

An Exploratory Study to Examine the Relationship between Academic Achievement and
Physical Activity of Girls in Grades Three to Seven Participating in a Community-based
Physical Activity Program

by

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for the degree of Master of Arts

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DALHOUSIE UNIVERSITY
SCHOOL OF HEALTH AND HUMAN PERFORMANCE

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ABSTRACT

The purpose of this mixed methods study was to better understand the relationship between physical activity and academic achievement of girls in grades three to seven participating in a community-based physical activity program. Seventeen of eighteen possible participants were involved in this study. Findings revealed that there was no relationship found between the intensity, duration, and frequency of physical activity and English grades. There was also no relationship between the intensity, duration, and frequency of physical activity and mathematics grades. Parents were found to be the largest influence on girls' physical activity behaviours. This study contributed to health promotion research by building upon findings from past projects that have found no significant negative relationship to exist between physical activity and academic achievement. Future research may want to focus on providing interventions at the family level to support parents' and girls' participation in physical activity.

LIST OF ABBREVIATIONS USED

AHKC	Active Healthy Kids Canada
AS!BC!	Action Schools British Columbia
BMI	Body mass index
CAT	Canadian Achievement Test
CIHR	Canadian Institutes of Health Research
CLASS	Children's Lifestyle and School-Performance study
CSA	Caltrac
DPA	Daily physical activity
MAT	Metropolitan Achievement Tests
MET	Metabolic equivalent
NSDHPP	Nova Scotia Department of Health Promotion and Protection
NSDOEC	Nova Scotia Department of Education
NSERC	Natural Sciences and Engineering Research Council of Canada
OECD	Organization for Economic Co-operation and Development
PACY	Physical Activity Levels and Dietary Intake of Children and Youth Study
PAQ-C	Physical Activity Questionnaire for Children
PE	Physical Education
SSHRC	Social Sciences and Humanities Research Council of Canada
SPARK	The Sports, Play, and Active Recreation for Kids Study

WHO World Health Organization

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CHAPTER 1: INTRODUCTION

Physical activity is a key component of long-term wellness, affecting overall body health and psychosocial well-being (Active Healthy Kids Canada [AHKC], 2008; Koezuka et al., 2006; Trudeau & Shephard, 2008). Despite the widely discussed benefits, physical activity levels of youth have been steadily decreasing across Canada over the past few decades (AHKC, 2008). Many youth are not gaining the health benefits from physical activity as there is currently an epidemic of obesity and inactivity in the Canadian child and youth population (AHKC). For youth, in Nova Scotia, the *Physical Activity Levels and Dietary Intake of Children and Youth* (PACY) 2005 study reported that participation in daily physical activity in grades three, seven, and 11 had declined from the activity levels previously examined in 2001 (Campagna et al., 2005; Thompson et al., 2009). Campagna et al. reported the most significant change in physical activity rates took place between grades three and seven, declining by 50.7% for boys and 72.2% for girls. Although a significant decrease was found, there is currently no literature discussing the factors contributing to reduced physical activity levels in Nova Scotian youth for grades three to seven. Therefore, grades three through seven were used as study selection criteria for this project.

Recent research has indicated that as well as a general decline in physical activity levels with age, girls were much more likely to reduce their levels of physical activity than were boys (AHKC, 2008; Koezuka et al., 2006). The PACY (2005) study found that girls' physical activity levels declined by 21.5% more than boys from grades three to seven in Nova Scotia (Campagna et al., 2005). Justifiably, this study focused on assessing

girls' activity levels to better understand the physical activity behaviours of young females.

Increasing physical activity levels in youth is particularly important when attempting to determine the best ways in which to combat not only the gender disparities but also the rapidly increasing rates of childhood obesity (Campagna et al., 2005). Any factors that could contribute to increasing activity levels may be worth examining. The 2009 edition of AHKC report card suggested there could be a connection between increased physical activity and improved academic abilities. Doing well academically as a result of participating in physical activity may be a potential motivator to increase activity levels. Several authors found a small, but significant relationship to exist between academic achievement using mathematics and elements of language arts (English in Canada) and physical activity (Carlson et al., 2008; Sigfúsdóttir, Kristjánsson, & Allegrante, 2007). Using these areas of curriculum as measures of academic achievement is particularly useful because they are mandatory in Nova Scotian schools and widely recognized as providing students with knowledge and skills needed for the full participation in society (Organization for Economic Co-operation and Development [OECD], 2009). Therefore, this study focused on reviewing the relationship between physical activity and academic achievement using mathematics and English grades as measures of academic achievement.

Furthermore, the measures used by researchers to examine the relationship between physical activity and academic achievement in youth usually included the frequency and duration of physical activity but rarely the intensity (Ahamed et al., 2007; Carlson et al., 2008; Sallis et al., 1999; Sigfúsdóttir et al., 2007). Examples of such

measures included: teachers' self-report of children's' activity in physical education class (Carlson et al., 2008); questions concerning the level of physical activity youth participated in and how often they sweated per week (Sigfúsdóttir et al.); a *Physical Activity Questionnaire for Children* (PAQ-C) (Ahamed et al., 2007); and the *Caltrac* (CSA) accelerometer (worn by children on only one day per semester and on one weekend per semester) (Sallis et al., 1999). There were a limited number of studies; however, that systematically examined the connection between academic achievement and physical activity and/or reported a strong correlation between the two. Including the measurement of intensity of physical activity, when reviewing the relationship between physical activity and academic achievement, may be an important missing variable in the other research studies. Taking the previous methodologies into consideration, this principal investigator selected self-report as well as a more robust measure of physical activity to examine the relationship between physical activity and academic achievement in grade three to seven girls. Employing a CSA accelerometer, which records information about the intensity, duration, and frequency of physical activity, for eight consecutive days enabled the researcher to provide reliable estimates of usual physical activity patterns of children and youth (Troost, Pate, Freedson, Sallis, & Taylor, 2000). Using the accelerometer for an eight day timeframe allowed further exploration of the association between physical activity and academic achievement abilities as other studies have not used reliable measures of physical activity in past research.

Research has indicated the physical activity behaviours of youth to be associated with a multitude of factors that affect participation levels (AHKC, 2008). The ecological model is a theoretical perspective that recognizes behaviour as being affected by and

influencing an individual's social surroundings (McLeroy, Bibeau, Steckler, & Glanz, 1988). The ecological model suggests that there are many spheres of influence in health promoting behaviours such as intrapersonal factors, interpersonal processes, institutional factors, community factors, and public policy (McLeroy et al., 1988; refer to p. 18).

This thesis was a health promotion research study as it focused on physical activity, as a health behaviour, and how it related to academic achievement within the context of this study's environmental influences. The researcher found the ecological health promotion model was the most appropriate framework as it provided a means to better organize her thesis and to gain a clearer understanding of how to approach the health issue (Cottrell, Girvan, & McKenzie, 2009; MacDonald, 2006; McLeroy et al., 1988; Stokols, 1996). Thus, the framework was used as a behaviour change model to understand the environmental impact on physical activity behaviours.

Since the ecological health promotion model was deemed the most appropriate framework for this study, the model was applied to identify some of the factors influencing physical activity behaviours of girls. Factors of influence in this study included attitudes toward and perceptions of physical activity, parental/guardian influence, and school physical activity practices and policies. In particular, a community-based physical activity program was studied as a factor influencing the girls' physical activity behaviours as it was the study's recruiting location. The ecological health promotion model, therefore, assisted in contextualizing the factors influencing the girls' physical activity behaviours.

In summary, research indicated there was a decline in physical activity in grades three to seven, with a noted gender disparity in physical activity levels between boys and

girls. Research has also supported a positive relationship between physical activity and academic achievement exists; however, there were a limited number of studies that systematically examined the connection between physical activity and academic achievement. The ecological health promotion model was found to be the most appropriate framework for this study and was used as a behaviour change model to understand how multiple factors impacted the girls' physical activity behaviours. Therefore, this study sought to better understand the relationship between physical activity and academic achievement of girls in grades three to seven who participated in a community-based physical activity program. To explore this relationship the primary research question and its subsidiaries were as follows:

PRIMARY RESEARCH QUESTION

Is there a positive relationship between greater academic achievement outcomes and regular, moderate to very hard physical activity of girls in grades three to seven participating in a community-based physical activity program?

SUBSIDIARY QUESTIONS

1. What is the relationship between the intensity, duration, and frequency of physical activity and the girls' mathematic grades (parent/guardian and child self-reported grade)?
2. What is the relationship between the intensity, duration, and frequency of physical activity and the girls' English grades (parent/guardian and child self-reported grade)?
3. How do the girls' attitudes toward and perception of physical activity, parental/guardian influence, school physical activity practices and policies, and the community-based physical activity program influence the physical activity behaviours of girls with different grade outcomes (A/B compared to C/D)?

SIGNIFICANCE

The outcomes of this research study were intended to contribute to two important health promotion concerns: the increasing health challenges to young people as a result of reduced activity and increasing obesity rates, and supporting the participation in physical activity through non-conventional means. This pilot study was built upon the findings of the PACY project (Campagna et al., 2005) by objectively examining physical activity levels of girls in grades three to seven. In addition, it was anticipated that if a positive relationship was found between academic achievement and regular participation in physical activity, parents, school boards and the larger community would be able to use this information to promote this additional benefit of physical activity. Lastly, this study will add to the growing body of literature pertaining to physical activity and its potential impact on academic achievement.

DELIMITATIONS

The study was delimited to:

1. Females who were willing to participate in the study, were in the community-based physical activity program, and between grades three and seven.
2. Mathematics and English as indicators of academic achievement.
3. Factors influencing physical activity behaviours, including attitudes towards and perceptions of physical activity, parental/guardian influence, school physical activity practices and policies, and the community-based physical activity program.

SUMMARY

Physical activity levels in girls continue to decline, contributing to concerns about increasing levels of obesity. While there is some information in Nova Scotia about

several grade levels, little exists about the frequency, duration, and intensity of physical activity in grades three to seven. Conventional measures of academic achievement include grades in mathematics and English. Examining the relationship between physical activity levels and academic achievement can benefit the individual, as well as provide knowledge to parents, school boards, and physical activity programs.

DEFINITION OF TERMS

For the purposes of this paper, the following definitions are provided:

PHYSICAL ACTIVITY: “Any body movement produced by the skeletal muscles that results in a substantial increase over resting energy expenditure” (Tremblay, Shephard, & Brawley, 2007, p. S7).

REGULAR PHYSICAL ACTIVITY: The participation in physical activity on most days of the week (five days) (Campagna et al., 2005).

MODERATE TO VERY HARD PHYSICAL ACTIVITY: The participation in at least 60 minutes of accumulated moderate (3-5.9 Metabolic Equivalent [MET]s) to very hard (≥ 9 METs) levels of physical activity (Campagna et al., 2005).

INTENSITY OF PHYSICAL ACTIVITY (INDEPENDENT VARIABLE): The breakdown of physical activity levels to light (<1.0 - 2.9 METs), moderate (3-5.9 METs), hard (6-8.9 METs), or very hard (≥ 9 METs) (Campagna et al., 2005).

FREQUENCY OF PHYSICAL ACTIVITY (INDEPENDENT VARIABLE): Number of days per week individuals participated in 60 minutes of moderate to very hard activity.

DURATION OF PHYSICAL ACTIVITY (INDEPENDENT VARIABLE): Total number of minutes individuals participated in moderate to very hard activity in an eight-day consecutive period.

ACADEMIC ACHIEVEMENT (DEPENDENT VARIABLES): Outcome of academic achievement as measured by parent and daughter self-reported grades of mathematics and English grades.

MIXED METHODS: Studies focused on collecting and analyzing both qualitative and quantitative information in parallel or sequential periods (Tashakkori & Teddlie, 2003).

ACTIVITY LOG: Record of the date of an activity, the amount of time spent in the activity, type of activity, and intensity of the activity when an accelerometer is not worn.

PHYSICAL ACTIVITY SURVEY: Captures self-reported physical activity information over a seven day consecutive period.

CHAPTER 2: LITERATURE REVIEW

There has been a recent influx of literature suggesting a correlation between physical activity and academic achievement; the following literature review will explore these connections. It will also examine the ecological health promotion model as a framework to investigate factors that influence the physical activity behaviours of youth. The types of methodological tools that can be used in a study assessing the relationship between physical activity and academic achievement will also be discussed. Once the aforementioned topics have been reviewed, a conclusion is presented that highlights current understanding and identifies gaps in the literature that informed this study.

PHYSICAL ACTIVITY AND ACADEMIC ACHIEVEMENT

Despite the recent evidence, there is no general consensus as to whether physical activity has a strong correlation to academic achievement, and in particular if physical activity improves an individual's academic achievement. Studies finding a positive relationship between physical activity and academic achievement will first be explored.

POSITIVE EFFECTS ON ACADEMIC ACHIEVEMENT

A small yet growing body of literature has reported a positive association between physical activity and academic achievement. One particular study reviewed the relationship between body mass index (BMI), physical activity, and nutrition, to academic achievement in 5,810 Icelandic grade nine and 10 secondary school youth (Sigfúsdóttir et al., 2007). Academic achievement was analyzed from the students' self-reported grades in math, English, Icelandic and Danish subjects. These subjects are 'unitary' and required to be taken by all grade nine and 10 students to complete secondary school. The physical activity levels of the students were determined from four

questions addressing their participation levels in physical activity outside physical education time, their level of involvement in school sports clubs/teams, students' levels of involvement in non-school sports clubs/teams, and how often they were winded or sweated per week. It was determined that physical activity had a weak but significant relationship to academic achievement when controlled for other variables.

The data set was further examined in 2010 using the same academic achievement measures; however, the physical activity variable included only two questions around involvement in sports clubs/teams and frequency of feeling winded or sweating per week (Kristjánsson, Sigfúsdóttir, & Allegrante, 2010). An analysis of the data using structural equation modeling revealed that, "physical activity was directly and positively related to academic achievement" (Kristjánsson et al., 2010, p. 10). The authors noted that there are many contextual influences on the relationship between physical health and academic achievement and recognized the complexity of the relationship between the two factors. Furthermore, the authors suggested future research may want to address more diverse population samples and other health behaviours, which influence academic achievements.

Relevant limitations to both studies included the protocol of self-reporting grades and the inaccuracy of students reporting their own physical activities, which may have affected the studies' reliability (Kristjánsson et al., 2010; Sigfúsdóttir et al., 2007). Another limitation of the research included the authors' inability to directly assess the levels of physical activity participants completed (Kristjánsson et al.; Sigfúsdóttir et al.). An additional study conducted in the European Union concerning the relationship between physical activity and academic achievement is a Swedish study by Kwak et al. (2009).

Kwak et al. (2009) examined the relationships between physical activity, fitness and academic achievement. The researchers used the Swedish segment of the *European Youth Heart Study* as a data source to measure the relationship between objective measures of light, moderate, and vigorous intensity physical activity and academic achievement, as well as to measure whether physical fitness is a mediator between the two factors. The researchers randomly selected 1137 ninth grade students for the study. Academic achievement was the sum of the four categories of credit points (zero, ten, 15, 20, with a maximum of 340 credit points) for 17 school subjects (e.g., Swedish, English, Biology, Chemistry, Mathematics) and physical activity was measured using an accelerometer. The accelerometer collected data during the student's waking hours for four consecutive days (two weekdays and at least one weekend day) using one minute epochs. METs were categorized as light (<3 METs), moderate (3-5.9 METs), and vigorous (≥ 6 METs); the participants had to wear the accelerometer for a minimum of three days with ten hours recorded per day. Physical fitness was assessed by students pedaling on a cycle ergometer until exhaustion, where exhaustion was classified by the subjective assessment that the pupil could not continue; the students wore a polar heart rate monitor to capture their heart rates. Linear regression statistical analysis was used to describe the relationship between academic achievement and the various physical activity levels.

Relevant findings reported that for girls, only vigorous physical activity was significantly related to academic achievement, and was not mediated by fitness. Therefore, the researchers found that participating in vigorous activity was related to achieving higher grades. Recommendations by the researchers included future studies to

account for sex differences and to use more diverse intensity levels. A previously published North American study by Carlson et al. (2008) concerning the relationship between physical activity and academic achievement also found sex-specific results similar to the study by Kwak et al (2009).

Carlson et al. (2008) conducted a study in American elementary schools reviewing the effects of physical education on academic achievement in children in kindergarten through to grade five. Data for the study were analyzed in the fall and spring of kindergarten and the spring of first, third and fifth grade. Physical activity was measured by teachers who reported the number of minutes per day and the number of times per week the children participated in formal physical education. Because these data were self-reported, the researchers did not know the student's intensity of physical activity during physical education classes. Academic achievement was analyzed through math and reading tests developed by specialists in school curricula, teachers, and academicians. Mathematics and reading abilities were highlighted in this study as direct assessments of academic achievement. A cross-sectional analysis of academic achievement and physical education levels indicated a small but significant association between girls' highest level of participation (70-300 min/week) in physical education and an increase in math and reading ability; this association was not found in boys. Research studies in Canada have also been conducted regarding the relationship between physical activity and academic achievement (Wang & Veugelers, 2008).

In 2003 the *Children's Lifestyle and School-Performance Study* (CLASS) assessed 5517 grade five students in Nova Scotia gathering both physical activity and school performance data (Wang & Veugelers, 2008). The grade five students were given

a survey that contained validated questions related to physical and sedentary activity from the *National Longitudinal Survey for Children and Youth*. The *Elementary Literacy Assessment* was the standardized test used as the school performance variable, analyzing reading and writing at the individual and school-level. The researchers found that school performance was affected by active living, where sedentary activities negatively affected school performance. The authors suggested that the promotion of active living is important for both the obesity epidemic and cognitive development. The study's strength was its inclusion of objective measure of academic achievement (i.e., standardized literacy test); however, it would be difficult for other studies to use a similar measure of academic achievement for other grades as the literacy test is completed once per year and not administered to all grades.

Although, several studies have reported a positive relationship between physical activity and academic achievement, other studies have documented no significant relationship between these two factors. The following section provides two examples of such studies.

NO CHANGE IN ACADEMIC ACHIEVEMENT

In contrast to the aforementioned studies, several others have concluded that physical activity has no effect on academic achievement. Sallis et al. (1999) evaluated a Southern California two-year health-related physical education program and its effects on academic achievement in grade four students. The *Sports, Play, and Active Recreation for Kids* (SPARK) curriculum required classes to be taught by a certified physical education specialist for 30 minutes at least three days per week broken into two equal sections: a health-fitness activity (dance, running, games- cardiovascular endurance) and

a skill-fitness activity (soccer, basketball, Frisbee- cardiovascular fitness). Out-of-school physical activity was measured by a one-day physical activity recall questionnaire and by the CSA accelerometer, which was worn out of school one weekday and one weekend per semester. Fitness and anthropometric measures, as well as observations of physical education classes were used to assess health-related physical fitness. Academic achievement was assessed using the *Metropolitan Achievement Tests* (MAT6, MAT7) which analyzes reading, mathematics, language and provides a composite score (Basic Battery). The justification for the use of the MAT6 and MAT7 was that the tests used norm-referencing and results were reported as a national percentile ranking. The most significant finding from the study suggested that spending more time on physical education classes had no negative effect on the academic achievement scores in these elementary schools when compared to the national average. Limitations of the study included the lack of direct measurement of physical activity during the school day to assess the student's intensity of activity in the SPARK program.

