The Influence of Selected Individual and Contextual Factors on Active Physical Recreation Participation in Middle Childhood

by

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MSc, University of Victoria, 2014
BA, University of Victoria, 2006

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Supervisory Committee

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Abstract

Middle childhood is a dynamic period in children's lives marked by a host of dramatic and concomitant physical, cognitive, and social changes. Typically, during this time, fundamental motor skills improve and children develop sport-specific forms of those skills as they participate in active physical recreation. This participation occurs in expanding social worlds, and changes in children's cognitive development heightens their ability to reflect on their successes and failures in those contexts. This dissertation examined some of these concomitant changes and interactions longitudinally in three related studies among approximately 450 children from grade 2 to grade 5. In Study 1, *"Perceptions matter! Accuracy of perceived physical competence in middle childhood and the impact on active physical recreation participation,"* I found that children's self-perceptions of their physical abilities became more accurate by grade 3, and that children with both positive perceptions and high motor skills participated in the most active physical recreation. Contrastingly, children with less positive self-perceptions, whether they had relatively high or low motor skills, participated in less active physical recreation. The expanding social worlds of children were explored in Study 2, "*Social contexts and participation in recreational activities across middle childhood*." Supporting what had been theorized for children, I found significant expansion in with whom and where children participated across the grades, including a significant increase in children's participation by themselves and with friends, and a concomitant decrease in activities with their family. Overall, however, children still spent the largest proportion of their recreational time with their family in each grade. Lastly, in Study 3, *"Latent profile analysis of children's active physical recreation patterns in middle childhood,"* I identified unique profiles of children from grade 2 to grade 5 based on combinations of motor skills, perceptions of physical competence, social contexts, and

active physical recreation. Two consistent profiles of children persisted across the grades: one of children on a path toward active physical recreation engagement, and one seemingly at risk of disengagement. Ultimately, however, I discovered that with each subsequent grade came increasing diversity in children's profiles, highlighting the need for tailored programs that can accommodate children's individual differences. The findings from these three studies confirm that middle childhood is a dynamic time where children experience a multitude of changes. Overall, I found that children are developing cognitively as evidenced by improvements in accuracy, and socially, as evidenced by expanding social networks. Physically, in terms of motor skill development, children were not optimally developing, which is concerning.

Three concrete recommendations arising from this work relate to (a) children who underestimate their abilities; (b) the early engagement of many children in organized sports; and (c) how perceptions of physical competence are used in physical activity research during middle childhood. Approximately one-quarter of children underestimated their physical abilities, and of great concern was their lack of motor skill improvement from grade 2 to grade 5. Along with opportunities to develop their motor proficiency, children who underestimate their abilities, need instructors in active recreation contexts to point out, affirm, and confirm their actual abilities. The second recommendation relates to the early participation of a majority of children in organized sports in the community. As such, children were participating in formal physical activities, such as team sports, during a turbulent time in the development of their self-appraisals. Leaders and family members need to ensure that the expectations they convey to children are realistic. Further, children will benefit from activities and learning opportunities that are meaningful and provide choices that are suited to their current skill and confidence levels. Finally, when examining children's physical self-perceptions during middle childhood,

researchers should consider the expected developmental trajectory of the accuracy of those self-perceptions. A drop in perceptions of physical competence levels among children with inflated self-perceptions at the beginning of middle childhood is expected as these perceptions become more accurate. Overlooking this expected developmental trajectory may confound research findings, particularly if self-perceptions are an outcome measure.

Table of Contents

List of Tables

List of Figures

Acknowledgments

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Dedication

For Uncle Dave. Over and under.

Chapter 1 - Introduction

The way a child spends their discretionary time can have a significant impact on overall development (Hofferth & Sandberg, 2001; Larson & Verma, 1999). Broad participation in recreation activities can provide opportunities for physical, social, emotional, and cognitive development (Eccles, 1999; Mahoney et al., 2005). Understanding participation in physically active recreational activities is both complex and multidimensional (Pettee Gabriel et al., 2012; Sallis et al., 2006). There are many levels of influence in regard to children's participation in active physical recreation, from intrapersonal (individual) to cultural, policy, and environmental levels (Pate & Dowda, 2019; Sallis et al., 2006). My dissertation focuses on two individual-level factors that influence participation in active physical recreation: (a) motor competence, and (b) perceptions of physical competence. Further, these individual factors are combined to create a third factor, the accuracy of children's self-perceptions of physical competence. The trajectory of development of accuracy and the influence of accuracy on participation in active physical recreation are major focuses of my dissertation.

The other major focus of my dissertation is the changing nature of children's social contexts during middle childhood, and how these social contexts interact with participation in active physical recreation. In her perspicacious essay on the development of children ages 6-14 years, Jacquelynne Eccles stated that there are three key forces influencing confidence and participation in middle childhood. These forces are "(a) cognitive changes that heighten children's ability to reflect on their own successes and failures; (b) a broadening of children's worlds to encompass peers, adults, and activities outside the family; and (c) exposure to social comparison and competition in school classrooms and peer groups" (Eccles, 1999, p. 32). These

broadening social worlds are a relatively under-researched area of child development. I bring these more distal aspects of the social world into my work by tracking with whom and where children participate in leisure time recreation across middle childhood. My dissertation culminates with an examination of the relationships between these social contexts, motor competence, accuracy of perceptions of physical competence, and participation in active recreation.

Aim

The overall aim of my dissertation is to examine developmental changes in participation in active physical recreation, and factors associated with participation, during middle childhood. Three studies form the basis of my dissertation.

Study 1, in Chapter 3, is entitled "Perceptions matter! Accuracy of perceived physical competence in middle childhood and the impact on active physical recreation participation." It builds on one of my candidacy papers, where I found that boys' and girls' perceptions of physical competence became more accurate from grade 2 to grade 4 (Field, Crane, et al., 2020). However, in that study, I did not determine whether accuracy of perceptions predicted participation in physical activities. Study 1 is comprised of two parts. Part A extended the Field et al. (2020) study by including children in grade 5 to examine whether accuracy remained stable. In Part B, I examined how children's participation in active physical recreation differed based on clusters of high and low motor competence and high and low perceptions of physical competence.

Study 2, in Chapter 4, is entitled "Social contexts and participation in recreational activities across middle childhood." The premise of the study is that where and with whom children participated in recreation activities expand during middle childhood. I examined how

children's social contexts (where and with whom they participated) evolved from grade 2 to grade 5, and how these networks were associated with participation in both formal and informal recreational activities.

Study 3, in Chapter 5, is entitled "Latent profile analysis of children's active physical recreation patterns in middle childhood." In this third and final study, I built on chapters 3 and 4 by using latent profile analysis to examine how individual (motor skills, accuracy of perceptions, active physical recreation participation) and social context factors (with whom and where children participate) cluster together. My aim was to identify unobserved subgroups of children, some of whom may be on a path to low levels of participation.

The Overarching Motor Development Study

Data for each of my studies were collected as part of a larger longitudinal study that took place in Victoria, British Columbia from 2010 to 2017. This larger study, entitled "Physical activity and motor skills: A study of child development," was approved by the University of Victoria Human Research Ethics Board (protocol number 10-246) (see Appendix A) and the participating school district (SD 61). Throughout the remainder of this dissertation, I will refer to this larger study as the 'Motor Development Study.' The Motor Development Study includes longitudinal data collected from two cohorts of children as they moved from kindergarten to grade 5 who were attending one of eight participating schools from SD 61 between 2010-2017. Data collection began with kindergarten students in 2010-11 (Cohort 1) and 2011-12 (Cohort 2) and concluded when children completed grade 5 in 2015-16 (Cohort 1) and 2016-17 (Cohort 2). All children attending participating schools during years when data collection occurred (e.g., Grade 2 with Cohort 1 or 2) were invited to participate (see Appendix B). The Motor Development Study was funded by three separate Social Sciences and Humanities Research

Council (SSHRC) grants: IRG and SSHRC General Research Grant (2010-2011); SSHRC Insight Development Grant (2012-2014); and SSHRC Insight Grant (2014-2017). My roles in the Motor Development Study included: training undergraduate and graduate research assistants in how to administer the assessment tools; maintaining study equipment; assisting the project coordinator in liaising with schools, teachers, and research assistants; overseeing data collection among approximately 450 participants per year; reviewing, scoring, coding, and inputting data; maintaining and securing project data and consent materials; managing the study database; facilitating access to the database by other graduate and undergraduate students; co-supervising undergraduate, honours, and graduate students; and assisting with manuscript preparation.

The following demographic information about Victoria, British Columbia was not collected as part of this study, yet is included to provide context for the reader in regard to recreation and leisure participation. Greater Victoria has a population of approximately 370,000 individuals (Statistics Canada, 2016). Victoria is an island community with a relatively mild climate. The average summer temperature is 22.5 degrees Celsius and average winter temperature is 8 degrees Celsius (Weather Atlas, 2020). There are approximately 152 days of rainfall and 8 days of snowfall per calendar year (Weather Atlas, 2020). The City of Victoria, which includes a portion of the catchment area for the participating school district, is home to over 100 green spaces, parks, and natural areas, 20 maintained sports fields, as well as beaches and waterparks (City of Victoria, 2020). According to 2017 Statistics Canada data, the median total income for a two-parent household in Victoria is $101,800 and $51,660 for a lone-parent household, which is higher than the national median (Statistics Canada, 2017).

Operational Definitions

Active Physical Recreation. Active physical recreation will refer to any recreational activities that require physical exertion (King et al., 2004). This will include organized sports (e.g., hockey), non-team sports (e.g., tennis), individual physical activities (e.g., yoga), games (e.g., tag), and a variety of outdoor activities (e.g., riding bikes, skiing). Active physical recreation activities can be categorized as 'formal' or 'informal' (see subsequent definitions). For a comprehensive list of active physical recreation activities included in this study, see Table 1.

Formal Activities. Formal activities are defined as structured activities that are adult-led by a coach, leader, or instructor; involve rules or goals; and are often pre-planned as they involve coordinating multiple participant's schedules (King et al., 2004). Additionally, formal activities often emphasize skill-building, have developmentally-based expectations and rules, and focus on developing particular skills and achieving goals (Mahoney et al., 2005).

Informal Activities. Informal activities are often initiated by the child as they do not require the same pre-planning as formal activities (King et al., 2004). Often referred to as unstructured child-led, or child-directed play (Veitch et al., 2010), informal activities often involve children following their own instincts, ideas, and interests without a particular goal or objective (Canadian Public Health Association, 2019). Informal activities provide opportunities to: play with different types of equipment (e.g., playground equipment or loose objects such as blocks, puzzle pieces, Lego); modify speed (e.g., bike riding, running); and play at varying heights (e.g., climbing trees or playground equipment) (Canadian Public Health Association, 2019).

Early Childhood. Early childhood will refer to preschool-aged children between 3-5 years old (Eccles, 1999).

Middle Childhood. Middle childhood will refer to elementary school-aged children between 6 – 10 years old (Eccles, 1999).

Perceptions of Competence. Perceptions of competence are an individual's thoughts, attitudes, and beliefs about their skills and abilities (Harter, 2012a). There are a number of terms used in the literature to refer to self-perceptions, including, but not limited to: self-esteem, self-efficacy, self-confidence, perceived competence, perceived ability, and ability beliefs (Harter, 2012a). In this dissertation I use 'perceptions of competence' to represent this construct. More specifically, I use the term 'perceptions of physical competence' when referring to a child's beliefs about their athletic, sport, and physical activity-related perceptions.

Recreation Activities. In this dissertation I use 'recreation activities' to refer to those activities in which children voluntarily participated outside of school-time and apart from other obligations. Recreation activities are those in which people participate during their free time, meaning time away from work, school, or any other obligations. These activities are said to be voluntary and are partaken for the purposes of relaxation, diversion, learning, socializing, or creating (Dumazedier, 1967). Examples of recreation and leisure activities can include both formal and informal activities such as sports, dance, music, outdoor activities, shopping, socializing, and volunteering. For children, recreation and leisure activities happen during non-school hours.

Social Context(s). Throughout this dissertation I examine five dimensions of recreation participation as outlined in the Children's Assessment of Participation and Enjoyment (CAPE) (King et al., 2004). Two of the dimensions are with whom and where children participate. The authors of the CAPE suggest that with whom and where are contextual aspects of participation.

For ease of reading, I use the phrase ‘social context(s)’ as a comprehensive term when discussing with whom and where simultaneously.

Chapter 2 – Literature Review

Participation in active physical recreation is important for healthy child development (Colley et al., 2011), but understanding why children participate is complex (Pate & Dowda, 2019). There are a number of individual and environmental factors that influence participation in active physical recreation, including motor skill competence (Robinson et al., 2015; Stodden et al., 2008); perceptions of competence about abilities (Harter, 2012a; Horn, 2004); and social aspects of participation such as with whom (Wiltshire et al., 2017) and where participation occurs (Loebach & Gilliland, 2016). Middle childhood is an important time for the development of these factors due to the physical, cognitive, emotional, and social changes that occur during middle childhood (Eccles, 1999). Recreation environments can be thought of as a cauldron, where children's emerging sense of themselves interacts with the affordances in those environments that can nurture or hinder positive development (Eccles, 1999); subsequently, these interactions influence participation in active physical recreation (Mahoney et al., 2005). I have used Bronfenbrenner and Morris' bioecological model (2006) in my dissertation as a lens through which to longitudinally examine interactions between motor skill competence, perceptions of competence, and social contexts in an effort to more deeply understand participation in active physical recreation during middle childhood.

In this chapter, I first define middle childhood and explain some of the uniqueness of middle childhood. Then, I will examine developmental expectations related to perceptions of competence, fundamental motor skills, and social worlds in middle childhood.

Middle Childhood

Middle childhood is marked by a host of dramatic physical, cognitive, emotional, and social changes between the ages of 6-10 years (Eccles, 1999). Physically, the beginning of

middle childhood should align with the tail end of the fundamental motor skill phase of development (Gabbard, 2018; Gallahue et al., 2012), and during middle childhood most children transition from the proficient stage of the fundamental movement phase to the specialized movement phase (Gallahue et al., 2012). However, this developmental pathway presupposes that the children receive adequate instruction and practice opportunities. Recent evidence from this field, however, suggests that motor skill levels of children in middle childhood are relatively low and not as proficient as might be expected (Bardid et al., 2016; Gu et al., 2019; Temple & Foley, 2017).

During middle childhood, children become more aware of their abilities and begin to have a more realistic sense of themselves (Field, Crane, et al., 2020; Harter, 2012a). This increased awareness is related to rapid structural and functional neurodevelopmental changes that children experience throughout childhood (Paz-Alonso et al., 2014). Structurally, a child's brain undergoes cortical thinning as a result, in part, of synaptic pruning that decreases gray matter. Simultaneously, increased axion diameter and myelination result in stronger white matter pathways. The strengthening of these white matter pathways is linked to the development of higher cognitive functions such as working memory and cognitive control. These enhanced functions (e.g., working memory) allow children to perceive, maintain, and update relevant short-term information for the purposes of evaluation (Baddeley, 1998; Paz-Alonso et al., 2014). For example, a child who has undergone these neurodevelopmental changes is able to observe a peer performing a skill (e.g., dribbling a basketball), retain that observation, perform the skill themselves, and use that information to evaluate if their ability is stronger, weaker, or the same as that of their peer.

Children's social contexts also change during middle childhood from a narrow environment that is largely controlled by their parents or guardians to a more complex, diverse, and physically expansive social world (Eccles, 1999). As they expand their social contexts, children meet new people, have new experiences outside the home, and begin to have some autonomy around the activities in which they participate (Eccles, 1999). This exposure to new environments and new individuals can impact the development of a child's perceptions of competence as they become introduced to new sources of feedback at an age when they have the ability to process that feedback in a way that informs their self-concept (Eccles, 1999).

During middle childhood there are many key forces that influence the development of a child's self-confidence and engagement in activities, including: cognitive changes that allow a child to reflect on their successes and failures; expanding social contexts that introduce children to new peers, adults, and activities outside the family; and exposure to social comparison and peer competition (Eccles, 1999). Next, I will discuss the developmental expectations as they relate to perceptions of competence, fundamental motor skills, and social contexts in middle childhood.

Development of Perceptions of Competence

Perceptions of competence are an individual's thoughts, beliefs, attitudes, and feelings about themselves in general, or about their skills, abilities, competencies, characteristics, and behaviors (Horn, 2004). As per the operational definitions at the end of Chapter 1, I use the term 'physical' when referring to a child's perception of their motor competence, sport, and physical ability. This is to match an industry standard whereby the majority of literature in this field uses physical, as opposed to athletic, when discussing this construct. My dissertation focuses on perceptions of physical competence.

Psychological constructs such as perceptions of physical competence develop over time (Eccles, 1999; Harter, 2012a; Horn, 2004). Age-related changes in perceptions of competence are established through a combination of cognitive development and socialization experiences. It is believed, however, that socialization experiences contribute more heavily to an individual's personal evaluation of their abilities (Harter, 2012a).

Children typically enter middle childhood with a strong sense of optimism about their ability to master many tasks and activities (Eccles, 1999). For example, Crane, Foley, Naylor, and Temple (2017) found that toward the end of the early childhood period, kindergarteners (Mean age = 5.8 years) scored 18/24 on a perceptions of physical competence questionnaire, and these perceptions remained very positive (21/24) at the beginning of the middle childhood period (grade 2 Mean age = 7.8 years). Children at this age are aware that others are evaluating them, but are yet to internalize those evaluations as their own (Harter, 2012a). Others' standards for behavior, however, become a guide for behavior at this time (Harter, 2012a). In the earlier years of middle childhood, children are able to distinguish between their 'real' and 'ideal' selves, and can differentiate between their abilities in multiple domains; however, their evaluations remain black and white (e.g., "I am smart" or "I am not smart"). By the later years of middle childhood (~ 8-10 years), children are typically far less optimistic about their abilities, and there is a much stronger relation between their self-ratings and their actual performance (Eccles, 1999; Field, Crane, et al., 2020).

During the later years of middle childhood, children begin to rely on peer comparison for the purpose of self-evaluation, and have greater accuracy in that self-evaluation (Harter, 2012a). This may result in a decrease in perceptions around this age. Findings among three cohorts of children who were recruited in grades 1, 2, and 4 and followed for three years, supports this

trajectory of change (Wigfield, Eccles, Kwang, et al., 1997). Significant decreases in the children's perceptions of sports competence were observed for each cohort, i.e. from grades 1-3, grades 2-4, and grades 4-6. Similarly, Field and colleagues (2020) found that girls' perceptions of physical competence decreased significantly from grade 2 to grade 3 (~7-8 years of age), then stayed stable into grade 4. However, only boys who overestimated their physical competence in grade 2, significantly decreased their perceptions between grade 2 and grade 4 (Field et al., 2020). Contrastingly, van Veen and colleagues (2019) reported stable perceptions for both boys and girls aged 8-11 years in a one-year longitudinal cohort study (e.g., no change from 8-9 years, 9-10 years, and 10-11 years). The differences in the findings between these three studies may be partly explained by considering the measures used. Both Wigfield and colleagues, and Field and colleagues, used a domain-level measure of perceived competence (perceived sports competence and perceived physical competence, respectively), whereas van Veen and colleagues used a measure of skill-specific competence. It may be that during the middle childhood years, children have a decrease in the more general construct of perceived physical competence (e.g., their overall thoughts and feelings about their physical abilities) yet demonstrate more stable perceptions of specific skills.

In middle childhood, there are a number of domains of perceived competence: scholastic/academic (e.g., performance/ease of learning in a school environment), athletic (e.g., performance/ease of learning sports and physical activities), physical (e.g., perceptions of one's appearance), behavioral conduct (e.g., adherence to rules), and social (e.g., ability to make friends) (Harter & Pike, 1984). Children in the later years of middle childhood also become more discerning about their abilities within particular domains, and become capable of both negative and positive evaluations within each domain (e.g., "I am good at math but I am not good at

reading") (Harter, 2012a). Additionally, domain-specific perceptions of competence have the ability to fluctuate over time and across different domains (Horn, 2004). For example, an individual may have high perceptions of competence in the social domain, but low perceptions of competence in the physical domain. An important part of understanding this discrepancy is understanding the extent to which an individual can 'devalue' or 'discount' the importance of competence in a particular domain (Harter, 2012a; Horn, 2004). "With time, children receive more failure feedback and they become more able to reflect on their performances and compare those with the performances of other children. They learn that current failures are likely to be clues to future performances" (Eccles, 1999, p. 33). Rather than experience future failures in a particular domain, a child may devalue a domain and choose to withdraw from activities in that domain in an attempt to protect confidence (Berk, 2013). Summaries of research have shown that children who have high (i.e. positive) perceived physical competence are more likely to participate in active physical recreation while those who have low (i.e. negative) perceived physical competence are less likely to participate and develop a narrower range of interests (Berk, 2013; Robinson et al., 2015; Stodden et al., 2008). Understanding a child's perceptions of competence is crucial as "…children who do not see themselves as competent in academic, social, or other domains (such as athletics, social, drama, or scouting) during their elementary school years report depression and social isolation more often than their peers, as well as anger and aggression" (Eccles, 1999, p. 34).

Sex-based Differences in Perceived Physical Competence

In middle childhood, boys typically have higher perceived physical competence than do girls (Barnett et al., 2015; De Meester, Stodden, et al., 2016; Field, Crane, et al., 2020; Liong et al., 2015; Pesce et al., 2018) which may be a reflection of boys' higher object control

competence (Barnett et al., 2015; Liong et al., 2015). This trend is supported by several cross-sectional studies examining perceptions of physical competence in middle childhood (e.g. Barnett et al., 2015; Liong et al., 2015; Pesce et al., 2018; Rudisill et al., 1993) as well as longitudinal studies (Field, Crane, et al., 2020; van Veen et al., 2019; Wigfield, Eccles, Yoon, et al., 1997). In a recent study by Field and colleagues (2020) with the same sample used in this dissertation, girls' perceptions of physical competence were higher than boys' in grade 2, however boys had higher perceptions of physical competence in grade 3 and grade 4.

Fundamental Motor Skills

Motor development is a lifelong process that begins in the prenatal period and carries across the lifespan (Gabbard, 2018; Gallahue et al., 2012). There are a number of factors that influence motor development throughout life: individual factors such as physical maturation and heredity, environmental factors such as personal experience and learning opportunities, and task factors which are the physical and mechanical demands of a task (Gallahue et al., 2012). These factors work together, or transact, to influence one's motor development, including the development of fundamental motor skills. Across the lifespan, human beings move in and out of a number of phases of motor behavior as we move along the developmental continuum (Gabbard, 2018). Beginning around two years of age, children enter into the fundamental movement phase, which is a period of "landmark significance" (Gabbard, 2018, p. 294) for motor development and is where children theoretically develop motor skill proficiency.

