions and Behaviour in a context specific to Grade 9
students, as well as exploring the utility of TPB for predicting change/no change in
Physical Activity Intentions and Physical Activity Behaviour.

Preliminary Data Analysis

Of 11,032 possible data points (28 items x 197 total cases x 2 time points), only
48 data points were missing (99.6% complete data). SPSS Missing Data Analysis was run
on all items to determine significance of patterns of missing data. All variables had less
than 5% missing data with the Little’s MCAR test suggesting that the data were ‘missing
completely at random’ ($p = .83$; i.e., does not influence results: Tabachnick & Fidell,
2007); therefore all analyses were run using pairwise deletion to preserve the largest possible sample for all analyses.

No significant differences between the 26 students who only completed Time Point 1 versus the 197 students who completed both time points were detected using independent samples t-tests, thus indicating that there were external reasons for participants not completing the second time point (e.g., sick and absent from school) rather than some inherent difference between the two groups.

Girls significantly differed from boys on three continuous variables at the first time point when independent samples t-tests were run: 1) Attitude Scale ($t(219) = 2.51, p = .01$) with boys having a higher score (i.e., more positive; $M = 5.90, SD = 1.01$) than girls ($M = 5.55, SD = 1.08$); 2) Perceived Behavioural Control Scale ($t(219) = 2.60, p = .01$) with boys ($M = 6.19, SD = .96$) scoring higher (more positively) than girls ($M = 5.83, SD = 1.05$); and 3) Physical Activity Behaviour Scale ($t(217) = 3.73, p < .001$) with boys ($M = .20, SD = .73$) scoring higher (more positively) than girls ($M = -.18, SD = .77$).

In addition, a Chi-square test of independence was performed on Time Point 1 variables to examine the relationship among all dichotomous categorical variables. The relation between gender and having a gym membership outside of school was significant ($\chi^2(1, N = 223) = 10.02, p = .001$) with a greater number of boys reporting having a gym membership relative to girls. Due to the differences in initial characteristics of boys and girls and their unequal division across PHE first semester versus no PHE first semester, further analyses were run with boys and girls separately.

Students taking PHE first semester were compared to students not taking PHE first semester using independent samples t-tests to look for initial differences between the
groups with boys and girls separated. Boys who were in PHE and not in PHE were not significantly different at the first time point on any of the continuous variables. There was a significant difference between the girls taking PHE \((M = -0.26, SD = 0.95)\) and girls not taking PHE \((M = 0.10, SD = 0.84)\) for the Summer Physical Activity Scale \((t(114)= -2.09, p = 0.04)\) with the girls who were taking PHE first semester reporting less summertime physical activity than girls not taking PHE first semester. Thus the Summer Physical Activity Scale was controlled for in all subsequent analyses. No significant differences were found for other continuous variables. There were no significant differences from the Chi-square tests on dichotomous categorical variables between students in PHE and students not in PHE when students were run separately by gender.

**Descriptive Statistics**

In total, 40\% of Grade 9 boys in PHE class first semester reported having a membership to a gym/fitness facility outside of school, while 13.3\% of Grade 9 girls reported having a membership. The number of students taking PHE first semester who checked off that they participated in physical activity outside of school was 75.7\% for boys and 56.7\% for girls.

Means and standard deviations for all variables for boys taking PHE first semester and boys not taking PHE first semester are reported in Table 1, and for girls in Table 2. Skewness values were relatively high with the distributions heavily negatively skewed for both boys and girls (Shapiro-Wilk test of normality, \(p < 0.001\); see Appendix E for skewness and kurtosis values). Due to the significant negative skewness, a \(\log_{10}\) transformation was run to achieve acceptable normality as suggested by Tabachnick and
Fidell (2007). The distribution for each of the DVs was improved greatly after the transformation. All DVs were recoded after the transformation to ensure that the higher number still represented the more positive response value as the positive/negative ends had been switched during the transformation.

For students who did not take PHE class first semester, 43.2% of boys and 28.6% of girls reported having a gym membership outside of school, while 67.6% of boys and 73.2% of girls reported that they participated in organized physical activity outside of school.

Correlations for all Time Point 1 and Time Point 2 variables are reported in Table 3. For Time Point 1 variables, gender was significantly correlated with having a gym membership, Attitude toward physical activity, Perceived Behavioural Control, and physical activity level during semester one. As expected, all TPB constructs were significantly correlated with each other. Similar to the first time point, for Time Point 2, gender was significantly correlated with having a gym membership, taking PHE, Perceived Behavioural Control, and physical activity behaviour during semester one. Again as expected, all TPB constructs were significantly correlated with each other. Correlations for all variables from Time Point 1 and Time Point 2 separated by gender can be found in Appendix F.

Overall, more boys reported having gym memberships relative to girls for both students in PHE and students not in PHE. Girls in PHE reported more physical activity outside school relative to boys who reported less physical activity outside of school, albeit both were relatively high. Strong correlations between TPB variables were as expected given previous research using TPB as the theoretical framework (Ajzen, 2011).
Table 1

Means and Standard Deviations of Variables for Boys Taking PHE and Not Taking PHE First Semester

<table>
<thead>
<tr>
<th>Variable</th>
<th>Boys Taking PHE (n = 55)</th>
<th>Boys Not Taking PHE (n = 29)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Attitude Scale T1</td>
<td>5.90</td>
<td>1.09</td>
</tr>
<tr>
<td>Attitude Scale T2</td>
<td>6.01</td>
<td>.89</td>
</tr>
<tr>
<td>PBC Scale T1</td>
<td>6.23</td>
<td>1.08</td>
</tr>
<tr>
<td>PBC Scale T2</td>
<td>6.24</td>
<td>.91</td>
</tr>
<tr>
<td>SN Scale T1</td>
<td>5.69</td>
<td>1.07</td>
</tr>
<tr>
<td>SN Scale T2</td>
<td>5.54</td>
<td>1.16</td>
</tr>
<tr>
<td>PA Intentions Scale T1</td>
<td>6.07</td>
<td>1.16</td>
</tr>
<tr>
<td>PA Intentions Scale T2</td>
<td>5.98</td>
<td>1.03</td>
</tr>
<tr>
<td>PA Behaviour Scale T1</td>
<td>.21</td>
<td>.71</td>
</tr>
<tr>
<td>PA Behaviour Scale T2</td>
<td>.36</td>
<td>.63</td>
</tr>
<tr>
<td>Summer PA Scale T1</td>
<td>-.04</td>
<td>.90</td>
</tr>
<tr>
<td>Summer PA Scale T2</td>
<td>.15</td>
<td>.88</td>
</tr>
</tbody>
</table>

Note: Questions were answered on a 7-point Likert-type scale except for PA Behaviour Scale and Summer PA Scale, which were changed to standardized scores. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
Table 2

Means and Standard Deviations of Variables for Girls Taking PHE and Not Taking PHE First Semester

| Variable                  | Girls Taking PHE
<table>
<thead>
<tr>
<th></th>
<th>($n = 53$)</th>
<th>Girls Not Taking PHE</th>
<th>($n = 53$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude Scale T1</td>
<td>5.61</td>
<td>1.13</td>
<td>5.53</td>
</tr>
<tr>
<td>Attitude Scale T2</td>
<td>5.81</td>
<td>.96</td>
<td>5.50</td>
</tr>
<tr>
<td>PBC Scale T1</td>
<td>5.81</td>
<td>1.19</td>
<td>5.90</td>
</tr>
<tr>
<td>PBC Scale T2</td>
<td>5.81</td>
<td>.99</td>
<td>5.81</td>
</tr>
<tr>
<td>SN Scale T1</td>
<td>5.51</td>
<td>1.02</td>
<td>5.65</td>
</tr>
<tr>
<td>SN Scale T2</td>
<td>5.71</td>
<td>.96</td>
<td>5.72</td>
</tr>
<tr>
<td>PA Intentions Scale T1</td>
<td>5.66</td>
<td>1.24</td>
<td>5.82</td>
</tr>
<tr>
<td>PA Intentions Scale T2</td>
<td>5.81</td>
<td>1.11</td>
<td>5.78</td>
</tr>
<tr>
<td>PA Behaviour Scale T1</td>
<td>-.09</td>
<td>.68</td>
<td>-.28</td>
</tr>
<tr>
<td>PA Behaviour Scale T2</td>
<td>-.19</td>
<td>.69</td>
<td>-.27</td>
</tr>
<tr>
<td>Summer PA Scale T1</td>
<td>-.24</td>
<td>.94</td>
<td>.11</td>
</tr>
<tr>
<td>Summer PA Scale T2</td>
<td>-.28</td>
<td>1.02</td>
<td>.11</td>
</tr>
</tbody>
</table>

Note: Questions were answered on a 7-point Likert-type scale except for PA Behaviour Scale and Summer PA Scale which were changed to standardized scores. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
Table 3

Correlations Between Variables for both Time Point 1 and Time Point 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender</td>
<td>--</td>
<td>.14*</td>
<td>-.09</td>
<td>-.22**</td>
<td>-.17*</td>
<td>-.17*</td>
<td>-.10</td>
<td>-.13</td>
<td>-.25**</td>
<td>-.10</td>
</tr>
<tr>
<td>2. Taking PHE</td>
<td>.15*</td>
<td>--</td>
<td>.04</td>
<td>.07</td>
<td>-.05</td>
<td>-.01</td>
<td>.07</td>
<td>-.00</td>
<td>-.12</td>
<td>.17*</td>
</tr>
<tr>
<td>3. PA Outside School</td>
<td>-.08</td>
<td>.10</td>
<td>--</td>
<td>.03</td>
<td>.30**</td>
<td>.32**</td>
<td>.19**</td>
<td>.34**</td>
<td>.38**</td>
<td>.13</td>
</tr>
<tr>
<td>4. Gym Membership</td>
<td>-.15*</td>
<td>.01</td>
<td>-.08</td>
<td>--</td>
<td>.15*</td>
<td>.16*</td>
<td>.04</td>
<td>.17*</td>
<td>.26**</td>
<td>.13</td>
</tr>
<tr>
<td>5. Attitude Scale</td>
<td>-.12</td>
<td>-.15*</td>
<td>.36**</td>
<td>.18**</td>
<td>--</td>
<td>.75**</td>
<td>.49**</td>
<td>.84**</td>
<td>.66**</td>
<td>.47**</td>
</tr>
<tr>
<td>6. PBC Scale</td>
<td>-.20**</td>
<td>-.01</td>
<td>.30**</td>
<td>.16*</td>
<td>.61**</td>
<td>--</td>
<td>.42**</td>
<td>.70**</td>
<td>.56**</td>
<td>.33**</td>
</tr>
<tr>
<td>7. SN Scale</td>
<td>-.01</td>
<td>.05</td>
<td>.31**</td>
<td>.12</td>
<td>.50**</td>
<td>.46**</td>
<td>--</td>
<td>.44**</td>
<td>.39**</td>
<td>.33**</td>
</tr>
<tr>
<td>8. PA Intentions Scale</td>
<td>-.08</td>
<td>-.07</td>
<td>.34**</td>
<td>.23**</td>
<td>.78**</td>
<td>.63**</td>
<td>.57**</td>
<td>--</td>
<td>.64**</td>
<td>.45**</td>
</tr>
<tr>
<td>9. PA Behaviour Scale</td>
<td>-.31**</td>
<td>-.07</td>
<td>.46**</td>
<td>.20**</td>
<td>.57**</td>
<td>.48**</td>
<td>.37**</td>
<td>.64**</td>
<td>--</td>
<td>.52**</td>
</tr>
<tr>
<td>10. Summer PA Scale</td>
<td>-.17**</td>
<td>.11</td>
<td>.25**</td>
<td>.12</td>
<td>.43**</td>
<td>.31**</td>
<td>.29**</td>
<td>.45**</td>
<td>.50**</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: *p<0.05, ** p<0.001. Items above the diagonal represent Time Point 1 data; items below the diagonal represent Time Point 2 data. PA = Physical Activity. PBC = Perceived Behavioural Control. SN = Subjective Norms.
MANCOVA Analyses

MANCOVA Assumptions

Multivariate Analysis of Covariance (MANCOVA) is not considered robust for outliers; thus the transformed data were examined for any standard deviations that were +/- 3.29 from the norm (Tabachnick & Fidell, 2007). No outliers were found. A Levene’s test was conducted investigating the assumption for MANCOVA of the Homogeneity of Variance. This test was not found to be significant indicating that the groups analyzed had roughly equal covariances. In addition, the DVs did not have correlations greater than 0.9 (as suggested by Tabachnick & Fidell, 2007), indicating there was no multicollinearity; multicollinearity violates one of the assumptions of MANCOVA. For each group (boys and girls), assumptions of sphericity were not violated based on Mauchly’s Test of Sphericity. With these and preliminary data cleaning assessments being satisfactory, it was appropriate to proceed with a multivariate analysis.

