

Psychological factors as mediators of the relationship between motor skills and physical
activity in children

by

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BSc, University of Guilan, 2014

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of the Requirements for the Degree of

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Abstract

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The aim of this study was to examine the relationship between motor skills proficiency and participation in physical activity considering three mediators (ability beliefs, subjective task value, and expectancy of success) among Grade 3 children and considers those relationships in terms of sex-based differences.

The participants in this study were recruited from eight elementary schools from School District 61 in Victoria, British Columbia. Participants were 398 children (Girls: $n = 201$, Boys: $n = 197$). Motor skills were assessed using the Test of Gross Motor Development-2 (TGMD-2), physical activity participation was measured using the Children's Assessment of Participation and Enjoyment (CAPE), and ability beliefs, subjective task value, and expectancy of success were measured using the Expectancy Value Questionnaire (EVQ).

Descriptive statistics showed that participation in physical activities was low with a mean score of 3.7 on a scale of 14. Percent of maximum (POMP) scores of the psychological variables were in the middle of the range of possible scores; specifically: 68.7%, 74.8%, and 72.7% for children's ability beliefs, task value, and expectancy of success, respectively. A MANCOVA revealed a main effect of sex ($F(7, 389) = 29.684, p < .001$; Wilks' Lambda = 0.652) between boys and girls in terms of their ability beliefs, expectancy of success, subjective task value, motor skills proficiency. A second MANCOVA examining the effect of sex on total raw scores of motor skills and physical activity also revealed a main effect of sex ($F(2, 394) = 11.130, p < .001$; Wilks' Lambda

= 0.947). Separate parallel multiple mediator models were created for both boys and girls. The mediator model for boys revealed an overall significant effect of .044 ($p < .001$). The mediator model for girls revealed an overall significant effect of .031 ($p < .05$). The mediation model for boys showed that the psychological variables in this study did not mediate the relationship between motor skills and physical activity participation. Instead, boys' motor skills directly predicted their participation in physical activity. The girls' mediation model showed mediation between motor skills and physical activity with subjective task value as the mediator. Girls' motor skills did not have a direct relationship with their participation in physical activities.

Future research might: (1) include gender as a mediating factor in future mediation models, (2) explore mediation models with locomotor skills and object control skills as independent variables, and (3) explore the role of social and environmental factors such as the influence of parents, teachers, peers, culture, and society on children's participation in physical activity.

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Chapter 1: Introduction and Rationale

1.1 Introduction

The 2016 Canadian 24 Hour Movement Guidelines for Children and Youth recommends that children accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity (MVPA) each day (Tremblay et al., 2016). It is estimated, however, that currently only 9% of Canadian children aged 5- to 17-years meet this recommendation (ParticipACTION, 2016). Participation in a range of physical activities in a variety of environments and contexts is the primary way that children accumulate MVPA (ParticipACTION, 2016). In particular, participation in active recreation and leisure activities are vital to children's development and well-being (King et al., 2003; Larson, 2000; Telama et al., 2005). Participation in active recreation and leisure helps children to develop their motor skills and improve their self-worth/self-efficacy, emotional regulation, and social well-being (Caldwell & Witt, 2011; Dahan-Oliel, Shikako-Thomas, & Majnemer, 2012). Given the important role that participation in recreational and leisure activities plays in children's development, combined with the small proportion of Canadian children accumulating currently recommended levels of physical activity, it is evident that an important goal for Canada should be to increase opportunities for Canadian children to participate in active recreation and leisure activities.

Children's participation in physically active recreation and leisure is influenced by a number of factors that can be classified as either individual or environmental (Bronfenbrenner, 1979). Individual factors that influence children's participation in physically active recreation and leisure include a child's intrinsic motivation, their motor proficiency, as well as their self-perceptions of competence. Environmental factors that influence children's participation in physically active recreation and leisure include the extent of support provided by their parents, the culture in which they live, their social interactions, their use of technology, as well as the media to which they are exposed (Ferreira et al., 2007; Sallis, Prochaska, & Taylor, 2000).

This study focuses on several individual factors that may influence children's participation in physically active recreation and leisure. In particular, it examines the influence of children's motor skill proficiency, their ability beliefs, their expectancy of

success at a task, the value that they place on a task, and their sex, on participation in active recreation and leisure.

1.2 Motor Skill Proficiency

Children move and engage in physically active recreation through the execution of fundamental movement skills (FMS). FMS are commonly considered to be the building blocks for more advanced movements and sports-specific skills (Clark & Metcalfe, 2002; Robinson & Goodway, 2009). As such, FMS are basic motor patterns that facilitate children's participation in sports and games that require more advanced movements during the school-age years, as well as engagement in physical activity throughout the lifespan (Clark, 1994).

FMS are typically grouped into three broad categories: (1) locomotor skills, which involve moving the body through space (e.g., run, jump, hop, leap, slide, and gallop), (2) object control skills, which require the use of the hands and feet to manipulate and/or project objects (e.g., throw, catch, kick, dribble, roll, and strike), and (3) non-locomotor skills, which involve axial movements and movements of balance executed with minimal or no movement of the base of support (e.g., bending, twisting, and swaying) (Haywood & Getchell, 2009). Seefeldt (1980) suggested that it is essential for young children to achieve basic competence in motor skills in order to successfully engage in various forms of movements, sports, recreations and physical activities. Seefeldt (1980) also suggested that for some children the challenge of transitioning from basic motor competence to engagement in subsequent forms of physical activities can constitute a practical "proficiency barrier" (Seefeldt, 1980).

The relationship between motor skill proficiency and participation in physical activities highlighted by Seefeldt (1980) has also been noted and modeled by Stodden and colleagues (2008, see Figure 1).

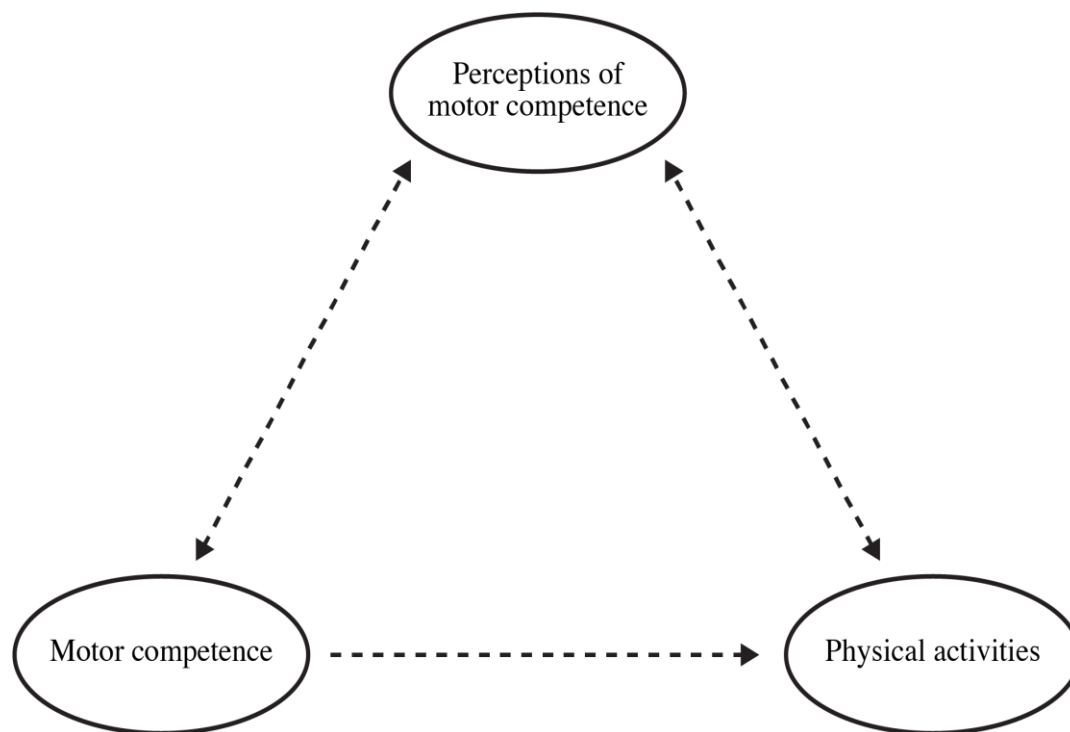


Figure 1. *Extract of a model developed by Stodden et al. (2008, p. 294) illustrating developmental mechanisms influencing physical activity trajectories of children in middle childhood.*

Stodden et al. (2008) argue that low levels of motor skill proficiency in children create a "negative spiral of engagement" in physical activity (p. 297). Conversely, higher levels of motor skill proficiency in children are associated with greater sport participation (Ulrich, 1987) and higher levels of physical activity (Crane et al., 2015; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006).

The number of longitudinal studies examining the relationship between physical activity and motor skill competence is limited, however, both longitudinal research (Lloyd, Saunders, Bremer, & Tremblay, 2014) and cross-sectional research have shown that motor skill proficiency is associated with participation in organized sport (Temple et al., 2016), participation in skill-specific physical activity (Raudsepp & Päll, 2006), and participation in general physical activity (Fisher et al., 2005; Lubans, Morgan, Cliff, Barnett, & Okely, 2010; Williams et al., 2008; Wrotniak et al., 2006). Therefore, motor skill proficiency has the potential to influence an individual's lifelong engagement in

physical activity (Stodden et al., 2008). In particular, De Souza et al. (2014) reported findings from a longitudinal study that showed gross motor proficiency (i.e., balance and locomotor skills) assessed at 6 years of age subsequently differentiated very fit and active children from unfit and sedentary children at age 10. What is not clear from De Souza and colleagues' research is why children with better motor proficiency at age 6, were more likely to be active and fit at age 10. It is possible that the influence of motor competence on physical activity in middle childhood is direct (see Figure 1). That is, children with higher gross motor proficiency engage in more physical activities than children with less motor proficiency. This explanation would support the “proficiency barrier” hypothesized by Seedfelt (1980). The mechanism may, however, be indirect (Stodden et al., 2008) or mediated by an intermediary variable. The term *mediation* refers to the existence of an intermediary variable that connects a predictor variable to an outcome variable (Field, 2013). For example, perception of competence may mediate the relationship between motor skills and physical activity participation. Under these circumstances, children with less well-developed motor skills may opt out of physical activities or choose not to engage in physical activities because they perceive themselves to be less competent than their peers and they do not want to reveal their lower proficiency to others (Stodden et al., 2008).

1.3 Perceptions of Competence and Ability Beliefs

Harter (1982) defined perceptions of competence as an individual's beliefs about their ability in an achievement domain, such as physical activity or sports. The model of the mechanisms influencing physical activity trajectories of children proposed by Stodden et al. (2008, see Figure 1) suggests that perceptions of motor competence along with FMS play an important role in children's motivation to learn, as well as their engagement in current and future motor behaviours (Robinson & Goodway, 2009; Valentini & Rudisill, 2004). Perceptions of motor competence are, however, not fixed. Children's perceptions of competence, as well as the accuracy of those perceptions, change as they grow older (Harter, 1999). In particular, young children's perceptions of their competence in motor skills are not always accurate (Crane et al., 2015; Harter, 1999; LeGear et al., 2012). Weiss (2004) found that children tend to evaluate themselves very positively and at times

their perceptions of their competence can be unrealistic. As cognitive development progresses throughout childhood, children typically become more accurate in comparing themselves to their peers. Harter (1999) has argued that cognitive development during middle childhood should also result in more accurate perceptions of motor skill competence. Weiss (2004) found that in middle and late childhood (i.e., 8- to 11-years), children exhibit more realistic evaluations of themselves, and have the ability to “see” or perceive differentiation between subdomains in regard to their relational competencies (e.g., scholastic, physical, social). This explanation is consistent with research demonstrating that poor motor skills are associated with lower perceptions of physical competence (Lubans et al., 2010; Watson & Knott, 2006).

The progression from early childhood to middle childhood also marks the beginning of a period of vulnerability during which children who have lower motor skill competence tend to demonstrate lower perceived motor skill competence and be less physically active (Stodden et al., 2008). This contrasts with children with high perceived competence who tend to exhibit greater self-esteem, exert greater effort, and select tasks that challenge their ability (Weiss & Amorose, 2005). Perceived competence is closely related to behaviours, such as choosing to participate in an activity, as well as the maintenance of continuing interest in an activity (Babic et al., 2014). That is, children who believe they are able to deal adequately with the demands that they encounter in a physical activity environment are more likely to continue their participation, while children who perceive themselves as having lower competence are more likely to avoid initial participation in the activity or withdrawal from the activity (Weiss & Amorose, 2005).

The indirect relationship between motor skill competence and participation in physical activity through perceptions of competence is a second way in which motor proficiency influences participation. There is evidence suggesting that perceptions of competence in older children and adolescents mediates the relationship between motor skill competence and physical activity (Barnett et al., 2008). In contrast, Crane et al. (2015) found that perceptions of physical competence did not mediate the relationship between kindergarten children’s motor skills and their participation in physical activity. Crane’s finding was not surprising as in early childhood perceptions of competence tend to be

unrealistically high. There is evidence suggesting changes in the relationship between physical competence and motor skills and perceptions of competence and physical activity as children mature. What is unclear to date, is when during development perceptions of competence begins to mediate the relationship between motor skill competence and participation in physical activity.

1.4 Expectancy of Success and Task Value

Achievement motivation theorists contend that individuals' choices, persistence, and performance in achievement-related domains such as sports and academics "...can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity" (Wigfield & Eccles, 2000, p.68). The expectancy-value theory of achievement-related choice (Eccles et al., 1983) has been used in the study of motivation for participation in sports and physical education (for example Fredricks & Eccles, 2005; Xiang, McBride, & Guan, 2004). Studies have shown that children's perceptions of the value of a task (i.e., whether a child values a specific sport or activity) and their expectations of success are related to their motivation and ability beliefs in that specific sport or activity (Xiang et al., 2004).

According to the expectancy-value theory of achievement-related choice (Eccles et al., 1983), subjective task value is comprised of attainment value (importance), intrinsic value (interest), utility value (usefulness), and cost (i.e., what the child has to give up to engage in the task). Individuals are more likely to choose activities they consider have higher task value (Eccles, 2005). Expectancies of success refers to an individuals' beliefs about how well they will perform an upcoming task, as well as their perceptions of their current competence in a sub-domain (e.g., physical, social, and academic) (Eccles et al., 1983; Eccles & Wigfield, 1995).

A number of studies have demonstrated a decline in self-perceptions of competence and subjective task values during middle childhood as children become better able to compare their abilities to their peers and more likely to be influenced by past successes and failures (Eccles, Roeser, Vida, Fredericks, & Wigfield, 2006; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Rodriguez, Wigfield, & Eccles, 2003). In early childhood children tend to have unrealistically high perceptions of their competence. Young

children's perceptions tend to be based on the time and effort they put into doing a task, rather than comparison with peers (Harter, 2012; Horn, 2004). In contrast, the perceptions of competence of children in middle childhood tend to be influenced by peer comparisons (e.g., with teammates, opponents, statistics), evaluative feedback from coaches, parents, game outcomes, as well as internal sources of information (e.g., improvement and ease of learning) (Horn, 2004). Older children thus tend to have lower, but more accurate perceptions of their competence than young children (Barnett et al., 2008; Harter, 2012; Stodden et al., 2008) and this in turn, affects the value they place on an activity. Jacobs and colleagues (2002) found that perceptions of competence accounted for 36% of girls' and 55% of boys' decrease in perceptions of the value of sport from Grade 1 to Grade 12. That is, the children in their study were much more likely to value sports when they felt competent (Jacobs et al., 2002). In addition, when children are not succeeding in an activity, they may perceive their competence less favorably, leading them to discount the importance of the activity in order to protect their self-esteem (Denissen, Zarret, Eccles, 2007; Ebbeck & Stuart, 1993; Fredricks & Eccles, 2002; Harter, 2012).

1.5 Sex-Based Differences

One variable not considered by Stodden et al. (2008) in their model of the mechanisms influencing physical activity trajectories of children is sex. Differences between boys and girls have, however, been demonstrated in participation in physical activity (Barnett et al., 2002; Barnett et al., 2009; Hume et al., 2008), in active recreational choices (Temple, Crane, Brown, Williams, & Bell, 2016), in motor skill proficiency (Barnett et al., 2008; Barnett et al., 2009; Hume et al., 2008; Temple et al., 2016; Thomas & French, 1985), and in perceptions of physical competence (Barnett et al., 2008; Crocker et al., 2000; LeGear et al., 2012). In childhood and adolescence, boys have been found to be generally more proficient than girls in performing object control skills, such as throwing, kicking, and catching (Barnett et al., 2008; LeGear et al., 2012). In some studies, girls demonstrated higher levels of locomotor proficiency compared to boys (Barnett et al., 2008; Barnett et al., 2002). In other studies, however, no differences were found in the performance of locomotor skills between boys and girls in either childhood or adolescence (Barnett et al., 2011; Hume et al., 2008).

Sex-based differences in motor proficiency have generally been attributed to environmental influences, biological factors, or the interaction of environment and biology. Thomas and French (1985) have suggested that before puberty, the physical characteristics of boys and girls are similar, therefore, environmental influences are more likely to explain sex-based differences in motor proficiency. The type of games and sports in which boys and girls participate may provide differential opportunities to practice and refine motor skills and in turn, may contribute to sex-based differences in motor proficiency. For example, Temple et al. (2016) found that sex-based differences among children in kindergarten (average age = 5 years and 11 months) were evident for the types of activities they chose, object control skills, and static balance. Girls participated in significantly more social activities (e.g., having friends over to play), as well as skill-based activities (e.g., learning to dance and gymnastics) (Temple et al., 2016). Furthermore, Temple and colleagues found that girls' static balance was better than boys', but boys' object control skills scores were significantly higher than girls'. There is also evidence that suggests sex-based differences track with children as they get older (Crocker et al., 2000). For example, Cocker et al. (2000) found higher rates of physical activity and self-perceptions in boys compared to their female peers as they got older.

1.6 Summary

There are two mechanisms related to motor skill proficiency that may explain higher or lower levels of participation in physical activities by children. The first is the direct influence of motor skills on participation, where motor skills are the tools that enable participation in physical activities by children. In particular, during middle and later childhood, higher levels of motor skill competence, and the associated increase in motor proficiency, facilitate engagement in a variety of physical activities, sports and games. The second mechanism related to motor skill proficiency that may explain higher or lower levels of participation in physical activities by children is indirect, and relates to perceptions of physical competence. For example, older children (8- to 12-years) who tend to have higher perceived physical competence also demonstrate higher physical activity frequency and intensity compared to those with low perceived physical

competence. Conversely, poor motor skills are associated with low perceptions of physical competence. In particular, highly skilled children tend to self-select higher levels of physical activity, whereas children with less-proficient motor skill competence tend to self-select lower levels of physical activity. In middle childhood perceptions of competence, in turn, are influenced by children's physical activity levels and motor skills, their expectancy of success in any activity, as well as the value that they attribute to an activity. In addition, the relationships between motor skills proficiency, perceptions of competence, expectancy of success, subjective task value, and participation in physical activities appears to be influenced by sex. For instance, boys who have higher object control proficiency tend to be more active and have higher perceptions of their sport competence compared to girls.

1.7 Aim of the Study

The aim of this study was to examine the relationship between motor skills proficiency and participation in physical activity considering three mediators: ability beliefs (also known as perceptions of competence), subjective task value, and expectancy of success among Grade 3 boys and girls.

1.8 Research Questions

The research questions that will be addressed in this study are:

1. What are the levels of ability beliefs, subjective task value, expectancy of success (psychological variables), motor proficiency, and participation in physical activities among children in Grade 3?
2. Do the psychological variables, motor skill proficiency, and participation differ by sex in Grade 3 children?
3. Do the psychological variables mediate the relationship between motor skill proficiency and physical activity levels in Grade 3 children (as depicted in Figure 2)?

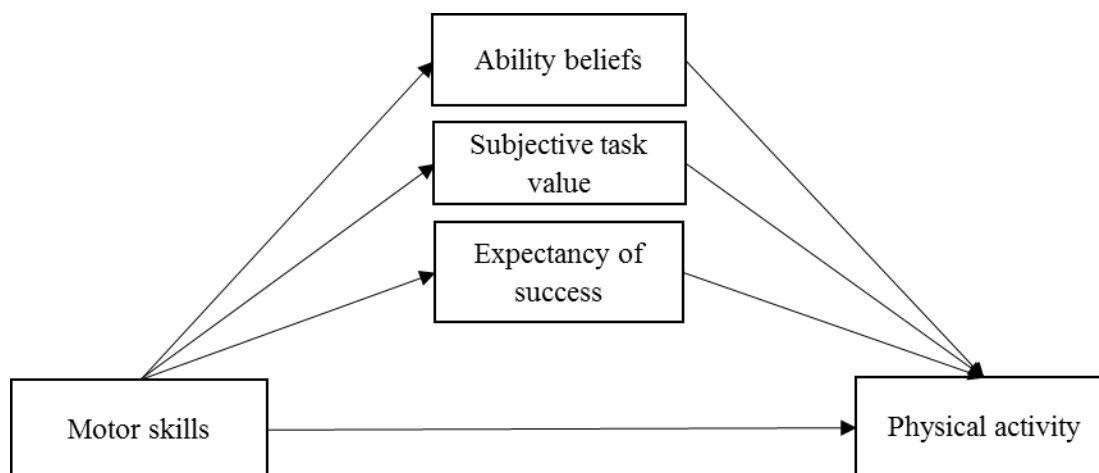


Figure 2. *The conceptual model of the mediation between motor skills proficiency and physical activity in children.*

1.9 Operational Definitions

1.9.1 Participation

In this study “participation” refers to children's daily involvement in formal and informal recreation and leisure activities (King et al., 2004). King and colleagues (2003) have defined recreation and leisure activities as pastimes, which are chosen freely and performed outside of the school environment, that are separate from self-care or school-work. Recreation and leisure activities are categorized into two domains: (1) formal activities such as taking music lessons, participation in competitive sports (including practice time), and participation in sport organizations; (2) informal activities such as active noncompetitive sports, playing games, outdoor activities, passive leisure (including watching television), music and arts, socializing and attending events, shopping for personal items, and hobbies. Organized sports are a subcategory of formal physical activities that are goal-oriented and based on competition (McPherson et al., 1989).