Within the fundamental movement phase, movement behaviors are often classified into three general groups: stability, locomotor, and manipulative skills (Gabbard, 2018). Stability skills involve an individual remaining stationary while completing axial movements such as bending, twisting, and curling of the body. Locomotor skills are movements that move an

individual through space, allowing them to travel from one place to another (e.g., running, skipping, hopping). Lastly, manipulative skills, or object control skills, involve the control of an object through actions such as kicking, catching, and throwing.

Fundamental motor skills are seen as the building blocks for more complex, sport-specific movements (Clark & Metcalfe, 2002) and are crucial to an individual's participation in a variety of sports and physical activities. Seefeldt (1986) suggested that there is a 'proficiency barrier' between the fundamental motor skills phase of development and application of those skills in a variety of contexts. He argued that if a child had not mastered a fundamental motor skill (or skills) they would not be able to use that fundamental movement pattern in sport and recreation specific contexts. For example, a child who has a proficient overhand throw is able to cross the proficiency barrier and use the fundamental movement of the overhand throw to execute an overhead clear in badminton, or an overhand serve in volleyball or tennis.

Development of Fundamental Motor Skills

As children physically mature throughout middle childhood, fundamental motor skills should improve (Gabbard, 2018; Gallahue et al., 2012). This has been demonstrated in a large cross-sectional sample of 3- to 8-year-old Belgian children using the Test of Gross Motor Development-Second edition (TGMD-2) (Bardid et al., 2016). In that cross-sectional study, each age band from 3 to 7 years performed better on the locomotor and object control subscales (e.g., 5-year-olds outperformed 4-year-olds, 4-year-olds outperformed 3-year-olds). However, Bardid and colleagues did not find any significant differences between the 7- and 8-year-old children. As the 7- and 8-year-old children had not achieved maximum scores on the subtests, this suggests a plateau during middle childhood. This pattern with early improvements and then plateauing has also been evident in the Motor Development Study (Crane et al., 2017; Field,

Esposito Bosma, et al., 2020; Temple & Foley, 2017). Crane and colleagues (2017) found that from kindergarten to grade 2, boys significantly improved nine of the 12 TGMD-2 skills, while girls demonstrated significant improvement in 10 of the 12 skills, showing children's improved performance during the transition from early to middle childhood. Among older children in middle childhood (e.g., grade 3 and up), however, a plateau was evident. Field and colleagues (2020) found that boys' and girls' object control skill scores from the TGMD-2 plateaued between grade 3 and grade 5. Using the revised Test of Gross Motor Development-Third edition (TGMD-3), Temple and Foley (2017) identified significant improvements in locomotor and object control skills of boys and girls from grade 3 to grade 4. These improvements equated to an increase of 1.0-2.0 components (e.g., in one trial of overhand throw a child demonstrated proper follow-through), indicating that, although significant, they are not reflective of meaningful skill development. The findings from this series of longitudinal studies indicates a pattern of motor skill development in earlier years followed by a plateau of less-than-optimal improvement and associated proficiency levels beginning around grade 3. It remains, however, that longitudinal evidence of changes in fundamental motor skill proficiency in middle childhood is limited, and more longitudinal research is needed to better understand motor skill development over time (Barnett et al., 2016; Robinson et al., 2015).

Levels of Motor Skills in Middle Childhood

As mentioned, levels of motor competence appear to be low in middle childhood, despite children having the physical maturity to perform skills. Using throwing, dribbling, sliding and hopping to evaluate motor competence in a group of 342 American grade 3 students, Gu and colleagues (2019) found that less than half of the students demonstrated motor proficiency. In fact, of the four skills evaluated, when compared to a group of kindergarten students in a national

dataset, participants in Gu et al.'s study performed only the throw better than kindergarten children. Theoretically, motor skills should be improving from early to middle childhood as children develop better coordination and strength; and age is an established correlate of children's motor competence (Barnett et al., 2016). However, this improvement is not the case for the individuals in Gu and colleagues' study or other recent studies (De Meester et al., 2016; Field, Esposito Bosma et al., 2020). Among grade 3-5 participants in the same population as this dissertation, locomotor scores were at roughly 80% of the maximum possible score, while object control skills were approximately 61% of the maximum possible for girls and 74% for boys (Field, Esposito Bosma, et al., 2020).

Sex-based Motor Skill Differences in Middle Childhood

It is consistently reported that boys have higher object control skill scores than girls (e.g. Bardid et al., 2016; Barnett et al., 2015; Hardy et al., 2010) and minimal or no difference in locomotor skills (Barnett et al., 2016; Liong et al., 2015; Temple & Foley, 2017). A study of 3- to 8-year-old Belgian children indicated that there were no significant sex-based differences in locomotor skills (as measured by the TGMD-2) in any year of age, while boys scored significantly higher than girls on object control skills in each year (Bardid et al., 2016). A recent study completed with grade 3, 4, and 5 participants reported that, on average across the grades, boys' object control skill scores were 12-15% better than girls' scores (Field, Esposito Bosma, et al., 2020).

Developmental Connections Between Perceptions, Motor Skills, and Participation

There are three main proposed mechanisms that influence active physical recreation participation in middle childhood in relation to perceptions of physical competence and motor

skill competence. The first is a hypothesized direct relationship between motor competence and physical activity. It is suggested that, during middle childhood, motor competence directly influences participation in physical activity (Robinson et al., 2015; Stodden et al., 2008). Children who demonstrate high motor skill competence, particularly object control proficiency, are more likely to participate in physical activity while those who demonstrate low motor skill competence are less likely to participate (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Robinson et al., 2015; Sallen et al., 2020); this is because children with high motor skill competence are equipped with the 'tools' necessary to play. As mentioned, motor skills are the building blocks for more complex, sport-specific movements (Clark & Metcalfe, 2002) and are crucial to an individual's participation in a variety of sports and physical activities.

The second mechanism is the relationship between motor competence and perceived motor competence. In middle childhood, it is suggested that there is a bi-directional relationship between these factors (Stodden et al., 2008). As mentioned, during middle childhood, children begin to have the cognitive capacity to accurately assess their own motor competence (Harter, 2012a; Horn, 2004; Stodden et al., 2008). Therefore, it is hypothesized that children who have strong motor competence will recognize this and have positive perceptions of their physical competence, which, in turn, will promote that child in further developing their skills through continued participation. In this way, their perceptions of competence will foster additional growth of their motor skills. Having higher perceptions of perceived competence has been linked to higher levels of achievement in domains such as sports and academics, but has also been associated with task persistence, intrinsic motivation, an internal locus of control, greater levels of happiness and pride, and lower levels of anxiety, shame, and boredom (Horn, 2004).

The third and final mechanism is the bi-directional relationship between perceptions of physical competence and participation during middle childhood. It is hypothesized that children who have positive self-perceptions are more likely to participate in active physical recreation, and, if those experiences are positive, they will reinforce a child's positive self-perceptions (Stodden et al., 2008). Contrastingly, children with negative self-perceptions are less likely to participate in active physical recreation, reinforcing those negative self-perceptions (Stodden et al., 2008). Ultimately, children will enter into a spiral of positive engagement or a spiral of disengagement, depending on the interaction of the variables.

Developmental Changes in Social Contexts

With Whom Children Participate

Developmentally, it is expected that children's social contexts will expand during childhood (Eccles, 1999; Hartup & Stevens, 1997; King et al., 2010; World Health Organization, 2007). This expansion includes change in the closeness of children's relationships as well as the number of relationships (Hartup & Stevens, 1997; King et al., 2010). A longitudinal study of 75 middle- to upper-middle-class American children and their mothers found that by the age of 3, a child's social circle regularly consists of approximately 22 people including immediate family members, extended family, adult friends of parents, peers, teachers, and babysitters (Feiring & Lewis, 1989). At 6 years of age, the 22-person social network did not show expansion. By 9 years of age, however, a child's network had grown to 39 people, and children spent an average of 70% more time with peers than when they were 6 years old (Feiring & Lewis, 1989). This expansion was largely the result of an expanding peer network. Nine-year-old participants in Feiring and Lewis' (1989) study reported having 9 to 10 friends in their social network. Peer

contact increases as children get older, especially during early- to middle-childhood (King et al., 2010). When comparing cohorts of children aged 6-8 years, 9-11 years, and 12-14 years, King and colleagues (2010) found that children without disabilities experienced a widening social circle with increasing age, characterized by more intense social participation and greater participation with non-family members.

During middle childhood there is concomitant change in parents' roles and utilization (seeking out and/or valuing help from a parent) (Kerns et al., 2006). Children spend less time under their parents' supervision and more time with different 'types' of people such as recreation leaders, camp counselors, and the like (Eccles, 1999). During early childhood, parents have fostered a social developmental pathway by providing opportunities for social interactions such as play dates and teaching their children skills for social contexts such as language and play skills (Eccles, 1999; Reich & Vandell, 2011). In middle childhood, however, others play more significant roles in development (Eccles, 1999), and these others, including their friends and peers "…afford different social opportunities" (Reich & Vandell, 2011, p. 265). It is also important to note that the spheres of influence of others overlap. Whether formally or informally, there is interaction between family, school, and community (Epstein, 2010). Although a child may want to join an organization because their friend participates, during middle childhood, parents have considerable influence over their child's choices in terms of approval/disapproval and providing instrumental support such as transportation and paying fees (Eccles, 1999).

Where Children Participate

During middle childhood, particularly around age 7 or 8 years, children begin to participate in more activities that take place outside the home (Loebach & Gilliland, 2016). Historically, grandparents' perceptions of their own childhood include memories of unsupervised

participation of games and activities in their neighborhoods; these opportunities to experience and explore new environments can provide children with confidence and a sense of autonomy (Bartlett et al., 1999; Gill, 2007). However, with increasing concerns about neighborhood safety, changes in neighborhood types (e.g., from single-family to multi-unit dwellings), and changes in land use and built environments, independent participation in activities outside the home is showing a downward trend in recent decades (Loebach & Gilliland, 2016; Veitch et al., 2010). Using home and go-along walking interviews, Chaudhury and colleagues (2019) found that approximately half of suburban neighborhood children in Auckland, New Zealand, aged 9–13 years were allowed to go to public open spaces independent of adult supervision. Having siblings and friends to go with and carrying a mobile phone were positive affordances in parents' decisions to allow their children to go to public open spaces (Chaudhury et al., 2019).

There is increased interaction with expanded contexts and structures such as school and sports clubs during middle childhood (Eccles, 1999; Zarbatany et al., 1990). Middle childhood is largely punctuated by a child's entry into elementary school (Eccles, 1999). According to Eccles, this event "…coincides for many with participation in other formal organizations and programs outside of the family" (Eccles, 1999, p. 32). Others have proposed that engagement in more organized activities is part of a wider social trend where children's informal interactions near their home have been supplanted by organized activities farther away from home (Rupprecht et al., 2016; Skår & Krogh, 2009). These changes have been attributed to increasingly busy family schedules necessitating the need for after-school programs (Skår & Krogh, 2009) and increased parental restriction due to safety concerns (Chaudhury et al., 2019; Holt et al., 2016; Schoeppe et al., 2016).

A Bioecological Model as a Framework

Applying an ecological model to an examination of active physical recreation participation can provide a multilevel picture of why some children participate and others may not. Högman and colleagues (2020) suggested that in an effort to create possibilities for participation in different settings, "there is a need to consider how influences interact reciprocally with other factors at different levels" (p. 396). Additionally, Weiss (2020) suggests the application of a multi-layer ecological model to the study of motor development and participation may help explain behavior and be useful in understanding processes that contribute to changes in children's motor competence and physical activity over time. In light of these suggestions, I have used Bronfenbrenner and Morris'(2006) bioecological model as a lens for this dissertation. Bronfenbrenner and Morris' (2006) bioecological model has four components (proximal processes, person, context, and time) that interact to influence development of a number of behaviors.

Reciprocal interactions between the individual and their immediate and more remote environments are called Proximal Processes (Bronfenbrenner & Ceci, 1993). These proximal processes are at the heart of the Process-Person-Context-Time (PPCT) model associated with Bronfenbrenner's bio-ecological theory (Bronfenbrenner & Morris, 2006). The ecological environments, or context, consists of four nested levels. The innermost of these levels is the microsystem. The microsystem is a pattern of activities, social roles, and interpersonal relations experienced by the developing person in a given face-to-face setting (Bronfenbrenner, 1994). Time relates to both chronological time as well as time spent in interactions. These components thus comprise the PPCT model, and the proximal processes are "the primary engines of

development" (Bronfenbrenner & Morris, 2006) and thus will be used as a lens through which to view this dissertation.

Children's interactions in relationships and with environments drive development (Bronfenbrenner & Morris, 2006). Each relationship and environment in which a child participates will drive development in a certain area that will ultimately connect to another area. It is healthy for children to interact with multiple groups as each group (e.g., family, friends) promotes development in a different way (Berk, 2013). For example, a child who is encouraged to do chores at home either alone or with their family learns practical life skills and responsibility (Berk, 2013). Subsequently, and ideally, a child will extrapolate lessons learned in these proximal environments and apply them in new contexts outside the home with new individuals, such as doing a paid job in the neighborhood or community (e.g., babysitting or a paper route) (Larson & Verma, 1999). Alwin et al. (2018) argued that social context science needs to be moved beyond examining only the relationships between individuals at the same level (e.g., between friends) to include "sets of ties" (p. 5) such as extended family, but also to school and other organizations. In order to look at maximizing participation, it is important to examine the reciprocal interactions between the individual and their relationships and contexts at different levels (Bronfenbrenner & Ceci, 1993; Högman et al., 2020).

Recreation Activity Participation

Examining the relationship between participation in recreation activities and healthy development and well-being in children is not a new concept. As far back as the 1930's, researchers have understood that how a child spends their discretionary time can impact a child's cognitive development (Boynton & Ford, 1933) and overall 'adjustment' (Hardy, 1935). Twenty-first century research continues to expand these findings that participation in recreation

activities is important to the overall healthy development of a child and can provide a multitude of benefits and learning opportunities (Hofferth & Sandberg, 2001).

School-age children in the 'Western world' spend almost half of their waking hours in recreation activities (Larson & Verma, 1999). Out-of-school time can be a time where children can learn and develop skills and competencies that may not be included in their formal education (Mahoney et al., 2005). Broad participation in extracurricular activities can provide opportunities for all of these developmental tasks (Mahoney et al., 2005). Participation in extracurricular recreation and leisure activities during middle childhood is indicative of positive achievement and emotional adjustment (McHale et al., 2001) as well as high levels of social competence (Pettit et al., 1997), and has been shown to predict perceived competence and values during adolescence (Jacobs et al., 2004). "Successful experiences in a wide range of settings can help to give a child a healthy, positive view of [their] competence, and a positive attitude toward learning and engagement in life's activities and challenges" (Eccles, 1999, p. 32). More specifically, participation in active physical recreation can provide children with many physical and psychosocial benefits.

Physical Activity and Active Physical Recreation Definitions and Guidelines

According to the World Health Organization (2020), physical activity "refers to all movement" (para. 2). As this definition suggests, physical activity is a large construct. Generally speaking, physical activity includes three different types: light (e.g., strolling), moderate (e.g., brisk walking), and vigorous (e.g., running). It is recommended that Canadian children and youth aged 5-17 years accumulate a minimum of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day through a variety of aerobic and muscle- and bone-strengthening activities (Tremblay et al., 2016).

Active physical recreation is a subset of physical activity (World Health Organization, 2020). Active physical recreation can include any number of activities such as cycling, hiking, sports, and free play, and can be performed by all individuals at any skill level. Using an itemized active physical recreation assessment as a measure of physical activity in my dissertation provides information on children's participation in certain activities; specifically, information on which activities children are doing. As different activities can provide different developmental benefits for children, it is important to identify the activities in which children are participating.

Benefits of Active Physical Recreation

Children who regularly engage in active physical recreation achieve a multitude of physical benefits including the development of strong bones and muscles (Poitras et al., 2016), healthy body weight (Berntzen et al., 2018; Saunders et al., 2018), healthy blood pressure (Kuzik et al., 2017; Saunders et al., 2018), and decreased risk of diseases such as diabetes (Hebert et al., 2017; Kuzik et al., 2017; Saunders et al., 2018). Children who participate in regular active physical recreation have also been shown to improve their motor competence (Barnett et al., 2016) and overall physical fitness (Berntzen et al., 2018).

Participation in recreation activities also provides children opportunities for social development (Hofferth & Sandberg, 2001). A survey of parents found that many registered their children in organized sports (specifically, soccer) as it was overwhelmingly viewed that sport participation is vital to the development of children, including learning communication skills and teamwork (Watchman & Spencer-Cavaliere, 2017). The most commonly cited benefits, however, were opportunity for socializing and developing friendships (Watchman & Spencer-Cavaliere, 2017). Increases in social interaction through recreation activities can increase opportunities for

community cohesion (Maller et al., 2006). This can be especially prominent in children with varying physical skill levels. When children are engaged in active free play, for example, in an open space with minimal equipment, physical strength is no longer a main contributing factor of who can participate. As a result, the playground social hierarchy is no longer strength-based (Bundy et al., 2011), and the environment becomes much more inclusive. This type of play promotes interaction between children of all abilities, and has been shown to provide interaction opportunities for children who would not normally play together (Bundy et al., 2011).

Participation in activities such as tag and other playground games affords opportunities for decision making and creative thinking, and stimulates problem solving as children need to determine who can play a game, when it starts and stops, and what the rules are (Burdette & Whitaker, 2005). Benefits of regular participation in active physical recreation include improved academic performance (Kari et al., 2017) and overall cognitive functioning (Lubans et al., 2016). Additionally, responsibility was cited as a benefit of participating in team sports, as was time management, goal setting, and commitment (Watchman & Spencer-Cavaliere, 2017), all of which can help a child be successful in future endeavors.

'Emotional intelligence,' including empathy, flexibility, self-awareness, and self-regulation, can be learned through active free play, and has been shown to contribute to success in the workplace later in life (Burdette & Whitaker, 2005). Activities such as unstructured free play provide opportunities for children to develop emotional skills including self-regulation (Hofferth & Sandberg, 2001) while regular participation in active physical recreation can result in positive self-esteem (Biddle et al., 2019) and reduced risk of anxiety and depression (Krafft et al., 2014; Schaeffer et al., 2014).

Participation Patterns

Evidence from North America and Australia indicates that children are participating in a variety of activities (Brown et al., 2011; Hofferth & Sandberg, 2001; King et al., 2007; Solish et al., 2010). On average, Australian children participate in between 23 and 33 voluntary out-of-school recreation activities (Brown et al., 2011), Canadian children participate in an average of 31 different activities (King et al., 2007), and children living in the United States reportedly participate in an average of 23 recreation activities per week (Hofferth & Sandberg, 2001).

Active Physical Recreation Participation

Of the recreation and leisure activities in which Canadian children are participating, findings indicate that children are participating in four (King et al., 2007) or five (Brown et al., 2011) active physical recreation activities within the same four month period. One area of difficulty when reviewing the literature on activity participation is the variety of measurement tools researchers are using. As a result, there is inconsistency in findings as, depending on the measure used, different activities are recorded. There is, however, consensus that active recreation activities can be classified as formal or informal domains of participation (Brown et al., 2011; King et al., 2004; World Health Organization, 2007). King (2004) defined formal activities as those which involve organization, planning, and often involve adult leadership and instruction (e.g., team sports), and informal activities are those which are child-led, require minimal equipment and organization, and occur more spontaneously. In an effort to synthesize the existing literature on the multitude of activities in which children participate, I will speak in terms of formal and informal activities for the following section.

According to parents, 77% of Canadian children and youth (5-19 years of age) participate in formal activities (e.g., organized physical activity and/or sports) (Barnes et al., 2018). The

most common formal activities in which children from North America and Australia participate are swimming lessons (Solish et al., 2010; Woodmansee et al., 2016) and team sports (Gu et al., 2019; Solish et al., 2010; Temple et al., 2016; Woodmansee et al., 2016), with horseback riding having the least participation (Solish et al., 2010; Woodmansee et al., 2016). Outdoor active recreation such as snow sports show varied participation (ranging from 15-40%) (Solish et al., 2010; Woodmansee et al., 2016) which is likely attributed to geography and seasonal participation. Regarding participation in informal active physical recreation, the most common activities are going for a walk (Solish et al., 2010; Woodmansee et al., 2016), riding bikes and playing games such as tag (Woodmansee et al., 2016). Although specific activities were not listed, Gu and colleagues reported that over 95% of their grade 3 participants engaged in unstructured physical activity (Gu et al., 2019).

Frequency of Active Physical Recreation Participation

Although it is acknowledged that time devoted to activities and active engagement in those activities is not always the same thing (Hastie et al., 2016; Low et al., 2013), time is an affordance (or constraint) associated with developmental processes and outcomes (Bronfenbrenner & Morris, 2006; Gabbard, 2018; Gallahue et al., 2012; Larson & Verma, 1999). In terms of recreation and in the context of the PPCT model, time provides opportunities to be active, acquire motor skills, engage with others, and pursue areas of interest. Examining the amount of time children spend in active physical recreation, with whom and where they spend this time, is important to our understanding of physical and mental health benefits associated with participation (Colley et al., 2017; Tremblay et al., 2016).

With Whom Children Participate

During middle childhood, participation in active physical recreation is largely predicated on a child's social connections. A diverse cast of characters influence children's participation, including: parents who are in a position to provide emotional, informational, and instrumental support (Fredricks & Eccles, 2005; Pate & Dowda, 2019); peers who also participate in activities (Pate & Dowda, 2019) or discourage participation (Wiltshire et al., 2017); and other individuals such as teachers and program leaders who encourage active physical recreation involvement (Pate & Dowda, 2019). Solish, Perry, and Minnes (2010) evaluated with whom Canadian children (Mean age 10.0 years) participated in active recreation and reported that 64% percent participated in active recreation with peers, 16% with parents, and 28% with other adults. These findings support developmental theory which suggests that by the later years of middle childhood, children are increasing interactions with peers and other adults as they enter into school and other activities out of the home (Eccles, 1999). When assessing outdoor out-of-school active physical recreation among 10- and 11-year-old children, Pearce and colleagues (2014) found that approximately 30% of boys and girls spent their outdoor time with friends, while more boys (27%) than girls (20%) spent their outdoor time with their parents. For outdoor time spent with neither parents nor friends, approximately 10% of boys spent their time with 'other grown-ups' while 13% of girls spent their time with siblings. More research on with whom children participate in active physical recreation is needed. As 'others' play significant roles in development (Eccles, 1999) and can influence participation in active physical recreation (Pate & Dowda, 2019), it is necessary to understand with whom children participate during this key developmental time.