MANCOVA Procedures

I used a 2 (condition: in PHE / not in PHE) x 2 (time: Time Point 1 / Time Point 2) x 2 (TPB status: above the mean / below the mean) mixed between-within-subjects MANCOVA, where condition (in PHE or not in PHE) and TPB status (above and below the mean) were the between-subjects factors, and time (Time Point 1 and Time Point 2) was a within-subject factor (Tabachnick & Fidell, 2007). To divide the students by TPB status, a score was created for each individual who completed both time points based on the average of the three TPB constructs (i.e., Attitude, Subjective Norms, Perceived Behavioural Control) and Physical Activity Intentions to create the TPB status variable, with a mean total for the boys who completed both time points ($n = 84$) of $1.56$ ($SD = .16$)
and a mean for the total girls who completed both time points \((n = 106)\) of 1.50 \((SD = .17)\) using the transformed data. The DVs for MANCOVA were Attitude, Perceived Behavioural Control, Subjective Norms, Physical Activity Intentions, and Physical Activity Behaviour. Two MANCOVAs were run (for boys and girls separately).

**MANCOVA Results for Boys**

Of the 55 boys who were taking PHE and completed both time points, 30 were higher than the mean on TPB status and 25 were lower than or equal to the mean on TPB status. Of the 29 students who were not taking PHE, 14 scored higher than the mean on TPB status, and 15 scored lower than or equal to the mean on TPB status.

**Multivariate results.** There were two findings from the multivariate portion of the MANCOVA. First there was a significant effect of time on TPB constructs, Physical Activity Intentions, and Physical Activity Behaviour (Wilks’ Lambda \(F(5, 70) = 13.21, p < .001, \text{partial } \eta^2 = .49\)). Second, and as expected given the grouping criteria of higher and lower than the mean on TPB status, there was a significant effect of TPB status on the DVs (Wilks’ Lambda \(F(5, 70) = 11.73, p < .001, \text{partial } \eta^2 = .46\)). There was no significant effect for the following: (1) condition; (2) the interaction between condition and TPB status; (3) the interaction between condition and time; (4) the interaction between TPB status and time; and (5) the interaction among time, TPB status, and condition. To examine which DVs were driving these multivariate responses, follow-up univariate Analyses of Covariance (ANCOVAs) were examined.

**Univariate follow-up results.** For the significant multivariate effect of time, follow-up univariate F-tests were conducted for each DV independently.
For the IV of time, there was a significant difference from the first time point to the second time point (across condition and TPB status) on: (1) Perceived Behavioural Control \((F(1, 74) = 8.76, p = .004, \text{partial } \eta^2 = .11)\), with boys reporting greater Perceived Behavioural Control at Time Point 1 \((M = 1.60, SD = .19)\) compared with Time Point 2 \((M = 1.54, SD = .19)\); (2) Subjective Norms \((F(1, 74) = 13.24, p = .001, \text{partial } \eta^2 = .15)\), with boys reporting greater Subjective Norms at the second time point \((M = 1.50, SD = .21)\) compared with Time Point 1 \((M = 1.42, SD = .20)\); and (3) Intentions \((F(1, 74) = 12.33, p = .001, \text{partial } \eta^2 = .14)\), with boys reporting greater Intentions to be physically active at Time Point 1 \((M = 1.61, SD = .22)\) compared with Time Point 2 \((M = 1.54, SD = .22)\).

For the significant effect of TPB status, follow-up univariate F-tests were conducted for each DV independently. For TPB status, there was a significant difference (across time and condition) on the following DVs between boys reporting a higher TPB status and those reporting a lower TPB status: (1) Attitude \((F(1, 74) = 44.39, p < .001, \text{partial } \eta^2 = .34; \ M_{\text{higher}} = 1.66, SD = .14; \ M_{\text{lower}} = 1.43, SD = .15)\); (2) Perceived Behavioural Control \((F(1, 74) = 31.64, p < .001, \text{partial } \eta^2 = .30; \ M_{\text{higher}} = 1.68, SD = .12; \ M_{\text{lower}} = 1.46, SD = .18)\); (3) Subjective Norms \((F(1, 74) = 17.23, p < .001, \text{partial } \eta^2 = .19; \ M_{\text{higher}} = 1.54, SD = .18; \ M_{\text{lower}} = 1.36, SD = .19)\); (4) Physical Activity Intentions \((F(1, 74) = 51.20, p < .001, \text{partial } \eta^2 = .41; \ M_{\text{higher}} = 1.73, SD = .15; \ M_{\text{lower}} = 1.43, SD = .18)\); and (5) Physical Activity Behaviour \((F(1, 74) = 15.55, p < .001, \text{partial } \eta^2 = .17; \ M_{\text{higher}} = .53, SD = .56; \ M_{\text{lower}} = -.12, SD = .74)\).
MANCOVA Results for Girls

Of the 53 girls who were taking PHE, 26 scored higher than the mean on TPB status at the first time point, and 27 were lower than or equal to the mean on TPB status. Of the 53 girls who were not taking PHE, 28 scored higher than the mean on TPB status, and 25 scored lower than or equal to the mean on TPB status.

Multivariate results. There was a significant effect of the following for the multivariate portion of the MANCOVA: (1) condition (Wilks’ Lambda $F(5, 94) = 3.29, p = .009$, partial $\eta^2 = .15$); (2) time (Wilks’ Lambda $F(5, 94) = 15.60, p < .001$, partial $\eta^2 = .45$); and (3) the interaction between time and TPB status (Wilks’ Lambda $F(5, 94) = 4.90, p < .001$). As expected given the grouping criteria of higher and lower than the mean, there was also a significant effect of TPB status (Wilks’ Lambda $F(5, 94) = 21.56, p < .002$, partial $\eta^2 = .53$). There were no significant effects for the following: (1) the interaction between TPB status and condition; (2) the interaction between time and condition; and (3) the interaction among time, condition, and TPB status. To examine which DVs were driving the multivariate responses, follow-up univariate ANCOVAs were examined.

Univariate follow-up results. For the significant multivariate effects of time, condition, TPB status, and the interaction between time and TPB status, follow-up univariate F-Tests were conducted for each DV independently.

There was a significant effect of time from the beginning to the end of the semester (across condition and TPB status) on the following DVs: (1) Perceived Behavioural Control ($F(1, 98) = 32.66, p < .001$, partial $\eta^2 = .25$) with girls reporting decreased Perceived Behavioural Control from Time Point 1 ($M = 1.54, SD = .20$) to
Time Point 2 ($M = 1.45, SD = .20$); (2) Subjective Norms ($F(1, 98) = 27.31, p < .001$, partial $\eta^2 = .22$) with reported Subjective Norms increasing from Time Point 1 ($M = 1.40, SD = .19$) to Time Point 2 ($M = 1.50, SD = .19$); and (3) Physical Activity Intentions ($F(1, 98) = 10.84, p = .001$, partial $\eta^2 = .10$), with girls overall decreasing their intentions to be physically active from Time Point 1 ($M = 1.55, SD = .22$) to Time Point 2 ($M = 1.50, SD = .21$).

There was a significant effect of condition (across time and TPB status) for the following DVs: (1) Attitude ($F(1, 98) = 10.0, p < .002$, partial $\eta^2 = .09$) with girls who were in PHE ($M = 1.53, SD = .20$) reporting overall higher Attitude towards physical activity than those who were not in PHE ($M = 1.48, SD = .17$); and (2) Physical Activity Behaviour ($F(1, 98) = 6.78, p = .01$, partial $\eta^2 = .07$) with those in PHE ($M = -.15, SD = .70$) having higher reported Physical Activity Behaviour than those not in PHE ($M = -.33, SD = .85$).

For TPB status, there was a significant effect (across time and condition) on the following DVs with girls reporting a higher TPB status compared to those reporting a lower overall TPB status: (1) Attitude ($F(1, 98) = 78.87, p < .001$, partial $\eta^2 = .45$; $M_{\text{higher}} = 1.62, SD = .13$; $M_{\text{lower}} = 1.37, SD = .13$); (2) Perceived Behavioural Control ($F(1, 98) = 69.13, p < .001$, partial $\eta^2 = .41$; $M_{\text{higher}} = 1.62, SD = .14$; $M_{\text{lower}} = 1.37, SD = .16$); (3) Subjective Norms ($F(1, 98) = 26.24, p < .001$, partial $\eta^2 = .21$; $M_{\text{higher}} = 1.54, SD = .17$; $M_{\text{lower}} = 1.35, SD = .16$); (4) Physical Activity Intentions ($F(1, 98) = 60.15, p < .001$, partial $\eta^2 = .38$; $M_{\text{higher}} = 1.67, SD = .15$; $M_{\text{lower}} = 1.39, SD = .18$); and (5) Physical Activity Behaviour ($F(1, 98) = 34.38, p < .001$, partial $\eta^2 = .26$; $M_{\text{higher}} = .21, SD = .60$; $M_{\text{lower}} = -.69, SD = .67$).
There was a significant interaction between time and TPB status (across both conditions) on the following DVs: (1) Attitude ($F(1, 98) = 19.55, p < .001$, partial $\eta^2 = .17$) with those scoring higher than the mean ($M_{\text{Time Point 1}} = 1.65, M_{\text{Time Point 2}} = 1.59$) decreasing over the course of the semester compared to those who scored lower than the mean ($M_{\text{Time Point 1}} = 1.35, M_{\text{Time Point 2}} = 1.39$) who increased over the course of the semester (see Figure 2); (2) Perceived Behavioural Control ($F(1, 98) = 8.23, p = .01$, partial $\eta^2 = .08$) with those scoring higher than the mean ($M_{\text{Time Point 1}} = 1.69, M_{\text{Time Point 2}} = 1.55$) decreasing at a faster rate than those scoring lower than the mean ($M_{\text{Time Point 1}} = 1.40, M_{\text{Time Point 2}} = 1.33$; see Figure 3); and (3) Physical Activity Intentions ($F(1, 98) = 13.34, p < .001$, partial $\eta^2 = .12$) with those scoring higher than the mean TPB status ($M_{\text{Time Point 1}} = 1.71, M_{\text{Time Point 2}} = 1.62$) decreasing more than those who scored lower than the mean TPB status ($M_{\text{Time Point 1}} = 1.39, M_{\text{Time Point 2}} = 1.38$) who maintained a relatively stable report of Physical Activity Intentions (see Figure 4).
Figure 2. Significant MANCOVA results for girls ‘time by TPB status’ interaction for Attitude. T1 = Time Point 1. T2 = Time Point 2.

Figure 3. Significant MANCOVA results for girls ‘time by TPB status’ interaction for Perceived Behavioural Control. T1 = Time Point 1. T2 = Time Point 2.
Figure 4. Significant MANCOVA results for girls ‘time by TPB status’ interaction for Physical Activity Intentions. T1 = Time Point 1. T2 = Time Point 2.

Overall for both boys and girls there was a significant effect of time (independent of condition and TPB status) where Perceived Behavioural Control and Physical Activity Intentions decreased over the course of the semester, and Subjective Norms increased over the course of the semester. There was also a significant effect of TPB status (independent of time and condition), where those who initially scored higher than the mean stayed higher than the mean, and the same for those students initially scoring lower than the mean. For girls alone, there was a significant effect of condition (independent of time and TPB status), with girls in PHE reporting higher Physical Activity Behaviour and more positive attitudes than girls not in PHE at both time points.
Multiple Regression Analyses

Multiple Regression Assumptions

The first assumption for multiple regression analyses is a lack of multicollinearity, which according to Vogt (2007) cannot have a Tolerance of less than .20, or a Variance Inflation Factor (VIF) greater than 5 (which is computed by dividing the tolerance into 1.0, p. 175). When the VIF was calculated for each potential IV (Attitude, Perceived Behavioural Control, Subjective Norms, Physical Activity Intentions, and Physical Activity Behaviour from both Time Point 1 and Time Point 2), no VIF was greater than 5; thus there was no multicollinearity and the assumption was not violated. According to Vogt (2007), one way of calculating the minimal sample size necessary to trust the data is 50 + (8 x ‘the number of variables’). For initial regression analyses used to look at TPB in a Grade 9 context, the maximum number of variables used in this study was 4; thus the minimal sample size considered ideal for this study was 50 + (8 x 4) = 82. Girls and boys at each time point were well over this number. For the latter regressions predicting Time Point 2 variables from Time Point 1 variables, the maximum number of variables in this case was 6; thus the minimum sample size considered ideal for this portion of the study was 50 + (8 x 6) = 98. Students who completed both time points only were included in this analysis. Girls were over the recommended number but boys were under (n = 84). Vogt (2007) suggested examining missing data for numbers of less than the ideal sample sizes. Based on initial analyses of missing data, the Little’s MCAR suggested the data were ‘missing completely at random’ (p = .83; i.e., does not influence results: Tabachnick & Fidell, 2007); thus missing data did not violate an assumption. With these and
preliminary data analyses being satisfactory, it was deemed appropriate to proceed with multivariate regression analyses.

**Multiple Regression Procedures**

Regression analyses were used to answer the fourth research question that explored the utility of the TPB for predicting (i) Physical Activity Intentions and (ii) Physical Activity Behaviour in a setting composed of Grade 9 students. In addition, regressions were used to answer the fifth research question that explored the utility of TPB for predicting change/no change in (i) Physical Activity Intentions and (ii) Physical Activity Behaviour. In effect, these analyses provide a simple test of the structure and relationships posited by TPB. These analyses were run separately for boys and girls. Both Time Point 1 and Time Point 2 data are provided. For the Time Point 2 data, the students who did not complete Time Point 1 were still included in the analysis for research question four.