In this study, participation in formal and informal active recreation and leisure activities were measured using the Children's Assessment of Participation and Enjoyment (CAPE; King et al., 2004; see Appendix A and B). Organized Sports, one of the “formal” domain subsets of the CAPE, includes six items (Questions 16-21, see Appendix B). These six items are listed as: doing martial arts, swimming, doing gymnastics, horseback riding, racing or track and field, and doing team sports. Active physical recreation, one of the

“informal” domain subsets of the CAPE, includes seven items (Questions 31-41, see Appendix B), which are dancing, going for a walk or hike, cycling, in-line skating/skateboarding, doing water sports, doing snow sports, playing with equipment, playing games, gardening, fishing, doing individual physical activities, and playing non-team sports.

1.9.2 Ability Beliefs

In this study “ability beliefs” refers to an individual’s perception of their current competence in a given activity as measured by the Expectancy Value Questionnaire (EVQ) (Wigfield and Eccles, 2000). Ability beliefs focus on present ability in a specific task (Eccles & Wigfield, 1995; Eccles et al., 1993). In this study, the term *ability beliefs* is used as a synonym for “perceived competence,” which is a term that is also used by some researchers when referring to an individual’s perception of their current competence in a given activity.

1.9.3 Expectancy of Success

In this study “expectancy of success” refers to an individual’s perception of their likelihood of being successful at a future task as measured by the EVQ (Wigfield & Eccles, 2000). That is, how well they believe they will do a task in the future. Although ability beliefs are distinguished conceptually from expectancies of success, these constructs are highly related to the expectancy-value theory of motivation (Eccles & Wigfield, 1995; Eccles et al., 1993).

1.9.4 Subjective Task Value

In this study “subjective task value” refers to the motivation that is associated with an individual’s willingness to engage in an activity as measured by the EVQ (Wigfield & Eccles, 2000). The determinant of a task’s value is the extent to which a task satisfies the personal needs of an individual (Eccles et al., 1983). Subjective task value in this study is divided into three subcategories: (1) attainment value (importance for identity or self), (2) intrinsic value (enjoyment or interest), and (3) utility value (usefulness or relevance).

1.9.5 Motor Competence

In this study “motor competence” refers to levels of proficiency in FMS as measured by the Test of Gross Motor Development-2 (TGMD-2). The TGMD-2 measures locomotor and object control skills (Ulrich, 2000). Locomotor skills are movements that transfer the body through the space (Gabbard, 2012). The TGMD-2 measures the following six locomotor skills: run, gallop, hop, slide, jump, and leap (Ulrich, 2000). Object control skills involve the use of hands and feet to project and/or control objects (Haywood & Getchell, 2009). The TGMD-2 measures the following six object control skills: dribble, catch, throw, strike, overhand throw, and underhand roll (Ulrich, 2000).

1.10 Assumptions

This study is part of a larger longitudinal study examining how children's motor skill proficiency, their perceptions of physical competence, and the value they place on physical activities influence their participation in sports and recreational activities (i.e., The Physical Activity and Motor Skills Study of Child Development). The data for the larger longitudinal study were collected on two cohorts of children as they progressed from kindergarten to Grade 5 over the period 2010 to 2017. The conduct of the longitudinal study and this study assumes that the child participants tried their best during the administration of the TGMD-2. It also assumes that the children in the study provided accurate responses to questions concerning their ability beliefs, their expectancy of success, and their assessments of subjective task value, as well as appraisals of their participation, enjoyment and preferences for activities.

1.11 Limitations

In the first year of the larger longitudinal study, eight schools were included in the sampling frame, whereas in the second year of the study, only two of those eight schools participated. As a result, the final sample used for the longitudinal study, of which the current cross-sectional study is a subset, is more representative of the two schools included in the second year of the parent study. There are two primary ways that these two schools affect the overall sample. Firstly, data from children at these schools were included in the study twice. Secondly, these schools had larger overall enrolments and as a result, a greater number of children in Grade 3.

An additional limitation associated with this study is that the CAPE assessed participation over a four-month retrospective period. As a result, it may not be representative of the recreational activities undertaken by children outside of this timeframe (see Table 1). For example, some seasonal activities may be underrepresented. In addition, the CAPE focuses on children's participation in 55 selected activities. Children's participation in activities not included in the CAPE were, therefore, not assessed.

Table 1

The Seasonal Activities Assessed by CAPE According to Schools' Numbers

School #	Months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
5												
6												
7												
8												
1*												
2*												

Note. The schools numbered 1* and 2* are the same schools numbered 1 and 2 in the first data collection cohort.

Chapter 2: Literature Review

2.1 Overview

The following sections provide a review of literature pertinent to this study, including: (a) the physical levels activity of Canadian children, (b) motor skill development, and in particular, the role of fundamental movement skills in physical activity and active recreation of children, (c) psychological variables such as perceptions of competency, perceived task value and expectancy of success perceptions of physical competence and their influence on children's participation physical activity and active recreation, and (d) the mediation of the relationship between motor skills and physical activity by psychological factors. Sex-based differences in motor skill proficiency and psychological variables affecting participation in active recreation, are presented within each section.

2.2 Physical Activity and Children

ParticipACTION is a national non-profit organization whose mission is to help Canadians be more active. ParticipACTION, in its 2016 Canadian 24 Hour Movement Guidelines for Children and Youth, recommends that children aged 5- to 17-years-old accumulate at least 60 minutes of MVPA each day (Tremblay et al., 2016). In 2016, ParticipACTION also published a report in which it assigned grades in 12 categories reflecting the degree to which Canadian children and youth met the current guidelines for engagement in physical activity each day. The 2016 ParticipACTION Report Card categories and their assigned grades were:

- “D-” for Overall Physical Activity
- “F” for Sedentary Behaviour
- “D” for Active Transportation
- “D+” for Active Play
- “D+” for Physical Literacy
- “C+” for Family and Peers
- “C+” for School

- “B” for Organized Sport and Physical Activity Participation
- “B” for Sleep
- “B-” for Government
- “A-” for Community and Environment
- “A-” for Non-Government

Of particular note in the 2016 ParticipACTION Report Card were the low grades awarded for “overall physical activity and “sedentary behaviour.” More specifically, key research findings informing the 2016 ParticipACTION Report Card on Physical Activity for Children and Youth indicated that based on the best available evidence: (a) only 9% of Canadian children and youth aged 5- to 17-years get the 60 minutes of physical activity they need each day, (b) only 24% of 5- to 17-year-olds meet the Canadian Sedentary Behaviour Guidelines recommendation of no more than 2 hours of recreational screen time per day, (c) in recent decades, children’s sleep duration has decreased by about 30 to 60 minutes, (d) every hour children spend in sedentary activities delays their bedtime by 3 minutes, (e) 33% of Canadian children aged 5- to 13-years, and 45% of youth aged 14- to 17-years, have trouble falling asleep or staying asleep at least some of the time, (f) 36% of 14- to 17-year-olds find it difficult to stay awake during the day at least sometimes, and (g) 31% of school-aged kids and 26% of adolescents in Canada are sleep-deprived (ParticipACTION, 2016).

In response to the data indicating that relatively few Canadian children are engaging in the recommended daily amount of physical activity, combined with a growing recognition that physical activity, sedentary behaviour, and sleep are closely interrelated, the Canadian Society for Exercise Physiology (CSEP) in 2016 announced the world’s first 24-Hour Movement Guidelines for Children and Youth (5- to 17-years). The Canadian 24-hour Movement Guideline for Children encourages children to “Sweat, Step, Sleep and Sit [less].” More specifically, the guidelines indicate that for optimal health benefits 5- to 13-year-old children should have 9-11 hours of uninterrupted sleep per night. They should accumulate at least 60 minutes of physical activity per day involving a variety of aerobic activities. Vigorous physical activities and muscle and

bone strengthening activities should also be incorporated at least 3 days per week. Several hours of a variety of structured and unstructured light physical activities should be included each day. Recreational screen time should be limited to less than 2 hours per day. And finally, sitting for extended periods of time should be limited.

Ensuring that Canadian children and youth engage in recommended levels of physical activity is important because research continues to highlight the health benefits of physical activity. Regular physical activity has been found to be inversely associated with body weight status and positively associated with increases in bone density (Basterfield et al., 2015; Cattuzzo et al., 2014; Robinson et al., 2015), cardiorespiratory fitness, and musculoskeletal strength/endurance across childhood and adolescence (Cattuzzo et al., 2014; Lubans et al., 2010; Robinson et al., 2015). For instance, an international study of more than 6,000 children from 12 different countries, including both developed and developing countries showed that 9- to 11-year-olds who get at least 55 minutes of physical activity per day are less likely to be obese compared to their less active peers (Katzmarzyk et al., 2015a). In a related study, Katzmarzyk et al. (2015b) found that the odds of being obese increased substantially in both boys and girls for every 25-minute decrease in daily physical activity. Other recent research has reported similar findings (Ferrari, et al., 2015; Herman, et al., 2015).

There is also increasing evidence of the benefits of physical activity for mental health (e.g., Biddle & Asare, 2011; Carson et al., 2016; Herman et al., 2015; Tremblay et al., 2016). Research shows a link between higher levels of physical activity in children and youth and lower levels of anxiety and depression (Biddle & Asare, 2011; Larun, Nordheim, Ekland, Hagen, & Heian, 2006). A recent study of older youth and adults from 15 countries in Europe revealed that as self-reported physical activity increased, levels of self-reported happiness also increased (Richards, Jiang, Kelly, Chau, Bauman & Ding, 2015).

A positive link has also been shown between physical activity and academic performance (Domazet, Tarp, Huang, Gejl, Andersen, Froberg, & Bugge, 2016; McIsaac, Kirk, & Kuhle, 2015). For example, children in Grades 4 to 6 from 18 schools in rural Nova

Scotia who had lower levels of physical activity were more likely to have lower scores in mathematics, English language, and arts (McIsaac et al., 2015).

Despite the evidence of the benefits of physical activity for both physical and mental health, there is a concerning trend for physical activity levels to be lower in children 5- to 11-years-old. Two cross-sectional studies have demonstrated a decline in children's physical activity as they transition from early to middle-childhood (5- to 10-years-old) (Arundell et al., 2013; Crane et al., 2015; Ridgers, Timperio, Crawford, & Salmon, 2012). Similarly, the majority of cross-sectional studies exploring Canadian children's physical activity have found that physical activity levels are much lower than sedentary behaviour levels in middle-childhood (8- to 11-years) (Chaput et al., 2012; Statistics Canada, 2011; Herman, Sabiston, Mathieu, Tremblay, & Paradis, 2014; Nettlefold, McKay, Naylor, Bredin, & Warburton, 2012).

Several factors have been found to influence children's physical activity, including their age, ethnicity, socio-economic status, beliefs, values, social support, environmental conditions, etc (Berger et al., 2008; Gallahue & Ozmun, 2006; Spurr, Bally, Trinder, & Williamson, 2016). Along with the decline in physical activity levels with age, physical activity of Canadian children also varies by geographic region. For example, two studies using the same participants from one cohort in Quebec, found that children aged 8- to 10-years-old engaged in 55 minutes of MVPA, 378 minutes of light physical activity, and approximately 6 hours (340 minutes) being sedentary per day (Chaput et al., 2012; Herman et al., 2014). Whereas, Statistics Canada (2011) has reported that children aged 6- to 10-years-old in Ontario engaged in 58 minutes of MVPA, 256 minutes of light activity, and 516 minutes (over 8 hours) being sedentary per day. The highest levels of physical activity among children in Canada have been found to be in British Columbia (Crane et al., 2015; Nettlefold et al., 2012). Nettlefold et al. (2012) found that 8- to 11-year-old children in British Columbia engaged in more than double the amount of MVPA (124 minutes) but less light activity (116 minutes) than similarly aged children in Ontario (Statistics Canada, 2011). Despite the higher levels of 8- to 11-year-old children engagement in MVPA, children in British Colombia still spent 540 minutes sedentary per day (Nettlefold et al., 2012). Possible explanations for the higher levels of MVPA in

children in British Columbia include: (1) the climate in British Columbia is milder and this reduces barriers to active leisure throughout the year, (2) the population in British Columbia has a higher level of education and highly educated Canadians participate more in active leisure, (3) there are higher income levels in British Columbia and Canadians with higher-incomes are more active in leisure, and (4) British Columbia has developed a culture that encourages participation in sport and recreation (Statistics Canada, 2009).

Sex-based differences in physical activity among Canadian children have also been widely documented. According to the Canadian Fitness and Lifestyle Research Institute boys have been found to be more physically active than girls from as early as 5-years of age (CFLRI, 2016). Importantly, sex-based differences in levels of physical activity follow children as they get older (CFLRI, 2016). For example, Berger and colleagues found that 66% of adolescent boys were engaged in sports, while barely 50% of Canadian girls were actively participating in sports by late adolescence (Berger et al., 2008). This trend is supported by several studies that have found that boys spend significantly more time engaging in physical activity than girls (Barnett et al., 2009; Cliff, Okely, Smith & McKeen, 2009; Herman et al., 2015).

It is well documented that exercise patterns and health outcomes in adulthood are shaped by early life experiences (Umberson, Crosnoe, & Reczek, 2010). Telama and colleagues (2005) have suggested that physical activity participation in childhood may assist the development of motor skills, as well as intrinsic motivation that increases the probability of being active later in life. They also argued that participation in physical activity at a young age forms a preference for choosing physical activity, which is maintained throughout life (Telama et al., 2005). In addition, several studies have shown that regular physical activity during early ages turns into a habit of an active, healthy lifestyle through adulthood (Hearst et al., 2012; Malina, 2001). In particular, a number of studies have emphasized the importance of learning FMS during early childhood in promoting long-term participation in physical activities (Barnett et al., 2009; Robinson et al., 2015; Vlahov, Baghurst & Mwavita, 2014). Not surprisingly, sedentary behaviour in childhood predicts obesity and increased BMI in adulthood (Thorp et al., 2011). As a result,

Tremblay and colleagues have suggested that more research is needed to identify the factors that encourage children to be physically active (Tremblay et al., 2016).

The following sections review literature that provides insights into active recreation, sports, as well as a range of factors that contribute to the physical activity levels of children. In particular, the following topics will be discussed: (a) active recreation and sports patterns, (b) motor development, (c) the psychological and physical factors affecting physical activity, (d) the relationship between motor skills and physical activity, (e) the relationship between expectancy-value theory elements (i.e., ability beliefs, subjective task value, and expectancy of success) and physical activity, as well as (f) sex-based differences.

2.3 Active Recreation and Sports

Participation in active recreation and leisure activities that are enjoyable and challenging has important developmental, well-being, and social benefits for children (Larson, 2000; Law et al., 2006). Active recreation is a type of physical activity that includes formal activities that are structured and goal-oriented (e.g., organized sports), and informal activities that require little preparation and training that are often driven by children themselves (e.g., playing games) (King et al., 2004). Participation in active recreation and leisure can positively affect children's physical well-being (Telama et al., 2005), which includes the acquisition of motor skills, lower risk of cardiovascular disease, obesity, and diabetes (Murphy & Carbone, 2008; Waxman & World Health Assembly, 2004; World Health Organization, 2007). Moreover, engagement in social, skill-based, and leisure activities may enhance mental health (Telama et al., 2005), which includes emotional well-being (e.g., relieving stress and anxiety), self-worth/self-efficacy (e.g., identity formation, achievement motivation, creativity), and social well-being (e.g., building friendships and connecting with family and community) (Caldwell & Witt, 2012).

Sport participation in children 3- to 5-years-old, in particular, has been found to influence participation in sport in adolescence (Basterfield et al., 2015). Furthermore, children 3- to 5-years-old who participate in organized sports are more likely to adopt an active lifestyle in adulthood (Telama et al., 2005). For instance, longitudinal research has shown that

children who participated in sports at age 10 were more likely to be physically active at age 42 (Smith et al., 2015).

There is also ample evidence that shows sex-based differences in children's participation in active recreation and leisure. For instance, King and colleagues (2010) examined multiple dimensions of participation in the active recreation and leisure of 6- to 14-year-old children using the CAPE (e.g., diversity, intensity, and enjoyment). They found that girls participated more in social, skill-based, and self-improvement activities, while boys were more intensely involved in active recreation and team sports (see Table B1 for a list of the types of activities and dimensions of participation used in the CAPE by King et al., 2010). Simpkins, Ripke, Huston, and Eccles (2005) found similar results for 7- to 9-year-old children. Namely, that girls participated more in art/lessons while boys reported higher participation levels in sports. However, sex-based differences in sports participation seem to fade as children grew older (i.e., 10- to 11-years-old). In a study by Mirjafari (2015), 7- to 8-year-old girls preferred to engage in social, skill-based, and self-improvement activities. Overall, boys and girls had the same amount of participation in sports but their choice of sport activities were not the same. Mirjafari (2015) found that boys participated more in team sports while girls participated more in gymnastics and dance. Similarly, Temple and colleagues (2016) in a study examining participation among kindergarten children, found no sex differences in organized sports in general but when it came to specific types of activities, team sports were more popular among boys, and dancing was more popular among girls.

In summary, the literature on participation in active recreation and leisure by children suggests that from early-childhood to early-adolescence girls consistently participate in social, skill-based, and self-improvement activities more than boys. However, in general there is no pattern of sex-based differences when it comes to sports and physical activity participation, although Temple et al. (2016) did find that boys were more likely to participate in team sports than girls. This suggests that factors other than age and sex may influence children's participation in physical activity. Several authors have proposed that environmental factors such as social ecologies (socio-economic status, ethnicity, region, and neighborhood), opportunities for practice, parental support, and peer interactions may

play a role in influencing children's participation in physical activity (King et al., 2010; Simpkins et al., 2005).

2.4 Motor Development

Motor development is part of overall developmental processes that occur in conjunction with general life experience (Payne & Isaacs, 2005). Gallahue and Ozmun (2006) have proposed the Hourglass Life Span model to describe the typical sequences that occur in human motor development. The model highlights how heredity and environment influence all phases of development (Gallahue & Ozmun, 2006). Their model suggests that the primary phases of motor development, which are highly predictable, start with reflexive and spontaneous movements from birth to approximately 1-year of age (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009). A reflexive movement is one where the infant responds automatically to stimulation. For example, infants close their hand when their palm is touched. On the other hand, spontaneous movements appear in the absence of any stimulation. For example, when infants are laid on their back, they often simultaneously kick with their legs. Also, most children spontaneous stand by 9 months of age. These motions are not merely movements without purpose; they are coordinated patterns that mimic the position and timing of walking.

The second phase of motor development also known as the rudimentary movement phase, involves basic forms of voluntary movements that continue to approximately 2-years of age, and provides the foundation for FMS. Rudimentary movement abilities involve stability movements such as gaining control of the head, neck, and trunk muscles; the manipulative tasks of reaching, grasping, and releasing; and the locomotor movements of creeping, crawling, and walking. This stage is not characterized by a sudden transition to complex movements, but rather, it is a process of learning fundamental skills that lead to skilled performance (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009).

The third phase of motor development occurs in early childhood (2- to 7-years of age) and is known as the fundamental movement phase. In this phase, children learn how to perform a variety of locomotor, manipulative movements and stabilizing skills, either in isolation, or in combination with one another (Gallahue & Ozmun, 2006). Locomotor

skills enable the child to transport their body from one place to another. After the child is able to manage locomotor skills, such as walking with no assistance, they begin exploring with their hands. Without the development of basic locomotor skills, more specific or difficult skills such as dribbling a soccer ball while running would not be possible. With time, experience and practice, eye-hand and eye-foot coordination improve and lead to the development of object motor skills such as transporting, intercepting, or projecting objects like throwing, catching, dribbling, kicking, underhand rolling, and striking. The presence of stabilizing skills allows the child to accomplish locomotor and manipulative movement skills. Stabilizing skills activate certain postural muscles to maintain a position in response to gravity (Haywood & Getchell, 2009).

The final phase of motor development, known as the specialized movement phase, represents refinement and application of FMS, more than a new stage in its own right. It includes three progressions: the transitional stage, the application stage, and the lifelong utilization stage (Gallahue & Ozmun, 2006). The transitional stage typically occurs between 7- to 8-years of age. In this stage children begin to combine FMS to create a more complex range of movements that are performed with greater accuracy and control. The application stage is characterized by children beginning to make decisions about their participation in activities (Gallahue & Ozmun, 2006). These decisions are frequently based on the child's ability beliefs, their interest in the task, as well as their expectancy of success in the task (Gallahue & Ozmun, 2006). The final stage of motor development is labelled the lifelong utilization stage, and is when individuals refine motor competencies and choices made during the previous stages and apply them to lifetime performance that can range from simple daily physical activities to participation in the Olympic Games (Gallahue & Ozmun, 2006). Although Gallahue and Ozmun have defined each phase of development in terms of chronological age, human development is highly individualized. It is also important to recognize that motor development does not strictly conform to aged-based progressions. Motor development, can and frequently is, influenced by individual and environmental experiences throughout the lifespan (Clark & Metcalfe, 2002).

2.5 Fundamental Movement Skills

The third phase of motor development, fundamental movement skills development, is associated with the likelihood of an individual participating in physical activity and an individual's level of fitness (Crane et al., 2015; Stodden et al., 2008; Vlahov et al., 2014). Fundamental movement skills are frequently considered the “ABCs” of physical activity (Stodden et al., 2008). As such, they are primary movement sequences that are required for engagement in organized and informal physical activities (Stodden et al., 2008). FMS are also the foundation of more complex and skilled actions (Gabbard, 2012) that enable children to participate in a variety of sports and physical activities (Clark & Metcalfe, 2002; Malina, Bouchard & Bar-Or, 2004).

FMS are commonly grouped into three main categories: non-locomotor or stabilizing skills, locomotor skills, and manipulative skills (Gabbard, 2012). Stabilizing skills are any movement in which some degree of balance is required. Stabilizing skills include: twisting, turning, pushing, and pulling. Locomotor movement skills are movements that transfer the body through the environment. Locomotor skills include: walking, running, jumping, skipping and leaping. Manipulative skills, which are also sometimes referred to as object control skills are movements that involve the control of objects primarily with the hands or feet. Manipulative or object control skills include: catching, kicking, throwing, and dribbling (Gallahue & Ozmun, 2006). If a child cannot proficiently run, jump, catch, and throw, they frequently have limited opportunities for engagement in physical activities because they do not have the prerequisite skills to be active.