Where Children Participate

It is expected that a child's social contexts in terms of where they participate will expand during middle childhood as children are entering into more activities (e.g., school, recreation programs) that take place away from home (Eccles, 1999). Additionally, with increasing autonomy, children begin to explore environments outside the home with confidence (Bartlett et al., 1999; Gill, 2007); however, more research is needed in the area of where children participate to wholly understand participation patterns in middle childhood. In Canada, children between the ages of 6 and 11 years old reported spending the majority of their out-of-school time in their neighborhood (King et al., 2010; Loebach & Gilliland, 2016) while older children (Mean age = 11 years) would also participate in locations they could access via active transportation (Loebach & Gilliland, 2016). Although increased fear about crime rates, less green space in communities, and more roads and traffic might lead many parents to restrict their children's time spent in play outside the home (Loebach & Gilliland, 2016; Veitch et al., 2010), less than 20% of Canadian parents cited these as issues in their neighborhood (Barnes et al., 2018). This is particularly salient when comparing participation of children living in urban and rural environments. Findings from an Australian study revealed that children in rural environments participate in activities farther away from their home than children who live in urban environments, likely due to the reduced availability of venues and activities in rural areas (Brown et al., 2011).

Sex-based Differences in Active Physical Recreation Participation

Boys and girls exhibit different patterns of recreation and leisure participation. During childhood, girls are more likely to participate in social and skill-based activities, such as talking on the phone and playing a musical instrument (Brown et al., 2011; Findlay et al., 2010; King et al., 2007). In contrast, boys tend to participate in more, and more frequently, in physical

activities, such as team sports (Temple et al., 2016) and riding bikes (Findlay et al., 2010; King et al., 2007; Telford et al., 2013). Additionally, girls demonstrated greater intensity in skill-based activities (once per month versus twice in the past four months). Lastly, boys enjoyed physical activity more than girls, while girls enjoyed social, skill-based, and self-improvement activities more than boys (King et al., 2010). These differences in participation are shown to vary by age (King et al., 2010), indicating there is some change over time, yet research has not determined how these changes present themselves longitudinally between the sexes.

Sex-based differences are also present for with whom children participate. Brown, O'Keefe, and Stagnitti (2011) found that for boys and girls (Mean age = 10.5) in Australia, there were no significant sex-based differences in four of five measured domains of participation (what, how often, where, and enjoyment). There was however, a significant difference in with whom children participate, with girls demonstrating a wider social network than boys (Brown et al., 2011). While evaluating how children chose to spend their recess time at school, Woods and colleagues (2012) identified a number of significant differences. Boys spent significantly more time participating in physical activities and preferred sports activities in large groups, while girls showed preference for locomotor activities, sedentary activities, and spending time in small groups (Woods et al., 2012). In contrast, King and colleagues (2010) did not find sex-based differences in with whom children participated, when assessing children of a similar age.

Age-related Trends in Participation

Active recreation participation patterns change as children get older (Hofferth & Sandberg, 2001; King et al., 2010). In Canada, more children in early childhood meet the recommended guideline for activity participation compared with children in middle childhood (Barnes et al., 2018); however, it is important to note that the recommended guidelines change

from early to middle childhood (Tremblay et al., 2016) so it is not possible to draw a direct comparison between the age groups. Additionally, as children age, there is a transition from more informal to formal activity participation (Hofferth & Sandberg, 2001). According to parent reports collected as part of the 2014-2016 Canadian Health Measures Survey, 77% of 5- to 19-year-olds participate in organized sports compared with 46% of 3- and 4-year-old children who participate in organized lessons, league, or on sports teams (Barnes et al., 2018; CANPLAY, 2016; ParticipACTION, 2018), suggesting an increase in formal activity participation from early to middle childhood and further into adolescence. Of children participating in organized sport, frequency of participation also increases from middle and late childhood to adolescence, with 26% of 5- to 12- year-olds participating in organized sport four times per week, increasing to 45% of 13- to 17-year-olds (Canadian Fitness and Lifestyle Research Institute, 2013). It should be noted that these parent report data do not include the itemized activities or sports that children are participating in. It must be considered that, particularly for the younger children, organized lessons could refer to a range of activities including preschool-aged water safety lessons and parent-and-child sports programs.

As children move through middle childhood, participation in active physical recreation begins to compete with other activities such as household chores and school-related tasks (e.g., homework) (Hofferth & Sandberg, 2001). Additionally, toward the end of middle childhood, children may begin to select particular activities on which they prefer to focus more of their attention, and thus decrease the variety of activities in which they participate (Côté & Hay, 2002). When asked about activity participation in the previous four months, it was discovered that younger children (aged 6-8 years) participated in a larger variety of recreation activities (10.5 out of 13) than did children aged 9-11 years (9.92 out of 13) (King et al., 2010). In light of

this, an examination into the participation of both formal and informal active physical recreation participation as well as participation in competing activities during middle childhood is warranted.

Summary

Participation in active physical recreation is important to overall health and development in multiple domains in middle childhood (Barnes et al., 2018; Colley et al., 2011). There are well-established relationships between motor skill proficiency and participation in active physical recreation (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Robinson et al., 2015) as well as between levels of perceived physical competence and participation in active physical recreation (De Meester, Stodden, et al., 2016). Both of these relationships differ between boys and girls (Bardid et al., 2016; Barnett et al., 2015; De Meester, Stodden, et al., 2016; Field, Crane, et al., 2020). There is also a re-emergence of interest in the concomitant influence of motor skills and perceptions on participation (De Meester, Stodden, et al., 2016).

Evidence suggests that new relationships and environments can influence children's participation in active physical recreation (Loebach & Gilliland, 2016; Pate & Dowda, 2019), and it is expected that children's social networks will expand during middle childhood (Eccles, 1999). However, how children's active recreation engagement tracks and interacts with individual and environmental variables across middle childhood has not been documented. Middle childhood is a time that is rich in physical, cognitive, emotional, and social development (Eccles, 1999); understanding the interaction of the factors that influence participation during these years is crucial (Högman et al., 2020), as behaviors in childhood are predictive of future participation (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009). Therefore, the overall aim of this dissertation is to track children's participation in active physical recreation across middle

childhood, and examine how individual factors (motor skill proficiency, perceptions of physical competence, and accuracy) and contexts (with whom and where) interact with participation.

Chapter 3 – Study 1

Perceptions Matter! Accuracy of Perceived Physical Competence in Middle Childhood and the Impact on Active Physical Recreation Participation

Preamble

Perceptions matter! Accuracy of perceived physical competence in middle childhood and the impact on active physical recreation participation is the first study in this dissertation and builds on a previous study entitled "A longitudinal examination of the accuracy of perceived physical competence in middle childhood" (Field, Crane, et al., 2020). In that study, I (along with my colleagues) found that perceptions of physical competence became accurate for the majority of participants by grade 3. This chapter is comprised of one study with two related parts. Part A extended the Field et al. (2020) study by including grade 5 children in a longitudinal evaluation of accuracy of perceived competence (previously examined up to grade 4). Subsequently, Part B examined whether clusters of high and low motor competence and high and low perceptions of physical competence generated from the longitudinal sample was associated with participation in active physical recreation. Part B builds upon a previous cross-sectional study demonstrating that 9-year-old children with low perceived physical competence, in combination with low skill levels, participated in less physical activity than those with high perceived physical competence and high skill levels (De Meester, Stodden, et al., 2016) by examining this effect longitudinally.

This study was presented at the National Assembly of the International Motor Development Research Consortium in October, 2020. A manuscript based on this chapter is being prepared for submission to the *Journal of Physical Activity and Health.*

Abstract

Evidence is emerging that the accuracy of a child's perceived physical competence, rather than their level of perceived physical competence, is more strongly associated with participation in physical activity. The aim of this study was to longitudinally examine the extent to which accuracy of perceived physical competence is associated with participation in active physical recreation during middle childhood.

Part A. Trajectories of Accuracy During Middle Childhood

The primary aim of Part A was to examine how the boys' and girls' actual and perceived motor competence and accuracy of perceptions changed longitudinally from grade 2 to grade 5. A secondary aim, to inform Part B, was to examine participation in active physical recreation across the grades.

Participants were grade 2, 3, 4, and 5 children (n = 155, 85 girls). Fundamental motor skills were assessed using the TGMD-2. Perceptions of physical competence were assessed using the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (for grade 2), and the Self-Perception Profile for Children (for grades 3-5). Active physical recreation participation was measured using the Children's Assessment of Participation and Enjoyment (CAPE). Accuracy of perceived physical competence scores were calculated for grade 2, 3, 4, and 5 participants by converting motor skills raw scores and perceptions of physical competence raw scores into z-scores, thereby creating three accuracy groups: underestimators, average estimators, and overestimators. Descriptive statistics were calculated for age in grade 2, and sex, motor skills, perceptions of physical competence, accuracy of perceptions, and active physical recreation levels in grades 2, 3, 4, and 5. Four repeated measures analyses of variance (ANOVA) with sex and accuracy group as factors were used to determine change over time in motor skills,

perceived physical competence, accuracy of perceived physical competence, and active physical recreation participation.

Examination of the results revealed that the majority of boys and girls had accurate self-appraisals by grade 3, and this remained stable into grades 4 and 5. In particular, there was a steady decrease in perceptions and a consistent improvement in motor skills among the overestimators. This resulted in perceptions that were more accurate in the higher grades. The underestimators, who began in grade 2 with the highest skills and lowest perceptions relative to their peers, did not have significant decreases in perceptions or increases in motor skills across the grades as might have been expected developmentally. The lack of improvement in motor skills from grade 2 to grade 5 in this group is very concerning.

Part B. Active Physical Recreation Participation of Children with High and Low Actual and Perceived Motor Competence: A Cluster Analysis

In Part B, I examined differences in participation in active physical recreation among children clustered by combinations of high and low motor competence and high and low perceptions of physical competence. This was investigated from grade 3, after, as demonstrated in Part A, children who grossly underestimated or overestimated their abilities in grade 2, had significantly more accurate perceptions of physical competence.

Except that participants in grade 2 were excluded from Part B, the same sample and measures used in Part A were used in Part B. K-means cluster analysis was used to create four clusters per grade based on participants' motor skills *z*-scores and perceptions of physical competence *z*-scores. Differences in motor skills, perceptions of physical competence, and active physical recreation with cluster group and sex as factors were examined using a series of 2 x 4 factorial ANOVAs for each grade. In each grade, participants in the high-high cluster

participated in significantly more active physical recreation than those in the low-low cluster. Among the less accurate clusters (i.e. low motor skills with high perceptions or high motor skills with low perceptions), there was a trend toward positive growth in motor skills among the children with higher perceptions, whereas motor skills were stable among children with low perceptions. These longitudinal data show that combinations of motor skills and perceptions of physical competence influence the pattern of engagement in active recreation participation persistently across middle childhood. Additionally, whether accurate or inaccurate, low perception levels appear to negatively impact development of motor competence. Children with low motor skills and low perceptions need urgent intervention regarding their motor skills, as their motor skills are low, and they know it. Children with low perceptions, but high motor skills, need to learn how to appreciate their actual skill level. These children had relatively good skills, but they did not accurately perceive their competence.

Key Words

Longitudinal, Accuracy, Perceived physical competence, Child, Activity

Perceptions Matter! Accuracy of Perceived Physical Competence in Middle Childhood and the Impact on Active Physical Recreation Participation

Background

Understanding factors that influence participation in physical activity is complex (Pate & Dowda, 2019). There are many individual (e.g., physical abilities) and environmental (e.g., socioeconomic status) factors that contribute to participation during middle childhood (Payne & Isaacs, 2016; Spessato et al., 2013). Two individual factors that have been widely researched are motor skill competence and levels of perceived physical competence (Robinson et al., 2015; Stodden et al., 2008). Children who demonstrate high motor skill competence, particularly object control proficiency, are more likely to participate in physical activity, while those who demonstrate low motor skill competence are less likely to participate (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Robinson et al., 2015). Two mechanisms are likely at play. The first is that children with more developed motor skills have greater capacity to engage (e.g., catching skills are useful for playing Frisbee and softball), and the second is that higher motor competence contributes to more positive self-perceptions (Stodden et al., 2008).

Motor skill competence contributes to children's perceptions of their physical competence in middle childhood (Barnett et al., 2015). Their self-appraisals are informed by temporal comparisons to their younger selves (e.g., "I can run faster now"), social comparisons, and the ease or difficulty of motor tasks for them (Harter, 2012a). Thus, children with high motor competence exhibit higher perceived physical competence than those with low motor competence (Barnett et al., 2015). In combination, high motor skill levels and high perceptions of competence are likely to contribute to a positive spiral of engagement in physical activities, providing both the tools and confidence to participate (Stodden et al., 2008). In middle

childhood, boys tend to have higher perceived physical competence than do girls (Barnett et al., 2015; Field, Crane, et al., 2020; Liong et al., 2015; Pesce et al., 2018), which may be a reflection of boys' higher object control competence (Barnett et al., 2015; Liong et al., 2015).

One mechanism receiving increased attention in physical activity participation research is the accuracy of a child's perceived physical competence (De Meester, Maes, et al., 2016; Field, Crane, et al., 2020). As children move through middle childhood, the accuracy of their perceived physical competence should improve as the result of increasing motor skill competence and a decrease in the inflated perceived physical competence children exhibit in early childhood (Harter, 2012a; Horn, 2004; Kipp & Weiss, 2013; Stodden et al., 2008). Developmental experts theorize that children should be able to develop accurate self-appraisals by seven years of age (Harter, 2012a; Horn, 2004); however recent literature suggests accuracy of perceived physical competence occurs later (De Meester, Stodden, et al., 2016; Field, Crane, et al., 2020; van Veen et al., 2019). In a longitudinal examination of accuracy of perceived physical competence from grade 2 to grade 4, Field and colleagues (2020) found the majority of children had accurate perceptions by grade 3 (Mean age = 8.8 years), and those perceptions remained stable to grade 4.

Understanding the influence of accuracy of perceived physical competence on participation in physical activity is particularly important in the case of children who underestimate their abilities. Children who underestimate their abilities have been shown to have higher anxiety, lower motivation, and are less aware of the locus of control of their performance in physical activity settings relative to their peers, all of which may contribute to withdrawal from physical activity (Weiss & Ambrose, 2005; Weiss & Horn, 1990). Children who underestimate their abilities may have the skills required to participate in physical activity; however, due to low levels of perceived physical competence, may choose to withdraw from

activity (Stodden et al., 2008; Weiss & Horn, 1990). Having low perceptions of competence may create a self-fulfilling prophecy, where children who perceive their skills to be low may end up with low motor competence as a result of not participating in physical activities that foster skill development (Stodden et al., 2008). This premise is partially supported by longitudinal evidence that children with high motor skills relative to their peers in grade 2, but who underestimated their physical abilities (i.e. had low perceptions of competence), had low motor competence relative to their peers by grade 4 (Field, Crane, et al., 2020). De Meester and colleagues (2016) furthered this line of research by examining the relationships between perceived physical competence and motor skill levels on participation in physical activity among 9-year -old children. These authors found that children with low perceived physical competence in combination with low skill levels relative to their peers, had lower physical activity participation. Conversely, a child's overestimation of their skills may encourage participation. This thought is supported by recent findings that 6- and 10-year-old children had inflated perceptions of object control proficiency, and those inflated perceptions were a significant contributor to participation (Bolger et al., 2019).

The extant literature reveals that the combination of motor skill competence and perceptions of physical competence influences participation in physical activities (De Meester, Stodden, et al., 2016) and that most children have accurate perceptions of their physical abilities by grade 3 (~8 years of age) (Field, Crane, et al., 2020). Further, boys' levels of motor competence and perceptions of their abilities in middle childhood tend to be higher (Field, Crane, et al., 2020; Temple & Foley, 2017). In this study, I present two related parts that further this work by examining the extent to which accuracy of perceived physical competence is associated with participation in active physical recreation longitudinally during middle childhood. Part A

builds upon my previous study examining accuracy of perceptions of physical competence from grade 2 to 4 (Field, Crane, et al., 2020) by including children in grade 5. The same sampling frame (Field, Crane, et al., 2020) was used, however, there was attrition between grades 4 and 5 (n = 83 children) because grade 5 data were included and another measurement tool was added. The primary aim of Part A was to examine how the boys' and girls' actual and perceived motor competence and accuracy of perceptions changed longitudinally from grade 2 to grade 5. A secondary aim was to examine participation in active physical recreation across the grades.

Part B examined participation in active physical recreation among children clustered by combinations of high and low motor competence and high and low perceptions of physical competence. This was investigated beginning from grade 3, after (as demonstrated in Part A) children who grossly underestimated or overestimated their abilities in grade 2, had developed significantly more accurate perceptions of physical competence. It is natural and healthy that the younger children had high, even inflated, perceptions of their abilities (Harter, 2012a) and that these perceptions dropped by grade 3 (Berk, 2013; Field, Crane, et al., 2020; Harter, 2012a; Horn, 2004). Indeed, the cluster analysis created two groups of children that accurately perceived their motor competence; the high motor competence and high perceptions cluster (high-high) and the low motor competence and low perceptions cluster (low-low). However, the cluster analysis also showed that there were children who still underestimated (high-low) and overestimated (low-high) their abilities in grades 3, 4, and 5. Although the children's cognitive abilities were likely to have been sufficiently mature to allow accurate self-appraisals by grade 3 (Harter, 2012a), each child's unique social milieu may have afforded different roles, socializing agents, and comparison opportunities that could have influenced the accuracy of their self-perceptions (Phillips & Zimmerman, 1990). Therefore, the aim of Part B was to examine

differences in participation in active physical recreation based on clusters of high and low motor competence and high and low perceptions of physical competence from grade 3 to grade 5.

Part A. Trajectories of Accuracy During Middle Childhood

Method

A longitudinal research design was used in this Part A. The University of Victoria Human Research Ethics Board as well as the participating school district granted approval for this study (protocol number 10-246). Data for this study were collected as part of the larger Motor Development Study and full methods have been described elsewhere (Field, Crane, et al., 2020) but are overviewed below with specific details about the longitudinal methods and analysis integrated in Part A.

Participants

Children attending grade 2 at one of eight participating elementary schools in Victoria, British Columbia were invited to participate. Participants were recruited in grade 2 in two cohorts (2012-2013 and 2013-2014) and subsequently tracked in grades 3, 4, and 5. Parents or guardians provided written informed consent at the beginning of each data collection year, and children provided written assent. Consent was obtained for 419 children to participate in grade 2, and of those children, 155 had complete data for grades 2, 3, 4, and 5. The mean age of participants was 7.7 years (*SD* = 4.0 months) and 55% were female.

Measures

Motor skills were assessed using the TGMD-2 (Ulrich, 2000) and perceived physical competence was assessed using the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (Harter & Pike, 1984) for grade 2 children and the Self-

Perception Profile for Children (Harter, 1982, 2012b) for grade 3, 4, and 5. These measures and the accompanying procedures are fully detailed in Field et al. (2020).

Active physical recreation participation was measured using the CAPE (King et al., 2004). The CAPE is a 55-item survey for individuals 6-21 years of age that assesses five dimensions of participation in voluntary recreation and leisure activities completed within the previous four months: diversity (the numbers of activities done), intensity (how often an activity is done), with whom, where, and enjoyment (King et al., 2004). CAPE items are divided into nine activity categories including informal Active Physical Recreation (11 items) and formal Organized Sports (6 items). Organized Sports included practice times, coaching sessions, and competitions. Each item within these activity categories requires physical exertion (King et al., 2004) and the term Active Physical Recreation is used throughout this chapter to represent both categories. Internal consistency of the CAPE is reported at .35 - .42 (formal activities) and .76 - .77 (informal activities) (King et al., 2004). Test-retest correlations for activity intensity range from .72 to .81 (King et al., 2004). Content validity for the CAPE was established through a thorough literature review on participation, expert review, and pilot work (King et al., 2004).

CAPE intensity scores (i.e., how often a child reported participating in an activity) were calculated for boys and girls in grades 2, 3, 4, and 5. As per the CAPE manual (King et al., 2004), to calculate an intensity score, the sum of intensity ratings (see Table 1) is divided by the number of possible items (i.e., 17 items).

Procedures

Consistent with the respective assessment tool manuals, research assistants were trained annually by the project coordinator and lead investigator in data collection procedures for fundamental motor skills, perceived physical competence, and active physical recreation (Harter,

1982, 2012b; King et al., 2004; Ulrich, 2000). See Field et al. (2020) for complete information on motor skills and perceptions of physical competence data collection procedures.

Table 1

Score Range and Interpretation of CAPE Active Physical Recreation Intensity Scores

Dimension (score range)	Score interpretations
Intensity (1 – 7)	1 = one time in the past four months
	2 = two times in the past four months
	3 = one time a month
	4 = two to three times a month
	5 = one time a week
	6 = two to three times a week
	7 = one time a day or more

Consented children completed the CAPE one-on-one with a trained research assistant in a quiet setting (e.g., school library, multi-purpose room) during school hours. Prior to completing the CAPE, children were instructed to only respond for activities they had voluntarily participated in outside of class time within the previous four months. They were also reminded that there were no right or wrong answers. Children were provided with a picture binder that included one drawing that corresponded to each CAPE item in order to assist the children's understanding (King et al., 2004). Children followed along with the picture binder while the research assistant administered the questionnaire. In some cases, children needed encouragement to provide responses, and as per the CAPE administration protocol (King et al., 2004), probing

for more information by asking children for clarification or using the picture binder as an aid; however, research assistants were careful not to lead the child's response.