**Multiple Regression Results for Boys**

The first analysis used the three TPB constructs (IVs) to predict Physical Activity Intentions (DV: see Table 4). Collectively, the TPB constructs from Time Point 1 significantly predicted Time Point 1 Physical Activity Intentions \( F(3, 101) = 51.61, p < .001 \), accounting for over one half of the total variance in Physical Activity Intentions \( R^2 = .61, \) adjusted \( R^2 = .59 \). Individually, Attitude was the strongest predictor (\( \beta = .61, p < .001, sr^2 \) unique = .44), followed by non-significant results of Perceived Behavioural Control and Subjective Norms. For Time Point 2, the TPB constructs followed a similar pattern \( F(3, 96) = 92.12, p < .001 \), accounting for over two thirds of the variance of Physical Activity Intentions \( R^2 = .74, \) adjusted \( R^2 = .73 \) with Attitude being the greatest
predictor of Physical Activity Intentions ($\beta = .67$, $p < .001$, $sr^2$ unique = .48) followed by Subjective Norms ($\beta = .16$, $p = .02$, $sr^2$ unique = .12) and non-significant Perceived Behavioural Control.

The second analysis used the three TPB constructs (IVs) to predict Physical Activity Behaviour (DV: see Table 5). Collectively, the three TPB constructs from Time Point 1 significantly predicted Physical Activity Behaviour at Time Point 1 ($F(3, 99) = 28.41, p < .001$), accounting for slightly less than half of the variance in Physical Activity Behaviour ($R^2 = .46$, adjusted $R^2 = .45$). Attitude ($\beta = .35$, $p = .001$, $sr^2$ unique = .25) and Perceived Behavioural Control ($\beta = .33$, $p = .001$, $sr^2$ unique = .25) equally and independently contributed to Physical Activity Behaviour, while Subjective Norms did not contribute significantly. Time Point 2 TPB constructs followed a similar pattern ($F(3, 96) = 27.44, p < .001$), accounting for slightly less than half of the variance in Physical Activity Behaviour ($R^2 = .46$, adjusted $R^2 = .45$). Unlike Time Point 1, for the second time point, Attitude independently contributed the most to Physical Activity Behaviour ($\beta = .63$, $p < .001$, $sr^2$ unique = .45), while Subjective Norms and Perceived Behavioural Control did not significantly predict Physical Activity Behaviour.
Table 4

*Regression Analysis for TPB Constructs Predicting Physical Activity Intentions, Boys (n = 102 Time Point 1, n = 97 Time Point 2)*

<table>
<thead>
<tr>
<th>Variable</th>
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<th>β</th>
<th>Adjusted R²</th>
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<td>.61**</td>
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<td><strong>Time Point 2</strong></td>
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<tr>
<td>Step 1 (T2)</td>
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<td>SN</td>
<td>.16</td>
<td>.07</td>
<td>.16*</td>
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</tr>
</tbody>
</table>

Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms.*
Table 5

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour, Boys (n = 102 Time Point 1, n = 97 Time Point 2)

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Adjusted R²</th>
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<td>Time Point 2</td>
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<tr>
<td>Step 1 (T2)</td>
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<tr>
<td>Attitude</td>
<td>2.53</td>
<td>.42</td>
<td>.63**</td>
<td></td>
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<tr>
<td>PBC</td>
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<td>.46</td>
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<tr>
<td>SN</td>
<td>.02</td>
<td>.35</td>
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</table>

Note: *p < .05, **p ≤ .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms.
The third analysis used the TPB constructs (IVs) to predict Physical Activity Behaviour (DV) while controlling for Physical Activity Intentions (IV). The results of the regression analyses for TPB constructs for boys in predicting Physical Activity Behaviour, while controlling for Physical Activity Intentions, are reported in Table 6 for both Time Point 1 and Time Point 2.

At the first step, Physical Activity Intentions significantly predicted Physical Activity Behaviour \(F(1, 101) = 78.49, p < .001\), which is similar to Time Point 2 \(F(1, 98) = 113.44, p < .001\), accounting for almost a half of the total variance in Physical Activity Behaviour at Time Point 1 \(R^2 = .44, \text{ adjusted } R^2 = .43\) and just over half at Time Point 2 \(R^2 = .54, \text{ adjusted } R^2 = .53\). Above and beyond the contribution of Physical Activity Intentions, the three TPB constructs had their own significant contribution to predicting Physical Activity Behaviour at Time Point 1 \(F(1, 98) = 5.37, p = .002\), accounting for a small but significant portion of Physical Activity Behaviour \(R^2 \text{ change } = .07\). In controlling for Physical Activity Intentions, the relationship between the TPB constructs and Physical Activity Behaviour weakened in that the TPB constructs did not contribute significantly above and beyond the contribution of Physical Activity Intentions (see Table 6). In line with the predictions of TPB, this finding suggests that Intentions act as at least a partial mediator between the TPB constructs and Behaviour. When Physical Activity Intentions were accounted for in the model, only Perceived Behavioural Control (at Time Point 1 alone) exerted a significant additional effect on Physical Activity Behaviour, but neither Attitude nor Subjective Norms had a significant effect (see Table 6). This significant result was not replicated at the second time point \(F(3, 95) = 1.25, p = .30\).
Table 6

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour while controlling for Physical Activity Intentions, Boys (n = 102 Time Point 1, n = 97 Time Point 2)

<table>
<thead>
<tr>
<th>Variable</th>
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<th>β</th>
<th>Adjusted R²</th>
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<td>.37**</td>
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<td>Attitude</td>
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<td>.12</td>
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<td><strong>Time Point 2</strong></td>
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<td>.73**</td>
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Note: *p < .05, **p ≤ .001. T1 = Time Point 1, T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
To answer the fifth research question regarding exploring the utility of the TPB for predicting change/no change in Physical Activity Intentions and Physical Activity Behaviour, multiple regressions were run using data only from the boys who completed both time points. To predict change/no change, there were three separate analyses run: (i) using the three TPB constructs from Time Point 1 while controlling for Physical Activity Intentions (IV) at Time Point 1 to predict Physical Activity Intentions (DV) at Time Point 2 (see Table 7); (ii) using the TPB constructs from Time Point 1 (IVs) to predict Physical Activity Behaviour (DV) at Time Point 2, while controlling for Physical Activity Behaviour (IV) at Time Point 1 (see Table 8); and (iii) using the TPB constructs (IVs) from Time Point 1 to predict Physical Activity Behaviour (DV) at Time Point 2, while controlling for Physical Activity Intentions (IV) and Physical Activity Behaviour (IV) at Time Point 1 (see Table 9).

In the first analysis (predicting Physical Activity Intentions at Time Point 2), the first step used Physical Activity Intentions at Time Point 1, which was found to significantly predict Physical Activity Intentions at Time Point 2 ($F(1,83) = 82.61, p < .001$), accounting for almost half of the variance in Physical Activity Intentions at Time Point 2 ($R^2 = .50$, adjusted $R^2 = .49$: see Table 7). Above and beyond the contribution of Physical Activity Intentions at Time Point 1, the three TPB Time Point 1 constructs had their own significant contribution to predicting Physical Activity Intentions at Time Point 2 ($F(3, 80) = 11.50, p < .001$) with an additional 14% of the variance accounted for ($R^2$ change = .14). Attitude was the greatest contributor to Physical Activity Intentions at Time Point 2 ($β = .51, p < .001$, $sr^2$ unique = .28).
Table 7

*Regression Analysis for TPB Constructs Predicting Physical Activity Intentions at Time Point 2 while Controlling for Physical Activity Intentions at Time Point 1, Boys (n = 84 Time Point 1, n = 84 Time Point 2)*

<table>
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<td>.14**</td>
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Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
In the second analysis, predicting Physical Activity Behaviour at Time Point 2, the first step of this model used Physical Activity Behaviour at Time Point 1, which significantly predicted Physical Activity Behaviour at Time Point 2 ($F(1, 82) = 47.78, p < .001$), accounting for just over one third of the variance in Physical Activity Behaviour at Time Point 2 ($R^2 = .37$, adjusted $R^2 = .36$). In the second step, TPB constructs from Time Point 1 significantly predicted Physical Activity Behaviour at Time Point 2 ($F(3, 79) = 5.03, p = .003$), accounting for an additional 8% of the variance for Physical Activity Behaviour at Time Point 2 ($R^2$ change = .08). When Physical Activity Behaviour at Time Point 1 was accounted for, Attitude was the only additional IV that predicted Physical Activity Behaviour at Time Point 2 ($\beta = .41, p = .002, sr^2$ unique = .26).

In the third analysis, predicting Physical Activity Behaviour at Time Point 2 while controlling for Physical Activity Behaviour and Physical Activity Intentions at Time Point 1, the first step was identical to the first step in the second analysis. Step 2 was not significant (see Table 9), but step 3 with the addition of the TPB variables from T1 was significant ($F(3, 78) = 5.06, p = .003$), accounting for an additional 8% of the variance in Physical Activity Behaviour at Time Point 2. Aside from Physical Activity Behaviour at Time Point 1, Attitude was the greatest contributor to predicting Physical Activity Behaviour at Time Point 2 ($\beta = .51, p = .001, sr^2$ unique = .28).
Table 8

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour at Time Point 2 while Controlling for Physical Activity Behaviour at Time Point 1, Boys (n = 83 Time Point 1, n = 83 Time Point 2)

<table>
<thead>
<tr>
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<th>β</th>
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<th>$R^2$ Change</th>
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<tbody>
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Note: *p < .05, **p ≤ .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
Table 9

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour at Time Point 2 while Controlling for Physical Activity Behaviour and Physical Activity Intentions at Time Point 1, Boys (n = 83 Time Point 1, n = 83 Time Point 2)

<table>
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<td>SN T1</td>
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<td>.34</td>
<td>.13</td>
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</table>

Note: *p < .05, **p ≤ .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
Overall, for boys Attitude was the strongest independent predictor of Physical Activity Intentions, and Physical Activity Intentions was the strongest predictor of Physical Activity Behaviour. Perceived Behavioural Control and Subjective Norms were inconsistently significant across the two time points. When Time Point 1 TPB constructs were used to predict Time Point 2 Intentions, Time Point 1 Intentions was the best predictor of Time Point 2 Intentions followed by Attitude. When Time Point 1 TPB constructs were used to predict Time Point 2 Physical Activity Behaviour, Time Point 1 Physical Activity Behaviour was the best predictor of Time Point 2 Physical Activity Behaviour followed by Attitude, even when Physical Activity Intentions from Time Point 1 was added to the analysis.

**Multiple Regression Results for Girls**

The same process was followed for the girls as for the boys. The first analysis used the three TPB constructs as independent variables to predict Physical Activity Intentions (DV: see Table 10). Collectively, the TPB constructs from Time Point 1 significantly predicted Time Point 1 Physical Activity Intentions \(F(3, 110) = 108.42, p < .001\), accounting for nearly three quarters of the total variance in Physical Activity Intentions \(R^2 = .75, \text{adjusted } R^2 = .74\). Individually, Attitude was the strongest predictor of Physical Activity Intentions \(\beta = .58, p < .001, sr^2 \text{ unique } = .36\), followed by Perceived Behavioural Control \(\beta = .33, p < .001, sr^2 \text{ unique } = .22\), and a non-significant finding for Subjective Norms. For Time Point 2, the TPB constructs followed a similar pattern \(F(3, 115) = 60.17, p < .001\), accounting for just under two-thirds of the variance of Physical Activity Intentions \(R^2 = .61, \text{adjusted } R^2 = .60\). Again, Attitude had the greatest independent contribution \(\beta = .49, p < .001, sr^2 \text{ unique } = .35\), followed by
Perceived Behavioural Control ($\beta = .26, p = .001, r^2_{unique} = .19$). However, unlike the findings for Time Point 1, for Time Point 2, Subjective Norms was also significant ($\beta = .16, p = .02, r^2_{unique} = .14$).
<table>
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<td>.18</td>
<td>.08</td>
<td>.16*</td>
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</tbody>
</table>

Note: *$p < .05$, **$p \leq .001$. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms.
The second analysis used the three TPB constructs to predict Physical Activity Behaviour (see Table 11). Collectively, the three TPB constructs from Time Point 1 significantly predicted Physical Activity Behaviour at Time Point 1 \( (F(3, 110) = 25.56, p < .001) \), accounting for slightly less than half of the variance in Physical Activity Behaviour at Time Point 1 \( (R^2 = .41, \text{adjusted } R^2 = .40) \). Independently, Attitude contributed the greatest to Physical Activity Behaviour \( (\beta = .54, p < .001, sr^2 \text{ unique} = .34) \), while Perceived Behavioural Control and Subjective Norms did not contribute significantly. Time Point 2 TPB constructs followed a similar pattern \( (F(3, 116) = 14.04, p < .001) \), although this time accounting for about one-quarter of Physical Activity Behaviour \( (R^2 = .27, \text{adjusted } R^2 = .25) \). Like Time Point 1, Attitude was the only significant contributor to Physical Activity Behaviour \( (\beta = .27, p = .02, sr^2 \text{ unique} = .19) \), while Subjective Norms and Perceived Behavioural Control did not contribute significantly.

The third analysis used the TPB constructs (IVs) to predict Physical Activity Behaviour (DV), while controlling for Physical Activity Intentions (IV). The results of the regression analyses for TPB constructs for girls in predicting Physical Activity Behaviour, while controlling for Physical Activity Intentions, are reported in Table 12 for both Time Point 1 and Time Point 2.