Children have been found to perform differently in terms of FMS domains according to their age and sex. In a recent study by Crane and colleagues (2017), the TGMD-2 was used to measure motor skills proficiency in the transition from early- to middle-childhood. Crane et al. (2017) compared TGMD-2 scores of kindergarten and Grade 2 children and concluded that motor skill proficiency scores in Grade 2 increased in comparison with the scores in kindergarten. This finding is consistent with research by Temple and Foley (2016) who found that both object control and locomotor skills significantly improved as children transitioned from Grade 3 to Grade 4. However, Crane et al. (2017) reported that the improvement in motor skill levels from kindergarten to

Grade 2 of the children in their study was not the same as would have been expected based on the normative data published with the TGMD-2. In particular, percentile ranks for Grade 2 children indicated that their motor skills were not reflective of their age (Crane et al., 2017). This finding is consistent with those of LeGear et al. (2012), who found that in a sample of children in kindergarten, boys' and girls' object control skills were less developed than expected by developmental theories. Similarly, Mirjafari (2015) in a study focused on Grade 2 children found that the total scores of locomotor skills and object control skills were poor in relation to normative data (Ulrich, 2000). One possible explanation for delays in the development of object control skills in Grade 2 children might be the influence of environmental factors such as exposure to opportunities to develop object controls skills at home or at school, and/or the children's access to skilled performers of object control skills on which to model their own performance (Clark & Metcalfe, 2002; Crane et al., 2017). Another possible explanation could be a shift in what is normative. The normative data associated with the TGMD-2 was established over two decades ago (i.e., 2000) and may reflect a generation of children who were more physically active and who had higher levels of motor skill proficiency, than the present generation.

In terms of the sex differences in motor skills, the literature consistently shows that boys are generally more proficient than girls in performing object control skills in both childhood and adolescence (Barnett et al., 2008; Crane et al., 2015; Crane et al., 2017; LeGear et al., 2012). Some studies have found higher levels of locomotor proficiency for girls compared to boys (Barnett et al., 2008; Barnett et al., 2002; Mirjafari, 2015; Vlahov et al., 2014). In other studies, however, the performance of locomotor skills was not different between boys and girls in either childhood or adolescence (Barnett et al., 2011; Hume et al., 2008). Temple and Foley (2016) in their study measuring motor skills in middle childhood reported that boys had consistently higher ball skills scores than girls in both Grade 3 and Grade 4. However, sex differences in locomotor skills were reported only in Grade 3, with girls having a higher proficiency than boys. The relationship between motor skills and physical activity differs between boys and girls based on the type of skill being performed. For instance, object control skills are generally considered to be positively associated with physical activity participation for boys (Cliff et al., 2009;

Crane, 2016; LeGear et al., 2012; Logan et al., 2015), and locomotor skills competence for girls (LeGear et al., 2012; Logan et al., 2015). Considering the long-term effect of motor skills, higher levels of object control skills in early childhood among both genders found to be a better predictor of physical activity in adolescence (Barnett et al., 2008; Barnett et al., 2009; Vlahov et al., 2014).

2.6 Motor Development Assessment Tools

Motor development assessment tools are used to observe and evaluate children's motor skill behaviour (Ulrich, 2000). These measurement tools can be either product-based or process-based. Product-based assessments are designed to find quantitative values that are the outcome of performance such as the number of sit-ups done in a certain amount of time. Process-based tests are measurements that evaluate quality of movement (i.e., form rather than product) such as time, speed or success rate (Gabbard, 2012).

In order to make judgements either on product or process oriented assessments, there are two types of standards that are applied. Norm-referenced standards arrange comparisons according to the individual's hierarchy. Assessment tools that use this type of evaluation are mostly quantitative tools that compare the participants to others of similar sex and age group. Criterion-referenced standards compare the individual to a criterion value; they are concerned with the level of individual's achievement on a specified motor performance, or physical status (Gabbard, 2012).

The Test of Gross Motor Development-2 (TGMD-2, Ulrich, 2000) is one of the most commonly used measures of motor skill proficiency of children aged 3- to 10-years (Gabbard, 2012). The TGMD-2 is a process oriented measurement tool that comprehensively assesses a wide range of motor skills and provides both norm-referenced and criterion-referenced interpretations (Gabbard, 2012; Ulrich, 2000).

2.7 Validity and Reliability of the Test of Gross Motor Development-Second Edition (TGMD-2)

The content-, predictive-, and construct-validity of the TGMD-2 has been established by Ulrich (2000). Content-validity was assessed by Ulrich in two ways. Firstly, three content experts judged whether the twelve specific gross motor skills used in the TGMD-2

reasonably represented their associated gross motor domains and whether the twelve gross motor skills in the TGMD-2 were frequently taught to children in preschool and early elementary grades. Content experts unanimously agreed that the gross motor skills in the TGMD-2 represented those taught in preschool and early elementary grades. Secondly, content-validity was assessed by examining the extent to which test items differentiated between test takers according to the purpose of the test item (i.e., item validity) and whether the test items were too easy or too hard (i.e., item difficulty). Pycszak (1973) suggested that item validities are considered acceptable if they are .35 or higher, while item difficulty (percent of children who pass an item) should range between 15% and 85%. For 8- to 9-year-old children (the age of participants in this study) item validities for the locomotor skills subtest were .38 and .41, respectively; and for the object control subtest were .42 and .42, respectively. Item analysis also demonstrated acceptable item difficulty for children aged 3- to 10-years. Specifically, for 8- to 9-year-old children, locomotor subtest difficulties were 92% and 91%, respectively; and for the object control subtest were 83% and 88%, respectively.

The predictive-validity of the TGMD-2 was assessed by Ulrich (2000) by administering the Basic Motor Generalization subtest of the Comprehensive Scales of Student Abilities (Hammill & Hresko, 1994) to 41 elementary school students approximately two weeks after administering the TGMD-2 to the same sample. Partial correlations (controlling for age) were .63 for the locomotor subscale and .41 for the object control skills; which both support the predictive-validity of the TGMD-2.

Finally, construct-validity of the TGMD-2 was established by Ulrich (2000) through a series of analyses intended to test a priori constructs. These analyses showed that the TGMD-2 differentiated between younger and older children, as well as between children with typical development and children with Down syndrome. Scores for the TGMD-2 locomotor and object control subtests for both boys and girls were strongly related to age with mean raw scores progressively increasing from 3 years and 0 months to 10 years 11 months of age. Exploratory and confirmatory factor analyses also supported that there were two subtest constructs (locomotor and object control). The goodness-of-fit index ranged from .90 to .96 (for full details see Ulrich, 2000).

Reliability of the TGMD-2 was established by Ulrich (2000) through examination of scale internal consistency scores, test-retest reliability, and inter-scorer differences. The alpha (α) coefficients (Cronbach, 1951), representing internal consistency of the two subtests were strong for the overall sample: locomotor skills $\alpha = .85$ and object control skills $\alpha = .88$. For 8- and 9-year-old children the locomotor subtest coefficients were $\alpha = .76$ and $\alpha = .83$, respectively; and for object control subtest were $\alpha = .85$ and $\alpha = .89$, respectively. Test-retest of 75 children aged 3- to 10-years two weeks apart revealed r-values of .88 for the locomotor subtest and .93 for the object control subtest. Results for the 6- to 8-year-old subset of children ($n = 13$) revealed reliability coefficients of .94 (locomotor) and .96 (object control). In addition, two research assistants independently scored 30 completed tests. Inter-scorer reliability for each of the subtests was very high, $r = .98$ for both subtests (Ulrich, 2000).

2.8 Determinants of Physical Activity

Children's participation in physical activity is a multidimensional behaviour and the stimuli to become and remain physically active are influenced by numerous individual and environmental factors (Berger et al., 2008; Hearst et al., 2012; Robinson et al., 2015). Bronfenbrenner (1979) has proposed an ecological theory of child development that attempts to acknowledge the direct and indirect systems or factors with which an individual interacts and which influences their behaviour. Bronfenbrenner (1979) conceptualizes these influences as layers of individual, social and environmental factors (e.g., age, sex, special needs status, family, school, and neighborhood). These factors can be close to the individual, such as the physical features they are born with or distant, such as environmental factors like the culture in which a person is raised and lives.

The determinants of physical activity have been explored in several studies (Bauman et al., 2012; Berger et al., 2008; Booth et al., 2001; Lämmle, Woll, Mensink, & Bös, 2013; Patnode et al., 2010; Spurr et al., 2016). In a similar fashion to Bronfenbrenner's ecological theory, the factors that influence physical activity behaviour have been categorized as individual, social, and environmental. In the context of physical activity research individual factors include age, gender, physical condition, ethnicity, socio-economic status, intrinsic motivation, beliefs, and values. Social factors include the

interpersonal relationships and influences of others such as family support, parents' physical activity level, influence of peers, teachers, and coaches. Finally, environmental factors include the context of neighborhood, school, community conditions, recreational time, and opportunities for practice.

The following sections discuss some of the individual factors (i.e., ability beliefs, subjective task value, expectancy of success, and motor skills) that may influence the physical activity behaviour of children in this study.

2.8.1 Psychological Variables

Expectancy-value theory (Eccles et al., 1983, 1989; Wigfield, 1994; Wigfield & Eccles, 2000) represents a useful framework for predicting physical activity behaviour (Fredricks & Eccles, 2005; Pang et al., 2010; Xiang et al., 2004). This theory provides a general explanation of the psychological variables that affect achievement related choices whether educational, occupational, or leisure-time choices (Eccles, 2005). Children's ability beliefs, subjective task values, and their expectancies of success are the strongest predictors of their performance, persistence, and choice of task (Wigfield & Eccles, 2000; Xiang et al., 2004). These elements are influenced by the goals, personal and social identities, culture, gender roles and the past experiences of the task (Eccles, 2005). Task value and expectancy of success have also been identified as important contributors when it comes to making a decision (Eccles et al., 1989; Eccles et al., 1993; Eccles & Wigfield, 1995). For example, several studies have found a link between decision making and the value of a task (Xiang, McBride, Guan, & Solmon, 2003) suggesting that a person may avoid participating in a task, not because of lack of competence in that task, but rather because the task is not valued by them (Eccles & Wigfield, 2002).

Developmental theorists of physical activity have emphasized the importance of children's ability beliefs in increasing motivation to participate in physical activity (Stuntz & Weiss, 2010). Ability beliefs refer to children's self-evaluations of their competence in different areas that are shaped over time by past experiences. That is, how good they think they are in doing a task (Eccles, 2005). Expectancy of success can be defined as children's beliefs about how well they might perform an upcoming task. Expectancy of success is related to ability beliefs, and the estimation of how difficult a

task is. Subjective task value is defined as the personal importance attached to doing well on, or participating in, a given task. Children might value a task if it includes three elements: (a) utility value or usefulness, how a task would fit into children's future goals, (b) intrinsic value or interest is the personal enjoyment of doing the task; and (c) attainment value refers to the importance attributed to a task (Wigfield, 1994; Eccles, 2005). Individuals are more likely to choose activities they perceive have higher value (Eccles, 2005). Pang and colleagues (2010) have suggested that physical activities should be organized in a way that appears useful to children and provides links to children's current and future goals, involves fun, and promotes health improvement.

During a 3-year longitudinal research study, Wigfield (1994) observed that children's beliefs about the usefulness and importance of sport decreased across the elementary school years and often continued to decrease into junior high and middle school. Children's way of thinking and perspective also change as they grow up. Studies of young children have revealed that in the early ages of their life, children are highly optimistic about their abilities while their actual levels of motor skills are quite low (Crane et al., 2017; LeGear et al., 2012). Kindergarten children often believe that they will do well no matter how many times they have failed a task in the past (Xiang et al., 2003). As cognitive development progresses from early childhood to middle childhood, children's ability beliefs and expectancies of their performance become more related to their previous experiences and whether they were successful or not. Moreover, they begin to place a lower value on the activities they think they are not good at. In other words, they become more realistic about their abilities (Eccles & Wigfield, 2002; Eccles, Wigfield, Harold, & Blumenfeld, 1993).

There is also research that suggests that children's response to different activities varies according to their gender. In one study, Freedman-Doan and colleagues (2000) examined sex-based differences in children's ability beliefs towards academics, sports, music, and arts. They found that gender differences existed as early as Grade 1 and essentially remained unchanged by Grade 4. For instance, girls felt more competent in dancing and singing than boys did. In addition, girls considered themselves better at reading, compared to other domains, while the majority of boys reported negative beliefs about

their reading abilities. Freedman-Doan and colleagues (2000) also analyzed children's ability beliefs towards physical activity in four categories: competitive activities and non-competitive activities, team sports, and individual sports. They found that boys in general attributed more usefulness to sports and more importance to doing well in sports than girls did. However, girls' ability beliefs varied according to the type of sport. Girls perceived themselves as least competent in competitive team sports compared to boys, but the majority of girls had positive beliefs towards their performance in non-competitive and competitive individual sports.

2.8.2 Importance of Motor Skills

Although expectancy-value theory (EVT) provides a partial understanding of the factors contributing to engagement in physical activity of children, the focus of EVT is predominately on psychological variables, such as beliefs about ability, the value children attach to physical activity, and their expectations of being successful in the future opportunities (Eccles et al., 1983; Stodden et al., 2008). EVT does not, however, take account of the influence of actual motor skill proficiency on children's engagement and disengagement in physical activities. Stodden and colleagues (2008) highlighted the importance of both actual motor skills and perceived competence in fostering engagement in physical activity. Stodden and colleagues argue that any comprehensive understanding of the factors contributing to engagement in physical activity must acknowledge the interaction of psychological variables, and motor competence.

For instance, motor skill proficiency has been identified as one of the factors that may contribute to physical activity engagement across childhood and into adulthood (Crane et al., 2015; Logan et al., 2015; Robinson et al., 2015). A number of researchers (Barnett et al., 2009, Vlahov et al., 2014) have suggested that physical education periods in elementary schools should emphasize motor skills over general physical activity because motor skills are related to physical activity levels in children. In one longitudinal study, Barnett and colleagues (2009) found that motor skills, particularly object control skills in childhood, were positively associated with physical activity in adolescence. This positive association was accounted for 12.7% of the variation in MVPA. Barnett and colleagues (2009) suggested that emphasizing the development of motor skills would result in

greater motor skill competence in children, which would contribute to increases in self-esteem, enjoyment, and ultimately increases in the likelihood of prolonged participation in physical activity.

2.9 Mediation

Mediation refers to the existence of an intermediary variable that connects a predictor (independent) variable to an outcome (dependent) variable (Hayes, 2013). In other words, an intermediary variable (mediator) builds an indirect pathway from an independent variable to a dependent variable. In this study, the independent variable is the motor skills of children and the dependent variable is the physical activity level of children. The mediation analysis is used to quantify and examine both direct and indirect pathways between two variables.

To date the limited research examining whether perceptions of competence mediate the relationship between motor skills and physical activity seems to follow a logical developmental path. In early childhood, ability beliefs do not act as a mediator of the relationship between motor skills and physical activity (Crane et al., 2015). In addition, Crane (2016) found that perceived physical competence does not mediate the relationship between motor skills and physical activity in Grade 2 and 3 children. Crane (2016), however, suggested that the mediation may occur in later childhood or adolescence. Most recently, De Meester and colleagues (2017), examined the mediation between motor competence and physical activity in 8- to 11-year-old children with perceived competence as the mediator. They concluded that motor competence directly predicted physical activity, while perceived competence was not a mediator of the relationship. The mediation of the relationship between motor skills and physical activity among adolescents in their study, however, was different when compared to younger age groups. Barnett et al. (2008) has also found that perceived competence mediated the relationship between object control skills and physical activity among Grade 10 students. Thus, the mediation of ability beliefs is minimal or not present in Grade 2 and 3 children but as they grow older, their motor skills predict their physical activity participation through the mediation of ability beliefs. Crane (2016) has explained this apparent contradiction by suggesting that the cognitive state of Grade 2 and 3 children might not have developed

sufficiently for them to make accurate judgements about their actual performance. It is worth noting that while Crane (2016) studied both Grade 2 and 3 children, this paper is focused on Grade 3 children only.

In summary, motor skills are expected to have a direct relationship with children's physical activity levels since motor skills are the primary requirements for a child to participate in active pastimes (Crane et al., 2015; Stodden et al., 2008; Vlahov et al., 2014). Also motor skills are expected to predict psychological variables measured by the EVT because children in middle childhood have reached a higher level of cognitive development than in early childhood (EC). Therefore, children in middle childhood are expected to have more accurate beliefs and expectancies about their ability than children in EC. The psychological variables are expected to affect physical activity levels in children (Wigfield & Eccles, 2000; Xiang et al., 2004). The levels of ability beliefs and expectancies of being successful in physical activity and the value encountered for physical activity would encourage or discourage children in their participation. Whether ability beliefs and expectations of success mediate the relationship between motor skill proficiency and participation is, however, not the same for children in middle childhood compared to the adolescence. The limited studies examining these mediating relationships in middle childhood are somewhat mixed (Crane, 2016; De Meester et al., 2017; Khodaverdi, Bahram, Stodden, & Kazemnejad, 2016), but it appears that by adolescence, perceptions of competence do mediate the relationship between motor skills and participation (Barnett et al., 2008). Neither Crane (2016) nor De Meester et al. (2017) found these mediating relationships during middle childhood, but Khodaverdi and colleagues found that the relationship between girls' locomotor skill proficiency and physical activity was mediated by perceived motor competence. Whereas, Barnett et al. (2008) discovered that perceptions did mediate the relationship between motor skills and physical activity in adolescence. It is important to note that the only psychological mediator modelled in those studies was perceived competence (ability beliefs). However, in this study, three variables of ability beliefs, subjective task value, and expectancy of success are modelled as the possible mediators.

2.10 Parallel Multiple Mediator Model

The mediation analysis and resulting mediation model in this study was derived using the “PROCESS” macro for SPSS (Hayes, 2013). PROCESS is a computational tool for path analysis-based moderation and mediation analysis, as well as their integration in the form of a conditional process model (Hayes, 2013). PROCESS generates direct and indirect effects using multiple mediation models, along with bootstrap confidence intervals for effect size inference.

Multiple mediator models explore the direct and indirect effects between an independent variable (antecedent) and a dependent variable (consequent) that includes more than one mediator (Hayes, 2013). The parallel multiple mediator model, used in this study (Figure 3), measures the direct and indirect relationships with the condition that no mediator is influencing another mediator in the model. This condition is apparent in Figure 3 by the absence of any arrows linking any mediator to any other mediator. This condition, however, does not indicate that the mediators are not correlated. Instead, it is intended to allow analysis of the individual paths of each mediator.

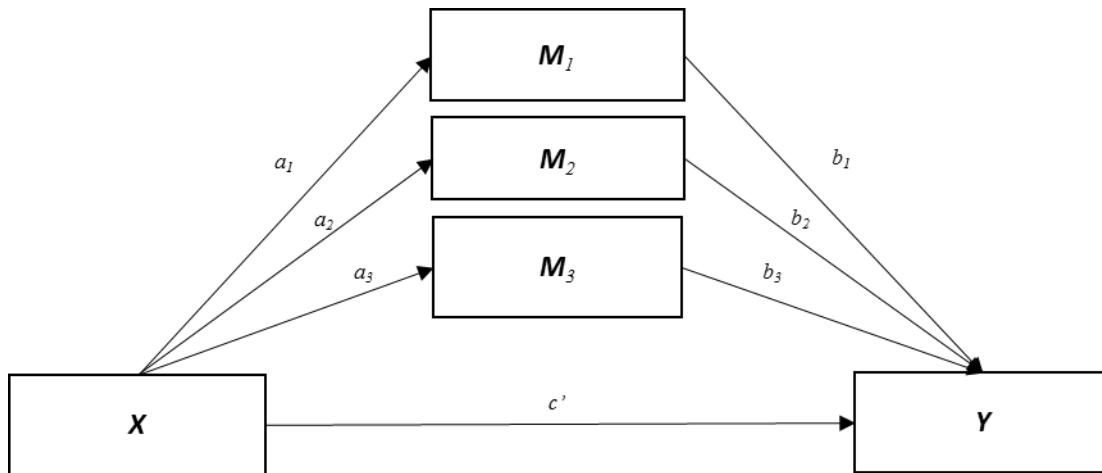


Figure 3. A parallel multiple mediator model with X (antecedent), Y (consequent) and M_n representing the mediators.

2.11 Summary

In summary, there is considerable evidence suggesting that motor competence and physical activity participation early in life tracks into adult years (Hearst et al., 2012; Telama et al., 2005; Umberson et al., 2010). There is also evidence of strong sex-based differences in motor competence (Barnett et al., 2009; Vlahov et al., 2014) and ability beliefs and values towards physical activity and sports (Kimiecik & Horn, 2012). The studies that have explored individual factors that contribute to engagement in physical activity have focused predominately on psychological variables, such as ability beliefs, subjective task value and expectancy of success (Stodden et al., 2008). Stodden and colleagues (2008) have, however, suggested that children's motor skill proficiency is also influential in explaining engagement and disengagement in physical activities. Therefore, the purpose of this study is to expand on recent work by Crane (2016) and De Meester et al. (2017) aimed at understanding individual psychological factors as mediators (ability beliefs, subjective task value, and expectancy of success) of the relationship between motor skills proficiency and physical activity participation in Grade 3 children.

Chapter 3: Method

3.1 Study Design and Sampling Frame

This study was part of a larger longitudinal study examining how children's motor skill proficiency, their perceptions of physical competence, and the value that they place on sport and physical education influence participation in physical activity. The data for the larger longitudinal study were collected on two cohorts of children as they progressed from kindergarten to Grade 5 over the period 2010 to 2017.

The children in the current study represent a cross-sectional subset of the sample who participated in the longitudinal study. The participants in this study were recruited from eight elementary schools from School District 61 in Victoria, British Columbia. Each of the schools had agreed to participate in the larger longitudinal study. Data for this study was collected from students in Grade 3 in 2013-14 (Wave 1) and 2014-15 (Wave 2).