Data Treatment and Analyses

Descriptive statistics were calculated for age (grade 2), sex, motor skills, perceptions of physical competence, accuracy of perceived physical competence, and active physical recreation in grades 2, 3, 4, and 5. Accuracy of perceived physical competence scores were calculated for grade 2, 3, 4, and 5 participants by converting raw motor skills scores (locomotor and object control combined) and raw perceptions of physical competence scores into *z*-scores, separately for boys and girls. Participants' motor skills *z*-scores were subtracted from perceived competence *z*-scores resulting in an accuracy of perceived physical competence *z*-score. Frequency distributions were generated for accuracy scores, and consistent with data treatment and analysis procedures of Weiss and Horn (1990) and Field et al. (2020), participants were categorized based on quartile cut points. Participants with an accuracy score in the lower quartile of the frequency distribution were categorized as underestimators ($n = 36$), those in the middle two quartiles as average estimators ($n = 79$), and those in the upper quartile as overestimators ($n = 40$).

A series of four, 2 (sex) x 3 (accuracy groups) repeated measures analyses of variance (ANOVA), were used to examine if significant changes were made in motor skills, perceptions of physical competence, accuracy, and active physical recreation across the grades (i.e. time). All data analyses were conducted with SPSS version 26 and significance was set at $p < .05$.

Results

Descriptive statistics organized by sex and group for motor skills, perceptions of physical competence, accuracy scores, and active physical recreation levels are presented in Table 2.

Mean motor skills scores for boys peaked at 69.51 (out of 96) and 64.95 for girls, indicating children in this study achieved, on average, between 68-73% of the percent of maximum possible score (Cohen et al., 1999) on the motor skills assessment. Across grades, perceptions of physical competence scores ranged from 17.3-20.9 on a 24-point scale, indicating generally positive physical self-perceptions. Children reported participating in approximately seven different active physical recreation activities within the four months prior to data collection. For each of those seven activities, participants reported participating in each of those activities 2 times in the 4 months.

Motor Skills

A repeated measures ANOVA revealed there was a significant effect of time on motor skills, $F(3, 147) = 53.71$, $p < .001$, partial eta-squared (η_p^2) = .523. There was no significant main effect for sex on motor skills over time, $F(3, 147) = .692$, $p = .558$, $\eta_p^2 = .014$. Post hoc comparisons revealed that both boys and girls significantly improved their motor skills from grade 2 to grade 5 (see Table 2). There was a significant effect of group on motor skills proficiency over time, $F(6, 294) = 13.15$, $p < .001$, $\eta_p^2 = .212$. Post hoc comparisons of group differences are presented in Table 2. These comparisons show that underestimators as a group had a significant change in motor skills from grade 3 to grade 4 only, but no significant changes were found across any grades when looking at underestimating boys or girls separately. Average and overestimators significantly improved each grade. The interaction between sex and group on motor skills over time was not significant, $F(6, 294) = 1.89$, $p = .086$, $\eta_p^2 = .037$.

Table 2

Descriptive Statistics and Post Hoc Comparisons for Motor Skills (FMS), Perceptions of Physical Competence (PPC), Accuracy z-scores, and Active Physical Recreation (APR) Intensity Scores by Group

		Grade 2		Grade 3		Grade 4		Grade 5	
Variable (range)	Sex	M	*SD*	M	*SD*	M	*SD*	M	*SD*
All participants (n = 155, girls n = 85, boys n = 70)									
FMS (0 – 96)	All [a,b,c,d]	60.50	8.45	64.46	9.33	65.02	8.17	67.01	8.35
	M [a,b,c,d]	62.33	9.00	67.33	10.79	67.97	8.08	69.51	8.25
	F [a,b,c,d]	59.00	7.74	62.09	7.17	62.59	7.45	64.95	7.89
PPC (6 – 24)	All [a,b,c,d]	20.41	2.64	18.19	4.22	18.17	3.80	18.45	3.77
	M [b]	19.79	2.80	19.33	3.77	18.71	3.82	19.07	3.67
	F [a,b,c,d]	20.92	2.40	17.26	4.35	17.72	3.74	17.94	3.79
Accuracy *z*-scores	All	-1.2E-3	1.23	-6.0E-4	1.22	2.0E-4	1.08	-1.0E-4	1.21
	M	-1.4E-3	1.07	-2.0E-4	1.08	9.0E-4	1.16	-1.0E-4	1.20
	F	-1.0E-3	1.35	-8.0E-4	1.33	-4.0E-4	1.01	-1.0E-4	1.23
APR	All	1.91	0.78	1.85	0.74	2.07	0.82	2.00	0.82
	M	1.87	0.81	1.81	0.80	1.97	0.84	1.88	0.74
	F [b,d]	1.93	0.75	1.89	0.69	2.16	0.81	2.09	0.88
Underestimators in grade 2 (n = 36, girls n = 20, boys n = 16)									
FMS (0 – 96)	All [c]	66.92	7.74	65.25	10.66	65.92	8.87	68.25	8.38
	M	68.94	9.57	66.38	13.23	69.19	9.73	70.38	8.57
	F	65.30	5.64	64.35	8.31	63.30	7.34	66.55	8.03
PPC (6 – 24)	All	18.47	2.97	18.19	3.96	18.06	3.70	17.75	3.50
	M	18.06	3.17	18.63	4.03	19.06	3.86	17.99	4.06
	F [b]	18.80	2.84	17.85	3.96	17.25	3.46	17.65	3.08
Accuracy *z*-scores	All [a,b,d]	-1.54	0.63	-0.14	1.03	-0.15	1.13	-0.34	0.95
	M [a,b,d]	-1.35	0.40	-0.10	0.97	-0.06	1.40	-0.43	1.10
	F [a,b,c,d]	-1.70	0.74	-0.18	1.10	-0.22	0.90	-0.28	0.85

APR	All	1.96	0.87	1.85	0.78	2.10	0.78	1.90	0.70
	M	1.97	1.01	1.97	1.00	1.85	0.85	1.70	0.77
	F [b,d]	1.94	0.76	1.76	0.54	2.30	0.66	2.06	0.61
					Average estimators in grade 2 (n = 79, girls n = 43, boys n = 36)				
FMS (0 – 96)	All [a,b,c,d]	61.18	6.73	65.86	8.90	65.20	7.95	67.44	7.83
	M [a,b,c,d]	62.89	6.97	70.28	9.65	68.58	8.11	70.92	7.60
	F [a,c,d]	59.74	6.25	62.16	6.20	62.37	6.68	64.53	6.85
PPC (6 – 24)	All [a,d]	20.37	2.24	18.10	4.29	18.54	3.77	18.85	3.57
	M	19.67	2.55	19.89	3.45	18.97	3.87	19.72	3.01
	F [a,d]	20.95	1.76	16.60	4.39	18.19	3.68	18.12	3.86
Accuracy z-scores	All	-0.09	0.44	-0.14	1.16	0.08	1.10	0.06	1.18
	M	-0.11	0.41	-0.12	0.96	-0.01	1.10	0.01	1.10
	F	-0.08	0.46	-0.16	1.31	0.15	1.11	0.10	1.26
APR	All	1.94	0.77	1.91	0.75	2.11	0.85	2.05	0.81
	M	1.90	0.78	1.86	0.77	1.96	0.84	1.95	0.70
	F	1.98	0.77	1.95	0.73	2.24	0.84	2.12	0.90
					Overestimators in grade 2 (n = 40, girls n = 22, boys n = 18)				
FMS (0 – 96)	All [a,b,c,d]	53.40	6.96	60.97	8.15	63.85	8.01	65.05	9.15
	M [a,b,c,d]	55.33	7.39	62.28	8.94	65.67	6.17	65.94	8.63
	F [a,b,c,d]	51.82	6.31	59.91	7.50	62.36	9.12	64.32	9.68
PPC (6 – 24)	All [a,b,d]	22.23	1.67	18.38	4.40	17.52	3.96	18.30	4.33
	M [a,b,d]	21.56	1.85	18.83	4.19	17.89	3.79	18.83	4.40
	F [a,b,d]	22.77	1.31	18.00	4.62	17.23	4.15	17.86	4.35
Accuracy z-scores	All [a,b,c,d]	1.57	0.68	0.41	1.41	-0.02	0.97	0.20	1.42
	M [a,b,d]	1.41	0.55	0.34	1.35	0.07	1.11	0.37	1.37
	F [a,b,c,d]	1.70	0.76	0.47	1.49	-0.10	0.87	0.06	1.47
APR	All	1.76	0.71	1.75	0.70	1.96	0.83	1.98	0.95
	M [b]	1.70	0.71	1.57	0.64	2.09	0.83	1.88	0.80
	F	1.81	0.73	1.89	0.73	1.85	0.83	2.06	1.07

Note. [a] significant change at $p < .05$ from grade 2-3. [b] significant change at $p < .05$ from grade 3-4. [c] significant change at $p < .05$ from grade 4-5. [d] significant change at $p < .05$ from grade 2-5. M = Male; F = Female.

Perceptions of Physical Competence

There was a significant effect of time on perceptions of physical competence, $F(3, 147) = 19.84$, $p < .001$, $\eta_p^2 = .288$ as well as a significant effect of sex on perceptions of physical competence, $F(3, 147) = 6.32$, $p < .001$, $\eta_p^2 = .114$. Post hoc contrasts revealed girls had significantly higher perceptions than boys in grade 2, $F(1,250) = 16.07$, $\eta_p^2 = .097$, and then their perceptions of physical competence significantly decreased from grade 2 to grade 3; dropping below the boys' level of perceptions. There was also a significant effect of group and perceptions of physical competence over time, $F(6,294) = 5.35$, $\eta_p^2 = .099$. Post hoc comparison results for group by grade level are reported in Table 2. There was no significant interaction effect between sex and group, $F(6,294)$, $p = .217$, $\eta_p^2 = .028$.

Accuracy

When considering the total sample, there was no significant effect of time on accuracy, $F(3,147) = .213$, $p = .887$, $\eta_p^2 = .004$, nor was there a significant interaction effect of sex on accuracy, $F(3, 147) = .031$, $p = .993$, $\eta_p^2 = .001$. However, there was significant effect of group on accuracy, $F(6,294) = 20.49$, $p < .001$, $\eta_p^2 = .295$. Table 2 and Figures 1 and 2 show the changes in accuracy for group. Under- and overestimators had significant improvements in accuracy across the grades while average estimators' accuracy scores remained stable. Post hoc comparisons revealed a significant difference in accuracy between groups in grade 2 for boys ($p < .001$) and girls ($p < .001$). There were no significant differences in accuracy scores between the groups for boys and girls, respectively, in grades 3 ($p = .310$; $p = .150$), 4 ($p = .949$; $p = .340$), or 5 ($p = .149$; $p = .514$). There was no significant interaction between sex and group on accuracy scores, $F(6, 294) = .804$, $p = .567$, $\eta_p^2 = .016$.

Figure 1

Accuracy Score Trajectories for Boys from Grade 2 to Grade 5

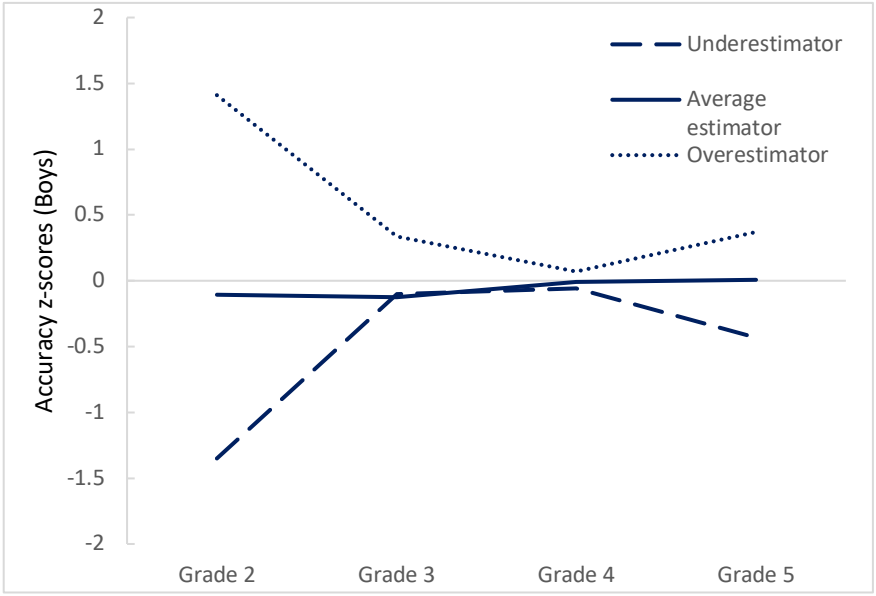
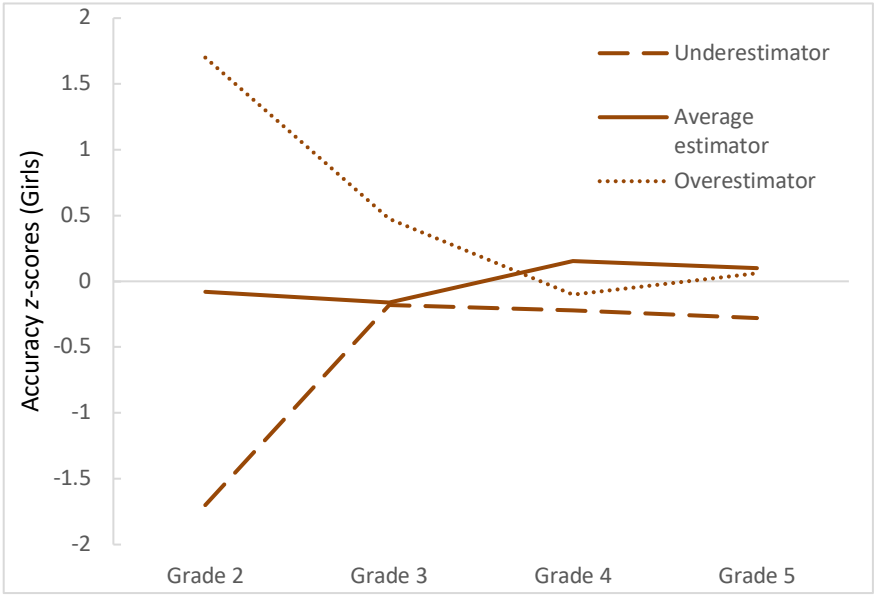


Figure 2

Accuracy Score Trajectories for Girls from Grade 2 to Grade 5



Active Physical Recreation

There was a significant effect of time on active physical recreation, $F(3, 147) = 2.98$, $p = .033$, $\eta_p^2 = .057$. Post hoc comparison for the total sample are reported in Table 2. There was no significant effect of sex on active physical recreation ($F(3,147) = .542$, $p = .654$, $\eta_p^2 = .011$), accuracy group on active physical recreation ($F(6, 294) = .334$, $p = .919$, $\eta_p^2 = .007$), or interaction between group and sex on active physical recreation ($F(6, 294) = 1.74$, $p = .111$, $\eta_p^2 = .034$). Post hoc comparisons revealed there was some positive change among the underestimating girls and the overestimating boys from grade 3 to 4.

Discussion

The aim of Part A was to extend my previous study of the accuracy of perceived competence among grade 2 to grade 4 children (see Field, Crane, et al., 2020) to include grade 5 children. I wanted to check the trajectory of accuracy of perceptions of physical competence in the sample that was somewhat reduced by attrition due to the inclusion of another grade and an additional measure. My colleagues and I had previously found that a majority of boys and girls had accurate self-appraisals by grade 3, which then remained stable into grade 4.

Consistent with my previous findings (see Field, Crane, et al., 2020), the majority of children in the current study developed accurate perceptions of physical competence by grade 3, and remained accurate into grade 5. Children who began grade 2 with accurate perceptions of physical competence, i.e. the average estimators, maintained their accuracy of self-appraisals across the grades, including from grade 2 to grade 3, a time when their under- or overestimating peers were becoming more accurate.

The path to accuracy was relatively ‘textbook’ for participants in the overestimating group. In grade 2, the overestimator group had inaccurately high perceptions and the lowest

motor skill scores of their peers. These overestimators steadily decreased their perceptions across the grades and consistently improved their motor skills, resulting in more accurate perceptions from grade 2 to grade 5. This trajectory for the overestimators is consistent with developmental expectations that children will move from inflated perceptions in early childhood to more realistic perceptions in middle childhood (Berk, 2013; Harter, 2012a; Horn, 2004). The picture is more complicated for children who underestimated their abilities.

The underestimators, who began in grade 2 with the highest skills and lowest perceptions relative to their peers, did not have increases in motor skills and decreases in perceptions across the grades as might have been expected (Phillips & Zimmerman, 1990; Stodden et al., 2008). Neither underestimating boys nor girls significantly improved their motor skills, and only the girls experienced a significant decrease in perceptions from grade 3 to 4 that appeared to rebound by grade 5. Of major concern for this group, compared to the average and overestimators, was a lack of improvement in motor skills from grade 2 to grade 5. I discuss issues and approaches to assist both the underestimating and overestimating children in the discussion of Part B.

Part B. Active Physical Recreation Participation of Children with High and Low Actual and Perceived Motor Competence: A Cluster Analysis

Method

Except that participants in grade 2 were excluded as they were used as the baseline to create the accuracy groups, the same sample and measures used in Part A were used in this part. Part A results revealed there were few differences in active physical recreation participation longitudinally across middle childhood (see Table 2). This cross-sectional study, on the other hand, examined whether active physical recreation levels in each grade differed based on cluster group (i.e. combinations of high and low motor skills and perceptions of physical competence).

Data Treatment and Analyses

K-means cluster analysis (Mirkin, 2016) was used to create four clusters per grade based on participants' motor skills *z*-scores and perceptions of physical competence *z*-scores in grades 3, 4, and 5. The four cluster groups were: low motor skills-low perceptions (low-low); high motor skills-high perceptions (high-high); low motor skills-high perceptions (low-high); and high motor skills-low perceptions (high-low). Descriptive statistics for the four clusters were computed for motor skills, perceptions, and active physical recreation for children in each grade. A series of three 2 x 4 factorial ANOVAs (with sex and cluster group as factors) were run for each grade to look for differences in: 1) motor skills, 2) perceptions of physical competence, and 3) active physical recreation. In total, nine factorial ANOVAs were run. Post hoc tests using the Bonferonni correction were run for each factorial ANOVA. All analysis was computed in SPSS version 26 and significance was set at $p < .05$.

Results

Descriptive statistics for motor skills, perceptions, and active physical recreation for each cluster are presented in Table 3, and for boys and girls separately in Appendix C. Results from a series of 2 x 4 factorial ANOVAs revealed a significant main effect of cluster on motor skills in grade 3 ($F(3, 147) = 65.88$, $\eta_p^2 = .573$, $p < .001$), grade 4 ($F(3, 147) = 100.93$, $p < .001$, $\eta_p^2 = .673$), and grade 5 ($F(3, 147) = 137.68$, $p < .001$, $\eta_p^2 = .738$). Bonferroni post hoc comparisons for motor skills between clusters are reported in Table 3. A main effect of sex on motor skills was present in grade 3 ($F(1, 147) = 19.95$, $p < .001$, $\eta_p^2 = .120$,), grade 4 ($F(1, 147) = 57.06$, $p < .0001$, $\eta_p^2 = .280$), and grade 5 ($F(1, 147) = 37.43$, $p < .001$, $\eta_p^2 = .203$,), with girls demonstrating lower motor skills than boys in each grade (see Appendix C). There was a significant interaction effect between sex and cluster for grade 3 only ($F(1, 147) = 3.75$, $p = .012$,

η_p^2 = .071), but not for grade 4 (F(3, 147) = .67, p = .574, η_p^2 = .013) or grade 5 (F(3, 147) = 1.14, p = .334, η_p^2 = .023).

A significant main effect of cluster on perceptions of physical competence was present in grade 3 (F(3, 147) = 149.08, p < .001, η_p^2 = .753), grade 4 (F(3, 147) = 146.32, p = .001, η_p^2 = .749,), and grade 5 (F(3, 147) = 108.96, p < .001, η_p^2 = .690,). See Table 3 for Bonferroni post hoc comparison results. There was a significant effect of sex on perceptions in grade 3 (F(1, 147) = 31.25, p < .001, η_p^2 = .175), grade 4 (F(1, 147) = 11.54, p = .001, η_p^2 = .073), and grade 5 (F(1, 147) = 8.61, p = .004, η_p^2 = .055), with boys demonstrating higher perceptions in each grade compared to the girls (see Appendix C). There was no significant interactions between sex and cluster for grade 3 (F(3, 147) = 1.45, p = .213, η_p^2 = .029), grade 4 (F(3, 147) = .27, p = .847, η_p^2 = .005), or grade 5 (F(3, 147) = .36, p = .782, η_p^2 = .01).

Results from a series of 2 x 4 factorial ANOVAs revealed a significant main effect of cluster on participation in active physical recreation in grade 3 (F(3, 147) = 6.20, p = .001, η_p^2 = .112), grade 4 (F(3, 147) = 5.29, p = .002, η_p^2 = .097), and grade 5 (F(3, 147) = 8.30, p < .001, η_p^2 = .145). In each grade, participants in the high-high cluster participated in significantly more active physical recreation than those in the low-low cluster. Bonferroni post hoc comparison results for differences in active physical recreation between the clusters are presented in Table 3. There was no significant effect of sex on active physical recreation participation in grade 3 (F(1, 147) = .89, p = .348, η_p^2 = .006), grade 4 (F(1, 147) = 2.01, p = .159, η_p^2 = .013), or grade 5 (F(1, 147) = 2.04, p = .155, η_p^2 = .014). There was also no significant interaction of sex and cluster for active physical recreation participation in grade 3 (F(3, 147) = 1.19, p = .317, η_p^2 = .024), grade 4 (F(3, 147) = 1.44, p = .234, η_p^2 = .028), or grade 5 (F(3, 147) = 1.95, p = .124, η_p^2 = .038).