Ahamed et al. (2007) also found no relationship to exist between academic achievement and physical activity. Ahamed et al. investigated whether grades four and five boys' and girls' academic achievement changed after participation in a British Columbian school-based physical activity intervention. Action Schools! British Columbia (*AS/BC*) was an intervention targeted to increase the physical activity levels in elementary school children by implementing a range of activities throughout the school day and school environment. More specifically, *AS/BC* targeted six school action zones: the school environment, extracurricular, family and community, school spirit, scheduled physical education, and classroom action. Regular physical activity practices for the

study schools included the participation in two-40 minute physical education classes per week. Intervention teachers were asked to incorporate an additional 15 minutes per day of extra physical activity such as skipping, dancing, and resistance exercises to equal a total of approximately 150 minutes of physical activity per week. The *Canadian Achievement Test* (CAT) was used to assess academic achievement across one year of school and included evaluations of mathematics, reading, and language. Finally, the children's physical activity was assessed using the PAQ-C, a seven day self-report evaluation of children's daily moderate-to-vigorous activity levels.

Ahamed et al. (2007) found that even though approximately 10- 15 minutes of physical activity were added to the curriculum per day, the children's academic performance was not compromised. Ahamed et al. cited a significant limitation to the study was the indirect assessment of physical activity levels and suggested the use of accelerometry measures would strengthen the validity of their study. A correlation between physical activity and academic achievement may have existed had the authors used more vigorous measures of physical activity, such as accelerometry.

While it is important to continue to understand how physical activity is related to academic achievement, it is also important to consider how this research is relevant to health promotion practices and physical activity interventions. The ecological health promotion model was the guiding framework used in this research study to examine some of the important factors affecting the physical activity levels of youth.

PHYSICAL ACTIVITY

An epidemic of childhood and adolescent physical inactivity is steadily increasing in both developing and developed countries and is a consequent burden on public health

(Spence & Lee, 2003). Health promotion is a practice that can be used to address the high rates of inactivity in the Canadian youth population (Nova Scotia Department of Health Promotion and Protection [NSDHPP], 2010). In the province of Nova Scotia, the strategic outcomes for the NSDHPP in 2010-2011, were to improve the health outcomes of children and youth (NSDHPP, 2010). Priorities for 2010-2011 were to create supportive physical activity environments, reduce the disparity between boys and girls physical activity levels, and increase the number of students in kindergarten to grade nine who participate in after-school programs. The NSDHPP is continuing to support the *Active Kids Healthy Kids Strategy* which seeks to “increase the number of children and youth who accumulate at least 60 minutes of moderate or higher intensity physical activity on a daily basis” (Active Kids Healthy Kids, 2009, p. 9). Therefore, physical inactivity in the youth population is at the forefront of policy agendas within health promotion communities, especially within Nova Scotia.

AN ECOLOGICAL HEALTH PROMOTION MODEL

Health promotion is a process that acknowledges the complexities of maintaining good health and well-being by recognizing the matrix of interrelations between and among individuals, their health, and their environments (World Health Organization [WHO], 1986). The ecological model is a theoretical perspective that is used in health promotion research, which understands the individual as being surrounded by his/her various interconnected environments (WHO, 1986). The ecological model was developed by Bronfenbrenner (1979) and portrays human behaviour as influenced by and influential to social surroundings (McLeroy et al., 1988). Bronfenbrenner’s model included the microsystem, a setting where the individual interacted, consisting of his/her pattern of

activities, roles, and interpersonal relationships experienced; the mesosystem, the level where two or more microsystems may influence behaviour; the exosystem, a composite of two or more microsystems, one of which did not include the person; and the macrosystem, a larger sociocultural level involving social class structure, cultural values, and the community. Applying this model to health promotion research, McLeroy et al. used Bronfenbrenner's model to describe *patterned behaviour*. McLeroy et al. explained behaviour as being determined by intrapersonal factors, interpersonal processes, institutional factors, community factors and public policy (refer to Figure 1).

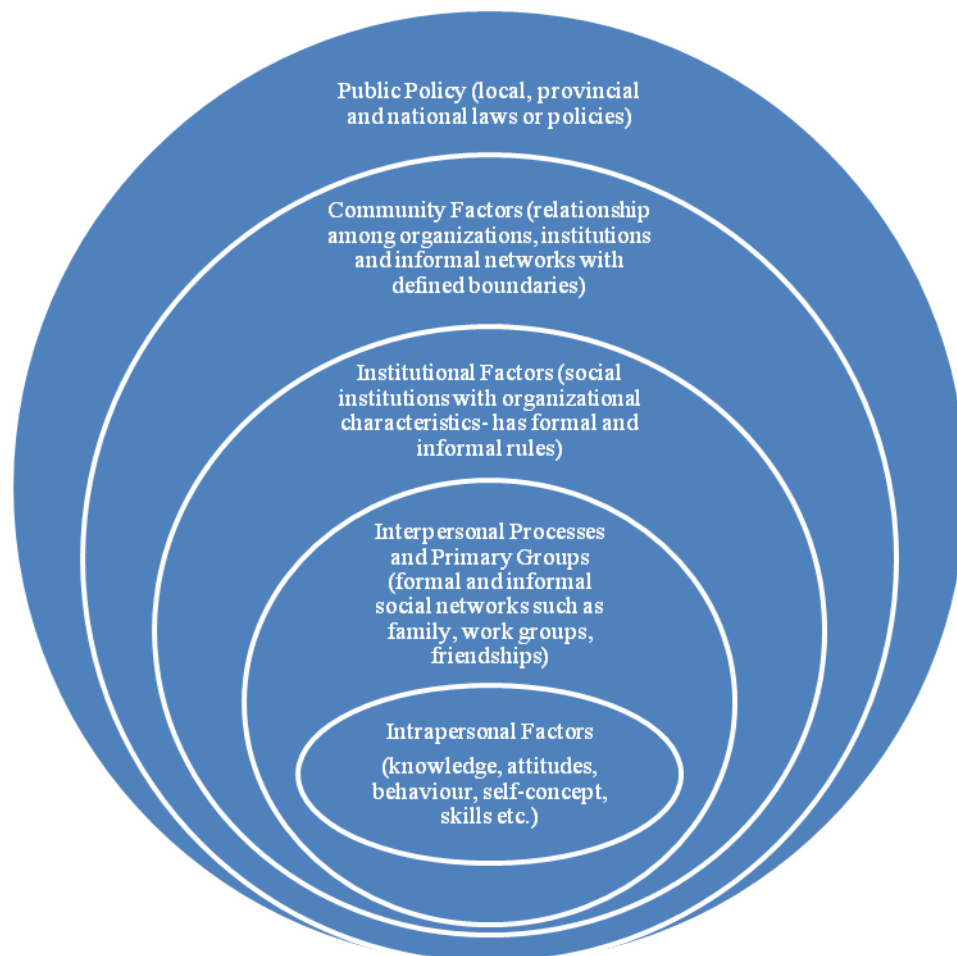


FIGURE 1. AN ECOLOGICAL HEALTH PROMOTION MODEL

Stathi, Gillison, and Riddoch (2009) argue that there needs to be a greater focus on ecological research frameworks, as individual approaches to physical activity research/interventions have had only modest success rates. Researchers have since used various forms of the ecology paradigm to frame their studies as it provides an array of conceptual and methodological tools for organizing health promotion projects (MacDonald, 2006; McLeroy et al.; Stokols, 1996). This researcher found the ecological health promotion model to be a useful organizational tool, as it allowed her to have clearer understanding of how to *attack* the health problem (Cottrell et al., 2009). For the purposes of this review, the ecological health promotion model was utilized to address some of the issues affecting physical activity participation in the Nova Scotian youth population. There are several factors affecting physical activity within each environmental level and it is beyond the scope of this study to review all factors. However, Table 1 outlines some of the factors influencing the physical activity behaviours in the youth population that were considered for this research project.

TABLE 1. APPLICATION OF THE ECOLOGICAL HEALTH PROMOTION MODEL

Environmental Levels	Type	Example
Intrapersonal factors	Factors influencing behaviour, such as attitudes toward and perception of physical activity	Difference between boys' and girls' physical activity participation
Interpersonal processes and primary groups	Parental/guardian influence	Parental/guardian support and participation in physical activity
Institutional factors	Schools	Understanding of schools' physical activity practices and policies in relation to academic achievement outcomes.
Community factors	Community-based physical activity program	Influence of program on physical activity behaviours
Public policy	Implications of study for future research and/or program/policy directions	Contribution of study to health promotion research

PHYSICAL ACTIVITY BEHAVIOURS OF YOUTH

Physical activity for youth can involve anything from organized sports to physical education classes to activities incorporated into daily living (e.g., biking, hiking, skateboarding, etc.). The *Canadian Society for Exercise Physiologists* has defined physical activity as “any body movement produced by the skeletal muscles that results in a substantial increase over resting energy expenditure” (Tremblay et al., 2007, p. S7). In Nova Scotia, 96% of both boys and girls in grade three, 45.3% of boys and 23.8% of girls in grade seven, and 9.7% of boys and <1% of girls in grade 11 met the recommended level of physical activity (60 minutes or more of moderate to very hard activity for a minimum of five days a week) when measured by objective instruments (Campagna et al., 2005). The PACY 2005 study found that participation in daily physical activity for

children and youth in Nova Scotia had been reduced further in grades three, seven and 11 since the 2001 report (Campagna et al.). Physical activity rates declined the most between grades three and seven in 2005, falling by 50.7% and 72.2% for boys and girls respectively (Campagna et al.). The 2001 and 2005 PACY studies did not collect any information regarding physical activity behaviours of youth in grades four to six, leaving an important gap. Although, the CLASS (2003) Nova Scotian study did collect physical activity information (i.e. self-reported physical activity levels) of individuals in grades five (Wang & Veugelers, 2008), no information concerning physical activity behaviours has been collectively gathered for individuals in grades three to seven. Therefore, this research study aimed to address this gap by gathering physical activity behaviour data for Nova Scotians in grades three to seven.

INTRAPERSONAL FACTORS

ATTITUDES TOWARDS AND PERCEPTIONS OF PHYSICAL ACTIVITY

Intrapersonal factors include characteristics of the individual within the ecological health promotion model (McLeroy et al., 1988). Intrapersonal factors involve characteristics such as attitudes and perceptions, including differences that exist between boys and girls attitudes towards and perceptions of physical activity. Gender differences arise in most facets of life, including the degree of involvement in physical activity and the types of activities chosen by each gender (Brustad, 1996; Vilhjalmsson & Kristjansdottir, 2003). Numerous studies found that boys enjoy vigorous, competitive, high-intensity activities and girls prefer medium, non-competitive, low-intensity activities (Brustad; Gibbons & Humbert, 2008; Vilhjalmsson & Kristjansdottir). These differences could be attributed to girls' negative attitude towards physical activity due to their

concern of sweating, having messy hair, and ruined make-up after very hard activity (Whitehead & Biddle, 2008).

Whitehead and Biddle (2008) qualitatively examined girls', aged 14-16, physical activity perceptions and motivations through subjective focus group discussions. It was discovered that when participating in their school physical education classes, girls found it bothersome to sweat since there was not enough time given to attend to their looks following exercise (Whitehead & Biddle). O'Donovan and Kirk (2008) also found issues surrounding femininity that contributed to the overall decline in physical education participation in co-ed classes. Girls perceived the opposite sex to be attracted to 'girly girls' and, therefore, were not participating in as much physical activity in order to appear more attractive to males (O'Donovan & Kirk). Furthermore, during after-school time researchers found girls cited 'teenage reasons' for not participating in physical activity; girls indicated that physical activity was less important than participating in social events such as watching movies, going shopping, going out at night, and dedicating more time to friends and boyfriends (Whitehead & Biddle). These thoughts and behaviours may be applicable to younger girls, as well. Attitudes toward and perceptions of physical activity play a role in girls' physical activity behaviours and will be further explored in this research study. An additional factor that influences children or youths' participation in activities is their parents.

INTERPERSONAL FACTOR

PARENTAL INFLUENCE

Interpersonal processes and primary groups in the ecological health promotion framework include interactions with others in the youth's environments (McLeroy et al.,

1988). For this study, a youth's parents/guardians were the focus. Parents have a significant influence on their child's behaviours and overall lifestyle. A study by Kimiecik and Horn (1998) examined the role parental beliefs had on their child's moderate to very hard physical activity. The researchers administered four different questionnaires to a sample of parents finding that 'fun' was the first reason parents encouraged their children to participate in physical activity (Kimiecik & Horn). AHKC (2009) report card has also indicated that when at least one parent is involved as an administrator (e.g., coach, organizer) in his/her child's sport, the child's participation rate increased by approximately 80%. Participation rates in physical activity can also be influenced by a parent's attitude towards the intensity of physical activity in which he/she encourages his/her child to participate. It was reported that a study by Anderson and Hughes (2009) reviewing parent/child attitudes toward physical activity intensity, that there are gender biases with more parents encouraging boys to participate in vigorous activities than girls. Recommendations by Anderson and Hughes address the need to reduce parents' gender bias and encourage parents to have both their sons and daughters participate in vigorous activities. With these findings in mind, the current study investigated parental impact from the daughter's perspective to gain further insight on how parents are influencing their daughter's physical activity behaviours.

INSTITUTIONAL FACTOR

SCHOOLS' PHYSICAL ACTIVITY PRACTICES AND POLICIES IN RELATION TO ACADEMIC ACHIEVEMENT OUTCOMES

In the ecological health promotion model institutional factors involve social institutions with formal and informal rules (McLeroy et al., 1988). The school environment is one example of an institutional factor that has been reported to have a

direct influence on the participation in physical activity. In *Canada's Report Card on Physical Activity for Children and Youth* (2008), researchers indicated that schools have a unique opportunity to engage the child and youth population during most daytime hours (AHKC, 2008). Over the past few years, there has been an increasing interest in allocating more time for physical activity during the school day, as a tactic to reduce obesity rates in youth (AHKC, 2009). There has been resistance, however, to justifying the removal of time allocated for core school subjects such as mathematics and English as no hard evidence has been presented to support the position that increased daily physical activity is correlated with increased academic achievement levels. Over the last ten years Nova Scotian school boards have gradually recognized that there may be a benefit to increasing physical activity without negatively affecting a child or youth's academic abilities.

Introducing daily physical education in schools may be important to help curb the obesity epidemic; however, more research is required to determine if time taken away from academic school subjects affects youths' academic achievement levels. Limited research in Nova Scotia has been done to better understand the relationship between academic achievement and physical activity. As reported previously, the *CLASS* (2003) study did facilitate this type of study using objective measures of academic achievement; however, the researchers' study population was limited to grade five students, they did not use objective measures of physical activity, and were limited to examining literacy levels only (Wang & Veugelers, 2008).

Although children spend the majority of their day within the school environment, adequate time is available to them for participation in physical activities outside school

time. The community factor, within the health promotion ecological model, captured how physical activity programs outside of school time may influence physical activity participation.

COMMUNITY FACTOR

PHYSICAL ACTIVITY PROGRAMS OUTSIDE OF SCHOOL TIME

Community factors in the ecological health promotion environment involve the relationship among organizations, institutions and informal networks with defined boundaries (McLeroy et al., 1988). Physical activity programs outside school time represent a community factor.

Physical activities that take place outside school time can provide further opportunity for girls to meet their daily physical activity recommendations. A project by Jago, Jonker, Missaghian, and Baranowski (2006) sought to better understand whether a four week Pilates after-school program was enjoyable for girls and had any effect on their body mass, waist circumference, and blood pressure. Thirty 11 year old girls were recruited from an after-school YMCA program in Houston, Texas. The classes were held every day for four weeks and 16 girls participated in the classes while 14 were assigned to a control group. The intervention found that there was a small decline in body mass index (BMI) percentiles in the participant group. The girls also enjoyed the classes and attended on a regular basis. This study indicates that even though there was not a great reduction in BMI percentiles, it was effective in revealing the type of activity younger girls enjoyed.

An additional program that sought to increase physical activity participation during non-school time was *Project Destiny*, a pilot project that took place over five

weeks during the summer of 2002 targeting non-athletic, young girls in the Los Angeles area (Kyles & Lounsbery, 2004). There were 15 girls ranging in ages from 11 to 14 years who participated. The daily routine included athletic activities (that did not focus on competition), health and wellness workshops, fine arts projects, leadership exercises, cooperative games, and guest speakers. Through the observation of the girls' participation, peer interactions, and participant impressions it was found that fostering a positive, fun, and safe atmosphere were key to engaging non-athletic, younger girls. As well, Kyles and Lounsbery found that employing knowledgeable coaches, who provided quality instructions, may have led to the girls receptivity and own initiation of competitive activities. Although this project did outline how to effectively increase participation in non-athletic girls, the study did not reveal whether there was an increase in physical activity levels, limiting the scope of this study.

Thus, the studies by Jago et al. (2006) and Kyles and Lounsbery (2004) were effective in increasing participation rates of physical activity and providing further opportunities to participate in activity within the community environment. It may be that physical activity programs outside school time that do not focus on competition or are non-traditional activities, such as yoga, may be more fun and of more interest to girls. The following section will review methodological tools that could be used to study the relationship between physical activity and academic achievement.

METHODOLOGICAL TOOLS

MIXED METHODS AND TRIANGULATION

Mixed methods research includes the collection and analysis of both qualitative and quantitative information in parallel or sequential periods (Tashakkori & Teddlie,

2003). The concurrent triangulation strategy can be used to corroborate quantitative research with qualitative findings (Creswell, 2003). Triangulation is using several methods to understand the same piece of a research study (Jick, 1979). When mixed methods research is triangulated and the quantitative and qualitative data come to a conclusion, this may provide a better understanding of that aspect of the research study (Jick). This tool may provide the researcher with a more accurate conceptualization of the factors influencing her study sample.

ACADEMIC ACHIEVEMENT SURVEY

Studies measuring the relationship between academic achievement and physical activity have used varying measures to determine academic achievement levels. Researchers have used standardized measures such as the MAT6 and MAT7 (Sallis et al., 1999) and the CAT (Ahamed et al., 2007) to determine academic achievement. Other researchers have used more subjective measures of academic achievement such as self-reported grades (Sigfúsdóttir et al., 2007). Using grades such as mathematics and English subjects as measures of academic achievement may be useful in this study because they are mandatory in Nova Scotian schools and widely recognized as providing students with knowledge and skills needed for the full participation in society (OECD, 2009).