At the first step, Physical Activity Intentions significantly predicted Physical Activity Behaviour \( (F(1, 112) = 60.84, p < .001) \), which was similar to Time Point 2 \( (F(1, 117) = 64.04 p < .001) \), accounting for more than a third of the variance for Physical Activity Behaviour at Time Point 1 \( (R^2 = .35, \text{adjusted } R^2 = .35) \), and Time Point 2 \( (R^2 = .35, \text{adjusted } R^2 = .35) \).
Table 11

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour, Girls (n = 111 Time Point 1, n = 116 Time Point 2)

<table>
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</tbody>
</table>

Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms.
Table 12

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour while Controlling for Physical Activity Intentions, Girls (n = 111 Time Point 1, n = 116 Time Point 2)

<table>
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<th>R² Change</th>
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Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
Above and beyond the contribution of Physical Activity Intentions, the three TPB constructs had their own significant contribution to predicting Physical Activity Behaviour at Time Point 1 ($F(3, 109) = 4.29, p = .007$), accounting for an additional 5% of Physical Activity Behaviour but not at Time Point 2 ($F(3, 114) = .55, p = .65$), where the amount accounted for was not significant. In controlling for Physical Activity Intentions for the girls, the relationship between the TPB constructs and Physical Activity Behaviour was weakened. In line with the predictions of TPB, this finding suggests that Intentions act as at least a partial mediator between the TPB constructs and Behaviour. When Physical Activity Intentions was accounted for in the model, only Attitude (at Time Point 1 alone) exerted a significant effect on Physical Activity Behaviour, but neither Perceived Behavioural Control nor Subjective Norms exerted a significant effect (see Table 12).

To answer the fifth research question regarding exploring the utility of the TPB for predicting change/no change in Physical Activity Intentions and Physical Activity Behaviour, multiple regressions were run using data only from the girls who completed both time points. Individuals who completed Time Point 1 but not Time Point 2 were not used in this analysis and vice versa. To predict change/no change, there were three separate analyses run: (i) using the three TPB constructs (IVs) from Time Point 1, while controlling for Physical Activity Intentions (IV) at Time Point 1, to predict Physical Activity Intentions (DV) at Time Point 2 (see Table 13); (ii) using the TPB constructs (IVs) from Time Point 1 to predict Physical Activity Behaviour (DV) at Time Point 2, while controlling for Physical Activity Behaviour (IV) at Time Point 1 (see Table 14); and (iii) using the TPB constructs (IVs) from Time Point 1 to predict Physical Activity Behaviour at Time Point 2.
Behaviour (DV) at Time Point 2, while controlling for Physical Activity Intentions (IV) and Physical Activity Behaviour (IV) at Time Point 1 (see Table 15).

In the first analysis (predicting Time Point 2 Physical Activity Intentions), the first step used Physical Activity Intentions at Time Point 1, which significantly predicted Physical Activity Intentions at Time Point 2 ($F(1, 103) = 129.39, p < .001$), accounting for over half the variance in Physical Activity Intentions at Time Point 2 ($R^2 = .56$, adjusted $R^2 = .55$: see Table 13). The TPB constructs from Time Point 1 did not significantly contribute any further variance.

In the second analysis (predicting Physical Activity Behaviour at Time Point 2: see Table 14), the first step of the model used Physical Activity Behaviour at Time Point 1, which significantly predicted Physical Activity Behaviour at Time Point 2 ($F(1, 104) = 157.93, p < .001$), accounting for over half of the variance in Physical Activity Behaviour at Time Point 2 ($R^2 = .60$, adjusted $R^2 = .60$). In the second step, TPB constructs from Time Point 1 did not contribute any significant additional variance to Physical Activity Behaviour at Time Point 2.
Table 13

*Regression Analysis for TPB Constructs Predicting Physical Activity Intentions at Time Point 2 while controlling for Physical Activity Intentions at Time Point 1, Girls (n = 104 Time Point 1, n =104 Time Point 2)*

<table>
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Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
In the third analysis, predicting Physical Activity Behaviour at Time Point 2, while controlling for Physical Activity Behaviour and Physical Activity Intentions at Time Point 1, the first step was the same as the first step of the second analysis. Physical Activity Intentions and Physical Activity Behaviour from Time Point 1 at the second step were also significant ($F(1, 103) = 8.35, p = .005$), accounting for an additional approximately 3% of the variance in Physical Activity Behaviour ($R^2 = .027$). Time Point 1 Physical Activity Behaviour at this step was the greatest contributor ($\beta = .65, p < .001$, $sr^2$ unique = .53) followed by Physical Activity Intentions from Time Point 1 ($\beta = .21, p = .005$, $sr^2$ unique = .17). The addition of the three TPB constructs from Time Point 1 had a small additional significant effect with Subjective Norms as the greatest and only independent significant contributor ($\beta = .14, p = .05$, $sr^2$ unique = .12).

Overall for girls, Attitude was the greatest predictor of Physical Activity Intentions, followed by Perceived Behavioural Control. Attitude was the greatest predictor of Physical Activity Behaviour, but when Physical Activity Intentions was added to the model, Attitude still contributed significantly but secondarily to Physical Activity Intentions. When Time Point 1 TPB constructs were used to predict Time Point 2 Physical Activity Intentions, Physical Activity Intentions from Time Point 1 was the best predictor. Physical Activity Behaviour at Time Point 2 was best predicted by Physical Activity Behaviour at Time Point 1, even when Physical Activity Intentions from Time Point 1 was added to the model (although Physical Activity Intentions had a small significant contribution to the model as well).

In summary for both boys and girls, Attitude was the strongest independent predictor of Physical Activity Intentions, and Physical Activity Intentions was the
strongest predictor of Physical Activity Behaviour, followed by Attitude. For both boys and girls, Time Point 1 Physical Activity Intentions was the greatest predictor of Time Point 2 Physical Activity Intentions followed by Attitude for boys, but not for girls. Physical Activity Behaviour at Time Point 2 was best predicted by Physical Activity Behaviour at Time Point 1, followed by Attitude for boys, but not for girls where Physical Activity Intentions from Time Point 1 was the second best predictor of Physical Activity Behaviour.
Table 14

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour at Time Point 2 while Controlling for Physical Activity Behaviour at Time Point 1, Girls (n = 105 Time Point 1, n = 105 Time Point 2)

<table>
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<th>β</th>
<th>Adjusted R²</th>
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<td>.06</td>
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Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
Table 15

Regression Analysis for TPB Constructs Predicting Physical Activity Behaviour at Time Point 2 while controlling for Physical Activity Behaviour and Physical Activity Intentions at Time Point 1, Girls (n = 105 Time Point 1, n = 105 Time Point 2)

<table>
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<th>β</th>
<th>Adjusted R²</th>
<th>R² Change</th>
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<td>.38</td>
<td>-.06</td>
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<td>SN T1</td>
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Note: *p < .05, **p < .001. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
CHAPTER 5: DISCUSSION

The primary purpose of this study was to evaluate how effective high school Physical and Health Education (PHE) classes were at meeting their objective of promoting physical activity, specifically related to examining changes in students’ perceptions of physical activity over the course of the semester. Three ideas guided this research: (a) comparing changes in Theory of Planned Behaviour (TPB) constructs (Attitude, Perceived Behavioural Control, and Subjective Norms) and Physical Activity Intentions from near the beginning to near the end of a single high school semester between students taking Grade 9 PHE and those not taking Grade 9 PHE; (b) comparing changes in physical activity behaviour from near the beginning to near the end of a high school semester between those taking PHE and those not taking PHE; and (c) comparing changes in physical activity intentions and behaviour from near the beginning to near the end of a single high school semester between those who had more and less initially positive reports of TPB constructs.

In addition to examining PHE classes, this study had an additional two ideas that sought to test theory-predictive relationships: (a) exploring the utility of TPB for predicting physical activity intentions and physical activity behaviours in a setting composed of Canadian Grade 9 students; and (b) exploring the utility of TPB for predicting change/no change in physical activity intentions and physical activity behaviour. The results of this study are discussed in two parts: first, PHE classes as a context for promoting physical activity; and second, theory-predictive relationships of TPB. Study limitations are then acknowledged and reflected upon through
recommendations for future research. Furthermore, practical implications and recommendations to potentially guide PHE teachers are provided based on the findings from this study. I conclude the chapter with lessons learned.

**PHE Classes as a Context for Promoting Physical Activity**

**Physical Activity Intentions and TPB Constructs**

The first research question compared changes in TPB constructs and Physical Activity Intentions from the beginning to the end of a high school semester between students taking Grade 9 PHE and those not taking Grade 9 PHE. For this concept, I utilized Multiple Analyses of Covariance (MANCOVA) for boys and girls independently to see if there were any interactions between time and condition, or among time, condition, and TPB status. There were no significant interactions, indicating that students enrolled in PHE and those not enrolled in PHE had no effect on change in physical activity intentions or TPB constructs over the study period (i.e., no between-condition group significant differences).

There are a few potential reasons for the lack of change over the course of the semester between those students who were in PHE and those not in PHE. One reason for this lack of change could be that PHE class does not actually have any sort of effect on changing students’ intentions to be physically active or on their feelings towards physical activity. There is much research that suggests PHE classes are a prime location for targeting physical activity promotion amongst adolescents (e.g., Stone, McKenzie, Welk, & Booth, 1998; Trost, 2006). However, in most research contexts that have been previously examined, there is some sort of external intervention that comes into the PHE
class to contribute to a change. For example, in the study conducted by Chatzisarantis and Hagger (2005), they specifically targeted and aimed to change students’ physical activity behaviour by focusing messaging around beliefs about physical activity. In the present study, there was no external intervention; we were examining regular PHE classes to see if they helped change students’ perceptions of physical activity. Thus perhaps PHE courses are not currently as effective as they have the potential to be with respect to promoting physical activity.

Another plausible logistical explanation for why there was no change found between those who were in PHE and those who were not in PHE over time was a result of the first time point data being taken after students had already been enrolled or not enrolled in PHE class for a relatively extended period of time (i.e., minimum of two weeks, maximum of six weeks). Thus to see change, it is possible that the first time point data needed to be taken during the summer months before either student population had access to PHE class (or not) in high school. In addition, in the present study, the boys initially reported high TPB construct scores and physical activity intentions, and thus had very little room for any potential increases (i.e., ceiling effect; van Sluijs, van Poppel, Twisk, & Mechelen, 2006), although they did decrease in certain TPB constructs, albeit not significantly. The average reported TPB constructs and physical activity intentions for both boys and girls were relatively positive at both time points whether they were in PHE or not in PHE, which could suggest there may have been something about the school environment that actually promoted (or at least did not hinder) a positive physical activity environment external to PHE class (e.g., Wechsler et al., 2000).
In alignment with the idea of the school environment as a potentially positive location for physical activity behaviour change, a review conducted by Wechsler et al. (2000) revealed several possibilities for how schools can provide opportunities for enhancing physical activity. Schools that had recess, intramural programs, and strong policies for promotion of healthy eating and physical activity provided environments that were able to contribute to positive behaviour changes among adolescents. The school board analyzed in the present study had implemented the provincial School Food and Beverage Policy in September 2011 to help students make healthier food choices in an effort to focus on students’ physical well-being (OME, 2010). While this is an example of a policy that could have an impact on overall health, it does not deal directly with physical activity. It could though conceivably contribute to an overall relatively stable physical health environment at the schools, which, in turn may contribute to initial higher overall reported scores of physical activity intentions and TPB constructs.

While there was no main interaction effects found from the MANCOVAs with respect to condition, there were significant main effects found for other IVs. First, for both boys and girls, there was a significant effect of time. Overall, students, regardless of gender, significantly decreased their reported Physical Activity Intentions (i.e., plan of action towards being physically active) over time. In addition to Physical Activity Intentions, students reported that Perceived Behavioural Control (i.e., sense of ease or difficulty of the control in engaging in physical activity behaviour) became more negative (i.e., more difficult) over the course of the semester.

The findings that students have decreased feelings of Perceived Behavioural Control and decreased intentions to be physically active could be a precursor to a
potential upcoming drop-off in physical activity behaviour that is often noted for this age group (Dumith, Gigante, Domingues, & Kohl, 2011). The strongest predictor of Physical Activity Behaviour tends to be Physical Activity Intentions (e.g., Ajzen, 2011), and in the present study there was a decrease in Physical Activity Intentions, but not in Physical Activity Behaviour. This decline could indicate that while students feel they are less likely to engage in physical activity (i.e., their intention to be physically active), there is a delay while they still maintain their Physical Activity Behaviour for at least the first semester of high school prior to the regularly predicted decline in Physical Activity Behaviour.

There may also be something inherent about students’ experiences of entering Grade 9, independent of PHE class, that influenced them toward lower reports of intentions to be physically active, and lower perceptions of behavioural control relating to physical activity over the course of their first semester of high school. While not my initial research question, these findings of changing physical activity perceptions during a time of transition and for this age group are common (e.g., Dumith et al., 2011; Garcia, Pender, Antonakos, & Ronis, 1998). The students who were involved in the present study were all transitioning from elementary school/middle school to high school.