Table 3

K-means Cluster Analysis Descriptive Statistics and Between Group Post Hoc Comparisons

	Low-Low		High-High		Low FMS-High PPC (L-H)		High FMS-Low PPC (H-L)	
Variable (range)	Mean	SD	Mean	SD	Mean	SD	Mean	SD
				Grade 3				
n	31 (boys = 15)		63 (boys = 30)		27 (boys = 12)		34 (boys = 13)	
FMS (0 – 96) [a,c,d]	57.71	6.01	69.32	7.32	54.22	6.37	69.74	6.18
PPC (6 – 24) [a,b,c,d,e]	12.87	2.69	21.81	1.83	19.15	2.16	15.59	2.66
APR [a,b,c]	1.37	0.60	1.97	0.66	1.98	0.93	1.98	0.67
				Grade 4				
n	33 (boys = 14)		46 (boys = 19)		34 (boys = 16)		42 (boys = 21)	
FMS (0 – 96) [a,c,d,e]	57.67	6.16	72.89	5.70	58.94	5.15	67.10	3.99
PPC (6 – 24) [a,b,c,e]	13.03	2.30	21.46	1.72	20.47	2.03	16.74	1.91
APR [a,b,c]	1.60	0.82	2.26	0.76	2.12	0.83	2.19	0.77
				Grade 5				
n	21 (boys = 9)		53 (boys = 24)		40 (boys = 18)		41 (boys = 19)	
FMS (0 – 96) [a,b,c,d,e]	55.33	5.54	74.32	5.15	61.03	4.16	69.39	4.18
PPC (6 – 24) [a,b,e]	14.52	2.60	21.11	1.74	20.78	2.06	14.76	2.51
APR [a,b]	1.32	0.57	2.22	0.75	2.19	0.79	1.85	0.87

Note. All differences at $p < .05$. [a] significant difference between Low-Low and High-High. [b] significant difference between Low-Low and L-H. [c] significant difference between Low-Low and H-L. [d] significant difference between High-High and L-H. [e] significant difference between High-High and H-L. FMS = Fundamental motor skills; PPC = Perceptions of physical competence; APR = Active physical recreation.

Discussion

The aim of Part B was to examine differences in active physical recreation participation based on four clusters of high and low motor competence and high and low perceptions of physical competence from grade 3 to grade 5. The four clusters were: low motor skills-low perceptions (low-low); high motor skills-high perceptions (high-high); low motor skills-high perceptions (low-high); and high motor skills-low perceptions (high-low).

The children in the high-high group in grades 3, 4, and 5 participated in significantly more active physical recreation than the low-low group in those grades. These findings support the hypothesized relationships depicted in the model of developmental mechanisms influencing the physical activity trajectory of children (Stodden et al., 2008) and De Meester and colleagues' (2016) cross-sectional findings showing that children with high motor skills and high perceptions participated in more physical activity. My findings build on those of De Meester and colleagues by not only including the level of perceptions (low or high), but also by including a preliminary assessment of accuracy in Part A. The findings from Part A allow further interpretation of the results from the high-high and low-low groups, by showing that participants in those groups had accurate perceptions, and that those accurate perceptions were impacting participation. These longitudinal data show that the pattern of engagement or disengagement based on a combination of motor skill competence and perceptions of physical competence persists across middle childhood. Stodden and colleagues' (2008) original model depicted reciprocal relationships between perceived motor competence and physical activity and between perceived motor competence and motor competence in middle childhood and my results support this. Moreover, these authors noted

> …middle childhood marks the beginning of a period of vulnerability during which children who have lower actual motor skill competence will, correspondingly, demonstrate lower perceived motor skill competence and are less physically active. That is, they will opt out of physical activity because (a) they understand they are not as competent as peers… (Stodden et al., 2008, p. 296).

The phrase "they understand they are not as competent as peers" has particular salience for this study. The children in the low-low cluster had significantly lower motor skills, perceptions, and

active physical recreation levels. As the children were highly accurate in their perceptions of their abilities, they understood their competence was lower than that of their peers. In every grade, children in the low-low cluster participated in significantly less active physical recreation than any other cluster. This outcome is consistent with what Stodden and colleagues (2008) conceptualized as a compounding spiral of disengagement. With poor motor skills leading to low perceptions of competence (or vice versa), this paves the way to low engagement with, or withdrawal from, physical activities. Conversely, children in the high-high cluster had more developed motor skills, more positive perceptions of their abilities, and were more active.

I cannot directly compare change over time in motor skills, perceptions, and participation within the clusters because the composition of the clusters changed from grade to grade. However, it is interesting to note that both clusters with higher perceptions of competence (high-high and low-high) appeared to have substantial positive growth in their motor competence from grade 3 to 5; whereas, in the two clusters of children with low perceptions of physical competence (low-low and high-low), it seemed there was no development of motor competence. In grade 5, the cluster of children classified as having low motor competence with high perceptions of competence had significantly and substantively better motor competence than the children in the low-low cluster did, intimating that having positive perceptions across middle childhood is beneficial to the development of motor competence even among lower skilled children. These findings are in contrast to a theoretical perspective put forth by Susan Harter (2012a), in which she argues that children who overestimate their abilities tend to avoid challenging themselves, which consequently inhibits the development of skills and problem solving abilities. This discrepancy raises an important philosophical debate between theoretical

perspectives and empirical findings and is grounds for additional investigation into these relationships to better determine if low perceptions help or hinder motor development.

The interactions between children's motor skill competence and their self-appraisals and their influence on physical activity engagement suggests that these factors need concurrent attention. However, attention does not necessarily mean that perceptions of physical competence need to increase; the interactions are more nuanced than that. Over time, I found that many children who overestimated their abilities demonstrated skill improvement; however, as these data illustrate, children can still have very positive perceptions of their physical abilities with relatively poor motor skills (i.e., the low-high cluster) during middle childhood. This has practical and methodological implications. As Susan Harter (2012a) expressed, "from the perspective of educational interventions, promoting more realistic self-evaluations among overraters [sic] should be a first step" (p. 264). Harter argued that more realistic self-perceptions will benefit these overestimators because they tend to avoid challenging themselves, which consequently inhibits the development of skills and problem-solving abilities. She suggested that when children abandon these unrealistic perceptions, they are more likely to engage in realistic challenges commensurate with their current abilities. Mastery-oriented approaches to learning (Berk, 2013) can be particularly useful in these circumstances. Mastery-oriented environments include offering a range of tasks and activities that may be meaningful and interesting and tasks are matched with the child's current skill level (Berk, 2013). Appropriate levels of challenge allow children to improve their actual skills, which is turn can lead to higher, but now more realistic, self-perceptions (Harter, 2012a). The matching of skill level and task demand ensures that children are not overwhelmed, but provided with appropriate levels of challenge (Berk, 2013).

Methodologically, researchers need to be cognizant (a) of developmental changes in perceptions of competence during middle childhood, (b) that children can have high perceptions and relatively low motor skill proficiency (or different combinations of high and low), and (c) of the developmental interactions between motor skill competence and perceptions of physical competence during this period. For example, a recent, well designed, school-year-long randomized controlled trial focusing on improving children's motor skills and perceptions of physical and movement skill competence among 8-year-olds, showed significant changes in motor skills, but not in perceptions of competence (Chan et al., 2019). The authors expressed concern about the lack of improvement in children's perceptions of competence and recommended more research on the effect of education environments on children's self-appraisals. However, on average, the children's perceptions of competence in the Chan and colleagues' study were positive and the lack of change may reflect that the children's perceptions had dropped to become more realistic or that they were not developmentally ready to appraise their competence accurately. Alternatively, improvements in motor skills may have stabilized these 8-year-olds' perceptions of their abilities, when otherwise, their perceptions may have been dropping. Obviously, we do not know. However, not considering expected developmental change during middle childhood might mean that researchers underestimate the efficacy and effectiveness of their interventions.

Lower Perceptions of Physical Competence Clusters

Two clusters of children in this study had relatively low perceptions of their physical abilities, the low-low and high-low clusters. As mentioned earlier, the low-low cluster had relatively poor motor competence and they knew it. They also had the lowest levels of active physical recreation participation. To assist this group of children to enter into positive spirals of

engagement, creating a positive motivational physical activity climate is recommended (Stuntz & Weiss, 2010). According to Stuntz and Weiss (2010), adults (e.g., parents, coaches, teachers) can create a positive motivational climate by providing children with choice, fostering the development of positive and supportive relationships between peers, focusing on feelings of individual competence (e.g., environments free from peer comparison), and by planning activities that are enjoyable for the learner. The combination of these efforts within a motivational environment can have a "dramatic influence on youths' physical activity motivation and behaviors" (Stuntz & Weiss, 2010, p. 433).

The second cluster with lower perceptions of physical competence was the high-low cluster. Children in this cluster, have relatively high motor competence, but low perceptions of their abilities. As can be seen in Table 3, there is no significant difference in motor skills in grade 3 between the high-high and high-low clusters, but in grades 4 and 5, the high-high clusters had significantly and meaningfully higher motor skills scores. This apparent stagnation in motor skill development may partly be explained by competence-motivation theory (Harter, 2012a), which posits that children are less motivated to participate in activities if they feel they do not have the skills to succeed. The lack of participation, in turn, suspends the development of motor skills, and so on (Stodden et al., 2008).

This underestimation of their abilities is particularly concerning because, as evidenced in the academic domain, underestimation is associated with feeling anxious and angry and avoiding schoolwork (Miserandino, 1996), lower intrinsic motivation and negative attitudes toward effort (Bouffard et al., 2003), depressive symptoms (Cole et al., 1998), and negative treatment of positive information (Vaillancourt & Bouffard, 2009). Longitudinally, from grade 3 to grade 5 and across middle childhood, Bouffard and others (2003) found that students who

underestimated their abilities had a deteriorating pattern of motivation and lower academic performance than peers with realistic or optimistic perceptions. Harter (2012a) recommends that children who underestimate their abilities need assistance to develop self-perceptions that are more accurate; however, the approach is very different from children who overestimate their abilities. Underestimators need others to point out and confirm their actual abilities, e.g., their ability to perform difficult skateboard tricks, or jog steadily, or to throw with accuracy. However, Harter (2012a) also pointed out that for some underestimators, the root cause of this issue, such as unrealistic parent expectations, may be beyond a teacher or coach, and counselling may be necessary (Harter, 2012a).

Sex-based Differences

Boys' higher motor skills and higher perceptions of physical competence than girls in grades 3, 4, and 5 are consistent with other studies examining these variables in middle childhood (e.g. De Meester, Stodden, et al., 2016; Liong et al., 2015; Pesce et al., 2018). I did not examine the reasons for these sex-based differences; however, as actual competence is believed to inform perceptions of competence in middle childhood (Harter, 2012a), it is reasonable to suggest that boys' higher perceptions of physical competence are partly being influenced by their higher motor skill proficiency. High motor skill competence and high self-perceptions are two ingredients for increased participation as evidenced by the participation rates of the high-high cluster in each grade in this study, and support from the extant literature (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Bolger et al., 2019; De Meester, Stodden, et al., 2016). Although boys in this study demonstrated higher motor proficiency and more positive self-appraisals than girls, there were no significant sex-based differences in active physical recreation. Reports on physical activity levels of boys and girls in childhood (~6- to 11-years

old) indicate that boys are more active than girls (Chung et al., 2012; Colley et al., 2017; Trost et al., 2002). It is important to note, however, that these differences are often attributed to the intensity of activity as measured by accelerometry (Chung et al., 2012; Colley et al., 2017; Trost et al., 2002), as opposed to frequency or volume of participation. Boys tend to engaged in more moderate- and moderate-to-vigorous physical activity (Colley et al., 2017), whereas levels of light physical activity are similar between boys and girls (Colley et al., 2011). In the current study, participation scores were generated from the frequency of participation for the listed CAPE items and more closely represent the volume of activity a child is doing (e.g., how often) as opposed to the intensity (e.g., moderate or vigorous).

Limitations

As is common with longitudinal studies, attrition is a limitation in this study (Thomas et al., 2011). From my previous study (Field, Crane, et al., 2020) to the current study, 83 participants were lost to attrition as a result of adding an additional year of data as well as another measurement tool. There was no systematic follow-up regarding why some participants did not continue with the study into grade 5, however informal conversations with teachers and students elicited reasons such as the child moved to another district, the child was persistently ill, or there was long-term absence from school. The research team did perform 'catch-up' visits to each school; however, some children were consistently not available.

A subjective measure of active physical recreation participation was used in this study. Other researchers in the field (e.g. Bolger et al., 2019; De Meester, Stodden, et al., 2016) have used accelerometry in recent cross-sectional studies. Including an objective measure of participation to longitudinal research would add strength to this area of developmental literature. An advantage, however, of using the CAPE was that these data were collected at school, thus

diminishing additional attrition from this study because parents may have been concerned about the additional burden of having their child wear an accelerometer. This concern was seen in a previous study using accelerometry in this school district (Crane et al., 2015), where permission to wear an accelerometer for 7 days was only provided for 51% of the $n = 403$ kindergarten children who had parental consent to participate in the at-school portion of the study.

Suggested Areas for Research

There were still children in grades 3, 4, and 5 who over- or underestimated their abilities. As evidenced in the academic domain (Bouffard et al., 2003; Harter, 2012a; Vaillancourt & Bouffard, 2009), it is likely that both of these groups will benefit from developing more realistic self-perceptions, but for different reasons. New research is needed to investigate how to help overestimators absolve themselves of unrealistic self-perceptions, and whether this helps them engage in suitably challenging tasks; and ultimately whether these children improve their motor skills and engagement in physical activities. Similarly, and perhaps more urgently, investigation into how to prevent children from underestimating their abilities and ways to help children become more realistic is needed. It is likely for some children that this is complex (Harter, 2012a) and may require inter- and multidisciplinary (e.g., psychology, pedagogy, motor development) teams for intervention and investigation.

Conclusions

My primary aims were to affirm the trajectory of accuracy of perceived competence and to determine whether children with high motor skills and accurately high perceptions participated in more active physical recreation than children with low motor skills and accurately low perceptions. There was considerable improvement in accuracy of children's self-appraisals of

their physical competence by grade 3. Subsequently, children with good motor skills and positive physical self-perceptions participated in significantly more active physical recreation than those with low motor skills and low perceptions. Additionally, children with positive perceptions, whether they had strong or poor motor skills, demonstrated positive growth in their motor skills, suggesting positive perceptions are beneficial to motor skill development, even for children with less developed skills. This was a consistent pattern from grade 3 to grade 5. The most concerning participants are those with low perceptions. Children with low perceptions and low motor skills need urgent intervention regarding their motor skills, as their motor skills are low, and they know it. Children with low perceptions, but high motor skills, need to learn how to appreciate their actual skill level. These children had relatively good skills, but they did not accurately perceive their competence, with seemingly negative consequences on development of motor competence.

Chapter 4 – Study 2

Social Contexts and Participation in Recreational Activities Across Middle Childhood

Preamble

Social contexts and participation in recreational activities across middle childhood is the second study in this dissertation. In this study, I tracked recreation and leisure activity participation of children from grade 2 to grade 5 in terms of: (a) what activities children were doing and how participation changed over time, and (b) with whom and where children participated in these activities. I also examined changes in formal and informal activity participation over time, as well as differences in with whom and where children participated between these domains. Theoretically, it was expected there would be an expansion of both with whom and where children participated during middle childhood (Berk, 2013; Eccles, 1999), however, limited research exists in this area. The evidence that does exist is cross-sectional (Brown et al., 2011; King et al., 2010); therefore, this study contributes longitudinal evidence for participation patterns, particularly in regard to with whom and where children participate.

A manuscript based on this chapter will be prepared for submission to *Children & Society*.

Abstract

Although the developmental psychology literature provides a foundation to suppose that children's participation in recreational contexts and interactions with others will expand with age, there is little evidence of this. The evidence that does exist is cross-sectional. How participation in formal and informal recreation tracks across middle childhood has not been examined. The aim of this longitudinal study was to examine whether children's recreation-related social contexts expanded during middle childhood, and whether these social contexts were associated with participation in formal and informal recreation activities. Participants (n = 203, boys = 99) in this longitudinal study were elementary school children with complete Children's Assessment of Participation and Enjoyment (CAPE) survey data in grades 2, 3, 4, and 5. Diversity scores (i.e. the activities in which children are participating) were calculated following the CAPE manual procedures for each item in each grade, as well as both domains (formal and informal). Descriptive statistics for diversity, where and with whom children participated were computed. Repeated measures ANOVA revealed significant positive change in diversity and in with whom and where children participated across the grades. From grade 2 to grade 5, there was a significant increase in children's participation by themselves and with friends, and a concomitant decrease in activities with their family. Overall, however, children spent the largest proportion of their recreational time with their family in each grade. Increases in activities by themselves and with friends, and a decrease in activities with their family, suggests that children were moving toward independence in activities such as doing chores and reading. It also suggests that their friends were becoming an increasingly important social group. Formal activities, in particular, provided participation in more distal social contexts (e.g., with others in

the community) which could provide children with opportunities to develop social and emotional skills as well as explore new environments.

Key Words

Longitudinal, Recreation, Child, Social Contexts

Social Contexts and Participation in Recreational Activities across Middle Childhood

Background

"Children grow up in a complex system of relationships that are affected by influences found in different levels of the surrounding environment" (Smith & Hart, 2010, p.139). These relationships provide children with instrumental (such as food and clothing), informational (teaching children what and how to do things), and emotional support, as well as companionship (Agneessens et al., 2006; Baumgartner et al., 2012; Zarbatany et al., 1990). Feeling socially connected to people and contexts within one's social ecology can be protective of psychosocial well-being, health, and quality of life (Barber & Schluterman, 2008; Jose et al., 2012; Waters et al., 2010). Additionally, children's relationships and interactions with their surrounding environments drive development (Bronfenbrenner & Morris, 2006).

Reciprocal interactions between the individual and their immediate and more remote environments are called Proximal Processes (Bronfenbrenner & Ceci, 1993). These proximal processes are at the heart of the Process-Person-Context-Time (PPCT) model associated with Bronfenbrenner's bio-ecological theory (Bronfenbrenner & Morris, 2006). The ecological environments, or context, consist of four nested levels. The innermost of these levels is the microsystem. The microsystem is a pattern of activities, social roles, and interpersonal relations experienced by the developing person in a given face-to-face setting (Bronfenbrenner, 1994).

Parents, teachers, and young children themselves agree that the inner circle, or microsystem, during early childhood is a small group of people; specifically, family members, school friends, and teachers (Baumgartner et al., 2012). Children with siblings always mentioned their brother/sister as part of the inner circle; and young children mention having a special or best friend (Baumgartner et al., 2012). Friendship networks among preschool aged children range

from an average of 0.9-1.7 friends to an average of 3-5 friends among school-aged children (Hartup & Stevens, 1997).

Developmentally, it is expected that children's social contexts will expand during childhood (Eccles, 1999; Hartup & Stevens, 1997; King et al., 2010; World Health Organization, 2007). This expansion includes change in the closeness of who children have relationships with as well as the number of relationships (Hartup & Stevens, 1997; King et al., 2010). When comparing cohorts of children aged 6-8 years, 9-11 years, and 12-14 years, King and colleagues (2010) found that children without disabilities experienced a widening social world with increasing age, characterized by more intense social participation and greater participation with non-family members. During middle childhood there is concomitant change in parents' roles and utilization (seeking out and/or valuing help from a parent) (Kerns et al., 2006). Children spend less time under their parents' supervision and more time with different 'types' of people such as recreation leaders, camp counselors, and the like (Eccles, 1999). During early childhood, parents have fostered a social developmental pathway by providing opportunities for social interactions such as play dates and teaching their children skills for social contexts such as language and play skills (Eccles, 1999; Reich & Vandell, 2011). In middle childhood, however, others play more significant roles in development (Eccles, 1999), and these others, including their friends and peers "…afford different social opportunities" (Reich & Vandell, 2011, p. 265). It is also important to note that the spheres of influence of others overlap. Whether formally or informally, there is interaction between family, school, and community (Epstein, 2010). Although a child may want to join an organization because their friend participates, during middle childhood, parents have considerable influence over their child's choices in terms of approval/disapproval and providing instrumental support such as transportation and paying fees (Eccles, 1999).

However, recent findings also suggest that as children transition from grade 1 to grade 4, they become more independent in their choices with respect to active play and inactive play such as screen time (Jago et al., 2018).

Expanding Contexts

In parallel with exposure to new people in the microsystem, there is increased interaction with expanded contexts and structures such as school and sports clubs during middle childhood (Eccles, 1999; Zarbatany et al., 1990). Indeed, Eccles identified that the "key social event that divides middle childhood from the preschool period is children's entry into elementary school, an event that coincides for many with participation in other formal organizations and programs outside of the family" (Eccles, 1999, p. 34). Others have proposed that engagement in more organized activities is part of a wider social trend where children's informal interactions near their home have been supplanted by organized activities farther away from home (Rupprecht et al., 2016; Skår & Krogh, 2009). These changes have been attributed to increasingly busy family schedules necessitating the need for after-school programs (Skår & Krogh, 2009) and increased parental restriction due to safety concerns (Chaudhury et al., 2019; Holt et al., 2016; Schoeppe et al., 2016). Using home and go-along walking interviews, Chaudhury and colleagues (2019) found that approximately half of suburban neighborhood children in Auckland, New Zealand, aged 9-13 years were allowed to go to public open spaces independent of adult supervision. Having siblings and friends to go with and carrying a cellphone were positive affordances in parents' decisions to allow their children to go to public open spaces (Chaudhury et al., 2019).

In addition to busy family schedules and parental concerns, the availability of neighborhood outdoor spaces influences opportunities for recreation in middle childhood (Rupprecht et al., 2016; Skår & Krogh, 2009; Thomson & Philo, 2004). Internationally, several

research teams have identified generational change in access to informal neighborhood outdoor spaces such as nature areas, fields, and vacant lots (Rupprecht et al., 2016; Skår & Krogh, 2009). Parents and grandparents have reflected that activities that formerly occurred locally are now conducted farther away, creating a spiral of disuse (Rupprecht et al., 2016; Skår & Krogh, 2009). Because more recreation occurs farther away, there is less upkeep on local environments for play, and therefore children do not play in those environments (Skår & Krogh, 2009). Conversely, where land use had been specifically planned to include play spaces near homes, 8-9 year-old children commonly play in 'the street' (e.g., cul-de-sacs, walkways, and vacant plots) (Thomson & Philo, 2004).

Formal and Informal Activities

The contexts in which children spend time are experiential niches that afford a range of physical and social opportunities (Chaudhury et al., 2019; Larson & Verma, 1999). Although children often make decisions about what they will do in a context (Chaudhury et al., 2019; Jago et al., 2018), each context has a set of structures, rules, and opportunities for the development of relationships, skills, and knowledge (Larson & Verma, 1999; Zarbatany et al., 1990). It also appears that the structure of experiential niches and functions of activities in those contexts are closely related (Larson & Verma, 1999; Zarbatany et al., 1990). Larson and Verma (1999) posited that the amount of time spent in an experiential niche increases exposure to those types of experiences and therefore to the development of skills and knowledge associated with that context.