OBJECTIVE VERSUS SUBJECTIVE PHYSICAL ACTIVITY DATA COLLECTION TOOLS

Various researchers have found a difference between youth's physical activity when objectively measured compared to subjective measures. Findings indicated that youth have consistently rated their physical activity levels higher in self-reported physical activity surveys than levels objectively determined (AHKC, 2008). There are many possible explanations for this discrepancy; for example, youth may have an intrinsic

social desire to appear active and, thereby, self-report higher levels of activity than actually obtained (AHKC). The difference between what is reported by youth and what actually occurs could also be attributed to difficulties in physical activity recall or differences in defining 'physical activity' (AHKC, 2009).

Thus, self-report measures may not accurately represent youth's physical activity levels. Self-report measures may be more useful to understand perceptions about youth's physical activity abilities (AHKC, 2009). Conversely, studies such as the 2001 and 2005 PACY study that use a CSA/Actigraph accelerometer to objectively measure intensity, duration, and frequency may better represent activity levels (Campagna et al., 2005). Including the measurement of intensity of physical activity, when reviewing the relationship between physical activity and academic achievement, may be an important missing variable in the other research studies. This may be why studies are not finding a strong correlation between academic achievement and physical activity.

Taking the strengths of subjective and objective measurements into account, it may be useful to use both methodologies to gain the most accurate measurements of physical activity. A CSA accelerometer and physical activity survey can be used to capture both objective and subjective physical activity.

INTERVIEWS

Interviews are used to capture the perspective of the interview participant on a particular subject matter (Kvale, 1996). Interviews involve conversations that are controlled by the interviewer (Kvale). Qualitative data are generated from an interview with the perspectives of the participant interpreted into meaningful experiences. Qualitative methodologies have been used in other studies to better understand girls'

physical activity experiences (O'Donovan & Kirk, 2008; Whitehead & Biddle, 2008).

Interviews may help the girls in this study to detail their thoughts and feelings concerning their own physical activity experiences within each ecological health promotion environment.

CONCLUSION

After reviewing the literature, it became clear that it was appropriate to recruit individuals in grades three to seven to participate in the project. There was a gap in the physical activity data in these grades and they represent a grade range where a significant decline in physical activity levels was found in Nova Scotia's youth (Campagna et al., 2005).

A gender disparity was found to exist between physical activity levels in the female and male population (Campagna et al., 2005; Koezuka et al., 2006). Due to the continued disparity, it was important to focus this project on the young, female population's physical activity levels.

Studies finding a significant, but weak relationship between academic achievement and physical activity used the subjects of mathematics or elements of English (Carlson et al., 2008; Kwak et al., 2009; Sigfúsdóttir et al., 2007). Mathematics and English subjects are also recognized as areas of learning needed for adulthood and skills sets necessary for the full participation in society (OECD, 2009). This project, therefore, used math and English grades as the academic achievement variables.

Given that many studies did not use objective measures of physical activity, it was useful for this project to use an instrument, such as a CSA accelerometer to capture

intensity, duration, and frequency levels (Ahamed et al., 2007; Carlson et al., 2008; Sallis et al., 1999; Sigfúsdóttir et al., 2007).

This research study used the ecological health promotion model to determine the environmental influences on participants' physical activity behaviours. Influential factors such as attitudes towards and perceptions of physical activity (O'Donovan & Kirk, 2008; Whitehead & Biddle, 2008), parental influence (Anderson & Hughes, 2009; Kimiecik & Horn, 1998), schools' physical activity practices and policies (Nova Scotia Department of Education [NSDOEC], 2002), and physical activity outside of school time (Jago et al., 2006; Kyles & Lounsbery, 2004) were used as environmental influences in this study. Appropriate methodological tools that were used in this research study were also discussed. The following chapter will describe the methodology of this research project and further detail the methodological tools used to examine the relationship between physical activity and academic achievement.

CHAPTER 3: METHODOLOGY

The purpose of this research study was to gain a better understanding of the relationship between physical activity and academic achievement of girls in grades three to seven, who participated in a community-based physical activity program. This objective was guided by the following main research question and its subsidiaries.

PRIMARY RESEARCH QUESTION

Is there a positive relationship between greater academic achievement outcomes and regular, moderate to very hard physical activity of girls in grades three to seven participating in a community-based physical activity program?

SUBSIDIARY QUESTIONS

1. What is the relationship between the intensity, duration, and frequency of physical activity and the girls' mathematic grades (parent/guardian and child self-reported grade)?
2. What is the relationship between the intensity, duration, and frequency of physical activity and the girls' English grades (parent/guardian and child self-reported grade)?
3. How do the girls' attitudes toward and perception of physical activity, parental/guardian influence, school physical activity practices and policies, and the community-based physical activity program influence the physical activity behaviours of girls with different grade outcomes (A/B compared to C/D)?

These questions were answered through a mixed methods approach to data collection, using a concurrent triangulation strategy. The ecological health promotion model (McLeroy et al., 1988) was incorporated into the strategy to further explore how

environmental factors influenced the physical activity behaviours of girls in the context of this study.

This chapter will discuss the pilot study, give a detailed step-by-step outline of the data collection process, explain the data collection tools and the data analysis, and will conclude with a brief discussion on the study's validity and credibility.

PILOT STUDY

Once approval was given by the Dalhousie Research Ethics Board on March 10, 2010, the principal investigator conducted a pilot project with a girl in grade six who lived in a Nova Scotian Municipality. A pilot study was conducted to provide the researcher with feedback on the academic achievement and physical activity survey questions, as well as have the participant provide feedback on what it was like to wear an accelerometer for eight consecutive days. The participant completed the academic achievement and physical activity surveys prior to and post the one week period she wore the accelerometer. The researcher also conducted an interview with the pilot study participant after she wore the accelerometer. Modifications to the tools were made based on pilot study findings and submitted as an amendment to the ethics board.

When the researcher compared the pre and post physical activity survey the participant completed, her self-reported level of activity declined. This was expected as she was off from school during March break when completing the second survey. There were no changes in the academic achievement survey when the pre and post tests were compared. The researcher determined from the pilot study and other sources of information that there were changes that should be made to the tools. These changes were made to an approved ethics document and submitted as an amendment (Appendix A,

p.97). The amended tools, approved by Dalhousie Research Ethics Board on March 26, 2010, were the final product given to the research participants.

STUDY POPULATION

The study population consisted of girls in grades three through seven who were involved in a community-based physical activity program. The focus on girls in this study was due to the gender disparity that existed between boys and girls physical activity levels (Campagna et al., 2005). It was found that both boys and girls physical activity declined as they aged; however, girls' levels of activity declined at a much faster pace than boys (Campagna et al.) Therefore, this study examined girls' physical activity behaviours and how physical activity was related to their academic achievement.

RECRUITMENT LOCATION AND PROGRAM DESCRIPTION

The community-based physical activity program selected was based out of various locations in Nova Scotia. The program was non-competitive and involved elements of yoga, which was discussed in the literature as a physical activity that may increase girls' physical activity participation rates (Jago et al., 2006; Kyles and Lounsbery, 2004). The program involved higher intensity levels of activity because of its focus on martial arts skills. Each class involved both boys and girls and was broken down into four 15 minute blocks of time over a one hour period. The first block was a warm-up consisting of stretches, jogging and meditation. The second block focused on accomplishing a martial arts skill; the skills include kicking, blocking, and other defensive tactics that were a combination of traditional martial arts such as Tae Kwan do, karate, jujitsu, amongst others. The third block of time was a life skills lesson and group discussion that was mostly centred on conflict resolution, however, lessons on proper

nutrition, the benefits of physical activity and others were given. The last block of time was an opportunity for the program participants to take part in a game. The game enabled the children/youth to participate in active play, with an overall goal to help individuals enjoy their physical activity experiences in the classes.

A unique aspect of the community-based physical activity program was the addition of a leadership training program. During the first two blocks of time, students on the leadership team helped the class instructors lead the warm-up and demonstrate the martial arts skills for the younger students. Any student who was nine years old or older or who had obtained their Blue belt was eligible to be on the leadership team and was to act as a role model for the younger participants. The leadership team was to encourage individuals in the class to complete a task, and they were to resolve any conflict that might develop between students. The objective of the leadership team was to encourage the older student to become peer leaders. Some of the girls who participated in this study were on the leadership team and assumed the role of peer leader in the physical activity classes. The role of peer leadership was not reviewed in this study; however, it may be a factor in future studies of this physical activity program.

METHODOLOGICAL PROCESS

The process that was used for this study is represented in Figure 2.

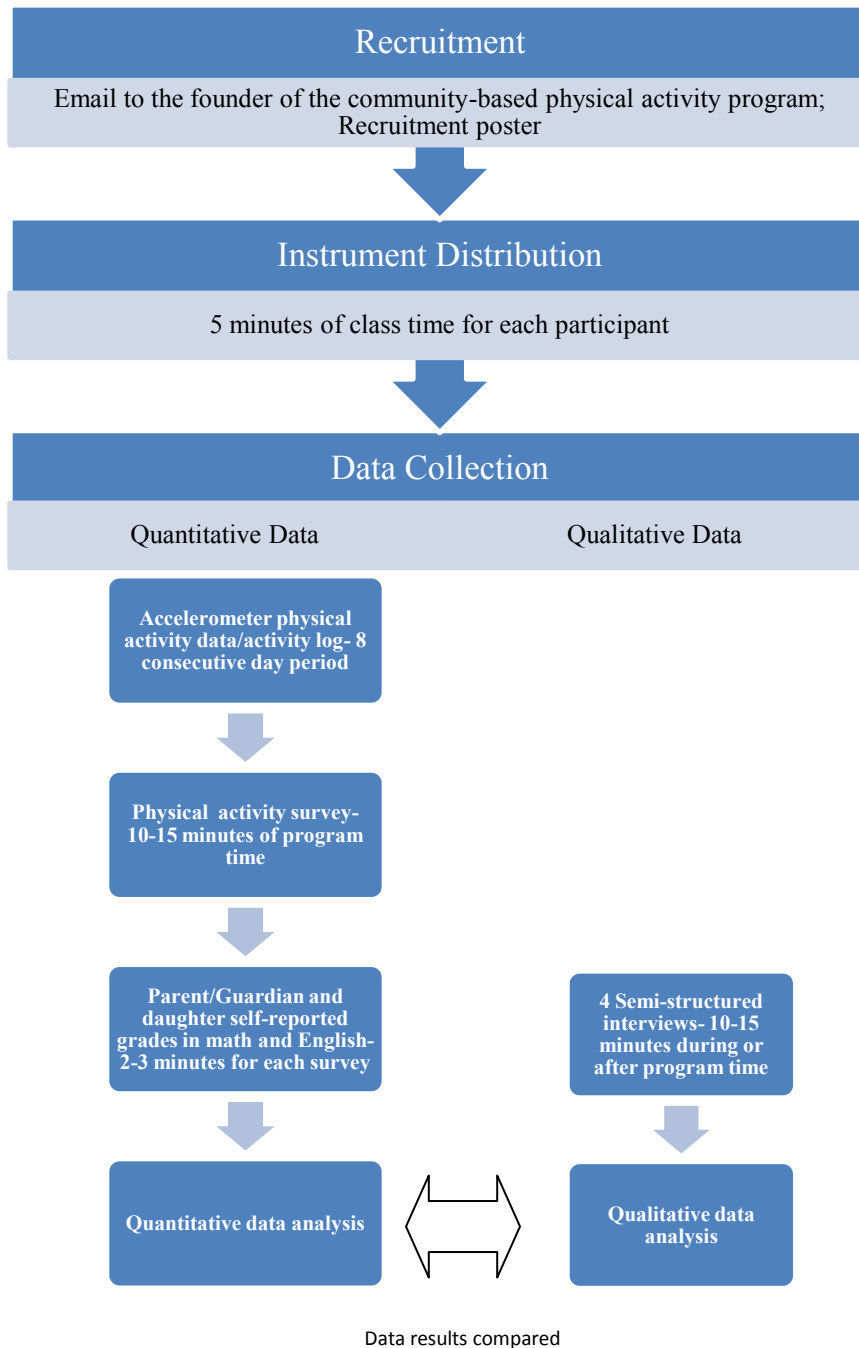


FIGURE 2. METHODOLOGICAL PROCESS

RECRUITMENT

The initial aim of the study was to recruit 40 participants for this research project from a Nova Scotian school. The school board was unable to commit to the project since there were too many similar studies previously approved for the 2009/2010 school year.

The researcher was led to a community-based physical activity program by her Master's thesis Supervisor, Dr. Laurene Rehman. The organization held regularly scheduled classes involving physical activity. Therefore, an email was sent to the founder of the program (Appendix B, p. 98), to determine the potential interest of the organization's participation in the proposed study. This email was followed up with a phone call requesting the use of the centres as recruiting locations. In the phone call, the program founder agreed to allow the researcher to recruit from her organization. Due to the major changes in her study's population and consequently recruitment and data collection methodology, the researcher underwent multiple revisions and re-submissions to the Dalhousie Research Ethics Board to modify her documents to reflect the changes in her new strategy.

Immediately after the researcher received her amendment approval, she gave recruitment posters to the founder to distribute to parents during the program classes (Appendix C, p. 99). The poster was also placed on the program's web page for parents to view at their leisure. The following weekend, the principal investigator participated in the program classes with the boys and girls, as well as facilitated the life skills lesson in each of the classes about the benefits of physical activity and proper nutrition. The lesson was based on *Canada's Food Guide to Healthy Eating* and information from her literature review. After the life lesson the principal investigator distributed the child information (Appendix D, p.100) and authorization forms (Appendix E, p.102) to all girls who were eligible.

Participating in the class with the students and conducting the life skills lessons allowed the researcher to familiarize herself with the organization, class structure, and the

students who were in the program. She observed that the students became more comfortable with her presence throughout the weekend and started to initiate conversations with her about physical activity and her study. Parents also began to initiate conversations with the researcher as he/she saw that his/her child was speaking with the researcher; this allowed the researcher to converse with the parents about her project, ask about their daughter's potential interest in the study, and to forward any information to those that who may have been eligible for the project, if they did not have an eligible daughter in the program themselves.

During the second weekend of recruitment, the researcher conducted a short five minute presentation for those girls in grades three to seven who had not previously heard about her research project (Appendix F, p. 106). The researcher also collected information and authorization forms from the girls who had been given the documents the previous weekend. Some parents and participants who did not attend class the previous weekend either decided to be in the study right away or took the forms home and made a decision about the study within the following two days. Overall a total of 17 girls in grades three to seven out of 18 eligible participants in the entire community-based physical activity program were fitted with accelerometers. Seventeen of the girls' parents also participated in the study.

INFORMED CONSENT

Girls in grades three to seven do not have the decisional capacity to provide informed consent; therefore, both child information forms and authorization forms were distributed by the principal investigator to potential participants and their parents (Appendix D, p.100; Appendix E, p.102). Verbal assent was granted by child participants

when the principal investigator asked the girls if they understood the study and if they were willing to participate.

DATA COLLECTION

After providing written consent and verbal assent to participate in the study, the girls were fitted with accelerometers. The girls were called out of class one at a time or were fitted after their class was finished. While the researcher was preparing the equipment the girls were asked to read through the accelerometer instruction sheet (Appendix G, p.107) and activity log form (Appendix H, p. 108), giving them an opportunity to ask any questions about the study. The participants were instructed to wear the instrument at all times, except when sleeping, swimming, bathing or showering, similar to procedures used by Campagna et al. (2005). They participants were also asked to have their parents complete a physical activity log. The parents were to record the time of day, length of time, the type of physical activity and the physical activity intensity in the activity log, if their daughter's physical activities were completed when the accelerometer was not worn. The researcher asked the participants to take home the activity log form and the accelerometer instruction sheet for reference if they had any questions about the equipment. The principal investigator followed up with a phone call mid-week to respond to any questions, reminded parents to bring the equipment to the next weekend's class, confirmed with parents/guardians that one person would be filling out a short survey when they dropped off their daughter to class, and to reminded parents/guardians that their daughter would also be filling out a survey and may be participating in an interview.

DATA COLLECTION TOOLS

ACCELEROMETERS

Over an eight consecutive day period participants were asked to wear a CSA accelerometer (Actigraph model 7164) similar to the device used by Campagna et al. (2005). Eight days were determined to be an appropriate time period to wear the accelerometers as it better captured a full seven day time frame. The accelerometer gathered data that determined the girls' intensity, frequency and duration of physical activity throughout the eight day period. The accelerometer has the ability to determine an individual's level of activity, including light, moderate, hard or very hard activity rates. Each level of activity was calculated using the MET equation (Thompson et al., 2005; refer to Figure 3).

$$[\text{METs} = 2.757 + (.0015 \times \text{counts/min}) - (0.08957 \times \text{age [yrs]}) - (0.000038 \times \text{counts/min} \times \text{age [yrs]})]$$

FIGURE 3. METABOLIC EQUIVALENT EQUATION

One MET of activity was determined for each minute and was categorized as light, moderate, hard or very hard.

The accelerometers were borrowed from Dr. Laurene Rehman of Dalhousie University. Similar accelerometers were used in the PACY 2001 and 2005 study. The units were placed on the right hip of the girls to detect vertical accelerations ranging in magnitude from 0.05 to 2.00 Gs with a frequency response of 0.25–2.50 Hz; the tools also collected these data in 60 second intervals (Campagna et al., 2005). The units were to be worn from the time the girls woke up to when they went to bed. The instruments were worn under the participant's clothing against the skin or on top of the individual's

skirt/pants, while held firmly in place in a velcro pouch and secured with an adjustable strap (Campagna et al.).

PHYSICAL ACTIVITY AND ACADEMIC ACHIEVEMENT SURVEYS

At the end of the eight day period the girls were asked to return the accelerometers and activity logs to the researcher. All accelerometers were collected; however, less than half of the parents returned the activity logs. The parent academic achievement surveys (Appendix I, p. 109) were completed either at the beginning or end of the community-based program class depending on whether the parent came into the building to drop off or pick up his/her daughter. The surveys were given to the parents on a clipboard, along with a copy of their consent/information form; the document was completed in approximately two to three minutes either outside the community-based physical activity program classroom or in a separate space from where the students were participating in class. The girls' physical activity surveys (Appendix J, p. 110) and academic achievement surveys (Appendix K, p. 117) were also completed in a separate space from their program classroom, in most cases. In one location, the participants completed the forms in the fitness facility's upstairs room that was not being used for activity classes. At the second location, the surveys were either completed in a deserted hallway or in a private room when one became available. In the third location, there was only one large room where the program classes took place; therefore, the researcher used a space away from where the other students were participating in class to have the girls complete the physical activity and academic achievement surveys.