While Perceived Behavioural Control and Physical Activity Intentions decreased across the participants, reported Subjective Norms regarding physical activity (i.e., students’ perceptions of the expectations for physical activity of others who are important to them) increased over the course of the semester. One longitudinal research study that examined gender-specific changes in physical activity beliefs and behaviours from the elementary to high school transition found, in contrast to the present study, that students
reported decreased social norms (i.e., Subjective Norms) for being involved in physical activity (Garcia et al., 1998). Similar to the present study, however, gender differences in physical activity beliefs were identified, reiterating the necessity that boys and girls should perhaps be segregated for promoting physical activity as they tend to have different needs around physical activity. Much other research has supported the notion that girls’ and boys’ PHE classes should be segregated (e.g., Corbin, 2002; Gibbons, 2009) with associated practical pedagogical implications; girls need a different environment and activities to boys in order to create a comfortable learning environment where they choose to participate in PHE class (Gibbons, 2009).

Second there was a significant effect of condition for girls on Attitude (i.e., positive or negative feelings toward Physical Activity Behaviour). Girls taking PHE reported more positive attitudes towards physical activity at both time points relative to girls who were not in PHE. Saying that, the effect size was small (partial \( \eta^2 = .09 \)) indicating that, while there was a significant difference between the two groups, the difference of being in PHE or not being in PHE was minimal. Girls may have had a higher Attitude in PHE class at both time points than those not in PHE class because they already had a few weeks of PHE class prior to the initial time point.

Based on a review of correlates of physical activity in adolescents, Sallis et al. (2000) determined that attitude towards physical activity was one of the modifiable factors that could help change physical activity behaviours. For girls who already have a tendency to start lower than boys in terms of attitude toward physical activity (e.g., Garcia et al., 1998), PHE class may have some positive impact, despite the small effect, and PHE class may potentially be a context in which to modify girls’ attitudes towards physical
activity. Thus while information from the present study is inconclusive, further research is necessary to understand if and how PHE classes can most effectively be utilized for positive impact on adolescent girls’ attitudes toward physical activity.

**Physical Activity Behaviour**

For the second research question, I used MANCOVAs to see if there were any interactions between time and condition, and among time, condition, and TPB status with respect to Physical Activity Behaviour. There were no significant interactions, indicating that students enrolled in PHE and those not enrolled in PHE had no effect on change in Physical Activity Behaviour over the course of the study.

The lack of change in Physical Activity Behaviour over the course of the study between those taking PHE and those not taking PHE could be attributed to similar reasons as the lack of change found in TPB constructs and Physical Activity Intentions (i.e., PHE ineffective at promoting physical activity behaviour change except under specific intervention conditions [Stone et al., 1998], timing of questionnaire administration, ceiling effect for boys [van Sluijs et al., 2006], and positive physical well-being environment [Wechsler et al., 2000]).

However, there were significant effects for other independent variables. For condition, there was a significant effect with girls who were taking PHE classes reporting greater Physical Activity Behaviour across both time points relative to girls who were not taking PHE. The results for the greater physical activity level for girls in PHE class relative to girls not in PHE class was not replicated for the boys. However, boys both participating in PHE and not participating in PHE started with high reported physical activity levels and remained high at the second time point (there was no significant
decrease in reported physical activity behaviour). Thus for boys, there again may have been a ‘ceiling effect’ (van Sluijs et al., 2006), where, because they already reported close to the maximum at the beginning, there can be little possibility of reporting anything higher and thus no positive change reported. There was no decline in boys’ physical activity behaviour reported despite this age group often being cited as having declining physical activity levels (Dumith et al., 2011).

Girls experience a greater drop-off in physical activity levels relative to boys in this age group (see review by Dumith et al., 2011). Considering the fact that girls in PHE reported higher Physical Activity Behaviour relative to girls not in PHE class, and that there was no change in Physical Activity Behaviour between the time points (despite no initial differences between the two groups), there is some factor influencing the higher reported Physical Activity Behaviour. One possibility is that, for the individuals in PHE class, students technically have access to regular physical activity participation, and therefore they are either physically active or not. The questions asked on the Physical Activity Behaviour Scale were aimed at soliciting information from students about their physical activity levels based on the “last seven days.” It is plausible that PHE class actually was the factor that had girls in PHE class reporting higher physical activity behaviour than girls not in PHE class because of the increased time doing physical activity in the PHE class.

In addition, given that one of the barriers to physical activity for this age group includes access to facilities (Sallis et al., 2000), PHE class may help adolescent girls by providing a space to be involved in physical activity that they might not otherwise have had access to—or chose to participate in—outside of PHE classes. In line with this
hypothesis and the lack of change over time, students who were involved in PHE would have already had access to this physical/environmental resource at the first time point. Physical Activity Intentions and other TPB constructs are more like psychological or feeling-related constructs when compared with Physical Activity Behaviour, which is an outwardly measureable construct (i.e., students are either participating in physical activity or they are not).

A previous meta-analysis by Ringuet and Trost (2003, as cited by Trost, 2006) that examined school-based physical activity interventions for both elementary and secondary school students using effect sizes found interventions within school PHE classes to be the most effective way of promoting physical activity. Interventions targeting physical activity levels in PHE class had a greater effect size than interventions targeting overall physical activity. Perhaps to get a positive change in PHE class, the content of these specific research-supported interventions should be implemented on a regular basis by PHE teachers to promote positive physical activity behaviour change. If students were to be tracked for a longer period of time (e.g., over the course of multiple semesters), it would be interesting to find out if more exposure to PHE classes actually had a positive or negative change on students’ physical activity behaviour. It could also lend insight as to whether or not PHE classes help students maintain the same physical activity level. It would also be worth seeing if the lack of mandatory PHE classes (lack of any mandatory physical activity) actually contributes to a decline in adolescents’ overall physical activity behaviour.
Initial TPB Status and Changes across the Semester

The third research idea compared changes in reported Physical Activity Intentions and Physical Activity Behaviour from the beginning to the end of a high school semester between those who had more and less positive initial reports of TPB constructs (i.e., TPB status) for those in PHE versus those not in PHE. For this research question, I utilized MANCOVAs for boys and girls separately to see if there were any interactions between time and TPB status and among time, condition, and TPB status. There was no significant interaction among time, condition, and TPB status, but there was a significant interaction found between time and TPB status for girls.

There was a significant effect of TPB status and time on Attitude, with those girls who started lower than the mean increasing their Attitude, and had less of a decrease in Perceived Behavioural Control and Physical Activity Intentions relative to those higher than the mean; whereas girls starting higher than the mean decreased on Attitude. One possible reason for this finding is regression to the mean, whereby extreme scores will often move toward the mean upon being retested (Vogt, 2007).

Another possible reason for this result is suggested in a study by Huhmen et al. (2005). The researchers launched an awareness campaign to promote physical activity with students (ages 9-13). Students who had had less exposure to physical activity previously, including a subgroup of participants who had lower initial reports of physical activity, derived the most benefit from the advertising campaign. Given that Subjective Norms for physical activity increased for both boys and girls in the present study, perhaps those girls who started lower perceived their classmates or their school environment as having more positive views toward physical activity and thus did not decrease like the
girls who started higher than the mean. This potential explanation would also be in line with the thought that perhaps there is something about the school environment promoting physical well-being (Wechsler et al., 2000). However, unlike the study conducted by Huhmen et al. (2005), those who had an initially lower TPB status did not increase in the specific context of PHE class for either boys or girls.

In addition, there was a significant effect of TPB status for both boys and girls (including those who were in PHE and not in PHE) across both time points. The difference between those who reported a higher TPB status and those who scored a lower TPB status was expected in that the groupings were selected based on maximum difference for comparison purposes of this study, and thus this finding of TPB status is simply an artifact of the grouping.

**PHE Curriculum Considerations in Ontario**

Previous research has indicated that early adolescence is a time when youths’ physical activity levels typically decline significantly (e.g., Dumith et al., 2011). It is also usually the time when youth enter high school as Grade 9 students in Ontario. Given the typical decline in physical activity levels for this age group, this time period is crucial in understanding what can be done to help youth maintain physically active lifestyles.

PHE curriculum in Ontario includes an overall expectation that PHE classes will provide students with opportunities to understand “the importance of physical fitness, health, and well-being and the factors that contribute to them” (OME, 1999, p. 2). This expectation targets an understanding of the importance of physical activity, which is representative of Attitude towards physical activity in the TPB constructs. In addition, the PHE courses aim to provide students with an opportunity for “a personal commitment to
daily vigorous physical activity and positive health behaviours” (OME, 1999, p. 2), which aims directly to improve Physical Activity Behaviour (or maintain it for those who already begin with high physical activity levels). Thus PHE classes in Ontario should be actively working toward changing students’ perceptions of PHE by providing lessons that target understanding of why physical activity is good, in addition to making students feel competent and encouraging them to participate in regular physical activity behaviour. Based on the current results, it would seem that there is not an overall large effect in doing so, but it would be interesting to understand what the teachers are doing that is helping or hindering these efforts.

Previous research has indicated that despite the curriculum being the same for boys and girls in PHE classes, there are specific unique needs for boys and girls in PHE classes that need to be carried out within those curriculum expectations to achieve benefits for the students (e.g., Corbin, 2002; Garcia et al., 1998; Gibbons, 2009). In the present study, there were multiple differences found between boys and girls, which supported the notion that girls and boys feel differently about physical activity, and engage in different amounts of physical activity. PHE classes may be a beneficial area to target physical activity, although perhaps based on the present study, currently not leveraging their full potential. Furthermore, and in line with the idea that perhaps single-gendered courses are good for students, according to a study with 77 adolescent girls (ages 11 to 14), the top barriers to physical activity included “I am self-conscious when I exercise” and “I am not motivated to be active” (Robbins, Pender, & Kazanis, 2003). In this study, students’ Physical Activity Behaviour did not decline significantly over the course of the semester, and perhaps one of the reasons for this maintenance was that all of
the courses examined were single-gendered, thus perhaps relieving some of the perceived barriers to physical activity for this age group (e.g., “I am self conscious when I exercise”; “I am not motivated to be active”). The research by Gibbons (2009) and Corbin (2002) on PHE classes also supports single-gendered PHE classes.

Theory-Predictive Relationships of TPB

TPB in a Grade 9 Context

For the fourth research idea exploring the utility of the TPB for predicting Physical Activity Intentions and Physical Activity Behaviours in a setting composed of Grade 9 students, I used multiple linear regressions to see how much of the variance was accounted for by the three TPB constructs in predicting: (a) Physical Activity Intentions (see Table 4 for boys, Table 10 for girls); (b) Physical Activity Behaviour (see Table 5 for boys, Table 11 for girls); and (c) Physical Activity Behaviour while controlling for Physical Activity Intentions (see Table 6 for boys, Table 12 for girls).

The regressions revealed that collectively the three TPB constructs were good predictors of Physical Activity Intentions; over 59% of the variance for Physical Activity Intentions was explained by the TPB constructs for boys at both time points, and for girls over 60% of the variance was explained at both time points. For boys and girls, comparison of the standardized regression coefficients indicated that Attitude was independently the strongest predictor of Physical Activity Intentions at both time points. Perceived Behavioural Control was the second strongest predictor of physical activity intentions for girls only at both time points.
Similar to previous research, the present study revealed Attitude as the greatest predictor of physical activity intentions for these Grade 9 students. With a similar age group, Chatzisarantis and Hagger (2005) used persuasive messaging as their main focus of an intervention in PHE class, which was intended to influence attitudes towards physical activity. The intervention group had more positive attitudes and stronger intentions to be physically active compared to the group of students that was in the control group and had no targeted persuasive messaging.

Another study with a nationwide sample of Canadian youth (Mummery et al., 2000), including students from Grades 3, 5, 8, and 11, found that, when analyzed by certain subsamples (e.g., grade or gender), the contribution across the three TPB constructs in predicting Physical Activity Intentions differed significantly depending on the subsample analyzed. Like the present study, Attitude was the strongest predictor for boys’ Physical Activity Intentions, but contrary to the present study, for girls, Perceived Behavioural Control was found to be the strongest predictor. This difference may be due to the combination of grades that participated in the study. When gender by grade analyses were performed, the researchers found that Attitude was the largest predictor of Physical Activity Intentions for boys in Grade 5 and girls in Grade 11, while Perceived Behavioural Control (which was the second strongest predictor for girls in the present study) was the greatest predictor of Physical Activity Intentions for girls in Grade 8 and boys in Grades 8 and 11 (contradicting the present study for Grade 9 boys). These findings, in combination with the findings from the present study, perhaps indicate that, as both girls and boys get older, there is a shift in the importance of individual TPB constructs that may influence Physical Activity Intentions.
Consistent with the findings regarding adolescents from Mummery et al. (2000), for girls in Grade 9, Attitude was the strongest predictor of Physical Activity Intentions. As girls move more into their older adolescent years, perhaps targeting attitudes towards physical activity should become a greater focus for achieving physical activity behaviour change. Attitude also appeared as a significant contributor to predicting Physical Activity Intentions in a review by McEachan et al. (2011).

Subjective Norms also was significant for boys in predicting Physical Activity Intentions but only at the second time point. The social component of the TPB may be more important in contributing to the prediction of intentions when it comes to the adolescent age group (e.g., McEachan et al., 2011). However, consistent with Mummery et al. (2000), the findings from the present study suggest that, for this particular age group, Subjective Norms appear to have the consistently lowest contribution to predicting Physical Activity Intentions. In the present study, the smaller and inconsistent contribution that Subjective Norms made could be due to the lower scale reliability or it could be that this particular variable was less important to this age group.