One distinction made in the nature of children's recreational experiences is level of formality, or structure, of those experiences (King et al., 2004). Typically, formal recreational activity contexts have particular structures and timeframes, involve others (e.g., coaches),

incorporate preplanning, are goal-directed, have standards and norms, and may require transportation (King et al., 2004; Larson & Verma, 1999). Although there is little evidence of the relative impact of formal and informal recreation during middle childhood, evidence suggests that children enjoy formal activities more than informal activities (King et al., 2009). Additionally, developmental psychologists suggest that organized activities are beneficial for positive youth development (Mahoney et al., 2006), and practitioners advocate for the inclusion of both formal and informal activities during after-school programs (King et al., 2004; Thompson, 2009).

It appears that children participate in fewer formal than informal recreation activities (Thomson & Philo, 2004), however this may be changing. Jago and colleagues (2018) found that as children transitioned from early childhood to middle childhood, their interests in free play decreased and their interest in more structured activities increased. Other recent evidence suggests that contemporary parents feel pressured to enroll their children in more formal activities (Pynn et al., 2019). Interviews with 14 grandparent-parent dyads in Alberta, Canada, revealed there was an increasing sense that 'good parenting' included enrolling children in structured and supervised activities (Pynn et al., 2019). These authors further concluded there was pressure, particularly through social media, not to allow children to play unsupervised, and that engagement in formal extracurricular activities served to provide children with "…advantages over their peers by providing them access to human, social, and cultural capital" (Pynn et al., 2019, p. 270). This latter view is supported by Watchman and Spencer-Cavaliere (2017) who found that parents considered structured sport more valuable than free-play for their 8- to 10-year-old children because it fostered the development of skills such as teamwork, communication, and goal-setting.

Among older children (~10 years of age), both structured and unstructured active games typical of after-school care, afford opportunities for moderate- and vigorous-intensity physical activity (Clevenger et al., 2016); however, the relationship between structure and activity levels may be more nuanced. When comparing physical activity levels associated with four types of recreation (basketball) facilitation styles, West and Shores (2008) found that 6- to 7-year-old children were less active during free play, skills/drills, and scrimmages, and more active during modeled play. Contrastingly, 9- and 10-year-old children were equally active during free and modeled play, and least active during directed skills and drills (West & Shores, 2008). It should also be noted that, at least in the context of sport, high levels and intense participation in formal activities can result in children dropping-out of those activities (Crane & Temple, 2015; Wall & Côté, 2007). In the psychosocial domain, an early study comparing the physical activity contexts of organized sport, informal sport, and physical education revealed that adolescents felt that much more was at stake, and they had a lower sense of control and skill, in organized sports compared to informal sport and physical education (Chalip et al., 1984). Also in the psychosocial domain, Norwegian parents and grandparents mentioned that friendships ended when children changed their organized activities (Skår & Krogh, 2009).

Study Aim

Although the developmental psychology literature (e.g. Eccles, 1999; Hartup & Stevens, 1997; Larson & Verma, 1999) provides a foundation to suppose that children's participation in recreational contexts and interactions with others will expand with age, there is limited evidence of this. The evidence that does exist is cross-sectional (e.g. King et al., 2010) and participation in formal and informal recreation tracks across middle childhood has not been examined. Although this study does not examine the developmental outcomes associated with time spent in particular

contexts, it sets the stage to hypothesize about developmental outcomes, based on a longitudinal examination of where and with whom children spend their time in recreational activities. The study will also provide another perspective on change in the balance of formal and informal recreational activities in middle childhood suggested by several qualitative Canadian studies (Holt et al., 2016; Pynn et al., 2019; Watchman & Spencer-Cavaliere, 2017). The aim of this study was to examine whether children's recreation-related social contexts were associated with their participation in recreation activities. The following specific questions were addressed:

1. How did children's social contexts (where and with whom they participate) evolve from grade 2 to grade 5?
2. What were children's patterns of participation in recreational activities from grade 2 to grade 5?
3. Did where and with whom children participated differ for formal and informal activities?

Method

Participants

Data for this longitudinal study were collected in eight elementary schools in one school district from 2012 to 2017 as part of the Motor Development study. Children in grade 2 were recruited in the 2012-2013 school year (cohort 1) or the 2013-2014 school year (cohort 2) and data were subsequently collected for each cohort in grades 3, 4, and 5. All grade 2 students attending the eight schools were invited to participate. Written informed consent was obtained from parents or guardians each year and children provided written assent each year. Children were included in this study if they had complete CAPE survey data in grade 2, 3, 4, and 5. The final sample was n = 203 children, boys = 99 (48.8%) and girls = 104 (51.2%). The number of children from each school in the longitudinal sample ranged from 12-81 (Mean = 25.4, SD =

24.3). In grade 2, mean age was 7 years and 9 months (*SD* = 4 months) and six children had a disability (3.0% of the sample).

Measure and Procedures

Demographic characteristics of the children were obtained from a brief survey attached to the consent materials and completed by the parents; children's age, sex, and disability status were collected. Further to the general demographic information provided in Chapter 1, the median income for a two-parent household in Victoria, British Columbia is $101,800 and $51,660 for a single-parent household (Statistics Canada, 2017). Twenty-five percent of households with children are single-parent households, with single mothers accounting for 72% of those households (Statistics Canada, 2016).

Consistent with the World Health Organization's definition of participation as "a person's involvement in a life situation…[representing] the societal perspective of functioning" (World Health Organization, 2007, p.229), the CAPE was created to assess children's and youth's (6-21 years of age) participation in formal and informal recreation and leisure outside of mandated school curricula (King et al., 2004). Formal activities in the CAPE are activities that are structured, preplanned, have goals, specific timeframes, often involve others (e.g., coaches), and may require transportation (King et al., 2004). Conversely, informal activities are often instigated by the child and these activities are less structured and require little planning (King et al., 2004). Five dimensions of participation are assessed by the 55-item CAPE survey: (a) diversity, the number of activities in which a child participates, (b) intensity, how often the child participates in an activity, (c) with whom the child participates, (d) where the child participates, and (e) enjoyment of the activities. Intensity of participation and enjoyment were not included in this study.

Content validity for the CAPE was established through a thorough literature review on participation, expert review, and pilot testing (King et al., 2004) and construct validity has been examined in terms of the expected relationships between participation and environmental, family, and child characteristics such as sex and motor skill proficiency (King et al., 2007; Temple et al., 2016). King and colleagues (2007) found that the frequency of participation and enjoyment of activities were associated with social and physical environmental factors, family affordances and constraints (e.g., income and time constraints), and child characteristics (e.g., perceptions of social competence), in expected ways. Construct validity of the CAPE has also been examined by Temple et al. (2016) among 74 children in their first year of school. These authors hypothesized that motor skill proficiency would be related to participation in physically active forms of recreation, but not to other types of activities. As predicted, motor skill proficiency was not associated with less active pastimes. Locomotor skill scores, however, were associated with participation in physical activities, and object control skills and balance scores predicted participation in organized sport among the boys. The mean test-retest reliability correlation coefficient for diversity is .75, ranging from .67 for skill-based activities to .78 for formal activities (King et al., 2004).

The CAPE was administered in accordance with the administration procedures of the CAPE/PAC manual (King et al., 2004). The CAPE was individually interviewer-administered in every grade at each child's school by a trained research assistant. Administration occurred in a quiet place, such as an area of the school library or resource room. Typically, children took approximately 25-30 minutes to complete the CAPE, however children completed the CAPE at their own pace.

The interviewer showed the child the 55 cards, each illustrating an activity, one at a time in sequence. The child was asked if they had done the activity shown in the past four months. This dimension of participation is referred to as diversity, and it was recorded dichotomously. If the child said "No," they had not participated in that activity, 0 was recorded; if they said "Yes," 1 was recorded. If the child had participated in the activity, then the dimensions of with whom and where the child participated were recorded. The dimension of with whom, identifies the type of person with whom the child does that activity most often. Scores can range from 1-5: 1 = alone, 2 = with family, 3 = with relative, 4 = with friends, and 5 = with others. The CAPE dimension of where, identifies the location the child does the activity most often. Scores can range from 1-6: 1 = at home, 2 = at a relative's house, 3 = in your neighborhood, 4 = at school (but not during classes), 5 = in your community, and 6 = beyond your community. As suggested in the administration guidelines (King et al., 2004), CAPE administrators operationalized 3, 5, and 6 of the 'where' construct for the children. Neighborhood was defined as "somewhere they might walk to," in your community was defined as "somewhere in Victoria they would need to drive to or take the bus," and beyond your community was defined as outside of Victoria, "up or off Vancouver Island."

Data Treatment and Analyses

Participation

The CAPE was used to assess the diversity of children's participation. Diversity is the number of different activities in which the child participated during the previous four months (King et al., 2004). The proportion of children participating in each CAPE activity and total diversity (55 items) were computed for all grades. Subsets of total diversity were also computed, specifically: 1) Informal activities (40 items) and formal activities (15 items), and 2) Activity

categories. The nine activity categories computed were: (a) hobbies, crafts, and games; (b) social activities; (c) quiet recreation; (d) organized sports; (e) other skill-based activities; (f) clubs, groups, and organizations; (g) active physical recreation; (h) entertainment and education; and (i) jobs, chores, and employment. The average participation score per category was calculated by summing the number of activities the child did per category and divided by the number of questions in that category.

Visual inspection of the total diversity, diversity of informal and formal activities, and activity category data for normality using Normal Quantile-Quantile (Q-Q) Plots showed most points fell on or near the line. Therefore, a series of repeated measures ANOVAs was used to examine change in these variables across grades.

Where and With Whom

As per the CAPE manual (King et al., 2004), where and with whom a child participated in activities was computed by summing the child's responses on those dimensions and dividing by the number of activities the child did. With whom and where were also examined with respect to participation in informal and formal activities. Repeated measures ANOVAs and Bonferroni pairwise comparisons were used to examine overall change in with whom and where across grades, and by informal and formal activities. Paired t-tests were used to compare informal and formal activity scores in each grade. Additionally, the frequency (and percentage) of participating with different people (alone, family, other relatives, friends, and others) and at different locations (from home-based to wider community) was computed for each grade. As with whom and where proportion data are interval level, the Friedman test for K Related Samples was used to examine difference in dimensions (where and with whom) across grades.

Post hoc analyses of significant differences were examined with Wilcoxon signed-rank tests and Bonferroni corrections.

Modal scores for with whom and where were also computed for each specific activity, and dependent t-tests were used to compare with whom and where scores using formality (formal and informal) as an independent variable. Finally, counts of with whom children participated in each activity context were explored using radar graphs for each grade level. All analyses were performed using IBM SPSS Version 24 for Windows, except for the radar graphs, which were constructed in Excel 2016.

Results

Participation in each of the 55 CAPE activities and the nine activity categories across grades are reported in Tables 4 and 5, respectively. Examination of the top five most frequently participated-in activities in each grade in Table 4 shows that board/card games, reading, and watching television/movies were the most common form of recreation activities across grades. Rounding out the top five activities in both grades 2 and 3 were playing with toys and playing on equipment, whereas playing computer/video games and homework emerged as top five activities in grades 4 and 5.

In company with changes in the pattern of the most prevalent activities, there was growth in the number of activities in which the children participated across grades. Repeated measures ANOVA showed a significant overall effect of grade level on the total diversity score as suggested by a Wilk's lambda (λ, Neal & King, 1969) of .843 with $F(3, 200) = 12.408$, $p < .001$, partial eta squared (η_p^2) = .16.

Table 4

Prevalence of Participation in Specific Recreational Activities by Category and Domain and Modal Scores for With Whom and Where Children Participate

	Percent participate				With Whom (Mode)				Where (Mode)			
Item (domain)	G2	G3	G4	G5	G2	G3	G4	G5	G2	G3	G4	G5
Hobbies, crafts, & games (Informal)												
1. Puzzles	59.6	52.7	54.7	52.7	F	F	F	F	H	H	H	H
2. Board/card games	90.6	87.7	89.2	89.7	F	F	F	F	H	H	H	H
3. Crafts/drawing	50.7	83.7	87.2	80.3	A	A	A	A	H	H	H	H
4. Collecting things	35.0	50.7	43.8	43.3	A	A	A	A	H	C	C	C
5. Computer/video games	44.8	81.3	87.7	88.7	F	A	A	A	H	H	H	H
Social activities (Informal)												
6. Talk on phone	31.5	61.6	68.0	77.8	F,Fr	Fr	Fr	Fr	H	H	H	H
7. Go to party	64.5	77.8	81.8	84.7	Fr	Fr	Fr	Fr	C	C	C	C
8. Hanging out	57.1	65.5	79.8	83.3	Fr	Fr	Fr	Fr	H	H	S	N,C
9. Visiting	73.4	80.8	79.3	83.3	Fr	Fr	Fr	Fr	C	C	C	C
10. Writing letters	43.3	31.0	26.6	27.6	A	A	A	A	H	H	H	H
11. Friends over to play	55.3	61.1	64.5	61.1	Fr	Fr	Fr	Fr	H	H	H	H
Quiet recreation (Informal)												
12. Playing with pets	56.2	54.7	71.4	72.9	F	A	A	A	H	H	H	H
13. Write story	40.9	42.4	35.0	34.0	A	A	A	A	H	H	H	H
14. Pretend play	60.6	58.6	54.7	46.8	A	A	Fr	Fr	H	H	H	H
15. Playing with toys	82.8	90.1	87.2	79.3	A	A	A	A	H	H	H	H
Organized sport (Formal)												
16. Martial arts	22.2	23.2	18.7	17.2	O	O	O	O	C	C	C	C
17. Swimming	71.4	77.3	77.3	75.9	F	F	F	Fr	C	C	C	C
18. Gymnastics	31.5	28.6	25.6	25.1	O	O	O	O	C	C	C	C
19. Horse riding	9.4	7.4	9.4	9.4	F	F	F	F	C,B	C	B	C
20. Track & field	9.9	31.0	31.5	31.5	Fr	Fr	Fr	O	S	S	S	C
21. Team sports	48.3	46.3	55.7	60.6	O	O	O	O	C	C	C	C
Other skill-based activities (Formal)												
22. Learning to sing	12.8	18.2	15.8	18.7	O	Fr	O	O	S	S	S	S
23. Art lessons	15.3	8.9	8.9	5.9	O	O	O	O	C	C	C	C
24. Learning to dance	20.7	20.7	17.2	17.7	Fr	O	Fr	O	C	C	C	C
25. Help from tutor	10.3	8.9	7.9	5.9	A	O	A,O	O	H	H	H	C
26. Play musical instrument	40.4	43.3	54.2	65.5	F	A	A	A	H	C	H	H
27. Music lessons	26.6	27.6	32.0	38.4	O	O	O	O	C	C	C	C
Clubs/groups/organizations (Formal)												
28. Community organization	8.4	19.7	19.7	19.7	O	Fr	O	O	C	C	C	C
29. Religious activity	19.7	20.7	20.7	21.2	F	F	F	F	C	C	C	C

30. School clubs	25.6	29.1	38.9	43.8	Fr	Fr	Fr	Fr	S	S	S	S
Active physical recreation (Informal)												
31. Dancing	45.3	41.9	40.9	41.4	F	A	F	Fr	H	H	H	H
32. Walk/hike	70.9	76.4	85.7	84.7	F	F	F	F	C	C	C	C
33. Bike riding /skateboard	71.4	68.0	74.9	65.0	F	F	F	F	N	N	N	N
34. Water sports	16.3	19.7	17.7	16.7	F	F	O	F	C	C	C	C
35. Snow sports	20.7	21.7	21.2	26.6	F	F	F	F	B	B	B	B
36. Playing on equipment	83.3	85.7	80.8	70.0	Fr	Fr	Fr	Fr	S	S	S	S
37. Games (e.g., soccer at the park)	68.0	75.4	85.7	84.2	Fr	Fr	Fr	Fr	H	S	S	S
38. Gardening	33.5	27.1	25.6	25.1	F	F	F	F	H	H	H	H
39. Fishing	15.3	8.9	14.8	14.3	F	F	F	F	B	B	B	B
40. Individual physical activities	28.1	29.6	37.9	40.9	F	A	A	A	C	H	H	H
41. Non-team sports	23.2	30.0	31.5	25.6	F	F	F	Fr	C	C	C	C
Entertainment & education (Informal)												
42. Go to movies	67.5	73.9	81.3	81.3	F	F	F	F	C	C	C	C
43. Public library	58.1	47.8	54.7	51.2	F	F	F	F	C	C	C	C
44. TV/rented movie	85.7	93.1	91.6	92.6	F	F	F	F	H	H	H	H
45. Go to live event	23.2	32.0	39.4	36.0	F	F	F	F	C	C	C	C
46. Full-day outing	30.5	28.6	34.0	31.5	F	F	F	F	B	B	B	B
47. Reading	83.3	89.2	92.1	93.6	F	A	A	A	H	H	H	H
48. Listen to music	63.1	67.5	75.4	75.9	F	A	A	A	H	H	H	H
Jobs, chores, & employment (Informal)												
49. Volunteering	8.9	10.8	17.7	19.7	F	F	Fr	Fr	C	C	C	C
50. Chores	63.1	66.0	70.9	82.8	A	A	A	A	H	H	H	H
51. Paid job	9.9	11.8	17.7	20.2	A	A	A	F	H	H	H	N
52. Making food	60.1	56.2	51.7	66.0	F	F	F	F	H	H	H	H
53. Homework	67.0	76.4	92.1	92.1	F	F	A	A	H	H	H	H
54. Shopping	71.4	79.3	73.4	77.3	F	F	F	F	C	C	C	C
55. Caring for a pet	54.7	55.2	64.5	64.0	A,F	A	A	F	H	H	H	H

Note. With whom: A, Alone; F, Family; R, Relatives; Fr, Friend; and O, Others. Where: H, Home; R, Relatives' home; N, Neighborhood; S, School; C, in their Community; and B, Beyond their Community.

As can be seen in Table 5, pairwise comparisons revealed significant increases in participation from grade 2 to grade 4, and no change between grade 4 and grade 5. There were also statistically significant differences across grades in specific activity categories; specifically: hobbies, crafts, & games $\lambda = .784$ with $F(3, 200) = 18.339$, $p < .001$, partial eta squared (η_p^2) = .22; social activities $\lambda = .827$, $F(3, 200) = 13.985$, $p < .001$, $\eta_p^2 = .17$; other skill-based activities $\lambda = .954$, $F(3, 200) = 3.247$, $p = .023$, $\eta_p^2 = .05$; clubs, groups, and organizations $\lambda = .882$ with

$F(3, 200) = 8.956$, $p < .001$, $\eta_p^2 = .12$; entertainment and education $\lambda = .904$ with $F(3, 200) = 7.066$, $p = .023$, $\eta_p^2 = .10$; and jobs, chores, and employment $\lambda = .769$ with $F(3, 200) = 20.056$, $p < .001$, $\eta_p^2 = .23$. There was no significant change across the grades in quiet recreation $\lambda = .976$, $F(3, 200) = 1.633$, $p = .183$, $\eta_p^2 = .02$, active physical recreation $\lambda = .0.967$, $F(3, 200) = 2.288$, $p = .080$, $\eta_p^2 = .04$, or organized sport $\lambda = .962$, $F(3, 200) = 13.985$, $p = .051$, $\eta_p^2 = .04$.

Table 5

Mean Diversity Participation Scores and Pairwise Comparisons for Recreation Category by Grade

Variable (max. score)	Grade 2 Mean	Grade 2 SD	Grade 3 Mean	Grade 3 SD	Grade 4 Mean	Grade 4 SD	Grade 5 Mean	Grade 5 SD
Hobbies, crafts, & games (5) [a, b, c]	2.8	1.4	3.6	1.1	3.6	1.0	3.6	1.1
Social activities (6) [a, b, c, e]	3.3	1.4	3.8	1.4	4.0	1.4	4.2	1.3
Quiet recreation (4)	2.4	1.2	2.5	1.0	2.5	1.0	2.3	1.0
Organized sport (6)	1.9	1.2	2.1	1.2	2.2	1.3	2.2	1.1
Other skill-based activities (6) [e]	1.3	1.3	1.3	1.2	1.4	1.1	1.5	1.1
Clubs, groups, & organizations (3) [b, c, e]	0.5	0.7	0.7	0.7	0.8	0.8	0.9	0.8
Active physical recreation (11)	4.8	2.5	4.8	2.0	5.2	2.0	5.0	2.0
Entertainment & education (7) [b, c, e]	4.1	1.9	4.3	1.4	4.7	1.3	4.6	1.3
Jobs, chores, & employment (7) [b, c, d, e, f]	3.4	1.7	3.6	1.4	3.9	1.5	4.2	1.4
Total diversity score (55) [a, b, c, d, e]	24.4	10.3	26.6	7.1	28.2	7.1	28.5	6.8
Informal diversity score (40) [a, b, c, d, e]	20.7	8.5	22.5	5.8	23.8	5.6	23.9	5.5
Formal diversity score (15) [b, c, d, e]	3.7	2.4	4.1	2.2	4.3	2.3	4.6	2.1

Note. Significant differences denoted by [a] between grade 2 and 3, [b] between grade 2 and 4, [c] between grade 2 and 5, [d] between grade 3 and 4, [e] between grade 3 and 5, [f] between grade 4 and 5.

Formal and Informal Activities

Children participated in many more informal than formal activities in each grade (see Table 5). Repeated measures ANOVA showed a significant overall effect of grade level on the informal activities score (40 items), $\lambda = .852$ with $F(3, 200) = 11.564$, $p < .001$, $\eta_p^2 = .15$ and on

formal activities (15 items), λ =.904 with $F(3, 200) = 7.084$, $p < .001$, $\eta_p^2 = .10$. Results for the pairwise comparisons for informal and formal diversity are shown in Table 5.

With Whom and Where Children Participated

Table 6 displays descriptive statistics for total with whom and where scores. Repeated measures ANOVA showed a significant overall effect of grade level on with whom, $\lambda = .843$ with $F(3, 200) = 12.433$, $p < .001$, $\eta_p^2 = .16$. As can be seen in Table 6, the total with whom scores increased from grade 2 to grade 5, and were stable from grade 4 to grade 5. With whom the children participated also differed significantly across grades when informal ($\lambda = .845$, $F(3, 200) = 12.189$, $p < .001$, $\eta_p^2 = .16$) and formal ($\lambda = .912$, $F(3, 200) = 6.469$, $p < .001$, $\eta_p^2 = .09$) activities were examined separately. Results of the pairwise comparisons between informal and formal activities are shown in Table 6.