Despite the researcher conducting a pilot study to determine whether the language was appropriate in the surveys for the participants, some girls found it difficult to answer

the physical activity questionnaire. The researcher decided after the first day of data collection that if she found any of the girls were struggling with the survey she would read through the document with the individual or group of individuals. Reading the questions out loud seemed to allow the girls to process the information more easily, verbally answer questions and then copy the answers to the sheet. In some cases, the parent would assist the participant with the surveys.

SEMI-STRUCTURED INTERVIEWS

Four of the 17 participants were purposively sampled to take part in an individual interview (Appendix L, p. 118). The interview was used to gain a contextual understanding of the girls' attitudes towards and perceptions of physical activity, parental/guardian influence, school physical activity practices and policies, and the community-based physical activity program. They were also asked how the factors influenced their physical activity and academic achievement behaviours. The initial aim of the interview was to sample girls with different grade outcomes (A/B compared to C/D); however, the researcher found that most of the participants had higher grades in both mathematics and English. The researcher had to modify her data collection technique and choose girls with whom she felt she had developed a rapport over the data collection period. The participants were also selected from those individuals where both the parent and participant had consented to the interview.

All four interviews were conducted on-site in a private room. The first two interviews took place in a private office. Both interviews were briefly interrupted, although it did not seem to negatively impact the participants and did not appear to alter the overall flow of the interview. The last two interviews were in a different space that

allowed for fewer interruptions. The interviews were between ten and 15 minutes in length. The interviews were recorded by a digital tape recorder and transcribed verbatim by an expert transcriber.

USE OF QUOTATIONS

The researcher wished to use quotations from the research participants in the results/presentation of the data; therefore, the participant's parents were asked in the consent form to allow quotes from their child to be used. Verbal assent was granted from the girls to use their quotes before the interview commenced. Consent was given by all parents and participants. In the dissemination of the study's findings, pseudonyms were used for the quotes.

COMPENSATION

Compensation was offered to participants through a random draw for one individual to win a \$50 dollar gift certificate for *Source for Sports*, a local sporting goods store.

RISK ANALYSIS

The accelerometer was a small, light-weight instrument attached around the waist that caused the participant minimal discomfort while being worn. The nature of the study was to collect usual physical activity practices; thus, the girls were not asked to participate in any activity other than their normal activity practices.

CONFIDENTIALITY AND ANONYMITY

The participants in this study were assigned a code number. A list of names and matching codes were stored in the project researcher supervisor's office (Dr. Laurene Rehman) at the School of Health and Human Performance at Dalhousie University. Only

the researcher and her supervisor had access to this list. The data will also be kept in a locked filing cabinet in the supervisor's office for a minimum of five years. The information will be destroyed by the supervisor after that time in keeping with the Tri Council Policy Statement (Canadian Institutes of Health Research [CIHR], Natural Sciences and Engineering Research Council of Canada [NSERC], & Social Sciences and Humanities Research Council of Canada [SSHRC], 2010).

The participants should not have felt that being involved in this study was a risk to the individual's reputation or have a risk of reprisal. However, some of the data were collected in a face-to-face interaction with the researcher (i.e., surveys, one-on-one interview) limiting participant anonymity. Participants were made to understand that their fellow group members may have known they were participating in the project. The steps taken to maintain the confidentiality of the participants were that the principal investigator coded the data collected, ensured the information written did not have any identifiers, and stored and destroyed the data according to the Tri Council Policy Statement procedures.

DATA ANALYSIS- QUANTITATIVE DATA

All quantitative data were analyzed using SPSS 15.0 statistical analysis program for Windows.

ACADEMIC ACHIEVEMENT DATA

Participants in the study attended schools in two separate school boards. The girls reported three different scales to represent their academic achievement levels. The scales included A, B, C, or D; 1, 2, 3, 4, 5; and C, U, R, D. The first two scales are, "codes for the academic achievement of a student in relation to the outcomes taught during that time

period. The C, U, R, D are codes used for the Learner profile items in relation to work habits and social development” (Anonymous, personal communication July 13, 2010). The researcher grouped the variables and gave them a numerical rating of 1) A, 5, 4, C; 2) B, 3, U; 3) C, 2, R and 4) D, 1, D. Three groupings were placed on the top end of the cut score, with the lowest bin representing a ‘does not meet’ variable. If the participant gave two answers or a one answer question, the data were discounted. Descriptive statistics, Cohen’s kappa and the coefficient of variation were used to analyze the academic achievement findings.

ACCELEROMETER DATA

Accelerometer physical activity information was initially compiled into raw data excel files and then these files were processed by a macro that was used by the researchers of the PACY study (Campagna et al., 2005). The macro organized the physical activity information using the participants age (years), weight (kg), school, recess and lunch start times and school, recess and lunch end times. The macro required all of these fields to be filled in order to process the physical activity information. Age of the participants was asked for on the physical activity survey. Age was used in the macro to modify when school, recess and lunch times would take place. The weight of the participant was reported as a general approximation from Statistics Canada, since this variable did not factor into a usable equation for this study. Typically weight was used to report on calories burned by individuals, which was not being studied in this thesis.

Accelerometer data were reported as:

1. The number of days participants wore the accelerometer for a minimum of four hours – PACY 2005 study discounted any days the accelerometer showed more than 20 hours of inactivity (Campagna et al., 2005).
2. The average daily minutes of moderate, hard and very hard activity, including the activity log information (activity log information included the date of the activity, the intensity of the activity, and the duration of the activity).
3. The average daily minutes of moderate to very hard activity, including the activity log information.
4. The average total minutes of moderate to very hard activity achieved by the participants in an eight day period, including the activity log information – any days that did not meet the four hour minimum were discluded.
5. The number of days participants achieved 60 minutes of moderate to very hard levels of activity, including the activity log information (Campagna et al., 2005).
6. The time of day individuals achieved the most minutes of moderate to very hard activity, not including the activity log information because time of day could not be distinguished using this tool. This analysis included all of the days the accelerometer was worn, not just those worn for a four hour minimum.
7. The day of the week individuals achieved the most minutes of moderate to very hard activity.

These data were analyzed using descriptive statistics, correlation analysis and one-way ANOVA.

PHYSICAL ACTIVITY SURVEY.

The physical activity survey was compiled into an SPSS file where the data were analyzed using descriptive statistics. Descriptive statistics included frequencies and crosstabs. Questions concerning non-physical activity events were reported as the average minutes and average number of days the individual participated in the activity. The self-reported activities the individuals participated in during the data collection period were compiled to represent the average daily minutes of *moderate*, *hard* and *very hard* activity and the total minutes of moderate to very hard activity in a one week period. Ridley, Ainsworth, and Olds (2008) method was used to assign the MET levels for the girls' self-reported physical activities. Ridley et al. (2008) assigned MET values for youth by evaluating other studies by Ridley and Olds and reviewing the *Compendium of Physical Activities* by Ainsworth et al. (2000) for adults. Ainsworth et al. also classified MET values for youth by using published and unpublished data, as well as published literature.

Questions in the physical activity survey about the time of day and the intensity of activity the individual participated in during that time period were reported as the time of day individuals participated in the most physical activity of moderate to very hard intensity. The day of the week that the participant reported they participated in the most activity was also analyzed using frequency statistics. If participants reported two answers for a one answer question the answer was discounted. If participants reported a range of minutes they participated in an activity, an average between the two answers was included in the data set.

DATA ANALYSIS – QUALITATIVE DATA

ACCURACY, TRUTH VALUE, AND RELIABILITY OF THE DATA ANALYSIS PROCESS

The information gained from the interviews was analyzed using descriptive, thematic analysis (Boyatzis, 1998). The analysis took place after all of the data had been collected for the research study. The researcher reviewed each transcript separately, coding the interviews and memoing ideas concerning possible relationships between the codes. The researcher then analyzed the interviews together, re-assessing the codes and compiling them into a codebook. The researcher began an exploratory process of organizing her information using both the codes, memos and field notes that were recorded to depict a more accurate description of the qualitative data. Meaningful themes or indicators began to emerge; the concepts were constantly compared between and within the girls' interviews. The researcher consulted her supervisor, who had also reviewed the transcripts on various occasions, to discuss re-occurring themes. This was to better ensure she was staying true to the data and that the researcher was recording similar themes to her supervisor to maintain consistency. The themes were also discussed in relation to her research questions and the ecological health promotion model. The researcher created a one page outline of the interview themes and phoned her participants to validate the findings (Appendix M, p. 120). The principal investigator then triangulated the data. The qualitative data was used to either validate the quantitative findings or explain differences between the two data sets (Jick, 1979).

RELIABILITY AND VALIDITY OF THE DATA COLLECTION TOOLS

ACCELEROMETER AND ACTIVITY LOG

The accelerometer and activity log were given to the participants over an eight day period. An eight day timeframe was to better ensure a seven consecutive day data collection period. Previous research has indicated that at least a seven day data period provides reliable estimates of usual physical activity patterns of children and youth (Trost et al., 2000). The accelerometer has been found to accurately record physical activity data for youth in studies such as Ekelund et al. (2001). Ekelund et al. discovered that when measuring physical activity of nine year old girls in Sweden the accelerometer accurately calculated the total amount of physical activity. This instrument was also found to be a valid and reliable tool when measuring physical activity data for children and youth in other studies (Campagna et al., 2005; de Vries et al., 2009; Trost et al., 1998). The accelerometer could not be worn when sleeping, swimming or showering; therefore, the participant's parents were given an activity log to record the date of an activity, the amount of time spent in the activity, type of activity, and intensity of the activity when the accelerometer was not worn. The activity log provided the researcher with the opportunity to capture the activities the participants were taking part in throughout the data collection period.

RIGOUR OF DATA COLLECTION

QUANTITATIVE DATA - INTERNAL AND EXTERNAL VALIDITY.

There were various threats to the internal validity of this study, one such being reactive measurements. Reactive measurements occur when the testing process stimulates change instead of acting as a passive record of behaviour (Portney & Watkins, 2000). It is

possible that the Hawthorne effect could have occurred and individuals selected for this research project may have altered their physical activity habits because of a social desirability to be perceived as active persons. The researcher also participated in some of the physical activity program classes with the girls, which may have caused the girls to alter their physical activity habits. Girls who consented to participate in the study may be those who are physically active, which may result in a non-representative sample of active or inactive persons. Furthermore, the external validity of the study is limited due to the specificity of the population and the short timeline of the project

QUALITATIVE DATA – TRANSFERABILITY, CREDIBILITY, DEPENDABILITY

The transferability of the qualitative findings is also limited because of the specificity of the population and the short timeline of the project. The researcher maintained the credibility of her findings by consulting the interview participants after her themes were developed. All participants agreed with what the researcher had determined to be the main themes. The researcher's study was not audited by another researcher to determine dependability; however, the researcher did consult her supervisor on her findings at various times in the study to ensure she was staying true to the data.

SUMMARY

The methodological process that was discussed in this chapter detailed the study population, recruitment location/program description and recruitment strategy. A sample of 17 of 18 girls in grades three to seven who participated in the community-based physical activity program were the study participants. Seventeen of the girls' parents also participated in the study. Informed consent and instrument distribution were described for the accelerometer, activity log, physical activity survey, and academic achievement

survey. The data collection and data analysis processes were detailed for this mixed-methods study outlining both quantitative and qualitative procedures. The reliability and validity of the research were outlined to show how the researcher's study maintained credibility throughout the methodological process. Results of the study will be discussed in the next chapter detailing both quantitative and qualitative outcomes.

CHAPTER 4: RESULTS

This results chapter is organized according to the main research question and the subsidiary quantitative and qualitative research questions used to guide the data collection process. The research findings are then triangulated to examine how the quantitative and qualitative data support or contradict each other.

DEMOGRAPHIC INFORMATION

Table 2 below outlines the demographic information of this study’s participants:

TABLE 2. DEMOGRAPHIC INFORMATION OF STUDY PARTICIPANTS

Age of Participants	School Grade	Location	Income Levels	Family Structure
Age 8 n=3, 17.6%	Grade 3 n=8, 47.1%	100% lived in the same Eastern Canadian Municipality	\$30-49,999 (n=3, 17.6%)	Living with both parents (n=13, 76.5%)
Age 9 n=6, 35.3 %	Grade 4 n=4, 23.5%		\$50-79,999 (n=4, 23.5%)	Living with mother and not father (n=2, 11.8%)
Age 10 n=4, 23.5%	Grade 5 n=1, 5.9%		≥\$80,000 (n=10, 58.8%)	Living with mother and partner (n=2, 11.8%)
Age 11 n=2, 11.8%	Grade 6 n=2, 11.8%			
Age 13 n=2, 11.8%	Grade 7 n=2, 11.8%			

(Note: table is to be read vertically, not horizontally)

In general, most of the girls were ages nine and ten and were in grades three and four at school. Most of the girls lived with both of their parents in a household with \$80,000 or greater income. All of the participants lived in the same Nova Scotian Municipality; however, 12 of the girls went to schools in the same school board and five girls attended schools in different school board. The researcher did not anticipate that although all the girls lived in the same municipality some of the study participants would be attending schools in another school board. This impacted the types of evaluation systems through which girls were graded, as different systems were used at various schools. An additional finding from the demographic information was the relationship between parent’s reported income levels and girls’ self-reported family structure (Table 3).

TABLE 3. THE INTERACTION BETWEEN FAMILY STRUCTURE AND INCOME LEVELS

	\$30-49,999	\$50-79,999	Greater than or equal to \$80,000
Both Parents	2	2	9
Mother and not Father	1	1	0
Mother and Partner	0	1	1

Nine of the girls’ parents who lived in a two-parent household reported an income of greater than or equal to \$80,000, which falls within the average total income level statistics for the Nova Scotian Municipality; four of the girls living with both parents, however, were below the municipality’s income levels for a two parent family (Statistics Canada, 2007). One girl who lived with her mother and not father was at the median income level for the municipality, the other girl who lived in a female lone-parent family

was above the average total income level (Statistics Canada). The final two participants who lived with their mother and partner were representative of the median or above the median level reported by Statistics Canada for common-law couple families in the Nova Scotian Municipality. The following section will detail the main research question, the quantitative subsidiary questions and the associated quantitative data.

UNDERSTANDING THE RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND PHYSICAL ACTIVITY

This study sought to explore whether there was a positive relationship between greater academic achievement outcomes and regular, moderate to very hard physical activity of girls in grades three to seven participating in a community-based physical activity program. To answer the primary research question it was necessary to first outline the participants' academic achievement and physical activity outcomes.

ACADEMIC ACHIEVEMENT INFORMATION

Parents and daughters completed two similar academic achievement surveys. The majority of the surveys were completed by mothers (n=12). There was a high, significant measurement of agreement between parent and daughter reported grades (p-value < .05).

Table 4 illustrates these findings using Cohen's kappa.

TABLE 4. MEASUREMENT OF AGREEMENT BETWEEN GIRLS' AND PARENT'S SELF-REPORTED GRADES

	Value	Standard Error ^a	Approximate T ^b	Approximate Significance
Measurement of Agreement (Kappa)	.761	.110	4.818	.000
N of Valid Cases (Parents and daughters grades)	31			

a=Not assuming the Null hypothesis

b=Using the asymptomatic standard error assuming the null hypothesis

When reviewing the data, two mathematics scores and one English score were missing from the girls' self-reported grades; one girl did not report her grade and two girls gave multiple answers for a one answer question, so only parents reported grades of A, B, C, or D were used in the data analysis.

Eight (47.1%) parents reported their daughter achieved the highest grade levels in mathematics (i.e., A). Similarly, eight (47.1%) parents reported their daughters received the second highest score of B in mathematics. The remaining parent reported his/her daughter received an average score of C. Parents identified 12 (70.6%) of their daughters as having achieved the highest levels in English (i.e., A) and five girls (29.4%) achieved the second highest score of B. The coefficient of variation revealed that there was 18.1% variability in the mathematics scores and 12.7% variability in the English scores. The coefficient of variation was determined by dividing the standard deviation of the grades by the mean of the grades to reveal a percent score. Overall, 58.8% of grades were reported in the top percentile of A and 38.2% of the grade outcomes were reported as the second highest grade of B. Therefore, the variability between these two distributions was relatively comparable; however, there was little variability in the grade outcomes.

PHYSICAL ACTIVITY LEVELS

Sixteen of the 17 girls wore an accelerometer for five days or more with at least four hours of activity recorded in each day; one individual's data was discounted due to non-compliance/malfunction. There was very little data found on the accelerometer, so the participant may not have worn the accelerometer properly (e.g., upside down) or chose not to wear it consistently. Six of the 17 girls submitted an activity log information sheet that recorded their physical activities while not wearing the accelerometer. The

intensity of the activities, as well as the duration of the activities were incorporated into the accelerometer data to be a more accurate representation of their activity levels. For the other 11 girls, their activity levels may be underestimated. The average daily minutes of moderate, hard and very hard activity achieved by each participant was as follows:

- 114 ± 28 minutes of moderate physical activity
- 8 ± 6 minutes of hard physical activity; and
- 6 ± 14 minutes of very hard physical activity

The average daily minutes of moderate to very hard activity was approximately two hours or $128 \text{ minutes} \pm 35$. The average total minutes of moderate to very hard activity in an eight day period for the girls was 919 minutes (449 minimum, 1370 maximum).

In Table 5, the number of girls who met Nova Scotian physical activity recommendations of 60 minutes or more of moderate to very hard physical activity on at least five days of the week was as follows:

TABLE 5. THE NUMBER OF GIRLS IN EACH GRADE MEETING NOVA SCOTIAN RECOMMENDATIONS

	Days Participants Achieved 60 Minutes or More of Moderate to Very Hard Activity						
	3 Days	4 Days	5 Days	6 Days	7 Days	8 Days	Total
3	0	1	0	4	3	0	8
4	1	1	0	0	1	1	4
5	0	0	0	0	1	0	1
6	0	0	1	0	1	0	2
7	0	1	0	0	0	0	1

Twelve of the 16 girls (75%) of the sample were participating in the recommended amount of physical activity with most of the girls obtaining the greatest moderate to very hard activity after school. The minutes of moderate to very hard activity achieved by the

participants at different intervals in the day are provided. The minutes of physical activity represented in each of the time intervals is mutually exclusive and do not overlap.

TABLE 6. MINUTES OF MODERATE TO VERY HARD ACTIVITY AT DIFFERENT INTERVALS IN A DAY

Time Intervals	Total Minutes of Moderate Activity (8 day time period)	Total Minutes of Hard Activity (8 day time period)	Total Minutes of Very Hard Activity (8 day time period)	Total Minutes of Moderate to Very Hard Activity (8 day time period)
Before School	971	23	0	994
During School	3477	259	62	3798
During Recess	459	43	14	516
During Lunch	1369	123	43	1535
After School	4235	296	91	4622
After 6pm	2367	158	54	2579

The least amount of moderate to very hard activity achieved by the participants was during recess (i.e., 516) and before school (i.e., 994). Wednesday was the day of the week the girls achieved the greatest number of minutes of moderate to very hard activity (i.e., 2579). In Table 7 the total minutes of moderate to very hard activity the participants achieved during each day of the week are outlined.