Second, the regressions revealed that collectively the three TPB constructs were good predictors of Physical Activity Behaviour when Physical Activity Intentions were not accounted for in the model, with 45% of the variance for Physical Activity Behaviour explained by TPB constructs for boys at both time points, and 40% for girls at Time Point 1 and 25% at Time Point 2. Again, Attitude was the most significant independent predictor of Physical Activity Behaviour when regression coefficients were examined. According to the TPB (Ajzen, 1985), the three constructs have an influence on Physical Activity Intentions, which then have an influence on Physical Activity Behaviour. While
the present study did not run a path analysis, the finding that Attitude was consistently the strongest predictor suggests, like Chatzisarantis and Hagger (2005) who did use path analysis, that for this particular Grade 9 age group Attitude toward physical activity may exert a significant effect on Physical Activity Behaviour rather than via Perceived Behavioural Control, although the latter was still significant.

Finally, when the TPB constructs were used to predict Physical Activity Behaviour while controlling for Physical Activity Intentions, the relationship appeared to be partially mediated by Physical Activity Intentions, which was the strongest independent predictor of Physical Activity Behaviour. While the results were not a strict test of mediation, the results are directly in line with the predictions of the TPB, which say that the three TPB constructs exert their influence on behaviour through intentions (Ajzen, 1985). For boys, Perceived Behavioural Control (but only at one time point) significantly contributed to Physical Activity Behaviour independently of intentions, in line with the TPB model that suggests Perceived Behavioural Control exerts direct influence on behaviour. However, for girls (only at one time point), Attitude had a significant direct contribution, similar to the conclusions of Chatzisarantis and Hagger (2005). Thus to change students’ physical activity behaviour, it may be important for teachers to target changing students’ attitudes toward physical activity.

**Long-Term Predictive Ability of the TPB**

The fifth research idea sought to explore the utility of the TPB for predicting change/no change in Physical Activity Intentions and Behaviour. For this research idea, I examined the multiple linear regressions to see how much of the variance was accounted for by the Time Point 1 TPB constructs of: (a) Physical Activity Intentions at Time Point
2, while controlling for Physical Activity Intentions at Time Point 1 (see Table 7 for boys, Table 13 for girls); (ii) Physical Activity Behaviour at Time Point 2, while controlling for Physical Activity Behaviour at Time Point 1 (see Table 8 for boys, Table 14 for girls); and (iii) Physical Activity Behaviour at Time Point 2, while controlling for Physical Activity Intentions and Behaviour at Time Point 1 (see Table 9 for boys, Table 15 for girls).

The first regressions revealed that, for both boys and girls, Physical Activity Intentions at the first time point were the greatest predictor for Physical Activity Intentions at the second time point, accounting for 49% of the variance of Physical Activity Intentions at the second time point for boys and 55% for girls. Additionally, independently of the Physical Activity Intentions at the first time point, for boys alone, Attitude contributed significantly to the Physical Activity Intentions at the second time point, accounting for another 14% of the variance in Physical Activity Intentions at the second time point. In contrast, a longitudinal study on adolescents found Subjective Norms and Perceived Behavioural Control were the greatest predictors of a change in intention (Rhodes, Macdonald, & McKay, 2006). The finding that Attitude from Time Point 1 directly predicted Physical Activity Intentions at the second time point for boys may indicate attitudes would be a valuable area of focus given that they help to predict change over time, as they have also emerged in the present study and in other studies as a significant predictor of intentions when data are collected at a single time (e.g., Chatzisarantis & Hagger, 2005; Mummery et al., 2000).

For the second analyses that controlled for Physical Activity Behaviour at Time Point 1 and did not use Physical Activity Intentions, for both boys and girls, Physical Activity
Activity Behaviour at Time Point 1 was the best predictor of Physical Activity Behaviour at the second time point. Physical Activity Behaviour at Time Point 1 accounted for 36% of the variance in boys’ Physical Activity Behaviour at the second time point, and 60% of the variance for girls.

The finding that previous physical activity behaviour is the best predictor of later physical activity behaviour is similar to previous findings (e.g., Trost, 2006). Trost (2006) noted that it is difficult to track physical activity behaviour from childhood to adulthood, but that the link between adolescent and adult physical activity behaviour is strong. Hence, given what we know about the health benefits for youth of physical activity (e.g., Janssen & LeBlanc, 2010), it is important that, for those individuals who are not physically active, we find a way to intervene (such as PHE class or other physical activity venues) to help them establish a physical activity routine. The present study had a relatively short time period between the first measure and the second measure; longer term predictions may not be as strong (Ajzen, 2011; Plotnikoff, Lubans, Trinh, & Craig, 2012).

Furthermore, for boys, Attitude from Time Point 1 independently contributed to predicting Physical Activity Behaviour at the second time point accounting for an additional 8% of the variance of Physical Activity Behaviour at Time Point 2 when Physical Activity Intentions were not included in the analysis. Given that Attitude was the most consistent predictor when each time point was examined independently, and that Attitude has arisen as a significant predictor for this age group in multiple studies (e.g., Chatzisarantis & Hagger, 2005; Mummery et al. 2000), attitudes should perhaps be
further explored. It may be that for this age group, attitudes toward physical activity could be the optimal way to attempt to change Physical Activity Behaviour.

When both Physical Activity Intentions and Physical Activity Behaviour from the first time point were included in predicting Physical Activity Behaviour at the second time point, the greatest predictor for both boys and girls was Physical Activity Behaviour at the first time point (36% of the variance for boys; 60% for girls) followed by Time Point 1 Attitude for boys (contributing an additional 9%), and Time Point 1 Physical Activity Intentions for girls (contributing an additional 3%). The finding that past physical activity behaviour is the best predictor of future physical activity behaviour was expected based on previous research that suggests a strong link between these two variables (e.g., Craggs, Corder, Esther, Sluijs, & Griffin, 2011; Trost, 2006).

In addition to the link between adolescent and adult physical activity levels discussed by Trost (2006), Craggs et al. (2011) conducted a review study to determine the correlates of physical activity levels in children and adolescents. For this age group, one of the greatest correlates of physical activity participation was higher levels of previous physical activity. The findings from the present study are consistent with this research. However, greater time periods between measurements of physical activity behaviour may create a change in predictive effect (e.g., Plotnikoff et al., 2003).

Ajzen (2011) noted in a review of the TPB that temporal distances between the measurement of intention and the measurement of behaviour may have an effect on the relationship between variables as there could have been any number of intervening events (e.g., a physical activity intervention; sport season ending). Should there have been another set of data taken during the second semester of the school year, perhaps the
present research may have indicated that the TPB constructs became less predictive of behaviour over a greater time period or found a change in the specific constructs that contributed the most to Physical Activity Behaviour. In the present study, there was an approximate 2 to 3 month gap between the first time point and the second time point, and those students taking PHE remained in PHE, and those not taking PHE remained not in PHE. An additional complication is the way school sports are run: those who were involved in school sports during the fall term might not have been involved in winter sports and vice versa. Fall sports usually start at the beginning of September and continue until the end of October, sometimes the beginning of November (during the first time point for data collection), and winter sports generally start towards mid- or late-November and continue into late February or March (during the second time point for data collection). Any intervening events in the interim period between when data are initially taken and when the measurement of Physical Activity Behaviour is later taken may have an effect on the predictive ability (or the specific contribution of the TPB constructs) of TPB. Despite these potential temporal factors that could change the predictive ability of TPB over the given time period, TPB maintained its relative predictive power in this study.

A study that examined the predictive ability of TPB for a longer time period (15 years) in a large nation-wide randomly selected Canadian adult population ($n = 1427$) using Structural Equation Modelling found that the long-term predictive ability of TPB for Physical Activity Behaviour is modest for adults (TPB measures from 1988 accounted for 13% of the physical activity behaviour variance in 2003: Plotnikoff et al., 2012). This particular study seemed to have limited Physical Activity Behaviour variance accounted
for initially as the 1988 TPB constructs accounted for only 29% of Physical Activity Intentions and 9% of Physical Activity Behaviour. Fifteen years is a relatively long period in which many moderating factors could have taken place. With limited change in the interim period between TPB measurements, the present study suggests, over a relatively short period, that TPB is a good predictor of Physical Activity Behaviour in adolescents.

Additionally, while the study by Plotnikoff et al. (2003) had a much larger time gap and examined only an adult population, it would be interesting to see if TPB was able to predict change/no change in Physical Activity Behaviour between adolescence and adulthood given that adolescent physical activity level is suggested to be the best predictor of adult physical activity level (e.g., Trost, 2006).

**Limitations and Future Directions**

The findings from this study are not affected by selection biases as all Grade 9 students in this particular school board in Southeastern Ontario are automatically enrolled in PHE class during Grade 9 in either the first or second semester. After students have taken one single semester PHE credit, PHE becomes an elective as the Ontario graduation requirements only have one single semester course for graduation (OME, 2011). Therefore, students who both enjoy physical activity and do not enjoy physical activity must take a PHE course, with this course most often being taken in Grade 9. Additionally, this study had a relatively large and representative number of students for this particular school board, and, because of the longitudinal nature of the data collection, students were able to act as their own controls for change.
The primary limitation for this study that might have interfered with some of the results was the timing of the two data collection points. Given the length of the high school semester and ethical time constraints (i.e., not having access to schools until principals returned from summer holidays conflicting with wanting to access students prior to when they started regularly taking PHE class), it was necessary to collect the first time point data during the latter weeks of September and the early weeks of October. Students had already been in school and had either been taking PHE or not taking PHE for a full month prior to the initial data being collected with potential implications for the significant difference between girls who were in PHE when compared to those not in PHE in attitudes and physical activity behaviour, and the lack of change on measured constructs between the two time points. Earlier ethics clearance at the university level and approval at the school/school board level could allow access to student participants sooner. As well, for future research, it would be interesting to see if those students who continued to take PHE in future years of high school (e.g., multiple semesters of PHE classes) continued to derive more benefit from PHE or if the initial PHE benefit was all they received. If the initial benefit is all they would receive, a longer-term longitudinal study over at least two years of high school to see if additional PHE classes are necessary to maintain this initial effect and if the effect weakens when students stop taking PHE would prove beneficial. Given the results from the present study, a two-year period beginning with a group of Grade 9 students and following them throughout this period would be beneficial to see if students in the different groupings (e.g., those who started with a higher TPB status versus those who started with a lower TPB status) selected PHE as an elective course in their Grade 10 year and how their physical activity level and
feelings toward physical activity changed over this time period. Alternatively if a two-year study were not plausible, a one-year study could be interesting following the same students throughout the year to see how the students who were in PHE first semester respond to having no PHE the second semester (and vice versa for those not in PHE class first semester), and to see what sort of an impact PHE class has on a single student over his or her Grade 9 year.

Second, in addition, by using TPB, the scope of the study was limited to solely those constructs examined in TPB. However, while this is a limitation, it is also a methodological strength as TPB is one of the most cited and validated theories used in the social sciences for examining behaviour change quantitatively (Ajzen, 2011). On the other hand, while TPB is a good predictor of intentions to be physically active and physical activity behaviour, there is still a large portion of variance unaccounted for. While there are some concepts that a quantitative study of this nature cannot explore, TPB has been validated previously for use with this age group (e.g., Mummery et al., 2000), and has been further validated for use with a Grade 9 age group by the present study. A qualitative follow-up study could be used to probe deeper into the understanding of students’ perceptions of PHE class and their changing physical activity levels for this age group, both within the TPB framework (e.g., how do teachers change attitudes?), and in addition to the TPB framework (e.g., what are the students’ perceptions of what makes a good PHE course?). More specifically, based on results from this study, future qualitative research could focus on the content of students’ attitudes toward physical activity (i.e., what does it mean to have a positive or negative attitude towards physical activity?), and
how students respond to different elements of PHE curriculum (i.e., what is the lived experience of a student in a PHE class?).

A third limitation was using self-report questionnaires to measure both feelings toward physical activity in addition to actual physical activity behaviour. Thus the measures taken might be inflated or inaccurate. However, the measures that were used for both the TPB questionnaire and physical activity questionnaire were validated instruments that used questions designed to elicit responses from the participants that were as accurate as possible (Biddle, Gorley, Pearson, & Bull, 2011; Hagger, Chatzisarantis, & Biddle, 2002). Similar findings that correspond to previous research lend support to the convergent validity of using this theory and thus allow meaningful interpretation of the present findings. Future research could try to measure physical activity behaviour through both observation and accelerometer data to lend insight into the overall PHE class behaviour and attitudes that were found for girls.

Fourth, the scale that was created for Subjective Norms had a slightly lower reliability, which might have affected its ability to be considered a reliable predictor of physical activity intentions and physical activity behaviour. As a possible result, Subjective Norms sometimes appeared as being predictive of physical activity intentions and behaviour, but inconsistently. Any result drawn from the Subjective Norms Scale should be interpreted with caution. Future research may need increased attention on piloting questions for the Subjective Norms Scale given the consistent lower reliability in other studies as well (e.g., Ajzen, 2011).

Finally, while there was a relatively large representative sample size taken from the school board (including students from both urban and rural schools within this school
board in Southeastern Ontario), there were fewer boys than is considered ideal for the regression analyses that used both time points. Future research should attempt to gather an equivalent amount of data between boys in PHE and boys not in PHE for accurate comparisons.