3.2 Consent and Ethics Approval

Information concerning the study was distributed by the project coordinator to parents via each school. Parents who agreed to their child participating in the study returned signed consent forms to the project coordinator. The consent forms asked parents to indicate their agreement to their child's participation in the study and requested information concerning their child's date of birth, sex, and prematurity and disability status (see Appendix C). The overall project has approval of the Greater Victoria School District No. 61 (SD61) and ethics approval from the University of Victoria (See Appendix D).

3.3 Participants

The total number of children in Grade 3 in 2013/2014 (Wave 1) who were invited to participate in this study was $n = 503$. The total number of children in Grade 3 in the 2013/2014 school year for whom consent was given to participate in the study was $n = 306$. As a result, 61% of Wave 1 Grade 3 children invited to participate in the study were enrolled in this study. In 2014/2015 (Wave 2), the total number of children in Grade 3 who were invited to participate in this study was $n = 190$. The total number of children in Grade 3 in that year for whom consent was given to participate in the study was $n = 129$.

As a result, 68% of Wave 2 Grade 3 children invited to participate in the study were enrolled in this study. Of the $n = 435$ children who participated in this study, 398 children had complete data sets for all measures of the TGMD-2, CAPE, and EVQ. As a result, the sample for this study was 398 children in Grade 3 (Girls: $n = 201$, 50.5% Boys: $n = 197$, 49.5%). Sixteen children in the study sample had prematurity or disability status. The average age of participants was 8 years and 7 months (mean = 104.4 months, SD = 3.9 months).

3.4 Measures

3.4.1 Test of Gross Motor Development-Second Edition (TGMD-2)

The Test of Motor Development-2 (TGMD-2) is a criterion and norm-referenced tool that can be used to measure fundamental movement skill development in children 3- to 10-years of age (Ulrich, 2000). The test provides an estimate of a child's current motor skill development by assessing 12 motor skills that are grouped into two categories: (1) locomotor skills, and (2) object control skills. Locomotor skills assessed by the TGMD-2 are run, hop, gallop, skip, horizontal jump, leap and slide. Total locomotor skills scores range from 0 to 48 (Ulrich, 2000). Object control skills assessed by the TGMD-2 are striking a stationary ball, stationary dribble, catch, kick, overhand throw, and underhand roll. Total object control skills scores range from 0 to 48 (Ulrich, 2000). Test-retest reliability of locomotor skills and object control skills for children aged 6- to 8-years-old using the TGMD-2 have been reported respectively as .94 and .96 (Ulrich, 2000). The content-, predictive-, and construct-validity of the TGMD-2 has been established and documented by Ulrich (2000).

3.4.2 Expectancy Value Questionnaire (EVQ)

Ability Beliefs (AB), Expectancy of Success (ES) and Subjective Task Values (STV) were assessed using the EVQ (see Appendix E), which was initially developed by Eccles et al. (1983), and later adapted by Rodriguez et al. (2003) to

measure subjective task values relating to sporting activities engaged in by children from Grade 1 to Grade 6. All items in the EVQ are evaluated using a 7-point scale with "1" being the lowest value and "7" being the highest value. Items 1-3 of the EVQ relate to

ability beliefs, items 4 and 5 relate to expectancy of success, and items 6-12 relate to subjective task values (i.e., usefulness, importance and interest). All EVQ items were read aloud to child participants (Rodriguez et al., 2003). Fredricks and Eccles (2005) report that the EVQ is highly reliable ($\alpha = .81-.92$). No information on the validity of the EVQ is provided by Eccles et al. (1993) or Rodriguez et al. (2003), however, Eccles does indicate that the items in the EVQ are empirically based on common key constructs (see Eccles & Wigfield, 1995; Eccles et al., 1993).

3.4.3 The Children's Assessment of Participation and Enjoyment (CAPE)

Participation in sport and active recreation was assessed using the Children's Assessment of Participation and Enjoyment (CAPE; King et al., 2004). The CAPE has high construct validity and test-retest reliability with r values of .64 to .86, respectively (King et al., 2004). The CAPE measures children's participation outside of mandated school activities over a four-month period. The CAPE assesses participation in physical activity in terms of five dimensions: "Diversity," "Intensity," "With whom," "Where," and "Enjoyment" (see Appendix A). This study, focused on the dimensions of "Diversity" and "Intensity," which were used to assess the types of activities, and the frequency of participation in those activities by children in the study in a four-month period (see Table 2).

Table 2

Definition and Calculation of Diversity and Intensity of Participation

Variable	Definition	Calculation for total scores
Diversity	Number of activities undertaken in a 4-month period	Diversity scores ranged from 0-1 for each item. Recorded scores were summed. The possible range of total scores for this dimension was 0-55.
Intensity	Frequency of participation measured as a function of the number of possible activities within a category	Intensity scores ranged from 1-7. Recorded scores were summed and divided by 55 (the total number of possible items). The possible range of total scores for this dimension was 0.0-7.0.

The CAPE assesses participation in 55 everyday activities (see Appendix F). The 55 activities are grouped into either “Formal” or “Informal” domains (see Appendix B, Table B2). Within each domain, activities are classified into five activity types: “Recreational activities,” “Social activities,” “Skill-based activities,” “Self-improvement activities” and “Physical activities” (King et al., 2004). Activity types are further grouped into nine activity categories: “Organized sports,” “Other skill-based activities,” “Clubs, groups and organizations,” “Hobbies, crafts and games,” “Social activities,” “Quite recreation,” “Active physical recreation,” “Entertainment and education,” and “Jobs, chores and enjoyment” (see Appendix B, Table B1). In this study, participation in physical activity was assessed using responses to the CAPE items associated with the “Organized sports” and “Active physical recreation” activity categories (see Appendix B, Table B1).

3.8 Procedure

3.8.1 Administration of the TGMD-2, CAPE, and EVQ

All test sessions were scheduled by the project coordinator and performed under the supervision of trained research assistants. Due to scheduling and time constraints, data were collected over multiple visits to each school.

Approximately two weeks prior to data collection, the project coordinator conducted a training session for all research assistants. At this training session, the research assistants were introduced to the skills comprising the TGMD-2 assessment tool, taught how to demonstrate each skill, how to explain each activity to participants, as well as where to set up camera equipment to maximize the recording of each skill. During the same training session, research assistants were taught how to administer the CAPE and the EVQ. The TGMD-2 was administered to determine the motor skills of participants. The CAPE was administered to determine participations’ engagement in physical activity. Lastly, the EVQ was administered to determine participants’ ability beliefs, subjective task values, and expectancy of success.

The TGMD-2 was administered during the physical education period scheduled for each class. The TGMD-2 was administered across 2-3 sessions in each school’s gymnasium.

The TGMD-2 was administered according to the procedures described in the *TGMD-2 Examiner's manual* (Ulrich, 2000). For each testing session, the research assistants set up four stations prior to the arrival of participants. Each station involved 3 to 4 skills and was managed by two assistants; one assistant was responsible for communicating with children and demonstrating the TGMD-2 skills, and the other assistant was responsible for video recording the skill performance of each participant. The video recording of participant performance allowed for coding of skill components at a later point in time. Beforehand, children were divided into four small groups. As children arrived at the gymnasium they moved into their groups. Groups rotated around the four testing stations. Non-consented children also participated in the testing activities, however, for these children the video camera was turned off and no data was collected. Each child was given two opportunities to perform each skill. Before starting the video recording, the research assistant responsible for the video camera wrote the name of the school, the date, the class teacher's name, the skill being tested, the child's code, and the trial number on a small whiteboard. The research assistant displayed the information written on the whiteboard to the video camera for a short period of time. The whiteboard was then removed from the front of the video camera and the child was asked to perform the skill. The same procedure was used for the second trial. If the research assistant believed that a child had not understood the requirements of a task, the research assistant provided additional instruction and the child was asked to try again.

Depending on the time available, the CAPE and the EVQ were administered either immediately after completion of motor skill testing or during a subsequent testing session. The CAPE and the EVQ were administered using an interviewer-administered method. The interviewer-administered method was used because it permitted clarification and further exploration of child participant responses as needed (Patton, 1991). The CAPE and the EVQ were administered individually to each child in a quiet location. Before commencing each questionnaire, the research assistant provided a brief explanation of the instrument, emphasizing that there were no right or wrong answers. Visual activity cards were used as part of the CAPE to ensure that each child had a good sense of the activities that were being considered.

3.9 Data Treatment

3.9.1 The Test of Gross Motor Development Second Edition (TGMD-2)

The senior doctoral student associated with the longitudinal study, from which the data on Grade 3 children in this study was generated, scored the 12 TGMD-2 locomotor and object skill components. The motor skills of each child were scored from video recordings of the testing sessions. Children's performance on the TGMD-2 was scored according to the procedures outlined in the *TGMD-2 Examiner's manual* (Ulrich, 2000). For example, the running skill was scored in relation to the following four components: (1) arms move in opposition to legs, elbows bent, (2) brief period where both feet are off the ground, (3) narrow foot placement landing on heel or toe (i.e., not flat footed), and (4) non-support leg bent approximately 90 degrees (i.e., close to buttocks). A child whose performance included the component was scored 1, while a performance that didn't include the component was scored 0. This procedure was used for both the first and the second trial of the skill. The scores from trial one and trial two were summed to create the total score for that component. The total score for the running components, therefore, ranged from 0-8. This procedure was repeated for each of the sub-tests (locomotor and object control skills) to obtain a raw skill score. The maximum raw score for each sub-test was 48, which corresponds to the number of components completed correctly for either locomotor or object control skills (Ulrich, 2000). A second investigator scored 15% of the video recordings of individual skill components to establish inter-observer reliability. Using the percent agreement method, scoring agreement was found to be 89.4%. The motor skills results in this study have been reported as raw scores and percent of the maximum possible scores (Cohen, Cohen, Aiken, & West, 1999), which ranged from 0 to 100. The percent of maximum possible score (POMP) was calculated using the following equation: $[(\text{Observed score} - \text{minimum possible} / \text{maximum possible} - \text{minimum possible}) \times 100]$.

3.9.2 The Expectancy Value Questionnaire (EVQ)

The EVQ includes three items that ask children about their ability beliefs, two items that ask children about their expectancy of success, and seven items that ask children about the value that they attach to physical activities. Children respond to each item in relation

to a seven-point scale. Total scores for the ability belief item ranged from 3-21. Total scores for expectancy of success item ranged from 2-14. Total scores for the task value item, which included usefulness, importance, and interest questions, ranged from 7-49. The results were reported using the POMP scoring calculation.

3.9.3 The Children's Assessment of Participation and Enjoyment (CAPE)

The CAPE examines children's participation and enjoyment in a variety of different activities. In this study, only participation in the "Organized sports" and "Active physical recreation" categories of the CAPE were examined. Of the nine categories of activities measured by the CAPE, these are the two categories that are most concerned with physical activity. For each category of activity, the CAPE assesses children's participation and enjoyment in terms of five dimensions: "Diversity," "Intensity," "With whom," "Where," and "Enjoyment." In this study, only the CAPE items relating to "Diversity" and "Intensity" were used. Items related to the "Diversity" dimension provided information about the range of physical activities engaged in by children, while items related to the "Intensity" dimension provided information about the frequency of children's participation in those activities.

The diversity score for each activity for each child could be either 0, meaning that a child had not participated in that activity in the past 4 months or 1, meaning that a child had participated in that activity in the past 4 months. Total diversity scores for each child ranged from 0-55. Diversity scores of all 55 activities were assessed individually using chi-squared analysis to find the total number of boys and girls who participated in each activity and the associated *p* value. The results were reported as the proportion of children participating in each activity (see Table 4).

Recorded scores for Organized Sports (i.e., 6 items) and Active Recreation (i.e., 11 items) were summed and divided by the total number of possible items (i.e., 17 items). The possible range of total scores for this dimension was 1-7 (see Table B1). The frequency of participation in physical activity was measured by summing the intensity scores for the organized sports and active recreation categories. Therefore, the term *frequency* in this study represents intensity scores as measured by CAPE.

Original paper response and scoring sheets for each child were stored in locked filing cabinets. Data from the original response and scoring sheets was transferred to, and then maintained in Microsoft Excel, and later analyzed using IBM SPSS (Version 24.0). Frequency histograms and box plots were used to detect errors and omissions in the data set. When errors or omission in the electronic data set were detected the original paper response and scoring sheets were examined to correct the errors.

3.10 Data Analysis

Question 1 of the study was to examine the psychological variables of ability beliefs (AB), expectancy of success (ES), subjective task value (STV), as well as the motor skills proficiency (MS), and participation in physical activity (PA) of Grade 3 children. To address Question 1, descriptive statistics (i.e., means and standard deviations) were used.

Question 2 examined sex-based differences in each variable addressed in Question 1. To address Question 2, two multivariate analysis of variance (MANCOVA) were conducted with sex as an independent variable and age as a covariate. The first MANCOVA analyzed the total scores of psychological variables and total scores of locomotor and object control skills, in addition to the scores of sports and active recreation participation. The second MANCOVA was used to prevent multi-collinearity of analyzing the total scores of MS and PA with the subsets measured in the first MANCOVA. The variables analyzed in the second MANCOVA were the psychological variables in addition to the scores of Total-MS and Total-PA.

Question 3 of the study was to examine whether the psychological variables (i.e., ability beliefs, subjective task value, and expectancy of success) mediated the relationship between motor skills and physical activity levels. To address Question 3 of the study, two parallel multiple mediator models were computed, one for boys and one for girls using the PROCESS macro for SPSS (Hayes, 2013). Figure 4 shows the mediation model with X as the independent variable (motor skills), Y as the outcome (physical activity), and M_1 , M_2 , and M_3 as the psychological mediators. The motor skills variable was composed of both locomotor skill and object control skill scores. The physical activity variable in the mediation model represented the frequency (intensity score) of children's participation in

organized sports and active recreation activities. The psychological variables (i.e., ability beliefs, subjective task value, and expectancy of success) were the total raw scores for the respective criteria in the EVQ. The direct relationship between motor skills and physical activity is indicated by c' and the indirect relationships are presented according to their mediators of ability beliefs (a_1b_1), subjective task value (a_2b_2), and expectancy of success (a_3b_3).

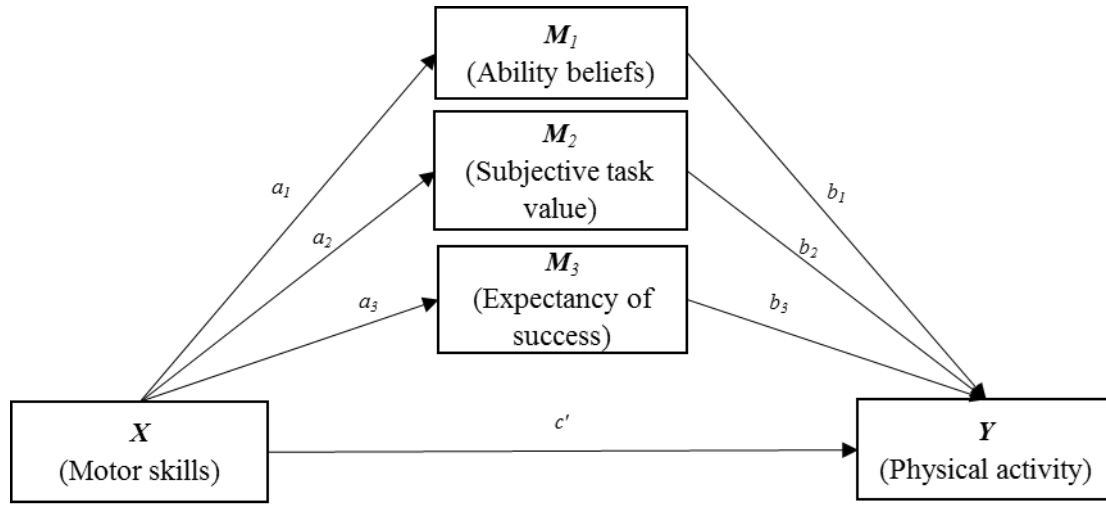


Figure 4. The parallel multiple mediator model presenting the examined variables.

Chapter 4: Results

4.1 Sample

In total, 435 Grade 3 children participated in this study. Data for 37 children were incomplete because these children did not respond to all of the questions associated with the CAPE and/or the EVQ. The final study sample was $n = 398$ Grade 3 children (197 boys and 201 girls). The mean age for boys was 104.48 months ($SD = 3.86$) and the mean age for girls was 104.36 months ($SD = 3.90$).

4.2 Levels of Motor Skills, Physical Activity Participation, and Psychological Variables

Table 3 shows information addressing Question 1 of the study, which was to measure the levels of ability beliefs, expectancy of success, subjective task value (i.e., psychological variables), motor proficiency, and frequency of physical activity among children. Means and standard deviations are provided for all children and for boys and girls separately.

Table 3

Mean Scores and Standard Deviations for All Variables

Variables (range)	All $n = 398$		Boys $n = 197$		Girls $n = 201$	
	Mean	SD	Mean	SD	Mean	SD
Locomotor skills (0-48)	31.4	4.9	30.5	5.1	32.3	4.5
Object-control skills (0-48)	31.9	6.7	35.0	6.6	28.9	5.3
Sports (0-7)	1.6	1.0	1.7	0.9	1.5	1.0
Active recreation (0-7)	2.1	0.9	2.1	1.0	2.2	0.9
Ability beliefs (3-21)	15.4	4.0	16.5	3.8	14.3	3.9
Task value (7-49)	38.4	8.3	39.6	8.2	37.3	8.3
Expectancy of success (2-14)	10.7	2.5	11.3	2.5	10.2	2.4
Total motor skills (0-100)	66.0	9.4	68.2	10.3	63.7	7.9
Total physical activity (0-100)	26.8	1.6	27.1	1.6	26.6	1.5

Note. Total Motor skills and Total Physical activity are reported as POMP scores.

Table 3 reveals that motor skill levels among all children were moderate, with the POMP scores of 65.5% and 66.4% for locomotor skills and object control skills, respectively. The POMP scores for the psychological variables were moderate, specifically: 68.7%, 74.8%, and 72.7% for children's ability beliefs, task value, and expectancy of success, respectively. Participation in physical activities were generally low, with the mean score of 26.8% among all children. Table 4 provides a more detailed, activity by activity, rate of participation in the physical and other leisure time activities of the children.

Table 4

Prevalence of Participation in Specific Activity Items

Item	N	All	Boys	Girls	<i>p</i>
Recreational activities					
Puzzles	216	54.1%	47.0%	61.2%	.004
Board/card games	336	84.2%	82.3%	86.1%	.305
Crafts/drawing	334	83.7%	75.8%	91.5%	< .001
Collecting things	213	53.4%	53.5%	53.2%	.952
Computer/video games	319	79.9%	89.4%	70.6%	< .001
Playing with pets	221	55.4%	52.5%	58.2%	.253
Pretend play	243	60.9%	58.1%	63.7%	.252
Playing with toys	356	89.2%	86.4%	92.0%	.068
Walk/hike ^{AR}	304	76.2%	76.3%	76.1%	.973
Playing on equipment ^{AR}	328	82.2%	74.2%	90.0%	< .001
TV/rented movie	366	91.7%	94.4%	89.1%	.340
Caring for a pet	221	55.4%	56.6%	54.2%	.639
Social activities					
Talk on phone	239	59.9%	56.1%	63.7%	.120
Go to party	315	78.9%	78.3%	79.6%	.747
Hanging out	277	69.4%	64.6%	74.1%	.040
Visiting	317	79.4%	78.8%	80.1%	.746
Entertaining others	242	60.7%	56.1%	65.2%	.062
Go to movies	295	73.9%	73.7%	74.1%	.929
Go to live event	129	32.3%	35.9%	28.9%	.135
Full-day outing	130	32.6%	28.8%	36.3%	.109

Listen to music	262	65.7%	60.1%	71.1%	.020
Making food	216	54.1%	43.9%	64.2%	< .001
Skill-based activities					
Swimming ^{OS}	306	76.7%	74.7%	78.6%	.362
Gymnastics ^{OS}	99	24.8%	15.7%	33.8%	< .001
Horse riding ^{OS}	35	8.8%	8.1%	9.5%	.628
Learning to sing	62	15.5%	6.1%	24.9%	< .001
Learning to dance	77	19.3%	4.5%	33.8%	< .001
Play musical instrument	181	45.4%	41.9%	48.8%	.170
Music lessons	113	28.3%	27.3%	29.4%	.645
Community organization	76	19.0%	23.7%	14.4%	.026
Dancing ^{AR}	176	44.1%	28.8%	59.2%	< .001
Art lessons	48	12.0%	6.1%	17.9%	< .001
Self-improvement activities					
Writing letters	125	31.3%	25.3%	37.3%	.009
Write story	164	41.1%	35.4%	46.8%	.021
Help from tutor	39	9.8%	9.1%	10.4%	.648
Religious activity	92	23.1%	20.7%	25.4%	.269
Public library	202	50.6%	40.9%	60.2%	< .001
Reading	346	86.7%	83.3%	90.0%	.048
Volunteering	42	10.5%	10.1%	10.9%	.784
Chores	270	67.7%	63.6%	71.6%	.087
Homework	308	77.2%	74.2%	80.1%	.163
Shopping	301	75.4%	69.7%	81.1%	.006
Physical activities					
Martial arts ^{OS}	84	21.1%	28.8%	13.4%	< .001
Track & Field ^{OS}	135	33.8%	32.3%	35.3%	.527
Team sports ^{OS}	181	45.4%	58.6%	32.3%	< .001
School clubs	123	30.8%	21.2%	40.3%	< .001
Bike riding /skateboard ^{AR}	295	73.9%	76.3%	71.6%	.332
Water sports ^{AR}	74	18.5%	16.2%	20.9%	.224
Snow sports ^{AR}	84	21.1%	19.2%	22.9%	.366
Playing games ^{AR}	316	79.2%	80.3%	78.1%	.589
Gardening ^{AR}	115	28.8%	24.7%	32.8%	.075
Fishing ^{AR}	43	10.8%	16.7%	5.0%	< .001
Individual physical activities ^{AR}	120	30.1%	33.8%	26.4%	.104

Non-team sports ^{AR}	129	32.3%	34.8%	29.9%	.286
Paid job	67	16.8%	19.2%	14.4%	.203

Note. ^{OS} Formal Organized Sports, ^{AR} Informal Active Physical Recreation.