There was a significant main effect, with medium effect size, for where children participated across grades, $\lambda = .825$, $F(3, 200) = 14.158$, $p < .001$, $\eta_p^2 = .18$. As shown in Table 6, five of the six pairwise comparisons were significant. Where the children participated changed significantly across grades for informal activities, $\lambda = .796$, $F(3, 200) = 17.066$, $p < .001$, $\eta_p^2 = .20$, but not for formal activities ($\lambda = .962$, $F(3, 200) = 2.614$, $p = .052$, $\eta_p^2 = .04$). Results of pairwise comparisons for informal activities are shown in Table 6 and indicate an increase in where informal activities took place across the grades.

More specific examination of with whom the children engaged in activities (see Table 6) using Friedman tests revealed there were statistically significant differences across grades, specifically: the proportion of activities participated in Alone $\chi^2(3) = 47.1$, $p < 0.001$, with family $\chi^2(3) = 36.9$, $p < 0.001$, and with Friends $\chi^2(3) = 39.8$, $p < 0.001$. Table 6 shows that the proportion of activities participated in alone increased almost in parallel with decreases in family

activities. There was no significant change across the grades for participating with relatives $\chi^2(3) = 7.4$, $p = 0.061$ or for participating with others $\chi^2(3) = 6.7$, $p = 0.084$.

Table 6

Where and With Whom Children Participate in Recreational Activities as a Percentage (SD) of their Total Participation

	Grade 2		Grade 3		Grade 4		Grade 5	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
With whom								
Total (range 1 – 5) [a, b, c, e]	2.28	0.77	2.47	0.37	2.55	0.36	2.60	0.38
Informal [a, b, c, d, e]	2.11	0.73	2.28	0.35	2.37	0.34	2.38	0.36
Formal [a, b, c]	3.20	1.40	3.53	1.04	3.52	1.04	3.70	0.83
Percentage								
Alone [a, b, c]	17.4	12.0	24.1	12.3	24.3	11.7	25.0	11.0
Family [b, c, d, e, f]	41.8	19.7	42.1	15.9	38.4	14.8	35.1	13.6
Relatives	3.4	5.9	4.9	7.2	3.6	5.2	3.5	4.7
Friends [b, c, d, e]	20.3	13.6	20.7	13.2	25.1	12.5	27.3	14.0
Others	7.2	6.8	8.3	7.2	8.5	7.2	8.9	7.1
Where								
Total (range 1 – 6) [a, b, c, d, e]	2.50	0.86	2.73	0.43	2.83	0.40	2.90	0.49
Informal [a, b, c, d, e]	2.28	0.80	2.49	0.44	2.61	0.43	2.67	0.52
Formal	3.78	1.51	4.09	0.96	4.06	0.91	4.08	0.78
Percentage								
At home [a, e]	42.9	17.0	49.4	10.8	47.1	9.8	45.2	11.7
Relatives' home	1.8	3.7	2.3	4.0	1.9	3.5	1.8	3.4
Neighborhood	10.1	8.8	9.7	7.5	9.9	7.7	10.3	7.8
School [c, e]	7.4	8.2	8.1	6.9	8.8	6.7	9.4	7.2
Community	23.0	12.4	25.4	10.0	26.6	9.9	26.0	10.5
Beyond community	4.8	6.7	5.1	5.9	5.7	8.0	6.9	8.7

Note. Significant differences denoted by [a] between grade 2 and 3, [b] between grade 2 and 4, [c] between grade 2 and 5, [d] between grade 3 and 4, [e] between grade 3 and 5, [f] between grade 4 and 5.

With respect to where the children participated, there was a significant increase in participation at school across the grades ($\chi^2(3) = 15.5$, $p = 0.001$) and a significant main effect for participating at home $\chi^2(3) = 16.8$, $p = 0.001$, although the pattern was not steady (see Table 6). Table 6 shows that school was the only where context that significantly increased, from 7.5% to 9.5% of the children's recreational activities. There were no overall changes in participation in the following contexts: relatives' homes $\chi^2(3) = 1.2$, $p = 0.749$, in the neighborhood $\chi^2(3) = 1.4$, $p = 0.705$, in the community $\chi^2(3) = 6.1$, $p = 0.106$, or beyond the community $\chi^2(3) = 6.1$, $p = 0.106$.

Interactions between engagement in specific activity categories and with whom and where the children participate are depicted in Figures 3 through 8. The data used to generate Figures 3-8 can be found in Appendix D. In addition, paired t-test results presented in Figures 9 and 10 illustrate that the scores for with whom and where children participated were significantly higher for formal activities compared to informal activities in each grade. Table 6 and the radar graphs show that at home (Figures 3a-3d) and community (Figures 7a-7d) are the two contexts where most recreational activities occurred.

Figure 3a-3d

Radar Graph of Engagement in Specific Activity Categories At Home from Grade 2-5

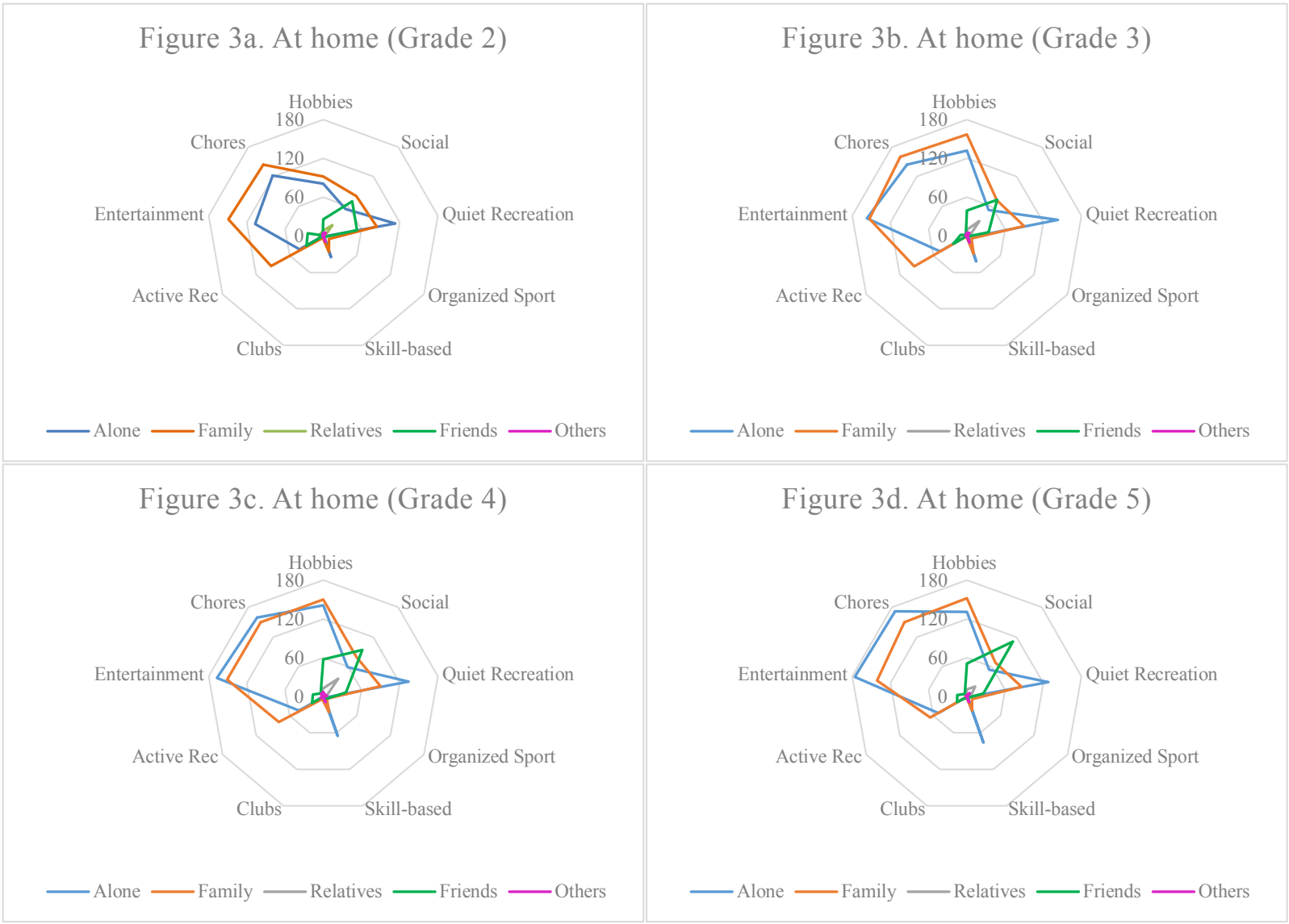


Figure 4a-4d

Radar Graph of Engagement in Specific Activity Categories at Relative's Home from Grade 2-5

Figure 5a-5d

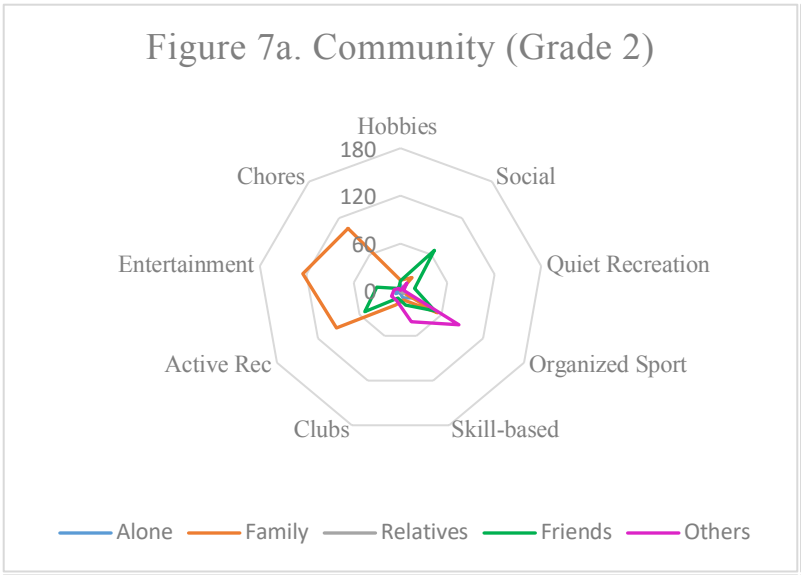
Radar Graph of Engagement in Specific Activity Categories in Neighborhood from Grade 2-5

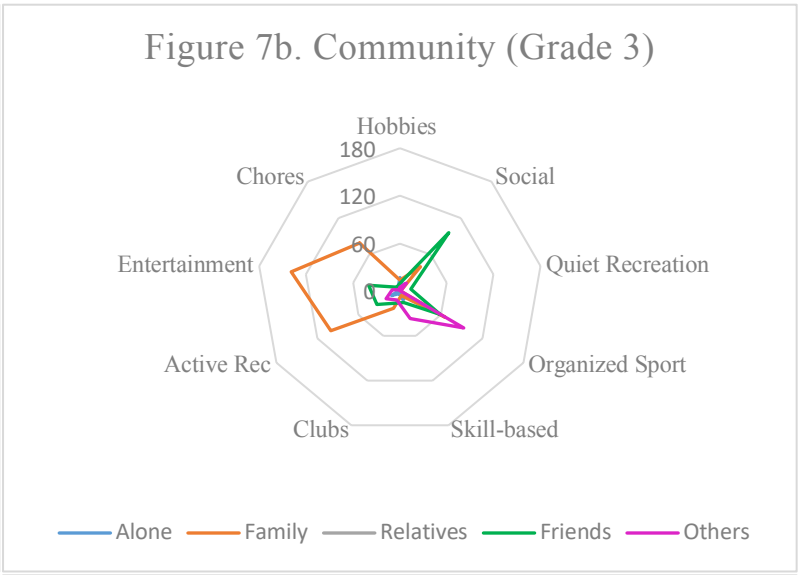
Figure 6a-6d

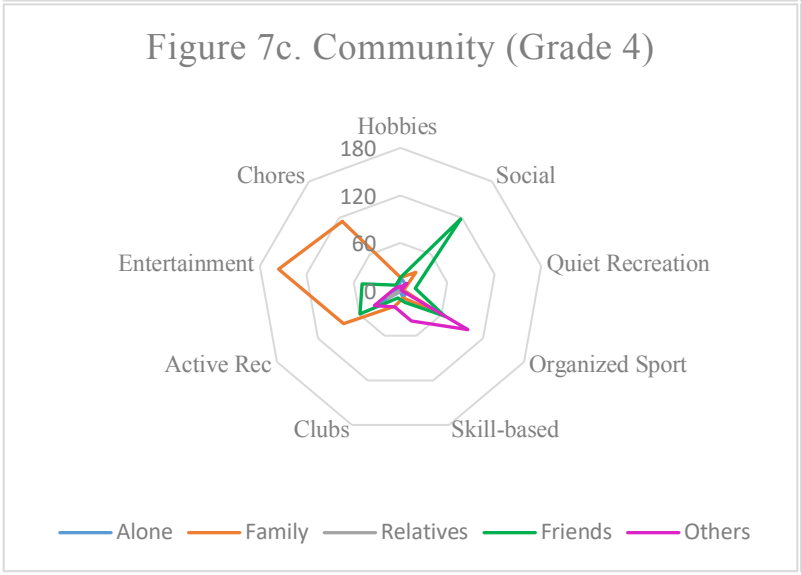
Radar Graph of Engagement in Specific Activity Categories At School from Grade 2-5

Figure 7a-7d

Radar Graph of Engagement in Specific Activity Categories in Community from Grade 2-5







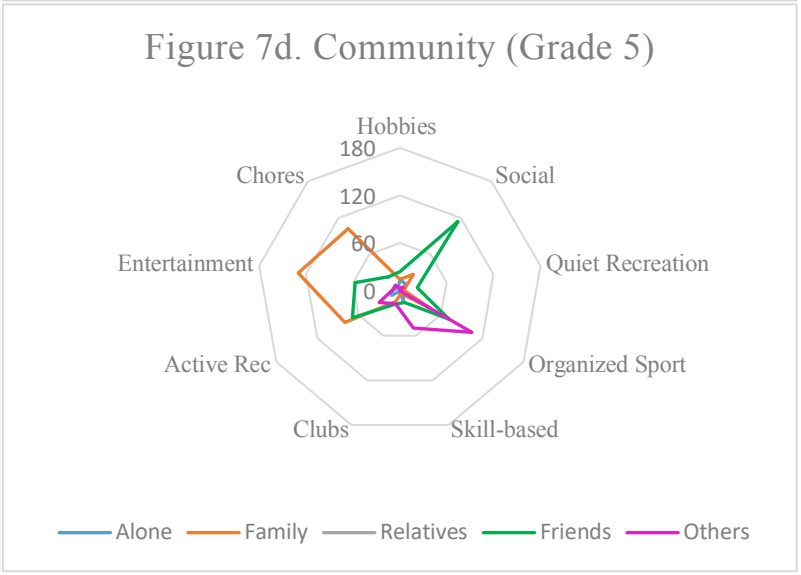
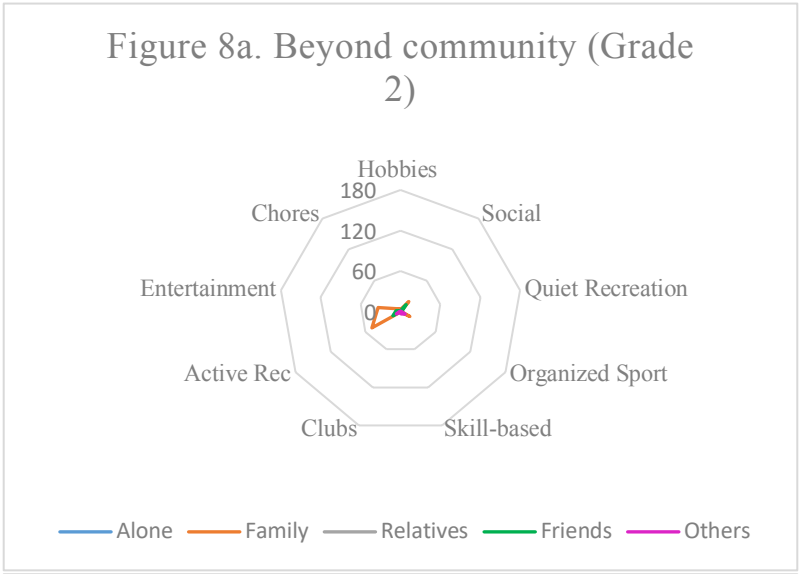
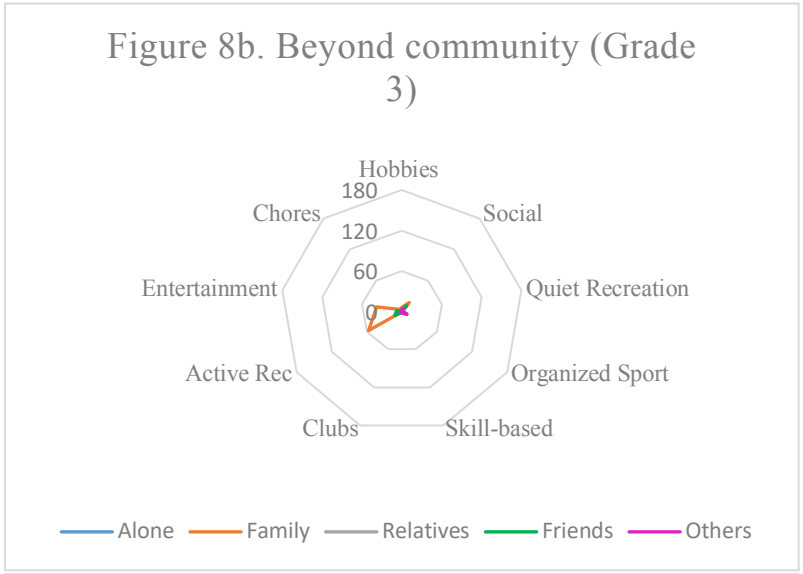
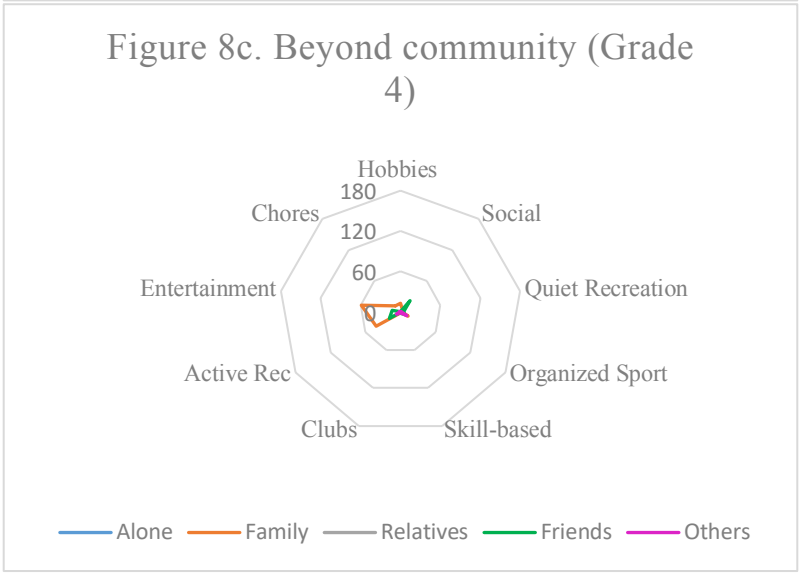


Figure 8a-8d

Radar Graph of Engagement in Specific Activity Categories Beyond Community from Grade 2-5







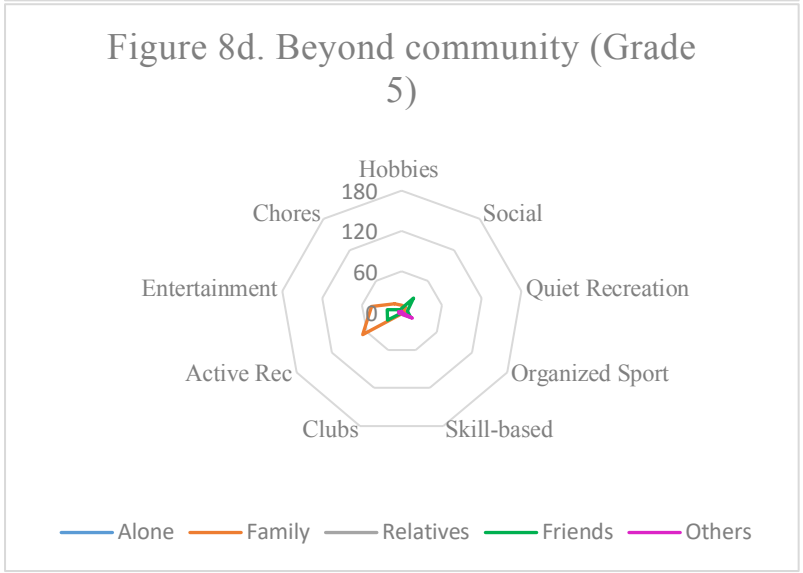


Figure 9

With Whom Children Participate in Formal and Informal Activities by Grade

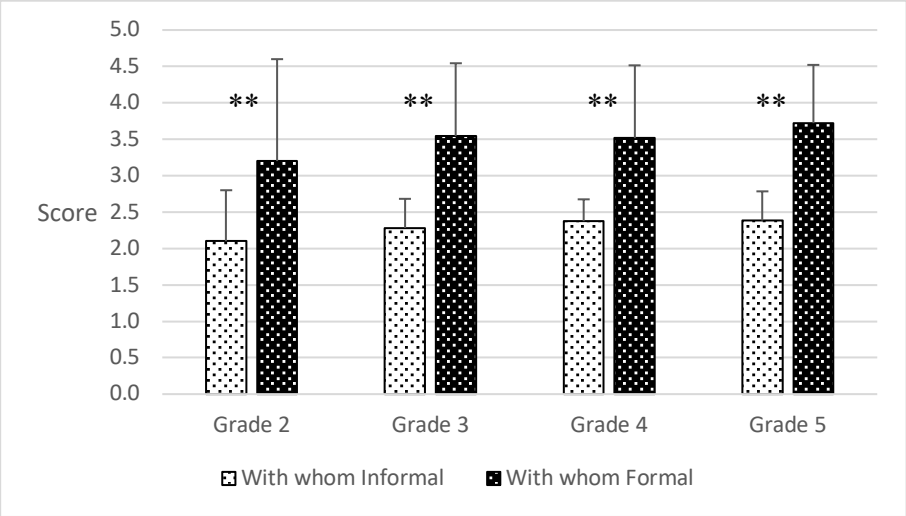
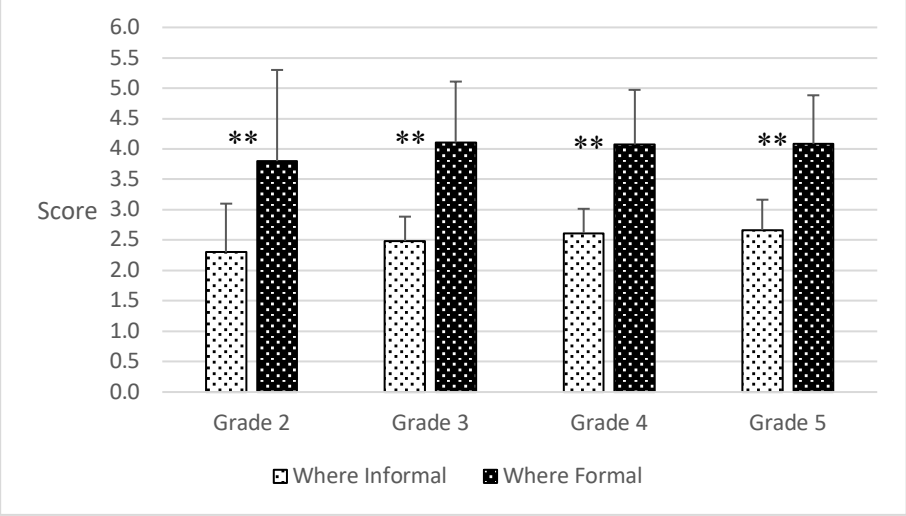


Figure 10

Where Children Participate in Formal and Informal Activities by Grade



Discussion

The aim of this study was to describe children's recreation-related social contexts. As expected, there were significant changes in with whom and where children participated from grade 2 to grade 5 that reflect expanding social contexts.