**Practical Implications and Recommendations**

While some of the findings from the present study indicate potential implications of using PHE classes as a public health promotion tool in Ontario, this was a very preliminary study and further research needs to be conducted to clarify and/or replicate the findings.

Based on the preliminary findings from the current research, attitudes seem to be a significant contributor to immediate physical activity behaviour in addition to being predictive of future physical activity behaviour in a setting composed of Grade 9 students. It would seem feasible that PHE teachers should focus on changing attitudes towards physical activity. Like Chatzisarantis and Hagger (2005), one way of changing attitudes towards physical activity behaviour could be by targeting salient beliefs about physical activity through presenting the positive effects of regular physical activity participation, such as decreased chances of hypertension, decreased blood pressure, positive contribution to bone density, and decreased symptoms of depression. Ensuring that information such as the positive implications for regular exercise in PHE classes is available could help instill appropriate beliefs for students regarding physical activity and thereby increase the likelihood of regular physical activity participation. The provider of the messaging may have an effect on students’ attitude changes (e.g., PHE teacher;
external healthcare provider; university/college student/intern), while the message structure may have implications for change/no change in physical activity behaviour.

Additionally, because we know that adolescents of this age group, and girls in particular, have such a large drop-off in physical activity level (see review by Dumith et al., 2011), it would seem important to investigate physical activity policies at the secondary school level and consider including more regular mandatory participation in physical activity, which is a recommendation seconded by researchers who have examined the influence of physical and psychosocial variables on math and reading achievement test scores (Srikanth, Petrie, Greenleaf, & Martin, 2014). Warburton, Nicol, and Bredin (2006) noted that physical inactivity prevalence is the highest of all modifiable risk factors for various illnesses, and yet PHE is still not mandated in high schools in Ontario throughout high school beyond one single credit (OME, 2011). Many of the issues associated with declining enrollment and effectiveness of PHE courses could be remedied with changing school policies to further enhance student opportunities for PHE and promotion of student health. If PHE were mandated throughout high school, then perhaps physical activity in the adolescent age group would not drop-off so drastically.

The assumption with PHE class as a workable and effective intervention for physical activity behaviour change is that the entire student population in high school must attend PHE classes from Grades 9 through 12 (Trost, 2006). Presently, the entire student population in high school is required to attend from Grades 9 through 12 (or until the age of 18), but only one single semester PHE credit is required to graduate (OME, 2011). In such a scenario where the entire student population was mandated to attend
PHE class, 100 percent of adolescents could be reached for physical activity promotion. If all high school students were then required to be engaged in physical activity for at least 20 minutes daily (less than approximately 50 percent of the lesson time), PHE would have an approximate 83 percent effectiveness in reaching the adolescent population (therefore approximately 83 percent of students in that age group would be sufficiently active based on physical activity guidelines; Trost, 2006). There are many other factors that may contribute to the ineffectiveness of a PHE program (e.g., teachers, student attendance rates, students selecting PHE as an optional credit versus not selecting it as an elective), which would further decrease the effectiveness of reaching all students. School policies could be revised to provide more opportunity for mandatory physical activities beyond one single semester course.

**Lessons I Learned**

Throughout the data collection and analyses processes, there were many things I learned and a few things that I wish I had done differently. I chose to discuss the lessons I learned in this final section to show some of the challenges I faced along the way and how I changed in this process.

**Lessons I Learned about the Research Process**

First and foremost, when I was entering my data onto the computer after the first round of data collection, I came across quite a few students who had missed a page. I did look at the front and back page of most of the students’ surveys as they handed them in, but I did not look at the pages in between. Regrettably, it was too late to do much about the missing data for the first round of data collection. I was fortunate to be able to remedy
the situation by analyzing for missing data and there were not enough missing data to interfere with the results. For the second round of data collection in December, as each student handed in a survey, I flipped through the survey as much as possible without taking away more of the teacher’s time than necessary and, if I noticed students were missing a page, I would just mention it to them in case they wanted to fill it in and did not do it on purpose. In this way I avoided having as much missing data at Time Point 2. Thus, for future studies I would do the same thing I did at Time Point 2 at both time points to give students an opportunity to fill in questions they accidently missed. In accordance with principles of ethical research and consideration of participants’ rights, if they did not want to fill in the questions, that was fine and I did not force them to do so.

The timing of the first time point was less than ideal for principals at the various high schools. The principals were on summer holidays until August 19th, and then spent the week before school started attempting to get staffing in order, ensuring that the school was set for the arrival of their students. They were not on the school campus for much of the first few weeks. I experienced many difficulties recruiting principals at schools because they often did not have time to read through or listen to the information I had provided to them, be it via email, telephone, or in person. One principal with whom I had difficulty being in contact, when I finally had an opportunity to meet at the beginning of October, suggested that I should have been in contact with the Heads of the PHE departments at all of the high schools as they would be the parties directly interested in my research. While I did contact the Heads of the PHE departments, it was only after I had received approval from the principals to conduct the research in the school. Had I contacted the Heads of PHE prior to the principals, they may have been able to indicate to
the principals that they were keen to have the research take place. While I did use my contacts at each of the schools, it would have been prudent to contact the Heads of the PHE departments to indicate I was doing this study if their school was interested in participating.

Another roadblock that I encountered was with consent forms. Teachers who agreed to have their students participate in the study mentioned how difficult it was to get the consent forms back from their students. Thus even though I had a large number of consent forms go home, the response rate was relatively low. I had considered the possibility of passive consent given the lack of ethical implications (i.e., no invasive procedures, no sensitive information being sought from students, anonymous survey, minimal time commitment) for this study, but the particular school board rarely (if ever) gives permission to use passive consent.

However, had it been a reasonable possibility, passive consent would likely have increased my response rate providing a greater base and possibly variety of students. The school that had the highest response rate was from a reasonably affluent neighbourhood that had students who already participated in many sports outside of school and understood the benefits of physical activity, in addition to having typically involved parents who were used to filling out and returning forms for the school.

Lessons I Learned about Myself

Overall, I thoroughly enjoyed the entire research process and am pleased to see both how the research process works in addition to gaining further understanding of how well PHE classes are promoting physical activity. This process for me was not just about the research itself. I began this process as a high school PHE teacher interested in seeing
how well PHE classes were doing in promoting lifelong physical activity. I have finished this journey, in addition to my initial questions and thoughts, with interests in a variety of educational research areas, a greater appreciation for the research process, and an overall intellectually stimulated and excited mind.

To me, it seems essential that we (as PHE teachers) are doing everything in our power to have students find some form of physical activity they can enjoy and incorporate into their lifestyles. While this was just a preliminary project, I think it has set a nice foundation for looking at PHE classes with a new light in determining students’ future physical activity levels as well as laying a foundation for probing deeper into what it is about PHE classes that do or do not provide a positive venue for physical activity behaviour change.

The way my study was set-up provided necessary challenges, barriers, and times of growth that I had to process and overcome to achieve this research piece. I was challenged organizationally (e.g., how to actually be physically present for all the surveys and coordinate times with teachers that worked for them at the various schools), educationally (e.g., go through the process of learning about statistical analyses and organizing my results into a full research piece), and with time management (e.g., research assistant work combined with coaching and teaching; how to actually compress my research questions into a timeframe that would allow me to answer the question without taking years and years of time). Additionally, throughout my two years, classes were intellectually challenging and kept sending me in fascinating directions that I had not thought of before. My peers and professors had such a variety of experiences that were so wonderful to draw upon and learn from.
However, throughout all of these challenges and growth periods, my initial question still persisted: how are PHE classes promoting physical activity to students? To me, given all of the health benefits for an individual’s life that can be achieved through physical activity, it just seems essential that PHE classes are able to do the job of promoting physical activity as all youth do attend high school and we can access them there. When I walk into a PHE class in high school, I see students typically running around and I hope they are having fun. I realized that for me, PHE classes are fun. They have the potential to be an opportunity for students to de-stress in a setting (school) that can often be stressful. I want to be able to help students feel what I feel when I exercise: freedom and relief (and, often, quite a bit of satisfying fatigue).

I feel that, as a beginning researcher, my learning has budded exponentially. I am excited to incorporate some of the findings from my study regarding attitudes toward physical activity to see if I can help instill positive behaviour change in students. I would also be incredibly interested in the prospect of continuing research in this field of physical activity promotion within a PHE context. I find myself already thinking about future research questions I could ask to get at further details, and would be excited to speak with students in addition to being actively in the PHE class doing my best to promote behaviour change. A central message that I have learned through this process is that policies within schools could be examined and changed to further opportunities for access to physical activity, and I would love to be a part of the process that brings about that change.

This project has given me hope that PHE classes can act as an avenue for positive physical activity behaviour change. I am looking forward to providing the findings of my
research to the school board and hope that it will be useful in informing physical activity policies for the future.
REFERENCES


May 29, 2013

Ms. Mary-Anne Reid
Master’s Student
Faculty of Education
Duncan McArthur Hall
Queen’s University
511 Union Street
Kingston, ON K7M 5R7

GREB Ref #: GEDUC-673-13; Rome # 6009852
Title: “GEDUC-673-13 Influence of Physical Education on Adolescents’ Intended Physical Activity”

Dear Ms. Reid:

The General Research Ethics Board (GREB), by means of a delegated board review, has cleared your proposal entitled "GEDUC-673-13 Influence of Physical Education on Adolescents’ Intended Physical Activity" for ethical compliance with the Tri-Council Guidelines (TCPS) and Queen’s ethics policies. In accordance with the Tri-Council Guidelines (article D.1.6) and Senate Terms of Reference (article G), your project has been cleared for one year. At the end of each year, the GREB will ask if your project has been completed and if not, what changes have occurred or will occur in the next year.

You are reminded of your obligation to advise the GREB, with a copy to your unit REB, of any adverse event(s) that occur during this one year period (access this form at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Adverse Event Report). An adverse event includes, but is not limited to, a complaint, a change or unexpected event that alters the level of risk for the researcher or participants or situation that requires a substantial change in approach to a participant(s). You are also advised that all adverse events must be reported to the GREB within 48 hours.

You are also reminded that all changes that might affect human participants must be cleared by the GREB. For example you must report changes to the level of risk, applicant characteristics, and implementation of new procedures. To make an amendment, access the application at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Amendment to Approved Study Form. These changes will automatically be sent to the Ethics Coordinator, Gail Irving, at the Office of Research Services or irvingg@queensu.ca for further review and clearance by the GREB or GREB Chair.

On behalf of the General Research Ethics Board. I wish you continued success in your research.

Yours sincerely,

[Signature]

John Freeman, Ph.D.
Professor and Acting Chair
General Research Ethics Board

cc: Dr. John Freeman, Faculty Supervisor
Dr. Don Klinger, Chair, Unit REB
Erin Wickham, c/o Graduate Studies and Bureau of Research
APPENDIX B: PRINCIPAL RECRUITMENT LETTER

Dear [Blank] Secondary School Principals,

I am writing this letter to request your permission to conduct research in your school for my Master’s thesis entitled, *Examining the influence of physical education on adolescents’ physical activity intentions*, under the supervision of Dr. John Freeman. I am currently an Occasional Teacher with the [Blank] secondary school list while I am in the process of doing a Master’s degree in Education at Queen’s University. I have received approval from both Queen’s University as well as [Blank] to conduct this research in the secondary schools within this board.

**Purpose of Research and Benefits to the School:** The proposed research will benefit the schools in providing insight into how the PHE courses are doing in promoting students’ lifelong physical activity adoption as a result of taking the PHE courses. Once the research is completed, I will be submitting the research report, including an abstract to the school board and all participating schools containing information regarding the results of my research.

**Time Requirement:** The research will require minimal time from the students and teachers (2 x 20 minutes, once in September and once in December for students to complete questionnaires). The teachers will also be asked to distribute Letters of Information and Consent Forms in addition to the 2 x 20 minutes of class time. I will photocopy and distribute the consent forms in packages to the teachers, and will arrange a time with teachers that I will administer the questionnaires. All participation is voluntary.

**Benefit to Students:** Participating students will be entered into a draw at each participating school for a $25.00 gift certificate for either Cineplex or SportChek.

**Maintaining Confidentiality:** I will ensure that there will be no identifying characteristics of the board, students, or teachers in my Master’s thesis or any other publications / presentations that come of the research. I will refer to [Blank] as “a school board in Eastern Ontario”.

**What I need your help with:** If I am able to conduct research in your school, I would ask that you: i) send out an email to Grade 9 home form teachers including a copy of the “Recruitment Letter” (please find enclosed), and ii) allow me to contact Grade 9 home form teachers in your school.

**Enclosed in this Package:** Please find enclosed a copy of the letter of information, consent form, and questionnaires that I will photocopy and have the teachers distribute to the classes. In addition, I have also included the ethics approval letters from both Queen’s University and [Blank].

Thank you for your time and consideration. Your help is greatly appreciated. If you have any further questions, please do not hesitate to contact me.

Sincerely,

Mary-Anne Reid
613-483-4698
4mr9@queensu.ca / [Blank]
M.Ed. Candidate, Queen’s University
B.Sc. / BPHE / B.Ed. / OCT
Letter of Information

"Influence of Physical Education on Adolescents' Intended Physical Activity"

This research is being conducted by Mary-Anne Reid under the supervision of Dr. John Freeman for her Master’s thesis, in the Faculty of Education at Queen’s University in Kingston, Ontario. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen’s policies.