TABLE 7. TOTAL MINUTES OF MODERATE TO VERY HARD ACTIVITY DURING EACH DAY OF THE WEEK

Day of the Week	Total Moderate Minutes	Total Hard Minutes	Total Very Hard Minutes	Total Minutes of Moderate to Very Hard Activity
Friday	62	7	3	72
Saturday	585	33	13	631
Sunday	1016	102	37	1155
Monday	2125	154	49	2328
Tuesday	1798	131	26	1955
Wednesday	2362	173	44	2579
Thursday	1811	94	10	1915
Friday	1865	113	30	2008
Saturday	1022	82	47	1151
Sunday	234	12	4	250

The lowest minutes of moderate to very hard activity achieved by the participants were during the weekend (i.e., 1151, 250). Friday, Saturday, and Sunday were the days of the week that the majority of community-based physical activity classes took place. Even when combining the two Saturdays together, after the accelerometer was put on the girls during the program class and the morning before taking the accelerometer off, it is a day with lower amounts of moderate to very hard activity. Details on how the intensity of physical activity was determined and why the researcher used those particular time intervals to break down her physical activity data are described in the data analysis section of Chapter three. Results of both the academic achievement information and accelerometer data have been detailed and will be used to answer the main research question.

PRIMARY RESEARCH QUESTION

UNDERSTANDING THE RELATIONSHIP BETWEEN REGULAR MODERATE TO VERY HARD PHYSICAL ACTIVITY AND ACADEMIC ACHIEVEMENT.

A correlation analysis measuring the relationship between physical activity and academic achievement revealed no significant relationship between average daily minutes spent in moderate to very hard activity and the girls' English or mathematics grades (refer to Table 8).

TABLE 8. PEARSON CORRELATION ANALYSIS OF AVERAGE DAILY MINUTES OF MODERATE TO VERY HARD ACTIVITY AND ACADEMIC ACHIEVEMENT

		Math	English
Average Daily Minutes	Pearson Correlation	-.265	.089
	Sig. (2-tailed)	.322	.742
	N	16	16

Next, the data were explored to determine the relationship between academic achievement and the intensity, duration, and frequency of physical activity.

QUANTITATIVE SUBSIDIARY QUESTIONS

PHYSICAL ACTIVITY INTENSITY, DURATION, AND FREQUENCY AND THEIR RELATIONSHIP TO ACADEMIC ACHIEVEMENT.

Statistical analysis using a one-way ANOVA was used to identify if there was a difference in means between physical activity (i.e. moderate, hard, and very hard) across academic achievement (i.e., mathematics and English) grade levels (Table 9, Table 10). Income and family structure were incorporated into this analysis, as well. The researcher was looking at the difference in means using these variables; however, she was not controlling for them as this study included a convenience sample.

TABLE 9. ANOVA ANALYSIS OF TOTAL MODERATE, HARD, AND VERY HARD ACTIVITY AND MATHEMATIC GRADES

		Sum of Squares	df	Mean Square	F	Sig.
Total Moderate Minutes	Between Groups	59949.438	2	29974.719	.446	.650
	Within Groups	873447.5	13			
	Total	933396.9	15	67188.269		
Total Hard Minutes	Between Groups	8246.580	2	4123.290	2.959	.087
	Within Groups	18114.357	13			
	Total	26360.938	15	1393.412		
Total Very Hard Minutes	Between Groups	7347.634	2	3673.817	.349	.712
	Within Groups	136960.3	13			
	Total	144307.9	15	10535.408		
Income	Between Groups	1.368	2	.684	1.094	.362
	Within Groups	8.750	14			
	Total	10.118	16	.625		
Family Structure	Between Groups	.485	2	.684	.216	.809
	Within Groups	15.750	14			
	Total	16.235	16	.625		

TABLE 10. ANOVA ANALYSIS OF TOTAL MODERATE, HARD, VERY HARD ACTIVITY AND ENGLISH GRADES

		Sum of Squares	df	Mean Square	F	Sig.
Total Moderate Minutes	Between Groups	20074.101	1	20074.101	.308	.588
	Within Groups	913322.8	14	65237.345		
	Total	933396.9	15			
Total Hard Minutes	Between Groups	530.101	1	530.101	.287	.600
	Within Groups	25830.836	14			
	Total	26360.938	15	1845.060		
Total Very Hard Minutes	Between Groups	7616.956	1	7616.956	.780	.392
	Within Groups	136691.0	14			
	Total	144307.9	15	9763.642		
Income	Between Groups	1.068	1	1.068	1.770	.203
	Within Groups	9.050	15			
	Total	10.118	16	.603		
Family Structure	Between Groups	.119	1	.119	.110	.744
	Within Groups	16.117	15			
	Total	16.235	16	1.074		

Findings indicate that there were no significant differences in means when reviewing the relationship between total minutes of moderate, hard, and very hard physical activity to academic achievement.

Statistical analysis using a one-way ANOVA was used to identify if there was a difference in means between the duration of physical activity and mathematics and English grades (Table 11, Table 12).

TABLE 11. ANOVA ANALYSIS OF TOTAL MODERATE TO VERY HARD MINUTES OF ACTIVITY AND MATHEMATIC GRADES

		Sum of Squares	df	Mean Square	F	Sig.
Income	Between Groups	1.368	2	.684	1.094	.362
	Within Groups	8.750	14	.625		
	Total	10.118	16			
Family Structure	Between Groups	.485	2	.243	.216	.809
	Within Groups	15.750	14	1.125		
	Total	16.235	16			
Total Minutes	Between Groups	123808.7	2	61904.353	.681	.523
	Within Groups	1181767	13	90905.133		
	Total	1305575	15			

TABLE 12. ANOVA ANALYSIS OF TOTAL MODERATE TO VERY HARD MINUTES OF ACTIVITY AND ENGLISH GRADES

		Sum of Squares	df	Mean Square	F	Sig.
Income	Between Groups	1.068	2	.1.068	1.770	.203
	Within Groups	9.050	15	.603		
	Total	10.118	16			
Family Structure	Between Groups	.119	2	.119	.110	.744
	Within Groups	16.117	15	1.074		
	Total	16.235	16			
Total Minutes	Between Groups	5995.692	1	5995.692	.065	.803
	Within Groups	1299580	14	92827.125		
	Total	1305575	15			

Findings indicate that there were no differences in means between the duration of physical activity and mathematics or English grades. A correlation analysis was used to identify if there was a relationship between physical activity frequency and mathematics and English grades (Table 13).

TABLE 13. CORRELATION ANALYSIS BETWEEN THE NUMBER OF DAYS OF 60 MINUTES OR MORE OF ACTIVITY AND ACADEMIC ACHIEVEMENT

		Number of Days of 60 Minutes or more of Moderate to Very Hard Activity
Math	Pearson Correlation Sig. (2-tailed) N	-.155 .567 16
English	Pearson Correlation Sig. (2-tailed) N	.036 .895 16

The analysis revealed that there was no significant relationship between the number of days study participants achieved 60 minutes of moderate to very hard activity and mathematics or English grades.

Therefore, no significant relationships were found between the intensity, duration, and frequency of physical activity and English grades. There was also no relationship between the intensity, duration, and frequency of physical activity and mathematic grades. The data from the physical activity survey were then explored in order to make comparisons between the subjective and objective physical activity findings. Information concerning the environmental influences on physical activity and academic achievement follow the physical activity survey data.

SELF-REPORTED PHYSICAL ACTIVITY SURVEY

Physical activity was also explored through self-reported survey questions to determine if there was any difference between subjective and objective data collected. Girls self-reported participating in 69 ± 50 minutes of moderate activity, 24 ± 40 minutes of hard activity, and 16 ± 16 minutes of very hard activity on an average daily basis.

Overall, participants were taking part in an average of 766 minutes of moderate to very hard activity in a seven day period (minimum 80 minutes, maximum 1710 minutes). The majority of girls self-reported that they participated in a moderate level of activity during an average of two physical education classes per week. There was a variation in the number of times in a seven day period the girls participated in daily physical activity (DPA). If they did participate in DPA, it was at a moderate or hard level. Most of the girls participated in physical activity at recess and lunch for five days a week at a moderate or hard level. After school, girls were either participating in activity a couple times a week or every day after school at a moderate level. On the weekends, participants were taking part in physical activity approximately two to four times at a moderate or hard level. Girls self-reported that the day of the week they participate the most often in activity was Wednesday. Overall, girls reported they spent the most minutes of activity in the community-based physical activity classes, followed by walking, swimming and dancing respectively. Table 14 highlights the girls' perceptions of their average physical activity intensity levels throughout a day.

TABLE 14. PERCEPTIONS OF AVERAGE PHYSICAL ACTIVITY INTENSITY LEVELS

	Frequency	Percent	Valid Percent
Moderate	47	46.1	51.6
Hard	26	25.5	28.6
Very Hard	4	3.9	4.4

Half the girls self-reported they were participating in mostly moderate levels of activity, with one third of the girls participating in hard to very hard levels of activity.

COMPARISONS BETWEEN ACCELEROMETER AND SELF-REPORTED PHYSICAL ACTIVITY SURVEY DATA.

When comparing accelerometer to self-reported physical activity findings, what was observed was girls were significantly under-reporting their moderate levels of physical activity compared to accelerometer findings (114 accelerometer versus 69 self-reported minutes) and significantly over-reporting their hard minutes of physical activity (8 accelerometer versus 24 self-reported minutes). The girls were also over-reporting their very hard levels of physical activity (6 accelerometer and 16 self-reported minutes).

Paired t-test analysis reveals that there was a significant difference in means (p -value $< .05$) between total moderate and hard self-reported physical activity minutes and total moderate and hard physical activity minutes captured by the accelerometer; there was also a difference, approaching significance, between self-reported and accelerometer findings for total very hard minutes of activity (Table 15). There was no significant difference between accelerometer and self-reported total minutes of moderate to very hard activity.

TABLE 15. THE TEST OF DIFFERENCE BETWEEN SELF-REPORTED AND ACCELEROMETER TOTAL MINUTES OF PHYSICAL ACTIVITY

	Paired Differences					t	df	Sig
	Mean	Strd. Dev.	Strd. Error Mean	95% C.I. of the Difference				
				Lower	Upper			
Self Reported and Accelerometer Total Minutes	-167.8	514.8	128.708	-442.1	106.6	-1.3	15	.212
Self Reported and Accelerometer Moderate Minutes	-347.5	485.5	121.365	-606.1	-88.8	2.2	15	.012
Self Reported and Accelerometer Hard Minutes	156.9	285.9	71.468	4.608	309.3	2.2	15	.044
Self Reported and Accelerometer Very Hard Minutes	73.6	152.8	38.203	-7.804	155.054	1.9	15	.073

These results suggest that self-reported physical activity may not be the best representation of the participants' physical activity data. Findings will now be explored concerning activity individuals participated in other than physical activities.

INACTIVITY FOR PARTICIPANTS

Questions in the physical activity survey were designed to better understand the sample's behaviours when not engaging in physical activity. The survey revealed that girls spent an average of 41 minutes per day sitting in a car on an average of five days a week. Twelve of the girls also either rode to school in a bus or an automobile. The survey also revealed participants spent nearly 100 minutes per day in front of a screen on an average of five days a week. The girls were reading about 38 minutes per day on an

average of 5 days a week and completing homework approximately 36 minutes per day on an average of 3 days a week. Most of the girls reported they were sleeping nine or more hours each night.

Overall, the quantitative data highlight that 12 girls (75%) were able to achieve 60 minutes of moderate to very hard activity on at least five days a week. Findings also revealed that the girls had high levels of academic achievement in mathematics and English. Results from the physical activity survey indicated that the girls self-reported they were participating in activity throughout the school day at relatively high intensity levels and they continued to participate in activity during after-school time and on the weekends at higher intensity levels, as well. Both the self-reported findings and accelerometer findings indicated that Wednesday was the day of the week that the most physical activity took place. The girls were also found to be under-reporting moderate levels of physical activity compared to accelerometer findings. The inactivity data highlighted that the girls were participating in 100 minutes of screen time on an average of five days a week, were not participating in active transportation and were not spending the majority of their after-school time doing homework. The qualitative data will now be explored.

ENVIRONMENTAL INFLUENCES ON PHYSICAL ACTIVITY

Four interviews were conducted to gain a contextual understanding of the factors influencing the physical activity experiences of the study population. An ecological health promotion framework was used to explore factors in each of the environments that had an influence on physical activity behaviours. Intrapersonal, interpersonal, institutional, and community factors helped to shape the interview questions and guided

the organization of the qualitative findings. The major themes that emerged from the data were that overall, the girls enjoyed higher intensity levels of physical activity, they perceived physical activity to be a benefit to them, and physical activity was a component of play. The study population also had positive parental support for physical activity. During school time the girls were engaged in physical activity. Outside of school time the community-based physical activity program was found to be a positive influence on physical activity behaviours, as well. The themes will be explored in greater detail and then used to compare/contrast with the quantitative data.

INTRAPERSONAL FACTORS

Intrapersonal factors include characteristics of the individual within the ecological health promotion model, such as knowledge, attitudes, behaviours, self-concept, and skills (McLeroy et al., 1988). The themes ‘enjoyment of higher intensity levels of physical activity’, ‘perceiving physical activity as a benefit’, and ‘physical activity as a component of play’ best fit into the intrapersonal factors category, as they include some of these characteristics.

ENJOYMENT OF HIGHER INTENSITY LEVELS OF PHYSICAL ACTIVITY

The intensity of physical activity the girls spoke of enjoying the most was moderate to hard activity. Megan voiced that she preferred hard activities, *Because I like to get competitive sort of thing. I like to be competitive and stuff, and I like to work for things.* While not all the girls were as competitive as Megan, they enjoyed participating in higher intensity activities. Jennie expressed that she liked moderate or hard activities, *Cause I’m not working my butt off and I’m not working too little. It’s just right in between. It’s nice.* Most of the girls expressed that they preferred to participate in higher levels of activity

and were not deterred by the activity causing them to breathe hard or sweat. When Danika was asked if she stopped activity once she was breathing hard or sweating she replied, *I continue to play, sometimes I'll stop, get a drink of water and then keep going again.*

One participant, however, did indicate that she did not enjoy breathing hard or sweating and preferred more moderate activities. When Anna was asked why she liked moderate activities she explained, *Because they're not hard, and not a lot of people like sweating and I don't like sweating cause I don't like taking showers.* The differences in explanations and preferences for the girls may be attributed to their age difference since Anna was younger than the other three girls by two to three years. An additional theme that involved attitudes towards physical activity concerned the perceived benefits of physical activity.

PERCEIVING PHYSICAL ACTIVITY AS A BENEFIT

During the interviews all of the girls expressed that participating in physical activity was a benefit to them. When asked to expand on why they found physical activity to be beneficial, the interviewees tended to focus on health outcomes. Girls felt that physical activity helped them to maintain good health. Danika specifically talked about how physical activity increased her energy levels, *Like if I'm tired and if I do physical activity it makes me do more throughout the day, it helps me stay awake in school.* Danika indicated the health benefits of physical activity for her included an increase in her mental and physical energy levels throughout the day. Another participant, Jennie, outlined the health benefits of physical activity in relation to her chronic condition, *For me it helps with my asthma, it gets me more active, it helps me get my exercise and it gets*

me off the couch. Jennie also expressed that physical activity did cause her asthma to ‘act up’ at times, however, she still expressed that it helped to manage her chronic disease.

PHYSICAL ACTIVITY AS A COMPONENT OF PLAY

The girls talked about an additional benefit of physical activity which was to play. In the interviews, the girls reported enjoying playing because it was fun to participate with friends, make up games, and play sports. Megan explained she participated in physical activity as a way to play:

I get lots of exercise, so I'm not always eating junk-food and stuff, and it's just fun to play with my friends outside and we like to play and we like to make up games, and we have characters.

In Megan’s case, physical activity seemed to facilitate creativity and was a way to enjoy time with friends. A theme that continually emerged from the data involved parental support of physical activity.

INTERPERSONAL FACTOR

POSITIVE PARENTAL SUPPORT

Parents have a significant influence on youth’s after-school and weekend activities. A common denominator for all of the interviewee’s was their parents’ support of their activity by acting as a spectator, coach, driver or a combination of the three. Megan’s parents were involved in her extracurricular activities, one as a coach, the other as a spectator, *My dad he’s like the manager of my ringette, my mom she usually just comes to the games.* It did not seem to matter whether parents were directly involved as a coach or indirectly involved, as someone who watched the activity, actively involving themselves supported the girls’ physical activity behaviours.

The interviewees also reported that parents supported their physical activities by encouraging them to participate in activity, playing with them and modeling positive physical activity behaviours. Jennie's parents encouraged her to participate in physical activity as means to decrease the amount of time she was spending in front of a screen, *All the time [parents encouraged her participation in physical activity] ...mostly because the past year or so, my thumbs have been getting the most exercise.* Despite Jennie's parents being inactive themselves, they encouraged and supported her participating in physical activity. Parents also supported their daughters' physical activity by playing with them. Megan's parents played with her by initiating soccer games and children's games, *Well when I'm outside my mom and dad will be outside with us, playing with us, they kick the ball with us.* Anna's mom and dad also played with her, *My dad likes playing catch with me and me and my mom like playing the Wii together.* By playing with their daughter, parents were supporting an interest in physical activity participation. Modeling positive physical activity behaviours seemed to support positive physical activity behaviours, as well.

The participants also noted that by the parents demonstrating that physical activity is a valued lifestyle choice, the girls seemed to embody that behaviour themselves. Danika's parents were both active individuals, *Well my dad does that P90X and my mom likes walking a lot.* Danika also expressed that her parents believed exercise was an important part of life and as a result, it was reportedly a valued activity for Danika, as well. By encouraging their daughters to participate in physical activity, actively engaging in physical activity with their daughters, and/or modeling positive physical activity behaviours parents seemed to be demonstrating the value of physical activity, which

supported their daughters' positive physical activity behaviours. The school environment was also found to be a factor in girls' physical activity experiences.

INSTITUTIONAL FACTOR

Institutional factors involve social institutions with formal and informal rules (McLeroy et al., 1988). In this study, schools seemed to fit best within this category. Overall, it was found that schools were engaging girls in physical activity that they found to be enjoyable.

SCHOOL ENGAGEMENT

During school time all four girls were actively participating in physical education classes two or more times per week and taking part in traditional activities, such as basketball, dodgeball, volleyball and other organized team sports. The girls did express that they liked the traditional physical education sports and group activities; however, some girls said that they enjoyed dancing too. Two girls explained that dance was already incorporated in their physical education curriculum. When Megan was asked what types of activities would be fun for her during physical education class, she explained that, *Well we just, this week was dance week and then like dancing, so I'd want them to have more dance weeks this year.* It may be that schools are engaging girls by incorporating physical activities that are enjoyable for them. Anna did say; however, there are activities that she would like to see more of during physical education classes. Anna said, *I would choose doing wrestling and um whack-a-sticker.* Preferences for the types of activities during physical education did vary across the girls, although, they all seemed seem to have fun in the classes. An additional influence on physical activity participation was the community-based physical activity program.