4.3 Sex-Based Differences

To address Question 2 of the study, which examined whether there were sex-based differences between boys and girls in terms of their ability beliefs, expectancy of success, subjective task value, motor proficiency, and participation in physical activity, two MANCOVAs were conducted. The first MANCOVA examined the total scores of each psychological variable, and the locomotor and object control skill sub-test scores, and the frequency of sports and active recreation participation. The results revealed an overall effect of sex ($F(7, 389) = 29.684, p < .001$; Wilks' Lambda = 0.652). As can be seen in Table 5, univariate tests revealed sex-based differences in locomotor skills, object control skills, and each of the psychological variables (i.e., ability beliefs, subjective task value, and expectancy of success). There were, however, no sex-based differences in the frequency of sports or active recreation participation (see Table 5).

The second MANCOVA was conducted on the MS total raw score and PA total score. These variables were included in the mediation analysis. The second MANCOVA also revealed an overall main effect of sex ($F(2, 394) = 11.130, p < .001$; Wilks' Lambda = 0.947). Table 5 shows that univariate between-subjects tests revealed a significant effect of sex for total score of motor skills but no significant effect for total participation in physical activities. Although there were no overall differences in participation in active recreation or organized sports, Table 4 shows there were three (out of 6) significant differences between boys' and girls' participation in organized sports, two of which favoured girls. Further, there were 3/11 differences between boys' and girls' participation in active recreation. For active recreation, two differences (dancing and playing on equipment) favoured girls and one difference (fishing) favoured boys.

Table 5*Tests of Between-Subjects Effects with Sex as the Independent Variable*

	<i>df</i>	<i>F</i>	Sig.	Partial Eta Squared
Locomotor skills	1	13.73	<.001	.034
Object control skills	1	104.01	<.001	.208
Ability beliefs	1	32.91	<.001	.077
Task value	1	7.66	.006	.019
Expectancy of success	1	18.28	<.001	.044
Sports	1	3.49	.063	.009
Active recreation	1	1.14	.286	.003
Total MS	1	21.92	<.001	.053
Total PA	1	0.23	.628	.001

Note. MS (Motor skills), PA (Physical activity).

4.4 Mediation of the Relationship between Motor Skills Proficiency and Physical Activity by Psychological Factors

Question 3 of the study was concerned with examining the conceptual model of this study (see Figure 4) which was whether ability beliefs, task value, and expectancy of success mediated the relationship between motor skills and physical activity participation.

Because boys and girls differed significantly in their motor skill proficiency and psychological variables, two parallel multiple mediator models were created, one for boys (Figure 5) and one girls (Figure 6) using the PROCESS macro in IBM SPSS (Version 24.0).

The specified model for boys displayed an overall effect of ($R^2 = .044$, $p < .001$, $CI = [.02, .07]$). The results show that the psychological variables in this study did not mediate the relationship between motor skills and physical activity participation for boys. Instead, boys' motor skills directly predicted their participation in physical activity ($R^2 = .034$, $p < .05$, $CI = [.01, .06]$). Table 6 shows information about the direct and indirect relationships, effect size, and their significance level among boys. Motor skills significantly affected ability beliefs ($R^2 = .11$, $p < .001$, $CI = [.06, .16]$), subjective task

value ($R^2 = .20, p < .001, CI = [.09, .31]$), and expectancy of success ($R^2 = .08, p < .001, CI = [.05, .11]$), while the psychological variables did not predict physical activity among boys (see Figure 5). In addition, age in months was negatively associated with boys' participation in physical activities (see Table 6).

The specified model for girls displayed an overall effect of ($R^2 = .031, p < .05, CI = [.004, .06]$). The results show that task value mediated the relationship between motor skills and physical activity among girls ($R^2 = .012, p < .05, CI = [.002, .03]$). Girls' motor skills did not have a direct relationship on their participation in physical activities. Table 7 shows information about the direct and indirect relationships, effect size and their significance level among girls. Girls' motor skills predicted their ability beliefs ($R^2 = .07, p < .05, CI = [.005, .14]$), subjective task value ($R^2 = .20, p < .05, CI = [.05, .34]$), and expectancy of success ($R^2 = .07, p < .001, CI = [.03, .11]$) (see Figure 6). Of these three psychological variables, only subjective task value predicted the girls' physical activity ($R^2 = .06, p < .05, CI = [.02, .09]$). There was no evidence of a direct effect of motor skills on physical activity participation (bootstrap 95%, $CI = [-.005, .046]$).

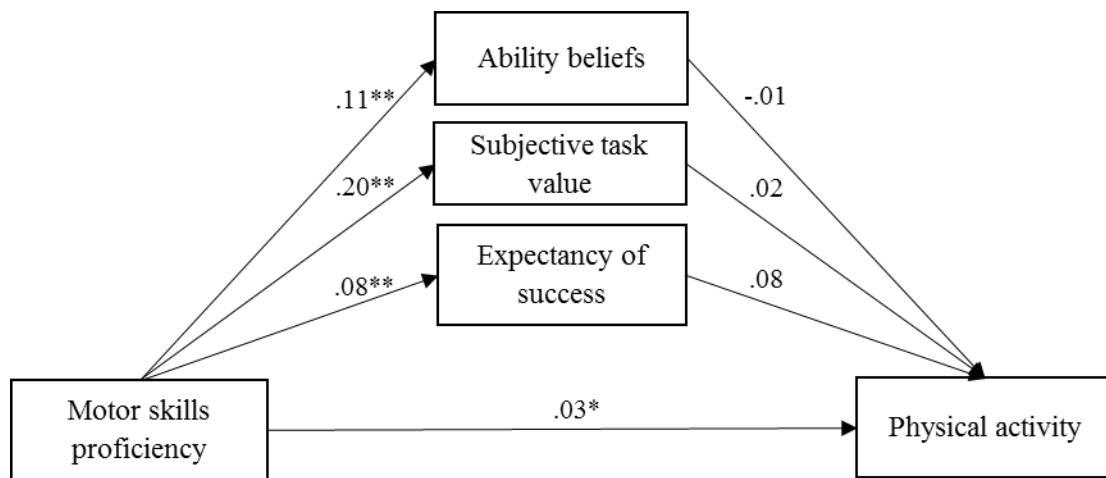


Figure 5. The specified parallel model for boys ($n = 197$), significance at $*p < .05$ $**p < .001$.

Total effect, $b = 0.0445$, $p = .0001$

Direct effect, $b = 0.0339$, $p = .0031$

Ability beliefs - Indirect effect, $b = .0006$, $p = .9167$

Subjective task value - Indirect effect, $b = .0045$, $p = .3524$

Expectancy of success - Indirect effect, $b = .0066$, $p = .2718$

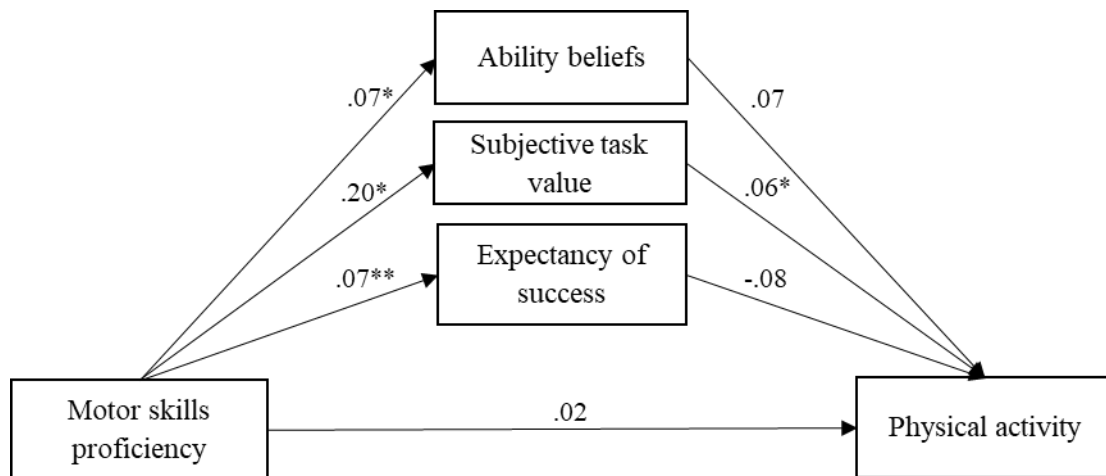


Figure 6. The specified parallel model for girls ($n = 201$), significance at $*p < .05$ $**p < .001$.

Total effect, $b = 0.0308$, $p = .0234$

Direct effect, $b = 0.0203$, $p = .1227$

Ability beliefs - Indirect effect, $b = .0049$, $p = .1983$

Subjective task value - Indirect effect, $b = 0.0116$, $p = .0448$

Expectancy of success - Indirect effect, $b = -.0059$, $p = .2689$

Table 6*Model Coefficients for the Parallel Multiple Mediator Analysis for Boys (n = 197)*

Antecedent		Consequent														
		Ability Beliefs			STV			Expectancy			Physical activities					
		β	SE	p	β	SE	p	β	SE	p	β	SE	p			
Motor skills	a_1	0.115	0.025	<.001	a_2	0.203	0.056	<.001	a_3	0.082	0.017	<.001	c'	0.034	0.011	.003
Ability beliefs		----	----	----		----	----	----		----	----	----	b_1	-0.005	0.046	.915
Task value		----	----	----		----	----	----		----	----	----	b_2	0.022	0.022	.320
Expectancy		----	----	----		----	----	----		----	----	----	b_3	0.081	0.070	.251
Age in months		-0.066	0.068	.334		0.013	0.148	.932		-0.015	0.044	.729		-0.060	0.028	.035
Constant	i_1	15.887	7.298	.031	i_2	24.954	15.870	.117	i_3	7.519	4.771	.117	i_c	6.172	3.067	.046
		$R^2 = 0.098$				$R^2 = 0.064$				$R^2 = 0.110$				$R^2 = 0.141$		
		$F(2, 194) = 10.487, p < .001$				$F(2, 194) = 6.658, p = .002$				$F(2, 194) = 12.045, p < .001$				$F(5, 191) = 6.280, p < .001$		

Table 7*Model Coefficients for the Parallel Multiple Mediator Analysis for Girls (n =201)*

		Consequent														
		Ability Beliefs			STV			Expectancy			Physical activities					
		β	SE	p	β	SE	p	β	SE	p	β	SE	p			
Antecedent																
Motor skills	a_1	0.073	0.035	.036	a_2	0.199	0.073	.007	a_3	0.072	0.021	<.001	c'	0.020	0.013	.123
Ability beliefs		----	----	----		----	----	----		----	----	----	b_1	0.067	0.037	.074
STV		----	----	----		----	----	----		----	----	----	b_2	0.058	0.018	.002
Expectancy		----	----	----		----	----	----		----	----	----	b_3	-0.082	0.068	.227
Age in months		0.093	0.071	.188		0.145	0.149	.333		0.049	0.042	.247		-0.041	0.026	.113
Constant	i_1	0.269	7.319	.997	i_2	10.00	15.428	.517	i_3	0.669	4.362	.878	i_c	4.512	2.681	.094
4																
$R^2 = 0.036$				$R^2 = 0.046$				$R^2 = 0.073$				$R^2 = 0.154$				
$F(2, 198) = 3.709, p = .026$				$F(2, 198) = 4.765, p = .009$				$F(2, 198) = 7.747, p < .001$				$F(5, 195) = 7.107, p < .001$				

Chapter 5: Discussion

The primary aim of this cross-sectional study was to examine whether psychological variables mediated the relationship between motor skills proficiency and participation in physical activities outside of mandated school activities among Grade 3 children. The mediators examined in this study were ability beliefs, subjective task value, and expectancy of success. In order to investigate sex-specific results, two mediation models were created, one for boys and one for girls.

5.1 Motor Skills

Descriptive results from this study indicate that the motor skill levels for Grade 3 children were 68.2% for boys and 63.7% for girls of the maximum possible score. However, when the raw scores were converted into aged-referenced values using comparative norms associated with the TGMD-2, the mean locomotor raw scores presented in Table 3 translate to standard scores of 4 for boys and 5 for girls; and the object control raw scores translate to standard scores of 5 for boys and 4 for girls. Narrative description for these scores in the TGMD-2 administration manual suggests that both locomotor and object control skills were relatively poorly developed in both boys and girls. However, the motor skills of the children in this study had increased in relation to the motor skills data collected by Crane (2015) on the same cohort of children during kindergarten and Grade 2.

To understand the relatively poor motor skills scores POMP scores for each to the 12 TGMD-2 skills were computed (see Appendix G). Table G1 shows that jumping and rolling a ball were not well developed among the boys and girls. In addition, the girls throwing was poor and boy has some difficulty galloping and leaping. The running skill was the strongest skill for both boys and girls. Both boys and girls had similar scores when it came to performing the locomotor skills of run, jump, slide, and the catch object control skill. This is consistent with the literature that has highlighted girls' mastery of locomotor skills and boys' mastery of object control skills. In this study, girls were significantly better than boys in performing 3 out of the locomotor skills, including the

gallop, hop, and leap. Boys on the other hand were more proficient than girls in 5 out of 6 object control skills, including the strike, dribble, kick, throw, and roll.

The presence of sex-based differences in the motor skills of the children in this study is also consistent with the findings of a number of previous studies. Grade 3 boys in this study were more proficient at performing object control skills than girls. However, girls obtained higher scores than boys in locomotor skills. A number of studies have also reported sex-based differences in motor proficiency such as higher levels of object control skills for boys in both childhood and adolescence (Barnett et al., 2008; Crane et al., 2015; Crane, 2016; LeGear et al., 2012) and higher proficiency of locomotor skills for girls compared to boys (Barnett et al., 2008; Barnett et al., 2002; Field & Temple, 2017; Mirjafari, 2015; Vlahov et al., 2014). In particular, the results of this study are consistent with the findings from a recent study conducted by Temple and Foley (2016) who found that Grade 3 boys were more proficient than girls in ball skills, while Grade 3 girls were more skilled in locomotor movements. The sex-based differences in motor skills might be attributable to differences in the type of activities undertaken by boys and girls. For instance, research shows that girls in middle-childhood participate more often in individual sports such as dancing, and gymnastics. In a research by Gutierrez and Garcia-Lopez (2012), girls displayed a smaller number of actions with the ball when participating in a team sport (i.e., basketball) and played more as a spectator role compared to boys. Popular sports among girls such as gymnastics and dance are based on locomotor skills and stability. Therefore, many girls have more opportunities to practice their locomotor and stability skills and they become better in those skills; and boys spend more time on mastering their object control proficiency by participating in object control sports.

Although this study only examined Grade 3 children, with no comparison with other age groups undertaken, age differences were present among Grade 3 participants, whose differences in age could range from a month to a year. Multivariate analysis of variance revealed that motor skill proficiency was positively correlated with children's age, indicating that older children in Grade 3 had more developed motor skills than their younger peers. This finding is consistent with two other studies by Crane (2016) and

Temple and Foley (2016) which were conducted on the same participants from kindergarten to Grade 4. Crane (2016) reported an improvement in motor skills from kindergarten to Grade 2, and Temple and Foley (2016) reported a positive change in the motor skills of children as they transition from Grade 3 to Grade 4.

5.2 Physical Activity

Children's physical activity participation was analyzed according to the intensity dimension of the CAPE for boys and girls separately. The POMP scores of total physical activity participation were 27.1% for boys and 26.6% for girls. Table 4 shows a summary of whether children participated in each of the 55 CAPP activities. The most popular physical activities among both sexes were swimming, bike riding /skateboard, and playing games. There were no sex-based differences in participation organized sports, active recreation, or total physical activity. Although there were no differences in the amount (i.e., frequency) of participation there were differences in participation in specific activities measured by the CAPE between boys and girls. For example, participation in team sports and martial arts were higher for boys, while playing on equipment, gymnastics, dancing, learning to dance, and participating in school clubs were more popular among girls.

One possible explanation for boys participating in different types of sports than girls might be stereotyping (Klomsten et al., 2005). Stereotyping is an oversimplified description of female/male characteristics that are based upon how society think boys and girls are oppose to how they actually are (Klomsten et al., 2005). Stereotyping among children stems from an adherence to social and cultural norms (Pawlowski et al., 2014; Stodden et al., 2008). For example, masculine stereotype defines in characteristics such as risk, violence, challenge, strength and feminine stereotype characteristics are defined with the elements of beauty, non-aggressiveness, and gracefulness. Feminine and masculine sports can be defined by the popularity they have among boys and girls (Klomsten et al., 2005). When children participate in formal physical activities such as sports deemed appropriate to their sex, the value placed on the task increases. For instance, boys are more inclined to show interest and value sports, such as soccer and

wrestling, which exhibit masculine characteristics of strength and power (Klomsten et al., 2005). Whereas, girls more often value and enjoy sports, such as gymnastics and dance that demonstrate feminine characteristics like agility and gracefulness (Klomsten et al., 2005; Mirjafari, 2015). While stereotyping has been observed to be a determinant to physical activity levels, Klomsten and colleagues (2005) found that stereotype beliefs were only effective for 65% of the individuals. Moreover, the number of girls participating in sports such as soccer is increasing (Klomsten et al., 2005). These sentiments are illustrated to some degree in the findings of this study. Girls participated in dance and gymnastics at significantly higher rates than the boys; while the boys participated in fishing, team sports, and martial arts at significantly higher rates than the girls.

Alternatively, sex-based differences in sports' participation have been attributed to boys being more proficient in ball skills and girls being more proficient in locomotor skills (Field & Temple, 2017; Logan et al., 2015). For instance, boys are more likely to prefer physical activities that require mastery of ball skills, while girls are more likely to prefer activities that require mastery of locomotor and stabilizing skills (Temple & Foley, 2016). While it is not clear if girls' participation in certain activities develops their locomotor and stabilizing skills or if those who are more skilled in certain activities are engaging in those activities because of their superior competence, this study does support that girls participated in physical activities such as gymnastics and dance at a significantly higher rate than boys (see Table 4). On the other hand, boys participated in activities such as team sports that require mastery of object control skills.

The physical activity participation scores were low in comparison with children's participation in other activities measured by CAPE. Children participated more in recreational activities and self-improvement activities than skill-based and physical activities. According to the diversity scores, the majority of children in this study participated in recreational activities such as board/card games, crafts/drawing, computer/video games, playing with toys, walk/hike, playing on equipment, TV/rented movie and self-improvement activities such as reading, and doing homework (see Appendix G). In general, participation in recreational and self-improvement activities

such as computer/video games, watching TV/rented movie, crafts/drawing, board/card games, and reading are less physically active than skill-based activities such as swimming, gymnastics, and dancing and physical activities such as track & field, team sports, and bike riding/skateboard. We cannot tell if the kids with less physically active pastimes had more sedentary behaviour. The sedentary levels might influence physical activity participation negatively. Children who are spending more time being sedentary often have lower physical activity participation (Crane, 2016).

According Bronfenbrenner's (1979) ecological theory, numerous factors influence children's development. Similarly, physical activity levels of children are determined by the same factors that are categorized into individual, social, and environmental factors. Although this study focuses on some of the factors that are considered as individual determinants (i.e., motor skills, ability beliefs, value, and expectancy of success), these variables and physical activity participation are influenced by other social and environmental factors. Social and environmental variables are another possible source of influence on children's participation in physical activity (Ferreira et al., 2007; Sallis, Prochaska, & Taylor, 2000; Spurr et al., 2016). In particular, Fredricks and Eccles (2005) and Kimiecik and Horn (2012) have highlighted the influence of parents on children's engagement in physical activity. For instance, parents provide children with financial, physical, and emotional support (Thompson, Humbert, & Mirwald, 2003). In particular, active parents who value physical activity have been found to have a significant influence on their children's beliefs about physical activity, as well as their physical activity participation (Welk, Wood, & Morss, 2003). Parents who value sports, are more likely to organize and plan sport activities for their children to attend, they are more likely to encourage their child to participate in sport clubs at school, and they are more likely to provide emotional, financial support (i.e., paying for the registration fees) and physical support (i.e., transportation, attending the practices) to their children. Neighborhood safety has also been found to be an indirect environmental factor which plays a role in children's activity levels. The unfavorable conditions in some neighborhood environments causes parents to restrict their children engaging in physical activities outdoors (Molnar et al., 2004, Nesbit et al., 2014).

In summary, there are variety of social and environmental factors that influence children's physical activity levels, including the physical activity levels of parents, the value that parents place on physical activity, the emotional, financial and physical support provided by parents, the influence of friends, teachers, and coaches, as well as perceptions of neighborhood safety.

5.3 Psychological Variables

In this study, all of the psychological variables that were assessed were related to children's actual motor skill scores, which suggest that the children's judgments about their motor skills were in large part accurate (see Tables 6 and 7). Boys did have higher beliefs and expectations towards their abilities, however, there was no significant difference between boys' and girls' values towards physical activity. This finding is not consistent with those of Klomsten and colleagues (2005) who found that adolescent boys valued being good at sports more than girls. The existing relationship between children's ability beliefs and motor skills suggest that Grade 3 children in this study had reached a level of cognitive development that led them to have more accurate judgments about their motor skills' performance. Judgements tend to be more accurate because children are increasingly able to consider the outcomes of their performances, how easy or difficult it was for them to acquire the skills, and they can compare their own performance with those of their peers (Horn, 2004). This correlation is consistent with a study by Weiss (2004) who noted that 8- to 11-year-old children exhibit more realistic evaluations of their motor skills compared to their early-childhood. The influencing factors on the psychological variables are actual motor skills levels which is supported by the current findings of this study. Higher levels of motor skills will affect children's beliefs about their ability, the value they consider for being active, and their expectancy levels of being successful in the future activities. Parents are considered as a social factor that has a substantial influence over children. Parents are role models of children. Children who have effective role modeling from their parents towards physical activity, are more active compared to their peers who have limited support from their parents (Thompson et al., 2003).