What is this study about? The purpose of this research is to look at Grade 9 Physical and Health Education (PHE) courses to see if students intend to increase their physical activity levels as a result of taking the course as well as their actual increase in physical activity during the course. As such, Mary-Anne will be looking at both students who are taking PHE first semester, as well as those who are not, and comparing the two groups of students on how much their intentions to be physically active change over the course of the semester. The study will require two visits (one in September, and one again in December) for 20 minutes per visit (total 40 minutes) where Mary-Anne will hand out questionnaires to be filled in by the students. There are no known physical, psychological, economic, or social risks associated with this study.

Is participation voluntary? Yes. Although it be would be greatly appreciated if students would answer all material as honestly as possible, students should not feel obliged to answer any material that they find objectionable or that makes them feel uncomfortable. Students may also withdraw at any time with no effect on their standing in school. They may request the removal of all or part of their data from the questionnaires by contacting the researcher directly.

What will happen to my son/daughter’s responses? The responses will be kept confidential. Only researchers (Mary-Anne Reid and Dr. John Freeman) will have access to this information. To help ensure confidentiality, your son/daughter will be asked not to put their name on any of the research study answer sheets. Other than the thesis, the data may also be published in professional journals or presented at academic conferences, but any such presentations will be of general findings and will never breach individual confidentiality. Should you or your son/daughter be interested, you are entitled to a copy of the findings. The paper questionnaires will be destroyed once the information is entered electronically, and if data are used for secondary analysis in that time period, they will contain no identifying information.

Will my son/daughter be compensated for their participation? Your son/daughter will be entered into a draw at their school for a $25 gift certificate to SportChek or to Cineplex for their participation. In addition, the results will help us to understand what we can do to make physical education classes better.

What if I have concerns? Any questions about study participation may be directed to Mary-Anne Reid at 4mr9@queensu.ca or her supervisor Dr. John Freeman at 613-533-6000 x 77298 & freemanj@queensu.ca. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

Your interest in participating in this research study is greatly appreciated.
Consent Form
“Examining the influence of physical education on adolescents’ physical activity intentions”

Name of parent/guardian (please print clearly): ______________________________________

1. I have read the Letter of Information and have had any questions answered to my satisfaction. I have
   retained a copy of the Letter of Information for my records.

2. I understand that [student’s name] ____________________________________________ will be participating in
   the study called “Examining the influence of physical education on adolescents’ physical activity intentions.”
   I understand that this means that my child will be asked to answer questionnaires at two different times related to
   their feelings toward, and participation in, physical activities both in school and outside of school in order to further
   our understanding of what makes a good physical education class. I understand that this research will take
   approximately 2 x 20 minutes of my child’s time (total 40 minutes).

3. I understand that my child’s participation in this study is voluntary and they may withdraw all or part of their
   data from the questionnaires at any time without consequence. I understand that every effort will be made to
   maintain the confidentiality of the questionnaires now and in the future. Only Mary-Anne Reid and Dr. John
   Freeman will have access to the data. Other than the thesis, the data may also be published in professional
   journals or presented at scientific conferences, but any such presentations will be of general findings and will
   never breach individual confidentiality. Should you be interested, you are entitled to a copy of the findings.

4. Any questions about study participation may be directed to Mary-Anne Reid at 4mr9@queensu.ca or her
   supervisor Dr. John Freeman at 613-533-6000 x 77298 & freemanj@queensu.ca. Any ethical concerns about
   the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or
   chair.GREB@queensu.ca

Please sign one copy of this Consent Form and return to your child’s homeform teacher (who will then
give it Mary-Anne Reid. Retain the second copy for your records.

I have read the above statements and freely consent to participate in this research (both parent and student need
to sign):

Parent/Guardian Signature:
I __________________________________ agree to let my son/daughter participate in this research study.
Signature: ______________________________________ Date: ______________________

Student Signature:
I __________________________________ agree to participate in this study.
Signature: ______________________________________ Date: ______________________

I wish to receive a copy of the results of the study: yes / no

If yes:
Email OR Postal Address: ___________________________________________________________
 Dear Grade 9 Home Form Teachers,

**Who am I?**
My name is Mary-Anne Reid and I am a Master’s student at Queen’s University conducting a study for my thesis looking at the physical activity level of our Grade 9 students. I am requesting your help in gathering data for this research. The questionnaires that I would distribute in your home form classrooms will take up 2 x 20 minutes of your class time (one meeting in September and one in December).

**What am I looking at?**
The purpose of this research is to look at Grade 9 Physical and Health Education (PHE) courses to see if students intend to increase their physical activity levels as a result of taking the course as well as their actual increase in physical activity during the course. As such, I will be looking at both students who are taking PHE first semester, as well as those who are not, and comparing the two groups of students on how much their intentions to be physically active change over the course of the semester. There are no known physical, psychological, economic, or social risks associated with this study.

**What happens if you agree to have your class participate?**
1) I would request that you send home a letter of information to provide students and parents with information about my study and a letter of consent for the parents. Parents and students both need to sign and return this consent form in order for the student to participate in the study. I will make the photocopies of both the letter of information and letter of consent and bring them to the schools for distribution.
2) I would request that if possible that you collect consent forms from students.
3) I will come into your class once in September and once in December based on an agreed upon date that is convenient for you to hand out the questionnaires.

**What do the students get?**
Each participating student will be entered into a draw at their school for a $25 gift certificate to SportChek or Cineplex movie tickets.

**How is this beneficial?**
The results of this study could help to lend insight into whether or not the Ontario Grade 9 PHE courses are doing what they are intended to do (e.g., increasing students’ physical activity behaviours once the course is completed). Understanding how to implement effective PHE courses may help with where to focus health promotion efforts to reduce the already increasing strain on our healthcare system. In addition, I plan to use the information from this study to begin the process of understanding how we can help students create positive intentions to be physically active as well as help increase actual physical activity behaviours.

Thank you for your time, and I hope to be in touch with you soon.

Sincerely,

Mary-Anne Reid
4mr9@queensu.ca
APPENDIX D: STUDENT SURVEY

Demographic Information

Code: [birth date / last 4 digits of their cell phone number and if they don’t have one then their home phone number / school number (I will assign the school number)]

Are you: Male □
Female □

Check the box that applies to you (only one)

□ I am currently taking Physical Education (Gym) class this semester (September until January).
□ I will be taking Physical Education (Gym) class next semester (February until June).
□ I will not be taking a Physical Education (Gym) class this year.

Check all of the boxes that apply to you (you may check more than one):

□ I participate in an organized physical activity IN SCHOOL (e.g., sport team, dance club, etc.).
□ I participate in an organized physical activity OUTSIDE of school (e.g., sport team, dance club, etc.).
□ I have a membership to a gym/fitness facility OUTSIDE of school.
Questionnaire Measuring TPB Constructs

Physical Activity: The following questions will ask you about your physical activity. For these questions, physical activity refers to any activities that take moderate to hard physical effort and that make you breathe somewhat or much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

Please answer each of the following questions by circling the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues.

In making your ratings, please remember the following points:
* Be sure to answer all items – do not skip any.
* Never circle more than one number on a single scale.
Please read each question carefully.

1. For me to be physically active on a regular basis is:
   extremely difficult: __1___ 2___ 3___ 4___ 5___ 6___ 7___: extremely easy

2. Most people who are important to me hope that I am physically active
   Absolutely true: __1___ 2___ 3___ 4___ 5___ 6___ 7___: Definitely false

3. For me to be physically active on a regular basis is
   extremely good: __1___ 2___ 3___ 4___ 5___ 6___ 7___: extremely bad

4. I plan to be physically active on a regular basis
   extremely likely: __1___ 2___ 3___ 4___ 5___ 6___ 7___: extremely unlikely

5. Whether or not I am physically active on a regular basis is completely up to me
   strongly disagree: __1___ 2___ 3___ 4___ 5___ 6___ 7___: strongly agree

6. Most of the students that I know in this class are physically active on a regular basis
   definitely true: __1___ 2___ 3___ 4___ 5___ 6___ 7___: definitely false
7. For me to be physically active on a regular basis is extremely valuable: 1 2 3 4 5 6 7 extremely worthless

8. I am confident that if I wanted to I could be physically active on a regular basis definitely true: 1 2 3 4 5 6 7 definitely false

9. It is expected of me that I am physically active on a regular basis definitely true: 1 2 3 4 5 6 7 definitely false

10. For me to be physically active on a regular basis is extremely pleasant: 1 2 3 4 5 6 7 extremely unpleasant

11. I will make an effort to be physically active on a regular basis I definitely will: 1 2 3 4 5 6 7 I definitely will not

12. For me to be physically active on a regular basis is impossible: 1 2 3 4 5 6 7 possible

13. Most people whose opinions I value would approve of my being physically active on a regular basis strongly disagree: 1 2 3 4 5 6 7 strongly agree

14. For me to be physically active on a regular basis is interesting: 1 2 3 4 5 6 7 boring
15. I intend to be physically active on a regular basis

strongly agree: __1__ __2__ __3__ __4__ __5__ __6__ __7__: strongly disagree

16. Doing physical activity during the next few weeks would be

relaxing: __1__ __2__ __3__ __4__ __5__ __6__ __7__: stressful

17. It is completely up to me whether or not I am physically active

strongly agree: __1__ __2__ __3__ __4__ __5__ __6__ __7__: strongly disagree

18. I plan to be physically active over the next two weeks

strongly agree: __1__ __2__ __3__ __4__ __5__ __6__ __7__: strongly disagree

19. Most people that are important to me think that I should be physically active

strongly agree: __1__ __2__ __3__ __4__ __5__ __6__ __7__: strongly disagree

20. Doing physical activity is generally

beneficial: __1__ __2__ __3__ __4__ __5__ __6__ __7__: harmful
PHYSICAL ACTIVITY QUESTIONNAIRE

Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, school activities, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, inline skating, biking, dancing, skateboarding, swimming, soccer, basketball, and football.

For these first two questions, add up all the time you spend in physical activity each day.

1. Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?
   - 0 days
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

2. Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?
   - 0 days
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

3. 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 your class time at school?
   - none at all
   - about ½ hour
   - about 1 hour
   - about 2 hours
   - about 3 hours
   - about 4 hours
   - about 5 hours
   - about 6 hours
   - about 7 or more hours

4. 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 your free time (for example, lunch) at school?
   - none at all
   - about ½ hour
   - about 1 hour
   - about 2 hours
   - about 3 hours
   - about 4 hours
   - about 5 hours
   - about 6 hours
   - about 7 or more hours
5. **OUTSIDE SCHOOL HOURS**: How often do you usually exercise in your free time so much that you get out of breath or sweat?
   - □ Every day
   - □ 4 to 6 times a week
   - □ 2 to 3 times a week
   - □ Once a week
   - □ Once a month
   - □ Less than once a month
   - □ Never

6. **OUTSIDE SCHOOL HOURS**: How many hours a week do you usually exercise in your free time so much that you get out of breath or sweat?
   - □ None
   - □ About half an hour
   - □ About 1 hour
   - □ About 2 to 3 hours
   - □ About 4 to 6 hours
   - □ About 7 hours or more

7. **DURING THIS PAST SUMMER** (summer 2013) over a typical or usual week, on how many days were you physically active for a total of at least 60 minutes per day?
   - □ 0 days
   - □ 1 day
   - □ 2 days
   - □ 3 days
   - □ 4 days
   - □ 5 days
   - □ 6 days
   - □ 7 days

8. **OVER THIS PAST SUMMER** (summer 2013), about how many hours a week did you usually take part in physical activity that made you out of breath or warmer than usual?
   - □ None at all
   - □ About ½ hour
   - □ About 1 hour
   - □ About 2 hours
   - □ About 3 hours
   - □ About 4 hours
   - □ About 5 hours
   - □ About 6 hours
   - □ About 7 or more hours
## APPENDIX E: SKEWNESS AND KURTOSIS VALUES

### Skewness and Kurtosis Statistics of Variables for Boys Taking PHE and Not Taking PHE First Semester

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<thead>
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<th>Boys Not Taking PHE</th>
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Note: There were 58 boys in PHE for both time points and 29 not in PHE for both time points. $S =$ Skewness. $K =$ Kurtosis. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
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Note: There were a total of 54 girls in PHE for both time points and 55 not in PHE for both time points. $S$ = Skewness, $K$ = Kurtosis. T1 = Time Point 1. T2 = Time Point 2. PBC = Perceived Behavioural Control. SN = Subjective Norms. PA = Physical Activity.
## APPENDIX F: CORRELATIONS FOR BOTH TIME POINTS

### Appendix F

_Correlations Between Variables for Time Point 1 and Time Point 2 together, Boys (n = 84)_

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*Note: *p < 0.05, **p ≤ 0.001. T1 = Time Point 1. T2 = Time Point 2. PA = Physical Activity. PBC = Perceived Behavioural Control. SN = Subjective Norms. Correlations are only for boys who completed both time points.*
### Appendix F

**Correlations Between Variables for Time Point 1 and Time Point 2 together, Girls (n = 106)**

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Note: *p < 0.05, **p ≤ 0.001. T1 = Time Point 1. T2 = Time Point 2. PA = Physical Activity. PBC = Perceived Behavioural Control. SN = Subjective Norms. Correlations are only for girls who completed both time points.