COMMUNITY FACTOR

Community factors involve the relationship among organizations, institutions and informal networks with defined boundaries (McLeroy et al., 1988). The community-based physical activity program is representative of a community factor as it has ties to other organizations and institutions, and creates informal networks between the students and parents within their community program. A theme that manifested from the data related to the physical activity program; the program seemed to have a positive influence on the girls' physical activity behaviours.

COMMUNITY-BASED PHYSICAL ACTIVITY PROGRAM'S POSITIVE INFLUENCE ON PHYSICAL ACTIVITY

As mentioned previously, parents have a strong influence on after-school and weekend time. All parents signed their daughters up for the community-based physical activity program. In the interviews, the girls discussed the reasons for their parents signing them up for the program, which included to prepare for bullying and to keep active. While it was acknowledged that their parents instigated their participation, the organization itself seemed to have an influence on some of the girls' physical activity behaviours outside class. Danika said that:

I think it gets me to think more active, like my friends on the weekend they want to just sit around and go on the computer and watch t.v. and stuff but since I've been in [the program] on the weekends I've been working out more and, like the two or three hours that I come, and it's making, it's made me want to do more through the week too.

Taking part in the community-based physical activity program classes encouraged Danika to think more about physical activity, which may have initiated further

participation in activity. Therefore, it seemed that the physical activity program did help some of the girls to participate in greater levels of physical activity and did not have a negative impact on their physical activity experiences. The themes that were found in the qualitative data will now be used to answer the qualitative subsidiary research question.

QUALITATIVE SUBSIDIARY QUESTION

UNDERSTANDING HOW THE GIRLS' ATTITUDES TOWARD AND PERCEPTIONS OF PHYSICAL ACTIVITY, PARENTAL INFLUENCE, SCHOOL POLICIES AND PRACTICES, AND THE COMMUNITY-BASED PHYSICAL ACTIVITY PROGRAM INFLUENCED THEIR PHYSICAL ACTIVITY BEHAVIOURS.

The qualitative data were intended to be used to better understand how the girls' attitudes toward and perceptions of physical activity, parental/guardian influence, school policies and practices, and the community-based physical activity program influenced the physical activity behaviours of girls with different grade outcomes (A/B compared to C/D). The lack of variability in the academic achievement information did not permit comparison of the physical activity behaviours of girls with different grade outcomes. However, the researcher did find that the study population of girls seemed to have their positive physical activity behaviours supported by the parents, who acted as a catalyst facilitating the participation in physical activity. As discussed earlier, parents have a strong influence on the attitudes and behaviours of their children. At the intrapersonal level, the girls may have learned from their parents to enjoy participating in higher levels of physical activity, perceive physical activity as a benefit, and understand physical activity to be a component of play. At the interpersonal level, parents supported their daughter by being a spectator, a coach, or a driver. Parents also supported the participation in physical activity by taking part in physical activity with their daughters,

encouraging physical activity, and by being a role-model to their daughters. At the community level, the girls were strongly supported by their parents to participate in the community-based physical activity program, as well. The parents were the ones who signed their daughters up for these classes and made the commitment to take the girls to these classes on a weekly basis. At the institutional level parents were not, however, a strong influence on physical activity participation in this study.

Figure 4 demonstrates a presentation of the findings from this study using the health promotion ecological model:

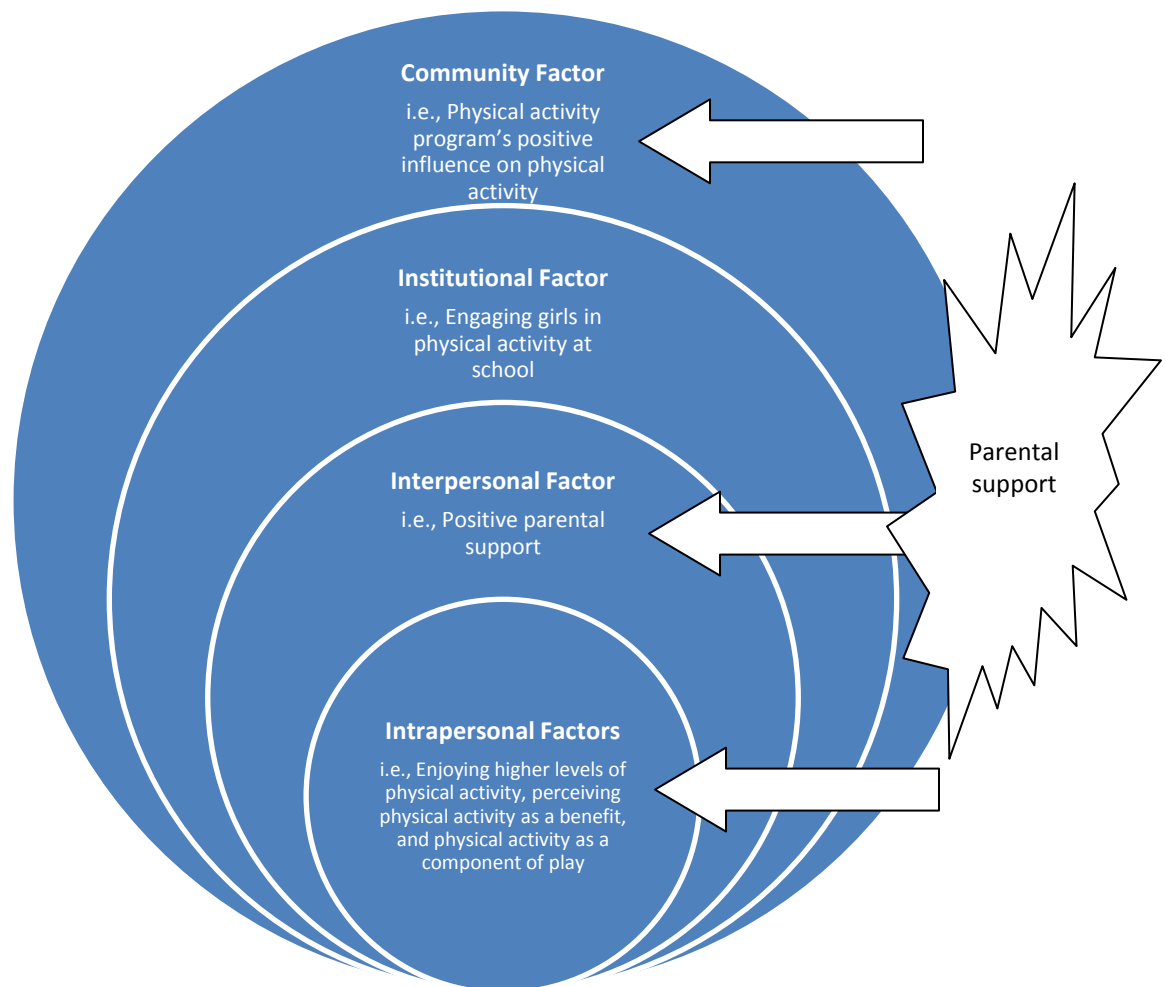


FIGURE 4. THE ECOLOGICAL HEALTH PROMOTION MODEL USING THIS STUDY'S FINDINGS

In this study, girls' parents were the most influential factor in facilitating physical activity. The data from the project were triangulated to better understand how the subjective and objective information supported or contradicted each other.

TRIANGULATION

COMPLEMENTARY FINDINGS

There was no significant negative relationship between physical activity and academic achievement. The girls were able to achieve the second highest level of physical activity during school, which may be a supportive factor in having no negative relationship between academic achievement and physical activity.

There were some similarities between the accelerometer and physical activity survey findings, as well. In particular, the physical activity survey supported the accelerometer data as Wednesday being the day the girls reported participating in the most minutes of physical activity. Furthermore, 12 of the 16 girls (75%) were able to achieve the recommended levels of physical activity, which was supported by the girls' parents influencing their physical activity behaviours at various environmental levels.

CONTRASTING FINDINGS

When comparing physical activity to the English variable, there was no relationship found between the intensity, duration or frequency of physical activity and English or mathematics grades. There was a variation in the accelerometer findings and the physical activity survey reports in regards to time spent in physical activity after-school. The accelerometer data revealed that the most minutes of moderate to very hard activity were spent in after-school time, where the girls self-reported in the physical activity survey that not everyone was participating in after-school activity on a regular basis.

SUMMARY

The participants in this study were ages nine and ten and were in grades three and four at school. Most of the girls lived with both of their parents in a household with \$80,000 or greater income. All of the participants lived in the same Nova Scotian Municipality, however, five of the 17 girls attended schools in a different school board.

The quantitative data revealed that there was a trend in this study population of girls, where they achieved higher levels of academic achievement and were predominantly able to meet the physical activity guidelines.

Contextually, what can be said about this sample of girls is they preferred higher levels of intensity when participating in physical activity, perceived physical activity as something beneficial to them and considered physical activity as a component of their play. Parents seemed to support these positive physical activity behaviours through their involvement in the girls' physical activities, encouraging the participation in activity, playing with their daughters, and modeling positive physical activity behaviours. The schools also encouraged physical activity, where most girls self-reported having two or more physical education classes per week. The schools were also found to better engage the girls in activities that they found fun. Parents facilitated the participation in the community-based physical activity program classes, which enabled some of the girls to think about participating in greater amounts of physical activity; this may have initiated the participation in higher activity levels.

CHAPTER 5: DISCUSSION & CONCLUSION

This chapter will explore key findings in relation to the previous research, in particular, the connection between academic achievement and physical activity. Chapter five explores how this study contributes to the literature on physical activity and academic achievement and its implications for health promotion.

PRIMARY RESEARCH QUESTION

Is there a positive relationship between greater academic achievement outcomes and regular, moderate to very hard physical activity of girls in grades three to seven participating in a community-based physical activity program?

SUBSIDIARY QUESTIONS

1. What is the relationship between the intensity, duration, and frequency of physical activity and the girls' mathematic grades (parent/guardian and child self-reported grade)?
2. What is the relationship between the intensity, duration, and frequency of physical activity and the girls' English grades (parent/guardian and child self-reported grade)?
3. How do the girls' attitudes toward and perception of physical activity, parental/guardian influence, school physical activity practices and policies, and the community-based physical activity program influence the physical activity behaviours of girls with different grade outcomes (A/B compared to C/D)?

CHALLENGES IN ESTABLISHING THE RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND PHYSICAL ACTIVITY

The relationship between physical activity and academic achievement continues to be complex. There was no significant relationship found between the intensity,

duration, and frequency of physical activity and mathematics or English grades. This research project, however, adds to the growing body of research supporting that the participation in physical activity does not have a significant negative influence on academic achievement. Meaning, the time taken away from academics and allocated to time spent participating in physical activity will not have a negative influence on an individual's academic achievements.

ACADEMIC ACHIEVEMENT VARIABLE OUTCOMES

There was a focus on the academic achievement variable in this study as recent research has highlighted its relationship to physical activity. The participants in this study had obtained high levels of academic achievement in both mathematics and English. 94.2% of the girls achieved the highest or second highest grade in mathematics and 100% of the girls achieved the highest or second highest grade level in English. Therefore, there was little variability in the grade outcomes, which limited the size of the correlation coefficient when analyzing the relationship between academic achievement and physical activity. Also, it cannot be determined whether this sample was above average in academic achievement as the data from the school boards were not available to make a comparative analysis.

Gathering academic achievement information through self-reported grades was the most appropriate data collection method for this study as, again, access to school grades was restricted. Standardized tests are a more objective measure of academic achievement and have been used in various studies (Ahamed et al., 2007; Carlson et al., 2008; Sallis et al., 1999; Wang & Veugelers, 2008); however, it was not an appropriate data collection source for this research project as utilizing a standardized test was not

within the timelines of the data collection period. Information concerning the self-reported grades will be further detailed in the limitations section. An additional important factor in this study was the physical activity data. Understanding why the girls had higher levels of physical activity and the context surrounding the girls' physical activity participation are essential pieces of the puzzle.

PHYSICAL ACTIVITY PARTICIPATION INFLUENCES

This study's population of girls had a specific interest in physical activity and self-selected to participate in the researcher's physical activity project, which may have created a biased study sample. Also, the program was non-competitive and involved elements of yoga, which may have made the program more fun for girls and increased their participation rates. The program involved higher levels of physical activity, allowing the girl to achieve more minutes of greater intensity activity levels. The data were also collected in the month of April when the days were beginning to get warmer. The warmer weather may have influenced the girls' physical activity participation.

SIMILARITIES BETWEEN PARTICIPANTS WHO DID NOT MEET NOVA SCOTIAN PHYSICAL ACTIVITY RECOMMENDATIONS

The four girls or 25% of the study population, who did not meet Nova Scotia recommendations, were of various ages and school grade levels. They did not attend the same schools, and were at schools in different school boards. Their parents' level of income varied with one girl living in a household that earned greater than or equal to \$80,000, two girls in households with \$50-79,999 incomes, and one girl in a household with \$30-49,999 income level. Most of the girls had two hours or less of screen time per day. The girls all had two hours or less of homework a week. The number of hours they slept ranged from zero to five hours to as high as ten or more hours a night. Two of the

girls lived with both parents, one girl lived with her mother and not father, and one girl lived with her mother and partner. Therefore, there did not seem to be a common factor among the girls who did not meet Nova Scotian physical activity recommendations. Next, differences between accelerometer and self-reported physical activity survey data will be discussed.

DIFFERENCES BETWEEN SELF-REPORTED AND ACCELEROMETER PHYSICAL ACTIVITY DATA

In this study, self-reported physical activity captured by the physical activity survey, was used to validate or find differences between what was self-reported by the participants and what was captured by the accelerometer. Overall, it was found that self-reported physical activity may not be the best representation of the girls' participation in physical activity. This is consistent with other studies that suggest there is an issue with self-reported physical activity measures since children and youth may have difficulty with physical activity recall or identifying what is 'physical activity' (AHKC, 2009). It was also found that the girls under-reported their levels of moderate activity, but over-reported their hard and very hard levels of physical activity, which is not the norm. Traditionally, youth have consistently rated their physical activity levels higher in self-reported physical activity surveys than what was found by objective measures (AHKC, 2008). Conversely, the accelerometer is considered to be a valid and reliable tool when measuring physical activity data for children and youth (Campagna et al., 2005; de Vries et al., 2009; Trost et al., 1998).

Some of the self-reported physical activity survey findings were, however, supported by the accelerometer physical activity data. Questions concerning the girls' levels of physical activity at different intervals in the day revealed that they perceived

themselves to be participating in activity at a moderate to very hard level, which was supported by the accelerometer data. Accelerometer data and self-report also indicated that the girls achieved the greatest amount of moderate to very hard activity on Wednesdays. Yet, when comparing time spent in after-school activity, self-reported data were inconsistent with accelerometer findings. The accelerometer found that the most time spent in physical activity was after-school, while the girls did not report they were participating in activity after-school on a regular basis.

Girls also reported they participated in the most minutes of activity during the community-based physical activity classes. However, most of the girls' physical activity was accumulated during the week (i.e., on Wednesdays), which indicates that the lowest levels of activity were experienced on the weekends, despite the girls participating in the community-based physical activity classes during that time period. It could be that participation in the structured physical activity classes during the weekend was perceived to be sufficient physical activity for the day. The expectation to participate in physical activity on weekend days may not be as high, since these days may also be perceived as being days to accomplish other chores or days of rest. Furthermore, the accelerometer was not always worn for the full physical activity class since that was when the researcher was distributing or collecting the instruments. The physical activity levels during the community-based physical activity program were, therefore, not completely captured due to the data collection methodology. This will be further discussed in the study limitations section. Next, the factors influencing the girls' physical activity behaviours will be discussed.

FACTORS INFLUENCING PHYSICAL ACTIVITY BEHAVIOURS USING THE ECOLOGICAL HEALTH PROMOTION MODEL

Descriptive, thematic analysis of the four interviews revealed that this study's population of girls preferred participation in moderate to very hard intensity level activities (i.e., intrapersonal factor). This is contrary to other studies' findings that have reported girls to prefer medium, non-competitive, low-intensity activities and males to prefer higher intensity levels (Brustad, 1996; Vilhjalmsson & Kristjansdottir, 2003). An explanation for this behaviour may be that this study's population of girls was less concerned about feeling or looking "sweaty". Most of the girls expressed in their interviews that they were not deterred from participating in physical activity because of breathing hard or sweating. It should be noted, however, that the overall population of girls were young and may not yet be influenced by the need to appear attractive (O'Donovan & Kirk, 2008). These feelings may change, however, as the girls move forward into their teenage years. Whitehead and Biddle (2008) found in their study that girls ages 14-16 were bothered by sweat in physical education since they were not given enough time to prepare their looks before the next class. For the current study's participants, sweating and breathing hard did not seem to be the largest predictor of low activity levels, as most of these girls were able to meet recommendations. A better predictor of their positive physical activity behaviours was the health benefits of participating in physical activity and the enjoyment they received from playing (i.e., intrapersonal factors). These attitudes towards physical activity may have been impacted by parents (interpersonal factor) as they were the largest influence on this study population's physical activity behaviours.

Structured physical activity also took place during physical education classes at school. Despite the focus on traditional physical activities, the girls enjoyed their physical education classes. Schools are moving to include activities in their curricula that are more diverse and may be more appealing to girls (i.e., institutional factor). Two girls who were interviewed expressed that dancing was now incorporated into the physical education curricula. Schools may be an avenue to increase physical activity participation in young girls. A comprehensive review of studies that have researched the relationship between physical activity and academic achievement resulted in the recommendation that approximately 60-90 minutes of physical activity or sport could be incorporated into school curricula and would not be detrimental to academic achievement (Trudeau & Shephard, 2010). Therefore, studies continue to recommend that more physical activity opportunities should be given to children and youth across the school day. The school day is where most young girls spend the majority of their day-time hours. Engaging young girls during the school day may be a place to continue increasing physical activity levels.

The community-based physical activity program also had an influence on positive physical activity behaviours by encouraging some of the girls to think further about the participation in physical activity (i.e., community factor). This contributed to the girls' positive physical activity experiences, where they may have associated positive feelings with the participation in the physical activity classes which encouraged further participation in physical activity. The following section will discuss lessons learned from this research project and recommend changes for future studies.

LESSONS LEARNED AND FUTURE STUDY SUGGESTIONS

At the inception of this project's research question it would have been ideal to secure a recruiting location. Securing a location to recruit participants may have enabled a smoother transition through the proposal and ethics process and may have allowed the researcher to move into her data collection process quicker. If it had been possible, recruiting girls from schools may have provided a more diverse sample, larger sample size, and may have allowed the researcher to obtain more objective measures of academic achievement. An objective measure of academic achievement may have resulted in a relationship between physical activity and these variables.