An additional finding of this study is that POMP scores for children's ability beliefs, task value, and expectancy of success (i.e., 68.7%, 74.8%, and 72.7% respectively) were in the middle of the range of possible scores. The ability belief scores of the children in this study were, however, slightly different to the scores reported by Crane and colleagues (2017) for the same cohort. Crane and colleagues (2017) found that girls had higher perceptions in both kindergarten and Grade 2 compared to boys, while the current study found that boys had higher ability beliefs score than girls. One possible explanation for this difference is that the questionnaire used in this study differed slightly compared to the questionnaire used by Crane et al. (2017).

Overall, the boys in this study reported stronger ability beliefs about their physical competence compared to girls. Boys also had stronger expectations of being successful in physical activities compared to girls. Motor skills in both boys and girls predicted their ability beliefs, values, and expectancy levels towards physical activity. As mentioned in the previous section on physical activity, it is not clear if children's participation in certain activities develops their motor skills or if those who are skilled are engaging in physical activities because of their superior competence. However, there is some evidence that might suggest an answer to this question. As Crane (2015) discovered in his mediation model of Grade 2 and Grade 3 children, object control skills did not predict physical activity but physical activity predicted object control skills among kindergarten children. Therefore, one possible suggestion is that physical activity levels in middle childhood affect motor skills primarily, which in turn improves children's beliefs, values, and future expectations towards physical activity.

5.4 Mediation Models

5.4.1 Boys

The specified model for boys in this study showed that the psychological variables did not mediate the relation between motor skills and physical activity. However, there was a direct relationship between boys' motor skills and physical activity. In other words, boys with more developed motor skills were more physically active compared to their peers with lower motor skills. This finding is consistent with De Meester and colleagues (2017)

who found a direct relationship between motor skills and physical activity in middle childhood.

Secondly, the boys' mediation model revealed that their ability beliefs, expectation of success and the value that they placed on physical activity were influenced by their levels of motor skills. Boys with higher motor skill levels had stronger beliefs about their ability and expectation to be successful and they valued physical activity more compared to their peers with lower levels of motor skills. The direct relationship between motor skills and physical activity in boys and the positive relationship between boys' motor skills and their ability beliefs is consistent with Stodden and colleagues' (2008) conceptual model. Higher levels of ability beliefs, expectancy of success and value, however, did not predict boys' participation in physical activity. The mediation results for boys is consistent with a study by Crane and colleagues (2015) who found a direct relationship between object control skills and physical activity in kindergarten children, while perceived competence did not mediate the relationship. The absence of the mediation might depend on boys' maturity levels compared to girls at the same age; since girls have the mediation between their motor skills and physical activity in this study and girls often reach maturity faster than boys. Barnett and colleagues (2008), in a study examined the mediation between adolescents' physical activity and their object control skills in childhood. They found a positive mediation for adolescent boys with perceived competence as the mediator. Therefore, boys' mediation results might change as they grow older. The other explanation might be the influence of social and environmental factors. In a systematic review of the literature on dropout from sport, Crane and Temple (2015) found that the majority of boys who dropped out of sports were influenced by their peers. Therefore, boys might value sports but because of the pressure from their peers to do other things, they do not participate as much as they would without peer pressure.

5.4.2 Girls

The specified model for girls in this study showed that tasks value mediated the relationship between motor skills and physical. Unlike the boys, there was no direct relationship between motor skill levels and physical activity for girls. Similar to boys, motor skills predicted girls' ability beliefs, task value, and expectancy of success.

Depending on girls' motor skill levels and the value they attributed to physical activity, their participation in physical activity was stronger. Therefore, the value girls attached to physical activity mediated the relationship between their motor skills and their participation. The mediation between motor skill competence and physical activity among girls is consistent with Eccles et al. (1983) expectancy value theory which suggests that individuals make decisions according to the value of a task. In this study, Grade 3 girls' participation in physical activity was affected by their motor skills indirectly through the value that they attributed to physical activity. This finding adds to the growing body of literature on the mediation between motor skills and physical activity. In similar research among Grade 3 Iranian girls, Khodaverdi and colleagues (2016) found that perceived competence mediated the relationship between locomotor skills and physical activity among Grade 3 Iranian girls. Unlike this study, Khodaverdi et al. (2016) found a direct relationship locomotor skills physical activity levels. It is conceivable that girls would have positive beliefs about their abilities towards locomotor related activities since they are more proficient in locomotor skills compared to object control skills. Girls' ability beliefs did not mediate the relationship in this study. However, Barnett and colleagues (2008) found that adolescent girls' perception mediated the relationship between their object control skills and physical activity levels. Therefore, ability beliefs might mediate the relationship as girls transfer from middle-childhood to adolescence.

5.7 Summary

The mediation models in this study revealed that boys' participation in physical activity was directly related to their motor skills levels, while girls' participation in physical activity was indirectly influenced by motor skills and mediated by the value that they ascribed to various physical activities. The motor skills predicted ability beliefs, values, and expectancy levels for both boys and girls which was expected according to the literature.

The mediation models in this study predicted 14% of the variance for boys and 15% of the variance for girls. The small effect size in both boys' and girls' mediation models indicate the presence of other factors in addition to motor skills, ability beliefs, subjective

task value, and expectancy of success that were not considered in this study. The ecological model presented earlier proposes that in addition to individual factors, such as motor skills, ability beliefs, subjective task value, and expectancy of success, social and environmental factors also influence children's engagement in physical activity. The influence of these additional factors might explain why ability beliefs and expectancies did not mediate the relationship for girls; and none of the psychological variables mediated the relationship for boys.

5.8 Implications

5.8.1 Implications for Theory

The findings of this study extend knowledge about three psychological factors (i.e., ability beliefs, task value, and expectancy of success) presented in expectancy value theory (EVT). Eccles and colleagues (1983) proposed EVT as motivational determinants of achievement-related choices. According to this theory, children choose to participate in a task (i.e., physical activity) as a result of beliefs they hold about their ability related to physical activity, the value they ascribe to physical activity, and their expectations of success in future physical activity. Consistent with EVT, we would expect that ability beliefs, task value, and expectancy of success should mediate the relationship between motor skills and physical activity. The findings of this study are, however, not fully consistent with this view. In this study, task value mediated physical activity for girls but not for boys. In addition, in this study ability beliefs and expectancy of success did not affect the physical activity levels of either girls or boys. This suggests that EVT needs to be expanded to account for sex-based differences in the motivational determinants of physical activity in children and that the influence of motivational determinants such as ability beliefs, task value, and expectancy of success might change as children grow older.

The findings of this study also revealed that ability beliefs do not mediate the relationship between motor skills and physical activity for children at age 9. This is consistent with other studies that have found no mediation of the relationship between motor skills and physical activity by ability beliefs (Crane, 2016; De Meester et al., 2017). The lack of

mediation by ability beliefs in the present study is not consistent with Stodden et al.'s (2008) model. Stodden et al. (2008) model suggested that perception of competence (i.e., ability beliefs) mediated the relationship between motor skills and physical activity. In addition, the mediation results of this study were not consistent with Khodaverdi et al. (2016) who found that perceived competence (i.e., ability beliefs) mediated the relationship between locomotor skills and physical activity among Grade 3 girls. It is important to note that children's ability beliefs become more accurate as the cognitive development occurs as children age (Harter, 2012). It is, therefore, possible that ability beliefs may mediate locomotor skills and physical activity as children grow older. For instance, Barnett and colleagues (2008) found that mediation exists for Grade 10 children. Perhaps the ability beliefs of children in this study will influence the relationship between motor proficiency and engagement in physical activity as they grow older. This is certainly something that future research could explore.

The findings of this study showed that the task value mediated the relationship between motor skills and physical activity for girls. The value that boys attach to physical activity however, did not influence their engagement in physical activity, but motor skills did (e.g., no mediation, but a direct relationship). These findings suggest that enhancing motor skills is important for promoting physical activity for boys. However, the physical activities engaged in by boys might not be the type of activity that they value since they are not making their own physical activity choices at this age. Therefore, further examination is required of the value that boys attach to physical activity as they get older to see if value plays a more important role as they exert more control over their physical activity choices.

The findings of this study showed that children in middle-childhood have low levels of physical activity, which is not beneficial for their health and well-being. In particular, children's cardiorespiratory fitness, musculoskeletal strength/endurance, and increased bone density may be adversely affected (Basterfield et al., 2015; Cattuzzo et al., 2014). In addition, high BMI levels and obesity are consequences of sedentary behaviour and low physical activity levels (Thorp et al., 2011). Children who are not participating in physically active pastimes are less likely to have an active, healthy life-style in adulthood

(Hearst et al., 2012; Malina, 2001). Therefore, teachers should put emphasis on children's physical activity during school time (e.g., doing active games instead of sedentary activities when it is rainy outside, and setting up active breaks during class time) and parents should encourage physical activities outside of school.

5.8.2 Implications for Practice

The findings of this study provide parents and teachers with an understanding of what to expect from their children in middle childhood. The findings of the mediation models are a reminder of the importance of motor skills in children's physical activity. The mediation models showed that motor skills directly predicted physical activity for boys and indirectly affected physical activity levels for girls. In addition, motor skills affect children's beliefs and values towards physical activity. Therefore, the findings of this study lend support to the suggestion that physical education periods in schools should be focused on developing motor skills in middle-childhood. High levels of motor skills are one of the main determinants of children's physical activity levels fitness (Crane et al., 2015; Vlahov et al., 2014). There are programs designed for schools that focus on strategies designed to initiate motor skills into physical activity periods. For instance, Physical and Health Education (PHE) Canada has developed a program called "Fundamental movement skills I" specifically to educate teachers and coaches about the importance of motor skills. This program offers specific tips, suggestions and a range of activities that teachers and coaches can use to develop motor skills among children in way that is effective, fun, and interactive. Furthermore, PHE Canada offers workshops, support tools, and other resources to help teachers promote healthy and active living at schools (PHE Canada, 2017). PHE Canada also provides information for parents about the importance of motor skills and advice on how they might engage in their children's learning process, particularly in elementary school years. In summary, in order to improve children's motor skills, one suggestion for schools is to design physical education lessons focused on mastery of motor skills.

5.9 Limitations

A limitation of the current study is the generalizability of the findings from the study sample schools to all schools within the related school district. More specifically, in the

first wave of the data collection, eight schools were included in the sampling frame, whereas in the second wave of the study, only two of those eight schools participated. As a result, the majority of data collected in the study was from the schools that participated in both the first and second waves of data collection.

A second limitation of this study is that information about children's physical activities for the period of April, May, and June was not collected. The participants in this study were recruited in two consecutive school years and the data collection days depended on the schools and their schedules. Table 1 shows the times of the year in which CAPE data was collected in each school. In particular, no data collection occurred in the months of April, May, and June and as a result, the physical activities and involvement in seasonal sports during these periods was not assessed. This may have resulted in an underreporting of children's physical activity levels. For instance, the spring sports that may have been omitted would most likely have been outdoor sports such as track and field which starts in May, mini-rugby, soccer, and cross country which starts in April.

A third limitation of this study is that the data concerning children's participation in physical activities was influenced by the classification structure used in the CAPE. For example, if a child participated in three team sports, they would have one score for all three sports since all the team sports are classified in the CAPE as one activity. On the other hand, a child who participated in one team sport, swimming, and martial arts would have answered "yes" to three questions. Therefore, although both children in this example participated in three types of sports, the second child would have received a higher activity score than the child who participated in three team sports.

5.10 Conclusion

In this study, the mediation results for boys showed that the psychological variables in this study did not mediate the relationship between motor skills and physical activity participation. Instead, boys' motor skills directly predicted their participation in physical activity. The second mediation model created for girls showed a positive mediation between motor skills and physical activity among girls with subjective task value as the mediator. Girls' motor skills however, did not have a direct relationship with their

participation in physical activities. In general, children's physical activity participation was low compared to the other activities in the CAPE. The motor skills of the Grade 3 children in this study were not as developed as expected in relation to associated normative data. Children's motor proficiency predicted their beliefs about their ability, the value they ascribed to physical activities, and their expectations of being successful at those activities. The findings related to the mediation models in this study showed a major difference between boys and girls. Boys' physical activity was directly affected by their motor skill proficiency but for girls, motor skills acted indirectly via task value.

5.11 Future Directions

Future areas of research stemming from this study might include:

- (1) This study analyzed two models, one for boys and one for girls; and the results showed that sex was a determinant factor in the mediation between motor skills and physical activity. Therefore, one suggestion for future investigators of the mediation between motor skills and physical activity is to consider sex as a mediator in their model.
- (2) In this study, sex-based differences were evident in motor proficiency; better object control skills belonged to boys and greater locomotor skills among girls. Therefore, considering the sub-skills of locomotor and object control skills as independent variables in future mediation models might show clearer mediation results in terms of sex. As LeGear and colleagues (2012) found, using total motor skills score instead of locomotor and object control skills might conceal sex-based differences.
- (3) The small effect size of boys' and girls' mediation models revealed that the relationship between motor skills and physical activity is influenced by other factors which were not measured in this study. These factors might be the reason why motor skills did not directly affect girls' participation in middle childhood. In addition, among all possible mediation effects measured in this study, only the value girls encountered for physical activity, mediated the relationship between motor skills and physical activity. Therefore, exploring the role of social and environmental factors such as the influence of parents, teachers, peers, culture, and society on children's participation in physical activity is required in future studies.

References

- Arundell, L., Ridgers, N. D., Veitch, J., Salmon, J., Hinkley, T., & Timperio, A. (2013). 5-year changes in afterschool physical activity and sedentary behavior. *American Journal of Preventative Medicine*, 44(6), 605-611.
- Babic, M. J., Morgan, P. J., Plotnikoff, R. C., Lonsdale, C., White, R. L., & Lubans, D. R. (2014). Physical activity and physical self-concept in youth: Systematic review and meta-analysis. *Sports Medicine*, 44(11), 1589-1601.
- Barnett, L. M., Morgan, P. J., Van Beurden, E., Ball, K., & Lubans, D. R. (2011). A reverse pathway? Actual and perceived skill proficiency and physical activity. *Medicine & Science in Sports & Exercise*, 43(5), 898-904.
- Barnett, L. M., van Beurden, E., Zask, A., Brooks, L. O., & Dietrich, U. C. (2002). How active are rural children in Australian physical education? *Journal of Science and Medicine in Sport*, 5(3), 253-265.
- Barnett, L. M., Morgan, P. J., van Beurden, E., & Beard, J. R. (2008). Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: a longitudinal assessment. *International Journal of Behavioral Nutrition and Physical Activity*, 5(1), 40-52. doi:10.1186/1479-5868-5-40
- Barnett, L. M., van Beurden, E., Morgan, P. J., Brooks, L. O., & Beard, J. R. (2009). Childhood motor skill proficiency as a predictor of adolescent physical activity. *Journal of Adolescent Health*, 44, 252-259.
- Basterfield, L., Reilly, J. K., Pearce, M. S., Parkinson, K. N., Adamson, A. J., Reilly, J. J., & Vella, S. A. (2015). Longitudinal associations between sports participation, body composition and physical activity from childhood to adolescence. *Journal of Science and Medicine in Sport*, 18, 178–182. doi:10.1016/j.jsams.2014.03.005
- Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J. F., Martin, B. W. (2012). Correlates of physical activity: Why are some people physically active and others not? *The Lancet*, 380(9838), 258-271. doi:10.1016/S0140-6736(12)60735-1
- Berger, I. E., O'Reilly, N., Parent, M. M., Séguin, B., & Hernandez, T. (2008). Determinants of sport participation among Canadian adolescents. *Sport Management Review*, 11(3), 277-307. doi:10.1016/S1441-3523(08)70113-X

- Biddle, S. J., Asare, M. (2011). Physical activity and mental health in children and adolescents: A review of reviews. *British Journal of Sports Medicine*, 45, 886-895.
- Booth, S. L., Sallis, J. F., Ritenbaugh, C., Hill, J. O., Birch, L. L., Frank, L. D., . . . Hays, N. P. (2001). Environmental and societal factors affect food choice and physical activity: Rationale, influences, and leverage points. *Nutrition Reviews*, 59(3), S21-S36. doi:10.1111/j.1753-4887.2001.tb06983.x
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, Mass: Harvard University Press.
- Caldwell, L. L., & Witt, P. A. (2011). Leisure, recreation, and play from a developmental context. *New Directions for Youth Development*, 2011(130), 13-27. doi:10.1002/yd.394
- Canadian Fitness and Lifestyle Research Institute. (2016). *Kids CAN PLAY: Participation in organized physical activity and sport*. [Bulletin.02]. Ottawa: Canadian Fitness and Lifestyle Research Institute. URL: <http://www.cflri.ca/document/bulletin-02-participation-organized-physical-activity-and-sport>.
- Carson, V., Hunter, S., Kuzik, N., Gray, C. E., Poitras, V. J., Chaput, J. P., et al. (2016). Systematic review of sedentary behaviour and health indicators in school-aged children and youth: an update. *Applied Physiology, Nutrition & Metabolism*, 41, 240-265. doi:10.1139/apnm-2015-0630
- Cattuzzo, M. T., Dos Santos Henrique, R., Ré, A. H. N., de Oliveira, I. S., Melo, B. M., de Sousa Moura, M., de Araújo, R. C., Stodden, D. (2014). Motor competence and health related physical fitness in youth: a systematic review. *Journal of Science and Medicine in Sport*, 19(2), 123-129. doi:10.1016/j.jsams.2014.12.004.
- Chaput, J. P., Lambert, M., Mathieu, M. E., Tremblay, M. S., O'Loughlin, J., & Tremblay, A. (2012). Physical activity vs. sedentary time: Independent associations with adiposity in children. *Pediatric Obesity*, 7(3), 251-258. doi:10.1111/j.2047-6310.2011.00028.x
- Clark, J. E. (1994) Motor development. In V. S. Ramachandran (Ed.), *Encyclopedia of Human Behavior* (3rd ed., pp. 245–255). Academic Press, New York, USA.
- Clark, J. E., & Metcalfe, J. S. (2002). The mountain of motor development: A metaphor. *Motor Development: Research and Reviews*, 2, 163-190.

- Cliff, D., Okely, A., Smith, L., & McKeen, K. (2009). Relationships between fundamental movement skills and objectively measured physical activity in preschool children. *Pediatric Exercise Science*, 21(4), 436-449.
- Cohen, P., Cohen, J., Aiken, L. S., & West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behavioral Research*, 34(3), 315-346.
- Crane, J. R. (2016). *An examination of the relationships between fundamental motor skills, perceived physical competence, and physical activity levels during the primary years* (Doctoral dissertation). University of Victoria, British Columbia, Canada.
- Crane, J. R., Foley, J. T., Naylor, P., & Temple, V. A. (2017). Longitudinal change in the relationship between fundamental motor skills and perceived competence: Kindergarten to grade 2. *Sports*, 5(3), 59-68. doi:10.3390/sports5030059
- Crane, J. R., Naylor, P. J., Cook, R., & Temple, V. A. (2015). Do perceptions of competence mediate the relationship between fundamental motor skill proficiency and physical activity levels of children in kindergarten? *Journal of Physical Activity and Health*, 12, 954-961. doi:10.1123/jpah.2013-0398
- Crane, J., & Temple, V. (2015). A systematic review of dropout from organized sport among children and youth. *European Physical Education Review*, 21(1), 114-131. doi:10.1177/1356336X14555294
- Crocker, P. R., Eklund, R. C., & Kowalski, K. C. (2000). Children's physical activity and physical self-perceptions. *Journal of Sports Sciences*, 18(6), 383-394.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Dahan-Oliel, N., Shikako-Thomas, K., & Majnemer, A. (2012). Quality of life and leisure participation in children with neurodevelopmental disabilities: A thematic analysis of the literature. *Quality of Life Research*, 21(3), 427-439. doi:10.1007/s11136-011-0063-9
- De Meester, A., Stodden, D., Goodway, J., True, L., Brian, A., Ferkel, R., & Haerens, L. (2017). Identifying a motor proficiency barrier for meeting physical activity guidelines in children. *Journal of Science and Medicine in Sport*. doi:10.1016/j.jsams.2017.05.007

- Denissen, J. J., Zarrett, N. R., & Eccles, J. S. (2007). I like to do it, I'm able, and I know I am: Longitudinal couplings between domain-specific achievement, self-concept, and interest. *Child Development*, 78, 430–447. doi:10.1111/j.1467-8624.2007.01007.x
- De Souza, M. C., de Chaves, R. N., Lopes, V. P., Malina, R. M., Garganta, R., Seabra, A., & Maia, J. (2014). Motor coordination, activity, and fitness at 6 years of age relative to activity and fitness at 10 years of age. *Journal of Physical Activity & Health*, 11(6), 1239-1247. doi:10.1123/jpah.2012-0137
- Domazet, S. L., Tarp, J., Huang, T., Gejl, A. K., Andersen, L. B., Froberg, K., & Bugge, A. (2016). Associations of physical activity, sports participation and active commuting on mathematic performance and inhibitory control in adolescents. *PLoS One*, 11(1), e0146319. doi:10.1371/journal.pone.0146319
- Duda, J. L. (1988). The relationship between goal perspective, persistence and behavioral intensity among male and female recreational sport participants. *Leisure Sciences*, 10, 95-106.
- Ebbeck, V. & Stuart, M. E. (1993). Who determines what's important? Perceptions of competence and importance as predictors of self-esteem in youth football players. *Pediatric Exercise Science*, 5, 253-262.
- Eccles, J. S. (2005). Subjective task value and the Eccles et al. model of achievement-related choices. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of competence and motivation*. New York: Guilford Press.
- Eccles J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75–146). San Francisco, CA: W. H. Freeman.
- Eccles, J. S., Roeser, R., Vida, M., Fredricks, J., & Wigfield, A. (2006). Motivational and achievement pathways through middle childhood. In L. Balter & C. S. Tamis-LeMonda (Eds.), *Child psychology: A handbook of contemporary issues* (2nd ed., pp. 325-355). NY: Psychology Press.
- Eccles, J. S., & Wigfield, A. (2002). *Development of Achievement Motivation*. San Diego: Academic press.