It may have been to the researcher's advantage to recruit individuals from a smaller age range. Cognitive abilities, communication patterns, and the ability to answer questions varied with age. More specifically, when conducting the pilot project the researcher should have asked an individual to participate who was at the younger end of her recruiting age range (i.e., grade three or four). This may have allowed her tools, specifically the physical activity survey, to be more age appropriate and easier to read for the study participants. The most difficult question for the girls was recalling how many minutes per day and days per week they participated in an activity. The researcher may not have used this question, had she pilot tested with a younger girl.

The recruitment process took longer than expected; however, this may have worked to the researcher's advantage as the extra time spent in the community-based physical activity classes seemed to allow the participants to feel more comfortable with her and familiarize themselves with her presence. When future researchers are considering their

project timelines, they may want to consider extending the recruitment process, as it may allow opportunity to develop a rapport with potential participants.

The set-up at each of the community-based physical activity centers was not an ideal space to conduct research, since there was not a room in each building that the researcher could use to prepare her equipment and to conduct a private conversation with each participant. This was unavoidable as the program organizers were not able to ask for rooms for her research in advance as it would have been costly to rent. Future researchers may want to consider ensuring a space is available that provides privacy.

An additional study suggestion is to phone participants during the data collection week. Phoning the participants and their parents/guardians mid-week to ask if they had any questions about the accelerometer and to confirm plans for the following weekend worked to the researcher's advantage as it allowed for her to make special arrangements if necessary and ensured all pieces of equipment were returned. In future studies, the researcher would recommend asking if there were any issues regarding the activity log to remind participants about completing this document if the accelerometer was not worn. This may have helped increase the number of activity logs returned at the end of the data collection week as less than half of the participants returned completed forms. This affected the results by having only a small number of the activity log data incorporated into the accelerometer data. Therefore, participants' activity levels may not be accurately represented and may be lower than what the study participants actually completed. The researcher would recommend finding a different way to capture physical activity participation when the accelerometer is not worn, as this is valuable information.

A larger sample size for the study may have allowed for a greater chance of finding those with varying academic achievement levels. The researcher may have been able to determine if individuals with lower or higher grades had different physical activity experiences. A larger sample may have also allowed the researcher to explore how income level, demographic location, or school districts influenced the girls' physical activity experiences.

One of the benefits to conducting research at a university is the level of resources available to the students. The researcher was able to speak with the original principal investigator of the PACY physical activity study, Dr. Phil Campagna, and use the same macros that the PACY project did for its data analysis. This allowed the researcher to analyze her data more quickly and compile her findings into groupings that made sense since other researchers had used this method previously. Other fundamental resources were the researcher's supervisor and committee members, an IWK consulting scientist, Nova Scotia's Director of Evaluation Services, and many more individuals who were willing to give her advice throughout the thesis process; utilizing these resources was pivotal to the success of the research project.

STUDY LIMITATIONS

REPORTING LIMITATIONS FOR ACADEMIC ACHIEVEMENT

There was a high significant measurement of agreement between parents and daughters self-reported academic achievement grades. This could be attributed to the fact that some parents completed the forms as they were dropping their daughter off to class and conversed with the child about her grade given in each of the school subjects. Some parents also briefly pulled their daughters out of class to discuss their grade scores. The

researcher tried to have the parents complete the forms away from the classroom doors or away from where the students were participating in class, however, she could not monitor all of the parents while they were completing the documents. An alternative reason for the high measurement of agreement between the parent and daughter reported grades could be because the report cards for the two Nova Scotian school boards were released within the study's data collection period.

One of the most interesting dilemmas of this study was the issue concerning the self-reported grades by the participants and parents. It was a constant discussion throughout the proposal and data collection process of how to best ask for the participants' academic achievement scores. Because the scores were reported as three separate scales it was a challenge to group the variables in order to analyze the information in SPSS 15.0. Due to the lack of information on the variable outcomes in public documents, the researcher had to speak directly to individuals working for the school boards or for the Department of Education in Nova Scotia. She was able to speak with various academic assessment experts and her supervisor, which allowed her to draw a conclusion on how to best group the academic scores according to the information she received. The final outcome was the most appropriate as most of the scores were reported as A, B, C, or D; these four variable were the only academic achievement outcomes analyzed as all parents reported their daughter's grade levels using A, B, C, or D.

ACCELEROMETER INSTRUMENT LIMITATIONS

There are some limitations of this research project associated with the accelerometer. The accelerometer is not waterproof, the instrument cannot be worn at all times, and it may not accurately assess some physical activities such as bicycling

(torsional accelerations) (Campagna et al., 2005). Some participants did not wear the accelerometer the whole day, however, most did wear the accelerometer for a minimum of four hours; therefore, the accelerometer information approximates values. The unit may have not captured physical activity information at all times of the day, results represent the times that the accelerometer was worn. The researcher is not able to report on the number of moderate to very hard minutes participants achieved during the community-based physical activity program classes. Participants were fitted with their accelerometers the first day of data collection during the program class and the instruments were collected during their class, as well. The accelerometer information reported during those time periods is not an accurate representation of the physical activity levels achieved.

ACCELEROMETER MACRO LIMITATIONS

When inputting information for macros to process accelerometer data in excel, the macro did not ask for recess start and end times for participants ages 11 and older. Individuals aged 11 were in grade six in this case and still participated in recess time, therefore, there may be a misrepresentation of the number of moderate to very hard minutes of physical activity spent in recess-time compared to during school-time for those individuals.

PHYSICAL ACTIVITY SURVEY LIMITATIONS

The physical activity survey was self-reported and may not be as reliable as objective measures. Participants may have under or over-reported their physical activity information.

ACTIVITY LOG LIMITATIONS

As mentioned previously, the researcher did not find the activity log information useful as less than half of the participants' parents filled out the form.

STUDY IMPLICATIONS FOR POLICY

Through this program of research it became apparent that there was room to improve physical activity participation at the school level for the study population. There was no negative relationship found between academic achievement and physical activity; therefore, consideration for the integration of a health promotion policy promoting daily physical activity in schools in Nova Scotia may be an avenue to increase the girls' regular participation in physical activity.

STUDY IMPLICATIONS FOR PRACTICE

Given that parents were such an influencing factor on girls' physical activity behaviours, future research may want to focus on providing interventions at the family level to support both the parent's and girls' participation in physical activity. After-school health promotion programming involving parents may also be an interesting implication for practice that involves both the community and interpersonal levels of the ecological health promotion model. Bringing to light how physical activity has no negative influence on academic achievement, in a brief education piece, may highlight to parents the importance of physical activity programming.

STUDY IMPLICATIONS FOR RESEARCH

Overall, this study contributed to health promotion research by building upon findings from past projects that have no relationship to exist between physical activity and academic achievement. Using a larger, more diverse sample size and objective

measures of academic achievement may enable future researchers to obtain results between the two variables. Choosing a population that was more diverse may have resulted in families with varying income levels, as well. Future researchers may want to study peer leadership and its influence on physical activity for this community-based physical activity program. Using a younger recruiting age (i.e., grades one to three) may help determine if there is any relationship between academic achievement and physical activity as those younger in age participate in greater levels of activity. If both boys and girls are studied may be identified that the relationship between the two variables is moderated by sex. Finally, future health promotion researchers may also want to consider using the ecological health promotion model as it was a useful tool to organize and focus the research project.

UTILITY OF THE ECOLOGICAL HEALTH PROMOTION MODEL IN FUTURE RESEARCH

The ecological health promotion model was a paradigm used to assist in organizing this health promotion project. The framework allowed the researcher to better understand some factors at the intrapersonal, interpersonal, institutional, and community level that influenced the physical activity behaviours of this population. It was a useful tool that allowed the researcher to organize her findings to demonstrate that there were not only factors within each of the environmental levels that influenced the girls' physical activity behaviours, but factors that influenced their behaviours at numerous levels. Future researchers may want to consider using the ecological health promotion model as a guide to organizing their physical activity research project.

CONCLUSIONS

There continues to be a complex relationship between academic achievement and physical activity. There is no clear indication that a relationship exists between the two variables. Using the ecological health promotion model, findings from this study indicated that parents were an influence on young girls' physical activity participation. It can also be said that support should be given throughout the environmental levels to enable the participation in physical activity throughout the different intervals in a day. Parent's strongly influence attitudes and behaviours of their children, as well as serve as a means of support for positive physical activity experiences. Parents further encourage the participation in physical activity by allowing their daughters to participate in after-school physical activity programs. At the institutional level, schools should continue to better engage young girls and possibly move forward in the integration of daily physical activity classes. The main limitations of this research project were the lack of variability in the population demographics, as well as a relatively active population sampled.

Future health promotion researchers may want to consider moving forward with reviewing the relationship between academic achievement and regular, moderate to very hard physical activity. Obtaining school academic achievement data or a larger, diverse sample may be key factors in finding a relationship between the two variables.

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APPENDIX A: PILOT STUDY MODIFICATIONS

The following is a detailed outline of changes that were made to the methodological tools based on pilot study findings:

1. **Physical Activity Questionnaire:** The researcher met with a statistician who recommended adding in activities that were not related to physical activity to reduce response bias. The researcher removed sleeping as an activity from question one and created a new question based on a recommendation from her pilot project, as calculating minutes spent sleeping was challenging for this age group. Question five was modified to ask only about DPA in class as the pilot study participant explained DPA was being facilitated more outside of class time than during class time as it was meant to be.
2. **Academic Achievement Survey:** Wording was changed in both tools to read 'April report card' instead of 'estimated grade' as the two school boards were releasing report cards in April, 2010 for grades primary (kindergarten)-nine which coincided with the researchers data collection time-frame.

APPENDIX B: REQUEST TO THE COMMUNITY-BASED PHYSICAL ACTIVITY
PROGRAM FOUNDER

Dear xxxx,

I am writing to ask your support for a research project that I am conducting for my Masters of Health Promotion thesis. I would like permission to recruit 32 grades three to seven girls from the (program) centers to participate in my study that is examining the relationship between academic achievement and physical activity in grades three to seven girls. The girls will be asked to:

1. Wear an accelerometer, a light-weight instrument worn around the waist, to collect physical activity data for eight consecutive days.
2. Complete a physical activity questionnaire about the different activities they will be participating in during the data collection week.
3. Complete an academic achievement questionnaire to give grades in math and English at the time of data collection.
4. Participate in a one-on-one interview to gather more information on the girls' physical activity behaviours/influences and how physical activity may be related to academic achievement. (Note: only four girls will be asked to participate in the interview process)
5. Parents/guardians of the participating girls will be asked to confirm his/her daughter's self-reported grades with an academic achievement questionnaire

This study aims to contribute to two important concerns: the increasing health challenges to young people as a result of reduced activity and increasing obesity rates, and helping individuals and their community in working to understand the implications of physical activity upon academics. Please allow me to invite the girls participating in the (physical activity program) to participate in this study that has the potential to provide insight on the relationship between academic achievement and physical activity.

If this is something that you feel the (physical activity program) participants would be interested in, I would be grateful for the organizations support and participation in the project.

For more information, please do not hesitate to contact me by phone or by email. I will follow up with a telephone call next week.

Warm Regards,

Krista Whittle

MA(c) Health Promotion Phone: 902-xxx-xxxx Email: krista.whittle@dal.ca

Dr. Laurene Rehman (Supervisor): laurene.rehman@dal.ca, 902-494-6389

Dalhousie University

School of Health and Human Performance

**A STUDY TO LOOK AT THE RELATIONSHIP
BETWEEN GRADES AND PHYSICAL
ACTIVITY OF GIRLS IN GRADES 3-7
PARTICIPATING IN THE (PHYSICAL
ACTIVITY) PROGRAM**

*(Physical Activity) Program Project with Dalhousie
University*



Purpose of the project:

The project will be used to answer questions about the relationship between physical activity and grades.

Why might you want to participate in the project?

Researching the relationship between physical activity and grades may help us to better understand how physical activity may be linked to academic learning.

Who can take part in the project?

If your daughter is in grades 3 to 7 and participates in the (physical activity) program, you and your daughter are invited to take part in a research project with Dalhousie University.

Where can you get more information about the project?

Please call Krista @ 902-xxx-xxxx or email her at krista.whittle@dal.ca for more information about the study details.

APPENDIX D: CHILD INFORMATION/ASSENT FORM



A study to look at the relationship between grades and physical activity of girls in grades three to seven participating in the (physical activity) program

Principal Investigator

Krista Whittle MA(c) Health Promotion

Supervisor

Dr. Laurene Rehman

Why are we doing this study?

I am doing a research study that may help answer some questions about the relationship between physical activity and grades.

What will happen during this study?

I will ask you to:

1. Wear an accelerometer, a light-weight instrument worn around your waist, to collect physical activity information for eight straight days.
2. Fill out a physical activity survey about the different activities you will be doing while you wear the accelerometer.
3. Fill out a survey to get your grades in math and English.
4. Take part in a one-on-one interview to get more information about your physical activity and grades. (Note: only four girls will be asked to do an interview).

One of your parents will be asked to:

1. Answer questions about your grades.

What may result from this study?

You may learn more about your physical activity habits. You may feel a little stress from answering questions about your physical activity and grades. Please note that if, in the rare case, the researcher suspects any type of abuse you may be experiencing, she will have to contact the Department of Community Services.

Who will know about what you did in this study?

No one except myself (the principal investigator) and my supervisor will know the results of your study unless you want to tell them. The other members of the (physical activity) class may know you are participating in the study.

Do you have to be in this study?

You do not have to be in this study. No one will be mad at you and it will not affect your participation in the (physical activity) classes. If you don't want to be in this study, tell

me. Even if you say yes now, you can change your mind later. Being in this study is totally up to you and your parents/guardians.

What if you have any questions?

You can ask questions about the study any time now or later. You can talk to your parents about things in the study you don't understand. You can also call me at (902) xxx-xxxx, during the day from Monday to Friday.

I have read the above information describing the research study and I agree to take part in the study. I understand my participation is voluntary, and I can stop taking part in the study at any time for any reason. My signature below indicates my permission to take part in the study.

Name (print): _____

Date: _____

Signature: _____



Title: *A study to look at the relationship between academic achievement and physical activity of girls in grades three to seven participating in the (physical activity) program*

Introduction:

We invite you and your daughter to take part in a research study being conducted by Krista Whittle who is a graduate student at Dalhousie University, as part of her Masters of Health Promotion program. You and your daughter's participation in this study are voluntary and you both may withdraw from the study at any time. The study is described below. This description tells you about the risks, inconvenience, or discomforts, that your daughter might experience. Participating in the study might not benefit your daughter; but we might learn things that will benefit others. You may discuss any questions you have about this study with the principal investigator, Krista Whittle.

Purpose of the Study:

The goal of the study is to understand the relationship between physical activity and academic achievement of girls in grades three to seven who are participating in the (physical activity) program.

Study Design and Activities:

This study is for Health Promotion research. Your daughter will be asked to:

1. Wear an accelerometer, a light-weight instrument worn around the waist, to collect physical activity information for eight straight days. The instrument should be worn from the time your daughter wakes up and until she goes to bed. Instructions on how to wear and use the accelerometer will be given to your daughter in an information sheet if she takes part in the study.
2. Fill out a physical activity survey about the different activities she does during the week we collect her physical activity information. The survey will be done during one of her (physical activity) classes taking five minutes to complete.
3. Fill out a five minute academic achievement survey to give this year's grades in math and English. This survey will also be done during one of her (physical activity) classes.
4. Take part in a thirty minute one-on-one interview with the principal investigator and asked questions related to physical activity and academic achievement. Only four girls will be asked to take part in the interview and it will take place before or after a (physical activity) class.

You (as the child's parent/guardian) will be asked to

1. Fill out a five minute survey about your child's academic achievement. This will be completed at the end of one of your daughter's (physical activity) classes.

32 girls in grades three to seven who are involved in the (physical activity) program will be asked to participate in this study. Data collection will take about 2 weeks to complete. If you allow your daughter to take part in the interview, she will be contacted about two months later to review what we found in the interviews.

Please note that participants, parents, and the (physical activity) program organization are not liable for the loss or damage of any accelerometer used in the study. However, it is assumed that participants will be careful with the equipment used in the study.

Study participants and their parents have the right to ask questions about the procedure at any time before, during, and after the study period.

Who can participate in the Study?

Your daughter may participate in this study if she is a girl in grades three to seven participating in the (physical activity) program.

Who will be Conducting the Research:

Principal Investigator:

Krista Whittle, MA Health Promotion Candidate
School of Health and Human Performance
6230 South Street
Dalhousie University
B3H 3J5
(902)-xxx-xxxx
krista.whittle@dal.ca

Supervisor:

Laurene Rehman, Ph.D.
School of Health and Human Performance
6230 South Street
Dalhousie University
B3H 3J5
(902)-494-6389
laurene.rehman@dal.ca

Possible Risks and Discomforts:

The accelerometer is a small, light-weight instrument attached around the waist that should cause your daughter minimal discomfort while being worn. The study's aim is to collect the day-to-day physical activities your daughter takes part in; therefore, she will not be asked to participate in any activity other than her normal activities. The interview, physical activity survey and academic achievement survey should cause minimal discomfort with their questions; however, the head (physical activity) program instructor can provide support if discomfort is experienced, as his role in class is to provide leadership and support to students. Although you may give permission for your daughter

to participate the study, there is a small risk that the principal investigator may have to randomly select the participants and she may not be asked to participate.

Possible Benefits:

There are no direct benefits from you or your daughter's participation in this study. You may benefit by becoming more aware of how physical activity may be related to academic achievement. The study may be reported to the local school board and provincial government to provide information on the study results.

Compensation:

Your daughter will be given a chance to be entered into a draw to win a \$50 dollar gift certificate to Source for Sports for her participation in this study.

Confidentiality & Anonymity:

Some of the data collected will be in a face-to-face meeting with the researcher (i.e., recall surveys, one-on-one interview) limiting her anonymity. Your daughter should understand that her fellow (physical activity) group members may know she is participating in the project. Your daughter will also be assigned a code number. The code will be used on all the surveys and data collected in this study. A list of the names, phone numbers, email addresses, and matching codes will be stored in the project researcher supervisor's office (Dr. Laurene Rehman) at the School of Health and Human Performance at Dalhousie University for a minimum of five years. The information will be destroyed by the supervisor after that time. Only the researcher and her supervisor will have access to this list. The physical activity and academic achievement data will be published without identifying individual children. Finally, in the unlikely situation that abuse or neglect is suspected by the principal investigator she will be required to notify Community Services.

Voluntary Participation:

Taking part in this research project is completely voluntary; you and your daughter are free to stop taking part, without penalty, at any time, for any reason. Please be assured that you will be provided with any new information that might affect your decision to allow your daughter to participate in the study. You will receive a copy of this authorization form for your records at the beginning of this study. The researcher also plans to give the results of her study to your daughter by mailing her a simple written summary of the findings once the study has been completed. If your daughter wishes or you wish your daughter to stop participating in the study, you can contact the researcher by phone (902-xxx-xxxx), email (krista.whittle@dal.ca) or talk with her in person. Dr. Laurene Rehman can be contacted at 902-494-6389 or at laurene.rehman@dal.ca. If your daughter chooses to stop taking part in this study, she has the option to withdraw her data and it will be destroyed immediately.

Authorization (Adult)

A Study to Look at the Relationship between Academic Achievement and Physical Activity of Girls in Grades Three to Seven Participating in the (Physical Activity) Program

I have read the attached letter describing the research study and I agree to allow my daughter to participate in the study. I understand my daughter's participation is voluntary, and that she can withdraw from the study at any time for any reason. My signature below indicates my permission for my daughter to participate in the study.

Name of parent or legal guardian

Signature of parent or legal guardian

Date

Location and class time-slot

Name of the participant: _____ Home Phone Number: _____

Home Address (street number, street name, city/town, postal code):

In the event you have any difficulties with, or wish to voice concern about any aspect of your daughter's participation in this study, you may contact Patricia Lindley, the Director of Dalhousie University's Office of Human Research Ethics Administration at: (902)-494-1462 or at patricia.lindley@dal.ca.

Are you willing to let your daughter participate in a one-on-one interview?

- Yes No

If Yes, are you willing to have your daughter's interview audio taped for data collection purposes?

- Yes No

If Yes, are you willing to have your daughter's words anonymously quoted in the study results or presentation of data?

- Yes No

Signature of the Principal Investigator: _____
Date: _____

APPENDIX F: OUTLINE OF RECRUITMENT PRESENTATION

Setting:

The recruitment presentation will be conducted during the (physical activity) classes in a private room for the girls in grades three to seven.

Outline:

- Introduction of principal investigator and study purpose.
- Distribute child assent form.
- Study details:
 - To complete my program I have to do a research project and I chose to do mine on understanding the relationship between academic achievement and physical activity. What that means is I will be asking you for permission to get information about things to do with school and your physical activity levels. First I will show you how to use the study's instrument called an accelerometer (show instrument at this time).
 - The accelerometer attaches around your waist and it will give me information about your physical activity levels. It will be very important if you participate in the study to take good care of these instruments and not lose them. I will ask you to wear the instrument for 8 straight days, only taking it off when you sleep, shower or swim. If you have to take it off (show activity log), all I ask is to record the date, what kind of physical activity you did (e.g., biking), how long you did it for in minutes, and how hard you did it (e.g., mild=very little physical effort).
 - Remember, all this information will only be given to me and my supervisor and no one will be able to tell who is who in my write up. Finally, when you have finished wearing the accelerometer I would like you to fill out two sheets. One will be about what you did for activity that week and the other sheet will be about your school subjects.
 - Remember, your participation in the project is voluntary and you have the right to stop taking part in the study at ANY time or ask any question if you don't understand what is going on or what you are doing for the study.
 - I will also be asking four of you to participate in a short interview to talk about your experiences with physical activity and how it may relate to your schooling. At the end of this process I will send a summary of the interview findings to you through the mail for you to look at and return to me with any changes you would like to make.
 - Thank you for listening and letting me talk with you about my project. Does anyone have questions?

I will now hand out the forms that your parents have to sign in order for you to participate in the study. Please discuss the project with your parents, have them sign the authorization form and bring the form back to the next class on (date). Thanks again for your time and don't hesitate to have your parents contact me if they have any questions or concerns.

APPENDIX G. ACCELEROMETER INSTRUCTION SHEET

What the accelerometer does:

The Actigraph accelerometer is used to monitor your physical activity.

How the accelerometer is worn:

The accelerometer is worn on the right hip of your body and is secured in a pouch that is placed on an elastic velcro belt that can be looped through your pant loops or placed on top of the waist of your pant/skirt. The unit can be worn on top or underneath your clothes, **but should fit snugly to your body.**

When you should wear the accelerometer:

The accelerometer is to be worn from the time you wake up until the time you go to bed. The only time you should take off the accelerometer is when you are sleeping, swimming, or showering/bathing. *If you are not allowed to wear the accelerometer during an activity or sport, please record the date, the type of activity, the length of the activity, and the average intensity of the activity in the activity log sheet given to you.

How long should you wear the accelerometer:

The accelerometer is to be worn for **8 straight days.**

How to use the accelerometer:

1. Check that the accelerometer is secured in the accelerometer pouch (i.e., that the pouch is still wrapped tightly in electrical tape).
2. The accelerometer is wrapped in the pouch so that it records your information properly. Please do not un-wrap the pouch to look at the accelerometer.
3. Loop the elastic waist band through the accelerometer pouch loop holes and attach snugly to your body.
4. The top of the pouch is indicated with a coloured dot. Please place the accelerometer pouch on the belt so the dot is facing so you can see it.
5. The unit should be placed on your right hip, either against your skin or on top of your clothes.
6. Wear the accelerometer from the time you wake up until you go to bed. Only when you are sleeping, showering/bathing or swimming should the accelerometer be taken off.

Additional instructions:

The accelerometer is an expensive piece of equipment. **Please do not lose, drop or get the unit wet.** If you have any questions about the accelerometer please call Krista Whittle at 902-xxx-xxxx or email her at krista.whittle@dal.ca.

APPENDIX I: ACADEMIC ACHIEVEMENT SELF-REPORT SURVEY BY PARENTS/GUARDIANS

FOR PARENT/GUARDIAN

Please take a few minutes to fill out the following questions as completely as possible. If you are not sure of an answer or feel uncomfortable answering the question, please write NA (not able to answer) by the question number.

Think only about your daughter's CURRENT school year.

1. What was your daughter's grade in mathematics in her April report card?

- A
- B
- C
- D

2. What was your daughter's grade in English in her April report card?

- A
- B
- C
- D

3. What is your household's average yearly income?

- ≤\$29,999
- \$30,000- 49,999
- \$50,000-79,999
- ≥ 80,000

.....
Your relationship to the participant: _____
Your Name: _____
Participant's Name: _____

Thank you for completing this questionnaire!

APPENDIX J: PHYSICAL ACTIVITY SURVEY

Name: _____
 Grade: _____
 Age: _____
 School Name: _____

We are trying to find out about your level of physical activity during the *last 7 days*. This includes any activity that makes you sweat or makes your legs feel tired, or games that make you breathe hard, like, skipping, running, and others. Please take a few minutes to fill out the following questions as completely as possible.

There are no right or wrong answers, this is not a test. Please answer the questions as honestly and accurately as you can – this is very important. If you are not sure of an answer or feel uncomfortable answering a question, please write NA (not able to answer) in the blank space.

Physical Activity = Any type of body movement (e.g., walking, skipping, running, rollerblading, skateboarding and others.)

1. Have you done any of the following activities in the past 7 days? If yes, for how many minutes per day and on how many days per week did you do the activity?

Activity	Minutes per day	Number of days this week
Time spent sitting in a car		
Skipping		
In-line skating		
Tag		
Time spent sitting in front of a screen (television, computer, video game)		
Walking		
Bicycling		
Swimming		
Dancing		
Time spent reading		
Badminton		
Skateboarding		
Indoor soccer		
Hockey		
Time spent doing homework		
Volleyball		
Basketball		

Activity	Minutes per day	Number of days this week
Ice skating		
Ringette		
Martial Arts		
Other		
Other		
Other		

2. In the last 7 nights, on average how many hours of sleep would you get per night?
- 0-5 hours per night.....
- 6 hours per night.....
- 7 hours per night... ..
- 8 hours per night.....
- 9 hours per night.....
- 10 or more hours per night.....
3. Who lives in your family home? (Check one only.)
- Both parents.....
- Mother and not father.....
- Father and not mother.....
- Mother and partner
- Father and partner.....
- Other arrangement
4. In the last 7 days, during physical education (PE) classes, how often were you physically active (skipping, running, jumping)? (Check one only.)
- I don't do PE.....
- I didn't have PE in the last week.....
- 1 class per week.....
- 2 classes per week
- 3 classes per week
- 4 classes per week.....
- 5 classes per week

- a. In the last 7 days, the PE classes that you were active, were you participating on average in mild, moderate, hard or very hard activities? (Check one only.)

Mild = very little physical effort, no sweating

Moderate = medium physical effort, breathing harder, sweating a little

Hard = hard physical effort, breathing quite hard, sweating quite a bit

Very hard = hardest effort you can give, hard to breathe, sweating a lot, feels uncomfortable

- Mild.....
Moderate.....
Hard.....
Very hard.....

5. In the last 7 days, during daily physical activity (DPA) time IN CLASS, how often were you physically active (skipping, running, jumping)? (Check one only.)

- I don't do DPA in class.....
1 time per week.....
2 times per week.....
3 times per week.....
4 times per week.....
5 times per week.....

- a. In the last 7 days, the daily physical activity (DPA) times that you were active IN CLASS, were you participating on average in mild, moderate, hard or very hard activities? (Check one only.)

Mild = very little physical effort, no sweating

Moderate = medium physical effort, breathing harder, sweating a little

Hard = hard physical effort, breathing quite hard, sweating quite a bit

Very hard = hardest effort you can give, hard to breathe, sweating a lot, feels uncomfortable

- Mild.....
Moderate.....
Hard.....
Very hard.....

6. In the last 7 days, how often were you physically active (skipping, running, jumping) *at recess*? (Check one only.)

- I am not active at recess.....
- 1 time per week.....
- 2 times per week
- 3 times per week
- 4 times per week.....
- 5 times per week

a. In the last 7 days, the days you were active *at recess*, were you participating on average in mild, moderate, hard or very hard activities? (Check one only.)

Mild = very little physical effort, no sweating

Moderate = medium physical effort, breathing harder, sweating a little

Hard = hard physical effort, breathing quite hard, sweating quite a bit

Very hard = hardest effort you can give, hard to breathe, sweating a lot, feels uncomfortable

- Mild.....
- Moderate.....
- Hard
- Very hard.....

7. In the last 7 days, how often were you physically active (skipping, running, jumping) *at lunch* (Check one only.)

- I am not active at lunch.....
- 1 time per week.....
- 2 times per week.....
- 3 times per week.....
- 4 times per week.....
- 5 times per week.....

- a. In the last 7 days, the days you were active *at lunch*, were you participating on average in mild, moderate, hard or very hard activities? (Check one only.)

Mild = very little physical effort, no sweating
Moderate = medium physical effort, breathing harder, sweating a little
Hard = hard physical effort, breathing quite hard, sweating quite a bit
Very hard = hardest effort you can give, hard to breathe, sweating a lot, feels uncomfortable

- Mild.....
 Moderate.....
 Hard
 Very hard.....

8. In the last 7 days, how many times did you do physical activities (skipping, running, jumping, martial arts) from *after school to bedtime*? (Check one only.)

- None
 1 time last week
 2 times last week
 3 times last week
 4 times last week
 5 times last week

- a. In the last 7 days, the days you were active *after school to bedtime*, were you participating on average in mild, moderate, hard or very hard activities? (Check one only.)

Mild = very little physical effort, no sweating
Moderate = medium physical effort, breathing harder, sweating a little
Hard = hard physical effort, breathing quite hard, sweating quite a bit
Very hard = hardest effort you can give, hard to breathe, sweating a lot, feels uncomfortable

- Mild.....
 Moderate.....
 Hard
 Very hard.....

9. *On the last weekend*, how many times were you physically active (skipping, running, jumping, participating in martial arts classes)? (Check one only.)

- None
- 1 time last weekend
- 2 times last weekend
- 3 times last weekend
- 4 times last weekend
- 5 or more times last weekend

- a. In the last 7 days, the days you were active *on the last weekend*, were you participating on average in mild, moderate, hard or very hard activities? (Check one only.)

Mild = very little physical effort, no sweating

Moderate = medium physical effort, breathing harder, sweating a little

Hard = hard physical effort, breathing quite hard, sweating quite a bit

Very hard = hardest effort you can give, hard to breathe, sweating a lot, feels uncomfortable

- Mild.....
- Moderate.....
- Hard
- Very hard.....

10. How many days of the week do you participate most often in your activities? Please check appropriate days.

- Monday.....
- Tuesday.....
- Wednesday.....
- Thursday.....
- Friday
- Saturday.....
- Sunday

11. Please fill in the blank: (i.e., 9 am, 10:15am, 10:30am, 12:00pm, 12:30pm, 3:00 pm)

- a. What time do you normally start school? _____
- b. What time does your morning recess normally start? _____
- c. What time does your morning recess normally end? _____
- d. What time does your lunch normally start? _____
- e. What time does your lunch normally end? _____
- f. What time does your school day normally end? _____

12. How do you get to school on most days? (Check only one)

Walk.....

Ride your bike/skateboard/rollerblade.....

Take the bus.....

Ride in an automobile.....

13. Did anything stop you from being physically active last week? (Cough or cold, extra school work, etc.) (Check one.)

Yes

No

If **Yes**, what prevented you from your normal activities? Please describe.

Thank you for your time!

APPENDIX K: ACADEMIC ACHIEVEMENT SURVEY

Name: _____

Grade: _____

FOR GIRLS (Grades three to seven)

Please take a few minutes to fill out the following questions as completely as possible. If you are not sure of an answer or feel uncomfortable answering the question, please write NA (not able to answer) by the question number.

This is not a test and there are no right or wrong answers.

Think only about THIS school year.

1. What was your grade on your April report card in mathematics?

- A
- B
- C
- D

2. What was your grade on your April report card in English?

- A
- B
- C
- D

Thank you for completing this questionnaire!

APPENDIX L: INTERVIEW GUIDE

Thank-you for agreeing to this interview. Remember that if I ask a question that you don't want to answer, you do not have to answer. If you need a break at any point during the interview, or if you'd like to stop the interview altogether, just let me know. Please also feel free to ask any questions you might have during the interview. I am going to be tape-recording this session, so I can go back to the tape and review what we talked about. I will send you the overall project summary of what I have found in the interviews to you by mail for you to look at. You may also ask me to turn off the tape recorder at any point during this interview. Do you have any questions before we start? Is it okay if I turn on the tape recorder? (Note: the researcher asked for respondent feedback during the interview process to ensure the interviewer was clear on the interviewee's responses).

I would like to use the information you give me here in my results and possibly in the presentation of my data. I would not use your name with the quote, your words would be used with a code number. Do you agree to let me quote what you say in my results and presentation of my research? Are you ready to start with the first question?

1. During the time you wore the accelerometer, did you have to take it off for any reason? Did you have to take the accelerometer off for any sports? Why? Did you remember to wear the accelerometer from the time you woke up? If not, how many days did you forget to wear it?
2. Describe the type of activities you do on a typical weekday (e.g., at school, after school, at home). Please describe what types of activity you do on a normal weekend day. Is participating in physical activity something that is important to you? How so? What are the benefits of participating in physical activity for you? What are the negatives of participating in physical activity for you? Thinking about the questionnaire, what types of activities do you prefer, ones that are mild (walking), moderate (volleyball), hard (hockey, basketball), or very hard (running, tae kwon do)? Why do you like these activities? Why you don't like the other activities? (When do you start to feel out of breath/sweaty; How long does it take until you feel out of breath/sweaty? If you feel out of breath/sweaty what makes you stop or do you continue playing the activity?)
3. How often do your parents or guardians participate in physical activities (Mom/Dad/Guardian)? What types of activities do your parents or guardians participate in with you (Mom/Dad/Guardian)? Do your parents/guardians encourage you to participate in physical activity (what types of activity, mild, moderate, hard or very hard)? Are your parents involved in any of your activities, like a coach, volunteer, driver, spectator)? How do you think your parents/guardians involvement in your physical activities affects the amount of time you spend in the activity?
4. How many hours of homework do your teachers give you per night? How do your parents influence the time you spend doing homework? Do you feel this time spent doing homework affects your time you spent in physical activities?
5. How does your school get you to participate in physical activity? How many physical education classes do you have per week (how long is each class)? What types of activities do you do in PE class? Would you change the type of

activities? If so, what would you like to do instead (what would be fun for you)? Do you have to change into gym clothes for gym class? If so, are you given enough time to get to your next class? What time of the day do you have PE class? Would you change the time you have PE class? If you could do any physical activity at school that you wanted, what would you choose? (i.e., at recess, lunch, in-class, after school while still at school). Would you like more group activities or individual activities in PE?

6. Why did you start participating in the (physical activity) program (e.g., fun, parents signed you up, interest?) Do you think participating in the (physical activity) program has had an impact on your grades (did your grades go up or down or stay the same when you started in the program?) Why or why not? Do you think participating in the (physical activity) program has had an impact on your overall physical activity participation in comparison to your friends not in the program (e.g., do you participate in more activity at school now that you are a part of the (physical activity) program or do you participate in less activity now, or the same? Do you participate in more, less or the same activity at home?)

Do you have anything else you would like to add? Thank you very much for your participation!

APPENDIX M: REVIEW OF RESULTS GUIDELINE

Hello xxxx,

Thank you for participating in the study that looked at the relationship between grades and physical activity of girls in grades 3-7 that were in the (physical activity) program. I really enjoyed getting to meet all of you during the time I spent at the (physical activity) centre. From the interviews that I did there were five main things that I found. What I will talk about is the main themes from the interviews and a short description of what they mean. Please answer the questions after I talk about the five themes

Theme A: Girls in this study enjoyed higher intensity levels of physical activity.

Description: In this study girls enjoyed taking part in moderate to very hard levels of physical activity because it was fun. Sweating or breathing hard did not stop most of the girls from taking part in harder levels of physical activity.

Theme B: Physical activity is a benefit to girls and a component of play.

Description: Girls liked taking part in physical activity because it helped them keep up their health and it was fun to play different physical activities.

Theme C: Parents supported girls' physical activity.

Description: Parents supported their daughters taking part in physical activity by watching their games, coaching their sports or driving them to their activities. Parents also encouraged the girls to take part in physical activity, played with their daughters or role-modeled positive ways to take part in physical activity.

Theme D: Schools are engaging girls in physical activity.

Description: Girls in this study were found to like most of the physical activities that were included in their physical education class, such dance, volleyball, basketball, and games.

Theme E: The community-based physical activity program's positive influence on physical activity

Description: For some of the girls, the community-based physical activity program helped them to think about participating in more physical activity outside of their program classes. The physical activity program did not have any negative influence on the girls' physical activities.

Is there anything missing from these five themes?

Do you think that I have been able to highlight the major things that we talked about in the interview? If not, please let me know what you think was something that I missed.

It was found that most of the girls were taking part in physical activity on Wednesday and after-school, why do you think this is the case?

Thank you!