- Eccles, J., Wigfield, A., Harold, R. D., & Blumenfeld, P. (1993). Age and gender differences in children's self- and task perceptions during elementary school. *Child Development*, 64(3), 830-847. doi:10.1111/j.1467-8624.1993.tb02946.x
- Eccles, J. S., Wigfield, A., Flanagan, C. A., Miller, C., Reuman, D. A., & Yee, D. (1989). Self-concepts, domain values, and self-esteem: Relations and changes at early adolescence. *Journal of Personality*, 57(2), 283-310. doi:10.1111/j.1467-6494.1989.tb00484.x
- Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' academic achievement related beliefs and self-perceptions. *Personality and Social Psychology Bulletin*, 21, 215-225.
- Ferrari, G. L., Oliveira, L. C., Araujo, T. L., Matsudo, V., Barreira, T. V., Tudor-Locke, C., & Katzmarzyk, P. (2015). Moderate-to-vigorous physical activity and sedentary behavior: Independent associations with body composition variables in Brazilian children. *Pediatric Exercise Science*, 27(3), 380-389.
- Ferreira, I., Van Der Horst, K., Wendel-Vos, W., Kremers, S., Van Lenthe, F. J., & Brug, J. (2007). Environmental correlates of physical activity in youth—a review and update. *Obesity Reviews*, 8(2), 129-154.
- Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th ed.). Thousand Oaks, Canada: SAGE Publications Ltd.
- Fisher, A., Reilly, J. J., Montgomery, C., Kelly, L. A., Williamson, A., Paton, J. Y., & Grant, S. (2005). Fundamental movement skills and habitual physical activity in young children. *Medicine & Science in Sports & Exercise*, 37, 684-688.
- Field, S. C., & Temple, V. A. (2017). The relationship between fundamental motor skill proficiency and participation in organized sports and active recreation in middle childhood. *Sports*, 5(2), 43. doi:10.3390/sports5020043
- Fredricks, J. A., & Eccles, J. S. (2002). Children's competence and value beliefs from childhood through adolescence: Growth trajectories in two male-sex-typed domains. *Developmental Psychology*, 38, 519-533.
- Fredricks, J. A., & Eccles, J. S. (2005). Family socialization, gender, and sport motivation and involvement. *Journal of Sport & Exercise Psychology*, 27, 3–31.
- Freedman-Doan, C., Wigfield, A., Eccles, J. S., Blumenfeld, P., Arboreton, A., & Harold, R. D. (2000). What am I best at? Grade and gender differences in children's beliefs about ability improvement. *Journal of Applied Developmental Psychology*, 21(4), 379-402. doi:10.1016/S0193-3973(00)00046-0

- Gabbard, C. (2012). *Lifelong motor development* (6th ed.). San Francisco: Pearson Benjamin Cummings.
- Gallahue, D., & Ozmun, J. (2006). *Understanding motor development: Infants, children, adolescents, adults* (6th ed.). New York: McGraw-Hill.
- Gutierrez, D., & Garcia-Lopez, L. M. (2012). Gender differences in game behaviour in invasion games. *Physical Education and Sport Pedagogy*, 17(3), 289-301. doi:10.1080/17408989.2012.690379
- Hammill, D. D., & Hresko, W. P. (1994). Comprehensive scales of student abilities. Austin, TX: Pro-Ed.
- Harter, S. (1999). *The construction of the self: A developmental perspective*. New York: Guilford Press.
- Harter, S. (2012). *The construction of the self: Developmental and sociocultural foundations*. New York: Guilford Press.
- Harter, S. (1982). The perceived competence scale for children. *Child development*, 53(1), 87-97.
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: The Guilford Press.
- Haywood, K., & Getchell, N. (2009). *Life span motor development* (5th ed.). Champaign, IL: Human Kinetics.
- Hearst, M. O., Patnode, C. D., Sirard, J. R., Farbakhsh, K., & Lytle, L. A. (2012). Multilevel predictors of adolescent physical activity: A longitudinal analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 9(8), 1–10. doi:10.1186/1479-5868-9-8
- Herman, K. M., Chaput, J. P., Sabiston, C. M., Mathieu, M. E., Tremblay, A., & Paradis, G. (2015). Combined physical activity/sedentary behavior associations with indices of adiposity in 8-to 10-year-old children. *Journal of Physical Activity and Health*, 12 (1), 20–29. doi:10.1123/jpah.2013-0019
- Herman, K. M., Sabiston, C. M., Mathieu, M. E., Tremblay, A., & Paradis, G. (2014). Sedentary behavior in a cohort of 8-to-10-year-old children at elevated risk of obesity. *Preventative Medicine*, 60, 115-120.

- Horn, T. S. (2004). Developmental perspectives on self-perceptions in children and adolescents. In M. R. Weiss (Ed.), *Developmental sport and exercise psychology: A lifespan perspective* (pp. 101-143). Morgantown, WV: Fitness Information Technology.
- Hume, C., Okely, A., Bagley, S., Telford, A., Booth, M., Crawford, D., & Salmon, J. (2008). Does weight status influence associations between children's fundamental movement skills and physical activity? *Research Quarterly for Exercise and Sport*, 79(2), 158-165.
- Jacobs, J. E., Lanza, S., Osgood, D. W., Eccles, J. S., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development*, 73(2), 509-527.
- Katzmarzyk, P. T., Barreira, T. V., Broyles, S. T., Champagne, C. M., Chaput, J. P., Fogelholm, M., ... & Church, T. S. (2015a). Physical activity, sedentary time, and obesity in an international sample of children. *Medicine & Science & Sports Exercise*, 47(10), 2062-2069.
- Katzmarzyk, P. T., Barreira, T. V., Broyles, S. T., Champagne, C. M., Chaput, J. P., Fogelholm, M., ... & Church, T. S. (2015b). Relationship between lifestyle behaviors and obesity in children ages 9-11: Results from a 12-country study. *Obesity*, 23(8), 1696-1702.
- Khodaverdi, Z., Bahram, A., Stodden, D., & Kazemnejad, A. (2016). The relationship between actual motor competence and physical activity in children: Mediating roles of perceived motor competence and health-related physical fitness. *Journal of Sports Sciences*, 34(16), 1523-1529. doi:10.1080/02640414.2015.1122202
- Kimiecik, J., & Horn, T. (2012). Examining the relationship between family context and children's physical activity beliefs: The role of parenting style. *Psychology of Sport and Exercise*, 13(1), 10-18. doi:10.1016/j.psychsport.2011.08.004
- King, G., Law, M., Hurley, P., Petrenchik, T., & Schwellnus, H. (2010). A developmental comparison of the out-of-school recreation and leisure activity participation of boys and girls with and without physical disabilities. *International Journal of Disability, Development and Education*, 57(1), 77-107.
- King, G. A., Law, M., King, S., Hurley, P., Hanna, S., Kertoy, M. E. A., & Rosenbaum, P. (2007). Measuring children's participation in recreation and leisure activities: construct validation of the CAPE and PAC. *Child: Care, Health and Development*, 33(1), 28-39.

- King, G., Law, M., King, S., Hurley, P., Hanna, S., Kertoy, M., ... & Young, N. (2004). *Children's assessment of participation and enjoyment (CAPE) and preferences for activities of children (PAC)*. San Antonio, TX: Harcourt assessment, Inc.
- King, G., Law, M., King, S., Rosenbaum, P., Kertoy, M., & Young, N. L. (2003). A conceptual model of the factors affecting the recreation and leisure participation of children with disabilities. *Physical & Occupational Therapy in Pediatrics*, 23(1), 63–90.
- Klomsten, A. T., Marsh, H. W., & Skaalvik, E. M. (2005). Adolescents' perceptions of masculine and feminine values in sport and physical education: A study of gender differences. *Sex Roles*, 52, 625–636. doi:10.1007/s11199-005-3730-x
- Lämmle, L., Woll, A., Mensink, G. B. M., & Bös, K. (2013). Distal and proximal factors of health behaviors and their associations with health in children and adolescents. *International Journal of Environmental Research and Public Health*, 10(7), 2944–2978. doi:10.3390/ijerph10072944
- Larouche R, Faulkner G, Fortier M, Tremblay MS. (2014). Active transportation and adolescents' health: The Canadian health measures survey. *American Journal of Preventive Medicine*. 46(5), 507-515.
- Larson, R. W. (2000). Toward a psychology of positive youth development. *American Psychologist*, 55(1), 170-183. doi:10.1037/0003-066X.55.1.170
- Larun, L., Nordheim, L.V., Ekelan, E., Hagen, K. B., & Heian, F. (2006). Exercise in prevention and treatment of anxiety and depression among children and young people. *Cochrane Database System Review*, (3), CD004691. doi:10.1002/14651858.CD004691.pub2
- Law, M., King, G., King, S., Kertoy, M., Hurley, P., Rosenbaum, P., ... Hanna, S. (2006). Patterns of participation in recreational and leisure activities among children with complex physical disabilities. *Developmental Medicine and Child Neurology*, 48(5), 337-342. doi:10.1017/S0012162206000740
- LeGear, M., Greyling, L., Sloan, E., Bell, R. I., Williams, B. L., Naylor, P. J., & Temple, V. (2012). A window of opportunity? Motor skills and perceptions of competence of children in kindergarten. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 29-34. doi:10.1186/1479-5868-9-29

- Lloyd, M., Saunders, T. J., Bremer, E., & Tremblay, M. S. (2014). Long-term importance of fundamental motor skills: A 20-year follow-up study. *Adapted Physical Activity Quarterly*, 31, 67–78. doi:10.1123/apaq.2013-0048
- Logan, S. W., Kipling Webster, E., Getchell, N., Pfeiffer, K. A., & Robinson, L. E. (2015). Relationship between fundamental motor skill competence and physical activity during childhood and adolescence: A systematic review. *Kinesiology Review*, 4(4), 416–426. doi:10.1123/kr.2013-0012
- Logan, S. W., Robinson, L. E., Wilson, A. E., & Lucas, W. A. (2012). Getting the fundamentals of movement: A meta-analysis of the effectiveness of motor skill interventions in children. *Child: Care, Health and Development*, 38(3), 305-315. doi:10.1111/j.1365-2214.2011.01307.x
- Lubans, D., Morgan, P., Cliff, D., Barnett, L., & Okely, A. (2010). Fundamental movement skills in children and adolescents: Review of associated health benefits. *Sports Medicine*, 40(12), 1019–1035. doi:10.2165/11536850-000000000-00000
- Malina, R. M. (2001). Physical activity and fitness: Pathways from childhood to adulthood. *American Journal of Human Biology*, 13, 162–172.
- Malina, R. M., Bouchard, C., Bar-Or O. (2004). Motor development. In R. M. Malina, C. Bouchard, O. Bar-Or (Eds.), *Growth maturation and physical activity* (2nd edn, pp. 195-210). Champaign, IL: Human Kinetics.
- McIsaac, J., Kirk, S., & Kuhle, S. (2015). The association between health behaviours and academic performance in Canadian elementary school students: A cross-sectional study. *International Journal of Environmental Research and Public Health*, 12(11), 14857-14871. doi:10.3390/ijerph121114857
- McPherson, B. D., Curtis, J. E., & Loy, J. W. (1989). *The social significance of sport: An introduction to the sociology of sport*. Champaign, Ill: Human Kinetics Publishers.
- Mirjafari, E. (2015). *The relationships between motor skills, perceptions of competence, and participation in active recreation and physical activities* (Master's thesis). University of Victoria, British Columbia, Canada.
- Molnar, B. E., Gortmaker, S. L., Bull, F. C., & Buka, S. L. (2004). Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *American Journal of Health Promotion*, 18(5), 378-386. doi:10.4278/0890-1171-18.5.378

- Murphy, N., & Carbone, P. (2008). Promoting the participation of children with disabilities in sports, recreation, and physical activities. *Pediatrics*, 121(5), 1057-1061. doi:10.1542/peds.2008-0566
- Nesbit, K. C., Kolobe, T. A., Arnold, S. H., Sisson, S. B., Anderson, M. P. (2014). Proximal and distal environmental correlates of adolescent obesity. *Journal of Physical Activity & Health*, 11(6), 1179-1186. doi:10.1123/jpah.2012-0245
- Nettlefold, L., McKay, H. A., Naylor, P. J., Bredin, S. S., & Warburton, D. E. (2012). The relationship between objectively measured physical activity, sedentary time, and vascular health in children. *American Journal of Hypertension*, 25(8), 914-919. doi:10.1038/ajh.2012.68
- Okely, A. D., Booth, M. L. & Patterson, J. W. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine & Science in Sports & Exercise*, 33, 1899–1904.
- Pang, B., Sau, A., & Ha, C. (2010). Subjective task value in physical activity participation: The perspective of Hong Kong schoolchildren. *European Physical Education Review*, 16(3), 223–235. doi:10.1177/1356336X10382971
- ParticipACTION (2016). *Are Canadian kids too tired to move? The 2016 ParticipACTION report card on physical activity for children and youth*. Toronto: ParticipACTION. Retrieved from ParticipACTION website: www.participaction.com/reportcard.
- Patnode, C. D., Lytle, L. A., Erickson, D. J., Sirard, J. R., Barr-Anderson, D., & Story, M. (2010). The relative influence of demographic, individual, social, and environmental factors on physical activity among boys and girls. *The International Journal of Behavioral Nutrition and Physical Activity*, 7(1), 79-88. doi:10.1186/1479-5868-7-79
- Patton, M. Q. (1991). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks: Sage.
- Payne, V. G. & Isaacs, L. D. (2005). *Human motor development: A lifespan approach* (6th ed.). Boston: McGraw-Hill.
- Payne, V. G., & Isaacs, L. D. (2012). *Human motor development: A lifespan approach* (8th ed.). New York: McGraw-Hill.

- Pawlowski, C. S., Ergler, C., Tjørnhøj-Thomsen, T., Schipperijn, J., & Troelsen, J. (2015). "Like a soccer camp for boys": A qualitative exploration of gendered activity patterns in children's self-organized play during school press. *European Physical Education Review*, 21(3), 275–291. doi:10.1177/1356336X14561533
- PHE Canada. (2017). Physical literacy, Retrieved from <http://www.phecanada.ca/programs/physical-literacy>
- Procesmarco.org (2017). PROCESS (Version 2.16) [Computer software]. Retrieved from <http://www.processmacro.org/index.html>
- Pyrczak, F. (1973). Validity of the discrimination index as a measure of item quality. *Journal of Educational Measurement*, 10(3), 227-231.
- Raudsepp, L., & Pall, P. (2006). The relationship between fundamental motor skills and outside-school physical activity of elementary school children. *Pediatric Exercise Science*, 18, 426-435.
- Richards, J., Jiang, X., Kelly, P., Chau, J., Bauman, A., & Ding, D. (2015). Don't worry, be happy: Cross-sectional associations between physical activity and happiness in 15 European countries. *BMC Public Health*, 15(1), 53-61. doi:10.1186/s12889-015-1391-4
- Ridgers, N. D., Timperio, A., Crawford, D., & Salmon, J. (2012). Five-year changes in school recess and lunchtime and the contribution to children's daily physical activity. *British Journal of Sports Medicine*, 46, 741-746.
- Robinson, L. E., & Goodway, J. D. (2009). Instructional climates in preschool children who are at-risk. Part I: Object-control skill development. *Research Quarterly for Exercise and Sport*, 80(3), 533-542.
- Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor competence and its effect on positive developmental trajectories of health. *Sports Medicine*, 45(9), 1273-1284. doi:10.1007/s40279-015-0351-6
- Rodriguez, D., Wigfield, A., & Eccles, J. (2003). Changing competence perceptions, changing values: Implications for youth sport. *Journal of Applied Sport Psychology*, 15(1), 67-81.
- Rodrigues, L. P., Stodden, D. F., & Lopes, V. P. (2016). Developmental pathways of change in fitness and motor competence are related to overweight and obesity

- status at the end of primary school. *Journal of Science and Medicine in Sport*, 19(1), 87–92. doi:10.1016/j.jsams.2015.01.002
- Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise*, 32, 963-975.
- Seefeldt, V. (1980). Developmental motor patterns: Implications for elementary school physical education. In C. Nadeau, W. Holliwell, K. Newell, & G. Roberts (Eds.), *Psychology of motor behavior and sport* (pp. 314– 323). Champaign, IL: Human Kinetics.
- Shikako-Thomas, K., Majnemer, A., Law, M., & Lach, L. (2008). Determinants of participation in leisure activities in children and youth with cerebral palsy: Systematic review. *Physical & Occupational Therapy in Pediatrics*, 28(2), 155-169. doi:10.1080/01942630802031834
- Simpkins, S. D., Ripke, M., Huston, A. C., & Eccles, J. S. (2005). Predicting participation and outcomes in out-of-school activities: Similarities and differences across social ecologies. *New Directions for Youth Development*, 2005(105), 51-69. doi:10.1002/yd.107
- Smith, L., Gardner, B., Aggio, D., & Hamer, M. (2015). Association between participation in outdoor play and sport at 10 years old with physical activity in adulthood. *Preventive Medicine*, 74, 31-35. doi:10.1016/j.ypmed.2015.02.004
- Spurr, S., Bally, J., Trinder, K., & Williamson, L. (2016). A multidimensional investigation into the predictors of physical activity in Canadian adolescents. *Journal of Holistic Nursing*, 34(4), 390-401. doi:10.1177/089801011562550
- Statistics Canada. (2009). Who participates in active leisure. *Canada Social Trends*. No. 87. Statistics Canada Catalogue no 11-008-X, 1-31.
- Statistics Canada. (2011). Physical activity of Canadian children and youth: Accelerometer results from the 2007-2009 Canadian health measure survey. *Health Reports*. Vol. 22, No. 1. Statistics Canada Catalogue no 82-003-XPE, 1-9.
- Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Robertson, M. A., Rudisill, M. E., Garcia, C., & Garcia, L. E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest*, 60, 290-306.

- Stodden, D. F., Langendorfer, S., & Ann Robertson, M. (2009). The association between motor skill competence and physical fitness in young adults. *Research Quarterly for Exercise and Sport*, 80(2), 223–229. doi:10.1080/02701367.2009.10599556
- Stuntz, C. P., & Weiss, M. R. (2010). Motivating children and adolescents to sustain a physically active lifestyle. *American journal of Lifestyle Medicine*, 4(5), 433-434.
- Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: A 21-year tracking study. *Journal of Sports Medicine and Physical Fitness*, 28(3), 267–273. doi:10.1016/j.amepre.2004.12.003
- Temple, V. A., Crane, J. R., Brown, A., Williams, B., & Bell, R. I. (2016). Recreational activities and motor skills of children in kindergarten. *Physical Education and Sport Pedagogy*, 21(3), 268-280. doi:10.1080/17408989.2014.924494
- Temple, V. A., & Foley, J. T. (2016). A peek at the developmental validity of the Test of Gross Motor Development - 3. *Journal of Motor Learning and Development*, 5(1) 5-14. doi: 10.1123/jmld.2016-0005
- Thomas, J. R., & French, K. E. (1985). Gender differences across age in motor performance: A meta-analysis. *Psychological Bulletin*, 98(2), 260-282. doi:10.1037/0033-2909.98.2.260
- Thompson, A. M., Humbert, M. L., & Mirwald, R. L. (2003). A longitudinal study of the impact of childhood and adolescent physical activity experiences on adult physical activity perceptions and behaviors. *Qualitative Health Research*, 13(3), 358-377. doi:10.1177/1049732302250332
- Thorp, A. A., Owen, N., Neuhaus, M., & Dunstan, D. W. (2011). Sedentary behaviors and subsequent health outcomes in adults: A systematic review of longitudinal studies, 1996-2011. *American Journal of Preventive Medicine*, 41(2), 207–215. doi:10.1016/j.amepre.2011.05.004
- Tremblay, M. S., Carson, V., Chaput, J. P., Gorber, S. C., Dinh, T., Duggan, M., Zehr, L. (2016). Canadian 24-hour movement guidelines for children and youth: An integration of physical activity, sedentary behaviour, and sleep. *Canadian Science*, 41, S311–S327. doi:10.1139/apnm-2016-0151
- Ulrich, B. D. (1987). Perceptions of physical competence, motor competence, and anticipation in organized sport: Their interrelationships in young children. *Research Quarterly for Exercise and Sport*, 58(1), 57-67.

- Ulrich, D. A. (2000). *The test of gross motor development* (2nd ed.). Austin, TX: PRO-ED.
- Umberson, D., Crosnoe, R., & Reczek, C. (2010). Social relationships and health behavior across the life course. *Annual Review of Sociology*, 36(1), 139-157. doi:10.1146/annurev-soc-070308-120011
- Valentini, N., & Rudisill, M. (2004). Motivational climate, motor-skill development, and perceived competence: Two studies of developmentally delayed kindergarten children. *Journal of Teaching in Physical Education*, 23(3), 216-234.
- Vlahov, E., Baghurst, T. M., & Mwavita, M. (2014). Preschool motor development predicting high school health-related physical fitness: A prospective study. *Perceptual & Motor Skills*, 119(1), 279–291. doi:10.2466/10.25.PMS.119c16z8
- Watson, L., & Knott, F. (2006). Self-esteem and coping in children with developmental coordination disorder. *The British Journal of Occupational Therapy*, 69(10), 450-456. doi:10.1177/030802260606901003
- Waxman, A., & World Health Assembly (2004). WHO global strategy on diet, physical activity and health. *Food and Nutrition Bulletin*, 25(3), 292-302. doi:10.1177/156482650402500310
- Weiss, M. R. (2004). *Developmental sport and exercise psychology: A lifespan perspective*. Morgantown, WV: Fitness Information Technology.
- Weiss, M. R., & Amorose, A. J. (2005). Children's self-perceptions in the physical domain: Between-and within-age variability in level, accuracy, and sources of perceived competence. *Journal of Sport and Exercise Psychology*, 27(2), 226-244.
- Welk, G., Wood, K., & Morss, G. (2003). Parental influences on physical activity in children: An exploration of potential mechanisms. *Pediatric Exercise Science*, 15(1), 19-33.
- Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review*, 6(1), 49-78. doi:10.1007/BF02209024
- Wigfield, A., Eccles, J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental Psychology*, 27(4), 552-565. doi:10.1037/0012-1649.27.4.552

- Wigfield, A., Eccles J. S., Schiefele U, Rosser R.W., & Davis-Kean P. (2006). Development of achievement motivation. In: W. Damon, & R. M. Lerner (Eds.) *Handbook of Child Psychology* (6th ed.). New York: Wiley, 933–1002.
- Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, 25(1), 68–81. doi:10.1006/ceps.1999.1015.
- Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbreton, A. J., Freedman-Doan, C., & Blumenfeld, P. C. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study. *Journal of Educational Psychology*, 89, 451-469.
- Williams, H. G., Pfeiffer, K. A., O'Neill, J. R., Dowda, M., McIver, K. L., Brown, W. H., & Pate, R. (2008). Motor skill performance and physical activity in preschool children. *Obesity*, 16(6), 1421-1426.
- World Health Organization. (2007). *International classification of functioning, disability and health: Children and youth version: ICF-CY*. Geneva: World Health Organization.
- Wrotniak, B. H., Epstein, L. H., Dorn, J. M., Jones, K. E., & Kondilis, V. A. (2006). The relationship between motor proficiency and physical activity in children. *Pediatrics*, 118(6), e1758-e1765.
- Xiang, P., McBride, R., Guan, J., & Solmon, M. (2003). Children's motivation in elementary physical education: An expectancy-value model of achievement choice. *Research Quarterly for Exercise and Sport*, 74(1), 25–35. doi:10.1080/02701367.2003.10609061
- Xiang, P., McBride, R. E., & Bruene, A. (2004). Fourth graders' motivation in an elementary physical education running program. *The Elementary School Journal*, 104(3), 253–266.

Appendices

Appendix A

Table A1

Definition and Calculation of Dimensions of Participation

Variable	Definition	Calculation
Diversity	Number of activities done	The basic formula was to sum the recorded scores, which should be either 1 or 0. The range for overall diversity score was 0-55.
Intensity	Frequency of participation measured as a function of the number of possible activities within a category	The basic formula was to sum the recorded scores in the intensity column, in which the child's responses may range from 1-7, and dividing by 55 (the total number of possible items). The possible range of scores for this dimension was 0.0-7.0.
With Whom	With whom activities are done	To calculate the overall “with whom score”, in which the recorded scores may range from 1-5, sum of the recorded scores in the ‘with whom’ column, divided by the number of activities the child does (which is also the overall diversity score). The possible range of scores for this dimension was 1.0-5.0.
Where	In which place activities are done	The basic formula was to sum the recorded scores (the recorded scores range from 1-6), in the where column and dividing by the number of activities the child does (which is also the overall diversity score). The possible range of scores for this dimension was 1.0-6.0
Enjoyment	How much participating in activities would be enjoyable	The recorded score ranged from 1-5, the sum of the recorded scores in the enjoyment column divided by the number of activities the child does (which is also the overall diversity score). The possible range of scores in this dimension was 1.0-5.0.

Appendix B

Table B1

Definition and Calculation of Different Type of Activities and Dimensions of Participation

Variable	Definition	Calculation
Dimension of participation (Overall)	The CAPE measures six dimensions of participation including: diversity, intensity, with whom, where, and enjoyment. They are important for describing the general participation of a child in active recreation and leisure activities.	As per Table A1
Recreation activities	“Recreation activities” is one of the subsets of informal activities which includes questions 1, 2, 3, 4, 5, 12, 14, 15, 32, 36, 44, 55 in order: doing puzzles, playing board or card games, doing crafts, drawing or coloring, collecting things, playing computer or video games, playing with pets, doing pretended or imaginary play, playing with things or toys, going for a walk or hike, playing on equipment, watching TV or a rented movie, and taking care of a pet.	For calculating the recreation activities scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, with whom, where, and enjoyment) scores except for the intensity dimension, which calculates by the sum of frequency, ratings divided by total items (12) in the informal domain.
Physical activities	“Physical activities” is one of the subsets of formal and informal domains which includes questions 16, 20, 21, 30, 33, 34, 35, 37, 38, 39, 40, 41, 51 in order: doing martial arts, racing or track and field, doing team sports, participating in school clubs, bicycling or in-line skating or skateboarding, doing water sports, doing snow sports, playing games, gardening, fishing, doing individual physical activities, playing non-team sports, and doing a paid job.	For calculating the physical activities scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, with whom, where, and enjoyment) scores except for the intensity dimension, which calculates by the sum of frequency, ratings divided by total items (13) in the formal and informal domains.

Social activities	“Social activities” is one of the subsets of informal domain which includes questions 6, 7, 8, 9, 11, 42, 45, 46, 48, 52 in order: talking on the phone, going to a party, hanging out, visiting, entertaining others, going to the movies, going to the live event, going on a full-day outing, listening to music, and making food.	For calculating the social activities scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, with whom, where, and enjoyment) scores except for the intensity dimension, which calculates by the sum of frequency, ratings divided by total items (10) in the informal domain.
Skill-based activities	“Skill-based activities” is one of the subsets of formal and informal domains which includes questions 17, 18, 19, 22, 23, 24, 26, 27, 28, 31 in order: swimming, doing gymnastics, horseback riding, learning to sing (choir or individual lessons), taking art lessons, learning to dance, playing a musical instrument, taking music lessons, participating in community organizations, and dancing.	For calculating the skill-based activities scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, with whom, where, and enjoyment) scores except for the intensity dimension, which calculates by the sum of frequency, ratings divided by total items (10) in the formal and informal domains.
Self-improvement activities	“Self-improvement activities” is one of the subsets of formal and informal domains which includes questions 10, 13, 25, 29, 43, 47, 49, 50, 53, 54 in order: writing letters, writing a story, getting extra help for school work from a tutor, doing a religious activity, going to the public library, reading, doing volunteer work, doing a chore, doing homework, and shopping.	For calculating the self-improvement activities scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, with whom, where, and enjoyment) scores except for the intensity dimension, which calculates by the sum of frequency, ratings divided by total items (10) in the formal and informal domains.
Organized sports	“Organized sports” is one of the subsets of formal activities, which includes questions 16 -21, in order: doing martial arts, swimming, doing gymnastics, horseback riding, racing or track and field, doing team sports.	For calculating the organized sport scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, with whom, where, and enjoyment) scores except for the intensity

dimension, which calculates by the sum of frequency ratings, divided by total items (6) in the formal domain.

Active physical recreation	”Active physical recreation” is one of the subsets of informal activities, which includes question 31 – 41, in order: dancing, going for a walk or hike, bicycling- in line skating or skateboarding, doing water sports, doing snow sports, playing on equipment, playing games, gardening, fishing, doing individual physical activities, and playing non-team sports.	For calculating the active physical recreation scores, researcher had to follow the same scoring procedures for each dimension the same as what they had done for scoring the overall (diversity, where, with whom, and enjoyment) scores except for the intensity dimension, which calculates by the sum of the frequency, ratings divided by total items (11) in the informal domain.
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Table B2

Activity Domains and Categories in CAPE

Domains	Activity Category
Formal	Organized sports Other skill-based activities Clubs, groups, and organizations
Informal	Hobbies, crafts, and games Social activities Quiet recreation Active physical recreation Entertainment and education Jobs, chores, and enjoyment

Appendix C

Consent Forms



**University
of Victoria**

**School of Exercise Science,
Physical & Health Education**

Physical activity and motor skills: A study of child development

Your child is being invited to participate in a study entitled “Physical Activity and Motor Skills: A Study of Child Development.” This study is being conducted by Dr. Vivienne Temple, Rick Bell, and PJ Naylor from the School of Exercise Science, Physical and Health Education at the University of Victoria. If you have further questions you may contact or Vivienne at 250-721-7846 or vtemple@uvic.ca or Rick at 250-721-8373 fbell@uvic.ca. This research was funded in part by an Insight Development Grant from the Social Sciences and Humanities Research Council of Canada, grant #430-2012-0343.

Aim and Objectives

The aim of this research is to understand the relationships between elementary children’s gross motor skills, perceptions of motor competence, physical activity levels, and aspects of health-related fitness. We want to see whether children’s actual gross motor competences, or their perceptions of their competence, influence their participation in physical activity and health-related fitness in Kindergarten, Grade 2/3, and in Grade 5.

Importance of this Research

Less than 15% of children in British Columbia meet Canada’s physical activity guidelines for children and a study published last year entitled the *Fitness of Canadian Children and Youth* indicates that the fitness levels of children have declined since 1981, regardless of age or sex. These statistics are alarming and point to an urgent need to help children’s stay engaged in physical activity.

Research suggests that actual motor skill competence and how children feel about their skills is the key to understanding participation (or not) in physical activity. Children’s actual skills and their feelings about their gross motor skills changes from early childhood (i.e. kindergarten) to middle and later childhood. However, the influence of this on participation in physical activity has not been studied over an extended period of time.

This research will be the first in the world to describe these relationships as children develop during elementary school. Ultimately, our intent is to help teachers, schools, and

school districts enhance physical activity participation by helping children optimize their fundamental motor skills (competence) and how they feel about their skills.

Participants Selection

Your child is being asked to participate in this study because she/he is in Grade 3 in a School District 61 school.

What is involved

During scheduled physical education time your child will be videotaped performing 14 fundamental motor skills. These are the: run, hop, gallop, leap, slide, jump, catch, kick, throw, underhand roll, t-ball strike, bounce, dodge, and balance. We videotape the skills so that we can accurately record the parts of each skill and to minimize the time it takes to complete all of the skills during physical education. Your child will also complete three questionnaires. One questionnaire focuses on how your child feels about his/her motor skills, the second examines your child's interest in sports, and the third is a picture-based questionnaire about their physical activity participation. Height and weight will be measured. We are also asking you about your child's age, gender, whether he/she was born prematurely, and whether your child has a disability as these factors can influence motor skill development and participation in physical activity.

You and your child may also choose to

We are also asking for volunteers to wear a motion sensor (accelerometer) for 7-days. An accelerometer is similar to a pedometer and accurately records your child's level of physical activity. The accelerometer is unobtrusively worn on the hip via an elastic belt. It is removed at night or when bathing or swimming.

Inconvenience

Approximately 30 minutes of class time and three of your child's physical education lessons will be devoted to this project. Plus if you and your child choose to participate in the motion sensor part of the project we would ask that your child wear the device for 7-days. Some parental assistance will be needed to record when the device was worn and to help the children put on the accelerometer.

Risks

It is possible that children will be embarrassed by having their weight recorded. To minimize this risk weight will be measured in a private space on a scale with the display covered with a flap. Only the research assistant will see the display. If a child doesn't want to be weighed that will be okay; only their height will be measured.

Benefits

Your child's participation in this research will help us better understand the role that motor skill development plays in physical activity participation; and may help reverse the decline in fitness/physical activity among Canadian children. The fundamental motor

skill test results will also help your child's teacher plan their physical education curriculum.

Voluntary Participation

Your child's participation in this research must be completely voluntary. Choosing not to participate in this study will in no way effect your child's physical education lessons. All children in the class will do the fundamental motor skills in physical education, but only the data from consented children will be used for research purposes. If your child does participate, she/he may withdraw at any time without any consequences or any explanation. If she/he does withdraw from the study her/his data will not be used in the study and will be destroyed.

On-going Consent

One of the goals of this project is to track the development of motor skills and physical activity participation across the elementary years. Your child may have been involved in this project in kindergarten. Rather than assuming your ongoing consent, we will seek your and your child's consent again when he/she enters grade 3.

Anonymity and Confidentiality

Your child's participation will not be anonymous as the fundamental motor skill data will be collected during physical education. There will be many small groups of children performing motor skills at the same time; therefore, your child will only be performing in front of a few children. The data we collect will be entered into the computer without names and all presentations will refer only to group data. You will not be asked to enter your child's name online; rather we will email you the code that we use for your child so that we connect the survey responses to your child's other data.

Dissemination of Results

Aggregated data from this project will be presented to School District 61 and at professional meetings. Additionally, articles will be published and graduate students will use the data for their theses. The fundamental motor skill data will also be provided to your child's class teacher and to the school. Your child's teacher will receive information about each child's motor skills and the school will receive scores and for the class as a whole.

Disposal of Data

The video data will be erased and surveys will be shredded five years after collection. The computer files (without names) will be kept in a secure database for 15 years. An important outcome of this project is to track the development of children's skills and physical activity longitudinally, therefore it is important to retain the grade 2 data to compare with future data collection (i.e. grade 3 and 5).

Contacts

Individuals that may be contacted regarding this study include Dr. Vivienne Temple PH: 250-721-7846 or email: vtemple@uvic.ca or Dr. Rick Bell on PH: 250-721-8373 or email: fbell@uvic.ca.

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of your child's participation in this study and that you have had the opportunity to have your questions answered by the researchers. We also ask that your child "signs" below to indicate that he or she is happy to be involved in the study.

<i>Child's Name</i>	<i>Child's Signature</i>	
<i>Parent Name</i>	<i>Parent/Guardian Signature</i>	<i>Date</i>

Additional option

My child agrees to wear a physical activity monitor for 7-days Yes ☐ No ☐

To help us describe motor skills and physical activity participation more specifically we ask that you provide the following information about your child:

1. Date of birth _____
(day/month/year)

2. Gender: Boy ☐ Girl ☐

3. Does your child have a disability? Yes ☐ No ☐

If yes, please describe _____

***PLEASE COMPLETE THE INFORMATION ON THE BACK OF THIS PAGE AND
RETURN IT TO SCHOOL IN THE ENVELOPE PROVIDED.***

Appendix D

Ethics Approval



Office of Research Services | Human Research Ethics Board
Administrative Services Building Rm B202 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
T 250-472-4545 | F 250-721-8960 | uvic.ca/research | ethics@uvic.ca

Certificate of Renewed Approval

PRINCIPAL INVESTIGATOR: Vivienne Temple	ETHICS PROTOCOL NUMBER: 10-246 Minimal Risk - Delegated
UVic STATUS: Faculty	ORIGINAL APPROVAL DATE: 23-Jun-10
UVic DEPARTMENT: EPHE	RENEWED ON: 16-Jun-17
	APPROVAL EXPIRY DATE: 22-Jun-18
PROJECT TITLE: Physical activity and motor skills: A study of child development	
RESEARCH TEAM MEMBER Co-Investigators: Dr. PJ Naylor (EPHE, UVic), John T. Foley (State University of New York, SUNY, at Cortland); Collaborator: David Hill (Canadian Sport Institute - Pacific); Project Coordinator: Buffy Williams (EPHE, UVic); Student/Research Assistants (UVic): Stephanie Field, Ashley Stewart, Elmaz Emadirad	
DECLARED PROJECT FUNDING: SSHRC Insight Development Grant (2011-completed); SSHRC Insight Grant (2013)	
CONDITIONS OF APPROVAL	
This Certificate of Approval is valid for the above term provided there is no change in the protocol. Modifications To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol. Renewals Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date. Project Closures When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.	
Certification	
This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants. _____ Dr. Rachael Scarth Associate Vice-President Research Operations	

Certificate Issued On: 16-Jun-17

10-246 Temple, Vivienne

Appendix E

Children's Ability Beliefs and Subjective Task Values Questionnaire

Ability Beliefs Items

1. How good in sports are you?	Not at all good	1	2	3	4	5	6	7	Very good
2. If you were to list all the students in your class at school from the worst to the best in sports, where would you put yourself?	One of the worst	1	2	3	4	5	6	7	One of the best
3. Some kids are better in one subject than in another. For example, you might be better in math than in physical education. Compared to most of your other school subjects, how good are you in sports or physical education?	A lot worse in sports/PE than in other subjects	1	2	3	4	5	6	7	A lot better in sports/PE than in other subjects

Expectancy Items

4. How well do you expect to do in sports this year?	Not at all well	1	2	3	4	5	6	7	Very well
5. How good would you be at learning something new in sports?	Not at all good	1	2	3	4	5	6	7	Very good

Usefulness, Importance, and Interest Items

1. Some things that you learn in school or camp help you do things better outside of school or camp, that is, they are useful. For example, learning about plants might help you grow a garden. In general, how useful is what you learn in physical education or sports camp?	Not at all useful	1	2	3	4	5	6	7	Very useful
2. Compared to most of your other activities, how useful is what you learn in sports?	Not at all useful	1	2	3	4	5	6	7	Very useful
3. For me, being good in sports is	Not at all important	1	2	3	4	5	6	7	Very important
4. Compared to most of your other activities, how important is it for you to be good at sports?	Not at all important	1	2	3	4	5	6	7	Very important
5. In general, I find practicing sports	Very boring	1	2	3	4	5	6	7	Very interesting [fun]
6. How much do you like doing sports?	Not at all	1	2	3	4	5	6	7	Very much

Appendix F

Table F1

CAPE, Item Descriptions and Distribution

Item	Expanded description	Domain	Activity type
1	Doing puzzles	e.g., jigsaws, crosswords, 3-D	Informal Recreational
2	Playing board or card games	e.g., using a deck of cards, does not include video games	Informal Recreational
3	Doing crafts, drawing or coloring	e.g., activities that involve paper and glue, crayons, markers etc. Does not include formal art classes	Informal Recreational
4	Collecting things	e.g., butterflies, dolls, cards, stamps, gathering berries	Informal Recreational
5	Playing computer or video games	e.g., hand-held, computer, internet-based	Informal Recreational
6	Talking on the phone	Talking to others e.g. cell phone, home-based	Informal Social
7	Going to a party	e.g., birthdays, weddings	Informal Social
8	Hanging out	Spending time with others, no specific activity planned	Informal Social
9	Visiting	e.g., Going to someone's house, sleepover	Informal Social
10	Writing letters	Includes corresponding on paper, email, audio	Informal Self-improvement
11	Entertaining others	Having friends and family over	Informal Social
12	Playing with pets	e.g., walking the dog, playing fetch. Does not include grooming or feeding	Informal Recreational
13	Writing a story	Includes writing an imaginary story, writing in a journal	Informal Self-improvement
14	Doing pretend or imaginary play	Includes creating plays, making 'houses' out of boxes, and acting out stories	Informal Recreational
15	Playing with things or toys	-----	Informal Recreational

16	Doing martial arts	e.g., judo, karate	Formal	Active Physical
17	Swimming	Includes swimming in a club or in lessons	Formal	Skill-based
18	Doing gymnastics	e.g., tumbling, vaulting, balancing	Formal	Skill-based
19	Horseback riding	Includes trail riding and riding in a fenced-in area	Formal	Skill-based
20	Racing or track and field	e.g., running, wheeling, relay race, shot put.	Formal	Active Physical
21	Doing team sports	Member of a sports team in any position	Formal	Active Physical
22	Learning to sing/choir	Individual singing lessons or choir	Formal	Skill-based
23	Taking art lessons	Class or individual lessons using clay, pain, metals, glass etc.	Formal	Skill-based
24	Learning to dance	Any type of dance with an instructor	Formal	Skill-based
25	Getting extra help with schoolwork from a tutor	Outside of classroom time	Formal	Self-improvement
26	Playing a musical instrument	Outside of lessons	Formal	Skill-based
27	Music lessons	With an instructor	Formal	Skill-based
28	Participating in a community organization	e.g., Brownies or Cub Scouts	Formal	Skill-based
29	Doing a religious activity	Includes praying, meditating, attending a place of worship	Formal	Self-improvement
30	Participating in school clubs	e.g., chess, science, book club, or athletic	Formal	Active Physical
31	Dancing	No instructor present	Informal	Skill-based
32	Going for a walk or hike	Walk is the main activity, not a means of transportation	Informal	Recreational
33	Bicycling, in-line skating, or skateboarding	-----	Informal	Recreational
34	Doing water sports	Includes splashing or casual swimming, tubing etc.	Informal	Active Physical
35	Doing snow sports	e.g., skiing, skating, snowshoeing etc.	Informal	Active Physical

36	Playing on equipment	e.g., swings, sand box, climbing bars	Informal	Recreational
37	Playing games	e.g., casual street hockey, soccer, skipping rope	Informal	Active Physical
38	Gardening	Includes planting, watering, weeding and harvesting	Informal	Active Physical
39	Fishing	-----	Informal	Active Physical
40	Doing individual physical activities	e.g., jogging, yoga, rock climbing	Informal	Active Physical
41	Playing non-team sports	e.g., badminton, arching, darts, pool	Informal	Active Physical
42	Going to the movies	-----	Informal	Social
43	Going to the public library	-----	Informal	Self-improvement
44	Watching TV or a rented movie	-----	Informal	Recreational
45	Going to a live event	e.g., a play, show, sporting event that is live	Informal	Social
46	Going on a full-day outing	e.g., amusement park or zoo	Informal	Social
47	Reading	-----	Informal	Self-improvement
48	Listening to music	-----	Informal	Social
49	Doing volunteer work	Activities volunteered for (no pay)	Informal	Self-improvement
50	Doing a chore	e.g., taking out the garbage, cutting the grass, folding laundry	Informal	Self-improvement
51	Doing a paid job	e.g., working at a store	Informal	Active Physical
52	Making food	Includes meals, snacks and baking	Informal	Social
53	Doing homework	Completed outside of school hours	Informal	Self-improvement
54	Shopping	Includes on-line or in store	Informal	Self-improvement
55	Taking care of a pet	Includes grooming and feeding	Informal	Recreational

Appendix G

Table G1

Sex-based differences in individual skills using paired-sample t-test

Skill	Boys (<i>n</i> = 197)		Girls (<i>n</i> = 201)		<i>p</i>
	POMP	SD	POMP	SD	
Run	85.6	1.17	85.7	1.13	0.958
Gallop	51.1	1.86	60.7	1.71	<0.001
Hop	62.3	1.50	65.6	1.34	0.017
Leap	57.0	1.11	67.0	0.87	<0.001
Jump	45.5	2.02	44.6	1.90	0.694
Slide	78.5	1.53	80.6	1.32	0.234
Strike	75.4	1.74	60.2	1.56	<0.001
Dribble	79.0	1.94	69.2	1.61	<0.001
Catch	74.2	1.39	74.0	1.25	0.979
Kick	84.1	1.10	70.7	1.27	<0.001
Throw	65.5	2.34	36.9	2.18	<0.001
Roll	58.4	2.05	53.0	1.73	0.025

Note. POMP = Percent of maximum possible score (range 0–100).