With Whom Children Participate

With whom children participated in recreation activities changed significantly, increasing from grade 2 to grade 4, then remaining stable into grade 5. Of particular interest, however, was the antithetical effect of increasing social connectedness and greater personal independence on these data. Although a broadening in social contexts was expected, the results showed that in some areas, the children completed a number of activities (e.g., chores) independently. As can be seen in the at home radar graphs, children did their chores, hobbies, entertainment, active recreation, and social activities primarily with their family in grade 2. However, by grade 5, more children did their chores and engaged in entertaining activities by themselves. This was particularly notable for homework, reading, and listening to music. The increase in solo participation in activities such as doing chores, reading, and homework, supports an expected trend towards independence during middle childhood (Larson & Verma, 1999). Although there was no measure of independence used in this study (i.e. there is no measure of whether the child was completing their homework alone because they were able to do so independently or because there was no one available to assist them), these findings suggest a move toward independence is occurring in these activities. This is likely a reflection of children's increasing competence. When children begin to demonstrate their ability to manage daily tasks and responsibilities, effective parents begin to engage in the process of co-regulation whereby they allow children to

"take charge of moment-to-moment decision making" while still maintaining general supervision such as a phone call check-in or reviewing homework once completed (Berk, 2013, p. 577). It is reasonable to assume, for example, that in the earlier years of middle childhood (e.g., grade 2) children in this study were taught how to make their bed, pick up their toys, and clear the table with assistance from their parents, and in later years completed these chores independently with general oversight from their parents.

When interpreting longitudinal patterns of with whom children participate, it is important to acknowledge and consider a limitation of the CAPE. One important consideration when interpreting with whom children participate, is the effect of an increase in alone scores (i.e. 1) on the total with whom score. It is possible that an increase in these 1s may be supressing an actual increase in total with whom scores, and more 1s may be balancing the effect of more distal scores (e.g., friends = 4), resulting in total scores that are not wholly representative of distal social networks. Although a score of 1 is low on the CAPE, it may be representative of increasing independence toward certain tasks such as completing homework and reading alone, which is a natural and healthy part of development. In a case such as this, with whom family scores of '2' are replaced by alone scores of '1.'

While activities alone were increasing, and activities with family were decreasing, there were significant increases in activities with friends over time. As seen in Table 4, activities such as talking on the phone, swimming, and non-team sports were initially partaken with family, yet by grade 5, had moved toward primary participation with friends. This transition from family to friends can be partly explained through the 'parent-to-peer pathway' which is to say that interactions with parents are viewed as preparation for interactions and relationships with peers (Reich & Vandell, 2011). This parent-to-peer pathway was particularly evident in the radar

graphs in regard to active physical recreation activities that took place in the neighborhood. Although children continued to participate in roughly the same volume of active physical recreation with family, it is clear that interactions with friends were increasing to a point where they were almost equivalent to those with family. This may be the result of parents becoming increasingly comfortable and trusting of children interacting with their friends, having prepared them for these interactions in younger years. Even so, when examining total participation, children still reported participating most often with family (35%) as compared with friends (27%) and alone (25%) in grade 5. What we are likely seeing here, however, is the increasing social interactions with peers and friends during middle childhood that marks the beginning of the transition where friends supersede family as the primary social interaction, which is expected to take place in adolescence (Berk, 2013; Eccles, 1999).

Children in this study reported relatively limited interaction with relatives across the grades, suggesting limited time is spent in recreation activities with extended family such as cousins, aunts, uncles, and grandparents. It is important to note that a limitation of the CAPE is that it measures the most distal response from a child. For example, if a child indicates they do puzzles alone, with relatives, and with friends, only the higher value score for friends is recorded. When interpreting the CAPE results, it should be considered that children may participate in activities with more than one group of individuals. Even so, the results clearly indicate that participation with relatives was not common nor was it a pivotal gateway to more distal social groups. Beyond this limitation, this minimal interaction with relatives could be partly explained by family structure. In Victoria, for example, family structure has evolved over the past 15 years, with a trend toward shrinking family sizes. The average family in Victoria consists of 2.5 individuals which is smaller, on average, than the family size of the Capital

Regional District of which Victoria is a part (Statistics Canada, 2016). Victorians also have a higher percentage of single parent families (25%) compared to the rest of the province (22%) (Statistics Canada, 2016). Of those single-parent families, 72% of single parents are mothers (Statistics Canada, 2016). It is possible that, for children who have minimal immediate family in the home, there may be less interaction with relatives as a child from a single-parent family may only engage with either relatives from maternal or paternal sides as opposed to both; however, this is speculation. Although not measured in this study, culture should also be considered when interpreting participation with relatives (Berk, 2013). Some cultures, particularly nonindustrial populations, place more emphasis on intergenerational interaction within the family; however, this is less prevalent in North American culture (Larson & Verma, 1999). In Victoria, approximately six percent of children live in multigenerational households (Statistics Canada, 2016). Future research on children's recreational patterns should include a measure of family structure and note all of the individuals with whom the child engages.

Participation with others was relatively low, with less than 10% of children's total participation being with people beyond their circle of friends and family. However, scrutiny of formal and informal domains revealed that children participated in more than half of their formal activities with others. Contrastingly, with the exception of water sports in grade 4, children did not participate in any informal activities with others. Formal activities (e.g., team sports) are partly characterized by participation with other adults and peers (King et al., 2004), meaning children in this study who participate in formal activities are engaging with others. Of the activities that children participated in with others, team sports had the highest prevalence of participation, with ~60% of children doing team sports in grade 5. Although I did not measure developmental outcomes of social interactions, some of the anticipated outcomes of participating

with others include additional sources of feedback that can assist in the development of perceived competence (e.g., evaluative and peer comparison) (Berk, 2013), skill instruction, emotional intelligence (Burdette & Whitaker, 2005), and teamwork (Watchman & Spencer-Cavaliere, 2017). As seen in Table 6, with whom children participated in formal activities plateaued in grade 3. As social interaction with others provides developmental affordances for children (Reich & Vandell, 2011), it is recommended that children participate in a variety of both formal and informal activities in order to increase diversity of social relationships. Disparities in children's access to formal activities such as sports, suggests that schools can play an important role. School policies supporting sport, after-school programs, and shared-use agreements with organizations, can provide access for children to formal recreation, which in turn will expose them to a range of other people in a familiar context and opportunities to develop more diverse social relationships (Committee on Physical Activity and Physical Education in the School Environment, 2013).

Where Children Participate

The patterns of where children participated in recreation activities is more nuanced than with whom children participated. As depicted in Table 6, there were significant changes in where children participated in recreational activities across grades; however, these changes were only significant for informal activities.

Children in this study consistently spent a considerable portion of their free time at home (~45% in each grade). Participation in certain activity categories (e.g., hobbies, quiet recreation, chores) was almost exclusively at home. For instance, the prevalence of participation at home in activities such as homework, chores, and talking on the phone increased substantially from grade 2 to grade 5, climbing almost 50% in the case of talking on the phone.

Similar to low participation with relatives, very little participation occurred in relatives' homes. Again, it is important to remember that the CAPE only measures the most distal items meaning that, if, for example, a relative lived out of town and a child visited their home, the recorded score would be for beyond the community. That being said, the modal scores and anecdotal conversations with children during data collection suggest that participation at a relative's home was rare.

Participation in neighborhood activities was minimal, with riding bikes being the only exception. While it must be considered that the CAPE only measures the most distal environment, this finding is consistent with the downward trend in participation in local neighborhoods in recent decades (Rupprecht et al., 2016; Skår & Krogh, 2009). Parents and grandparents have reflected that activities that once took place locally now take place more remotely (Rupprecht et al., 2016; Skår & Krogh, 2009). These changes have been attributed to increasingly busy family schedules necessitating the need for after-school programs (Skår & Krogh, 2009) and increased parental restriction due to safety concerns (Chaudhury et al., 2019; Holt et al., 2016; Schoeppe et al., 2016).

The results show that only within the school context did participation in recreational activities significantly increase. This finding supports previous evidence that during middle childhood, especially around grade 2 and 3, children begin to participate in more activities that take place outside the home (Loebach & Gilliland, 2016). The school environment plays a particularly important role for participants in this study in regard to active recreation and social activities. Two activities in particular, playing games (e.g., informal soccer) and hanging out, were done primarily at home in earlier grades and at school in later grades. While these are only two of the 55 possible activities, it should be noted that, by grade 5, approximately 84% of

children were both playing games and hanging out at school. Engaging in these types of informal activities (e.g., playing games) in any environment can provide positive developmental outcomes such as emotional intelligence and conflict resolution (Burdette & Whitaker, 2005). Participating in these activities in an environment outside the home, however, also allows for children to develop confidence and independence as they explore and experience these activities in new environments (Bartlett et al., 1999; Gill, 2007).

There was no significant change in participation in the community across the grades. However, children spent approximately 25% of their free time in each grade in community recreational activities. Predominantly, these community activities were formal activities. According to Eccles (1999), entry into school (which typically happens at 5 years old in Canada) coincides with participation in other formal activities that take place outside the home. Although this study begins with children in grade 2 (~7 years of age at entry), there was evidence of participation of this type occurring in this sample. Results indicate that the majority of formal activities were already taking place outside of the home by grade 2. For example, most organized sports were undertaken in the community or beyond, except for track and field, which occurred at school. One context where participation in formal activity in the community appears to be particularly salient is swimming, with over 75% of children participating. Swimming as a formal activity (e.g., swimming lessons) may be more prevalent in Victoria relative to other communities, as it is an island location and, as such, it is reasonable to assume parents' desire for their children to be water-safe with such close proximity to the ocean. Regardless of the reason for taking formal lessons, swimming is consistently providing an opportunity for the majority of children in this study to participate in a community setting, where they experience a new environment.

Two CAPE activities in this study that have consistent participation beyond the community in each grade are in the active physical recreation category; snow sports (e.g., snowboarding) and fishing. When interpreting patterns of where participation occurs, it is important to take the data collection location into consideration. For example, as this study took place in Victoria BC, it is necessary to travel beyond the community to participate in snow sports due to the temperate climate and generally flat topography of Victoria. However, a child who lives in Whistler BC, may indicate they participate in snow sports in their neighborhood or community. Children who lived in more urban or rural environments have demonstrated different patterns of participation based on proximity to activities, with children who lived in rural environments participating in activities farther away from their home than children who live in urban environments (Brown et al., 2011). This is thought to be due to the reduced availability of venues and activities in rural areas resulting in children needing to travel outside their community in order to participate. It is important to contextualize children's activity participation within the location they live. Even within the study school district where children in this study reside, there was variation within built environments (e.g., some areas include more green space, some areas have high volumes of traffic, some areas have bike lanes) which may have affected a child's ability to participate in activity in their neighborhood (Kaczynski & Rehman, 2013). Similarly, children who live in multi-unit dwellings (e.g., apartment buildings), may not have the same access to at-home activities as a child in a single-family dwelling with a backyard, which can impact where children participate.

Participation Webs: How Participation, With Whom, and Where Were interacting

The majority of participation occurred in two contexts: at home and in the community. Not only were they the two contexts where a majority of activities occurred, but those contexts

appeared to dictate relationship affordances. At home, children did activities by themselves and with their family, and to some extent with friends. In the community, children participated with their family, friends, and others, but with whom they participated in the community was also a function of the activity type. For instance, children engaged in entertainment (e.g., going to the movies or full-day outings) in the community, largely with their parents, whereas children who engaged in organized sports (e.g., team sports and martial arts) in the community did so with others. Interaction with others, particularly in the context of organized sport, could provide valuable benefits for children. "In the sport context, children have specific experiences: they are given a role within the team or group; they must communicate with other members of the social groups; they learn similar skills/tasks; and they work toward common goals" (Findlay & Coplan, 2008, p. 159). As discussed by Findlay and Coplan (2008), these benefits may be particularly relevant for shy children as this sport context can provide a sense of belonging and a common ground upon which children can have conversations outside of the sport context. Similar benefits of participating in organized sport with others, such as teamwork, friendship, and communication, have been cited by parents as key reasons for registering their children in organized sport (Watchman & Spencer-Cavaliere, 2017).

The interactions between the contexts, activity categories, and with whom the children interacted were particularly evident at school for social and active physical recreation participation, which was mostly done with friends. Interacting with friends is a healthy part of child development, and in middle childhood helps children develop social skills, provides grounds for peer comparison, and expands social-cognitive knowledge (Berk, 2013; Eccles, 1999). When school begins, there is a concurrent exposure to both the physical school environment and the accompanying social interactions (Berk, 2013; Eccles, 1999). It is hard not

to reflect on how current COVID-19 guidelines for physical distancing on school (Greater Victoria School District, 2020) and neighborhood playgrounds (BC Centre for Disease Control, 2020) may be affecting both children's social and active recreation engagement. Although most playgrounds are now open, guidelines such as "If the playground is busy, come back when there are fewer people" (BC Centre for Disease Control, 2020) suggest that children's current experiences are not what was seen in this study. If these circumstances persist, it will be interesting to follow-up on how interactions between children's where, with whom, and recreational activities are affected.

Formal activities have children participating in more distal social networks both in terms of with whom and where beginning in grade 2 and continuing into grade 5. Participation in formal activities is a complex issue and can be partially explained through examining the layers of the Bioecological Model of Human Development (Bronfenbrenner & Morris, 2006). As previously mentioned, the microsystem, the innermost layer of the bioecological model, consists of those who consistently interact with the developing child in face-to-face contexts (e.g., parents, teachers, close friends) and the immediate environments in which these interactions occur (Bronfenbrenner & Morris, 2006). To best examine participation in formal activities, however, we must examine the mesosystem, defined as the interaction between two or more 'players' within the microsystem (Bronfenbrenner & Morris, 2006). As described by Bronfenbrenner and Morris (2006), "…development is a function of forces emanating from multiple settings and from the relations among these settings" (p. 817). These interactions can be illustrated through participation in organized sports. In order for a child to participate in organized sports with others in the community, many things need to fall into place beforehand. For example, a child needs to have: someone (parents, teachers, coaches) to teach them the skills;

the means to register (financial and emotional support from parents); peers (friends or others) to participate with and to influence motivation and enjoyment; and an environment where they can participate (e.g., recreation facilities, program offerings in the community). The need for these reciprocal interactions, however, may create barriers to participation. Although I did not examine the broader social determinants of activities, it could be predicted that a child's family circumstance may influence their participation in recreation. As mentioned, approximately 25% of families in Victoria are single-parent families, with women accounting for 72% of those single-parents (Statistics Canada, 2016). Single-parent families present a complex issue in regard to participation. Often, a single-parent family sees children either spending more time alone or more time in formal programs, but those formal programs are more general after-school programs as opposed to programs that focus on development such as team sports or music lessons (Larson & Verma, 1999). Understanding the influence of parental involvement in children's participation should be considered in future research. Further exploration of the role that schools could play as a conduit to formal activities, particularly for those who lack access, is warranted. There was considerable growth in children's participation in formal school clubs in this study, from 26% in grade 2 to 44% in grade 5. However, the longitudinal nature of this study meant that it is possible that teachers and principals were recognizing this need and availability of school clubs was expanding, but it is also possible that school clubs were only available to older children.

Conclusions

This longitudinal study provides a description of recreation and leisure activity participation and social worlds in middle childhood. Overall, children significantly expanded

with whom and where they participated between grades 2 and 5. As might be expected developmentally, children engaged in more activities by themselves and with friends, and less with their family. These trends suggest that children were moving toward independence in activities such as doing homework, chores, and reading, and increasing their social interaction with friends. Surprisingly, there was not a significant change in where the children engaged in formal activities during middle childhood. Children who participated in the formal categories of organized sport and skill-based activities were already engaging in the community by grade 2. This participation with more distal social contexts (e.g., with other people in the community) provides children with opportunities to develop social and emotional skills as well as explore new environments. However, not all children in this study participated in formal activities on a regular basis. It is desirable to find approaches that afford all children opportunities to engage in experiences that expose them to different contexts and other people (e.g., dance instructors or Paralympic athletes), even if those experiences need to be brought to the children.

Chapter 5 – Study 3

Latent Profile Analysis of Children's Active Physical Recreation Patterns Across Middle Childhood

Preamble

Latent profile analysis of children's active physical recreation patterns in middle childhood is the third and final study of this dissertation. This chapter builds on chapters 3 and 4 by using latent profile analysis to generate clusters of children based on factors (motor skills, accuracy of perceptions, participation rates, with whom, and where) associated with active physical recreation. The findings from this chapter may be useful in identifying children who may be on a trajectory toward low participation in physical activities as well as tailoring individual or group programs based on these different clusters. I would like to acknowledge and thank Dr. Foley for conducting the latent profile analysis used in this study.

The manuscript based on this chapter will be prepared for submission to the *International Journal of Behavioral Nutrition and Physical Activity.*

Abstract

In order to maximize participation, it is important to understand factors that influence participation in physical activity so appropriate interventions can be implemented. A high volume of research focuses on individual, or person-centered, factors that influence participation, including motor skill proficiency and perceptions of physical competence. However, investigating participation in physical activity through a broader lens is being increasingly adopted. It is possible, and likely, that there are a number of unique combinations of behaviors and characteristics exhibited by children who participate in regular physical activity and those who do not. Understanding the unique clusters of children may help tailor active physical recreation and education programs for children who exhibit a unique combination of factors. The primary aim of this study was to identify clusters of children in grades 2, 3, 4, and 5 (n = 155; 55% girls) based on their motor skills, accuracy of perceived physical competence, active physical recreation participation, and with whom and where active physical recreation participation occurs. Latent profile analysis results revealed a range of clusters within each grade, with a 3-cluster solution in grade 2, a 5-cluster solution in grade 3, a 4-cluster solution in grade 4, and a 6-cluster solution in grade 5. Several distinct clusters of children were identified both within and between grades, including a cluster of children who seem to be heading toward a negative spiral of disengagement and a cluster on a spiral of engagement. It is also apparent that there is increasing diversity in clusters across the grades, indicating more variation in children's skill levels, accuracy of perceptions, participation, and with whom and where participation occurs through middle childhood. Identifying this diversity and the individual needs of each child, and then employing instructional styles to accommodate individual differences, are essential for maximizing participation.

Latent Profile Analysis of Children's Active Physical Recreation Patterns in Middle Childhood

Background

Physical activity participation is important to the overall health and well-being of a child (Biddle et al., 2019; Saunders et al., 2018; Watchman & Spencer-Cavaliere, 2017). In order to maximize participation, it is important to understand factors that influence participation in physical activity so appropriate interventions can be implemented (Sallis et al., 2000). A high volume of research focuses on individual, or person-centered, factors that influence participation, including motor skill proficiency and perceptions of physical competence (Bauman et al., 2012); however, investigating participation in physical activity through a more holistic lens is being increasingly adopted (Högman et al., 2020; Pate & Dowda, 2019). This can be done by examining individual and contextual factors concurrently, such as whether children with different levels of motor skill proficiency are participating in different social contexts (Högman et al., 2020; Pate & Dowda, 2019). Additionally, examining participation longitudinally and using time-related factors, such as how often a child is participating in activities, are important pieces of the puzzle (Högman et al., 2020).

Applying an ecological model to an examination of physical activity participation can provide a multilevel picture of why some children participate and others may not. Högman and colleagues (2020) suggest that in an effort to create possibilities for physical activity participation in different settings, "there is a need to consider how influences interact reciprocally with other factors at different levels" (p. 396). Building on the original ecological systems theory (Bronfenbrenner, 1994), Bronfenbrenner and Morris (2006) developed a bioecological theory of human development that will serve as a framework for this study.

Bronfenbrenner and Morris' (2006) bioecological model has four components that interact to influence development of a number of behaviors: proximal processes, person, context, and time. These components thus comprise the PPCT model, and the proximal processes are "the primary engines of development" (Bronfenbrenner & Morris, 2006). Proximal processes are centered around the interactions between the individual, their contexts, and time (Bronfenbrenner & Morris, 2006). This study focused on the interaction between these components as they relate to participation in active physical recreation. All of these components interact with one another to formulate an individual's proximal processes that influence development and behaviors.

'Person' refers to individual characteristics such as sex, age, skills, experience, and psychological constructs such as motivation and attitude (Bronfenbrenner & Morris, 2006; Högman et al., 2020). As indicated in motor development literature, individual characteristics influence participation in physical activity (Robinson et al., 2015; Stodden et al., 2008). Review evidence strongly supports a positive relationship between motor proficiency and physical activity participation in middle childhood, with the majority of findings based on cross-sectional research (Lubans et al., 2010; Robinson et al., 2015). Holfelder and Schott (2014) reviewed 23 studies and they reported that 12 studies showed a positive and significant relationship between fundamental motor skills and physical activity participation in childhood and adolescence, regardless of sex or skill level; however, they also noted that a cause and effect relationship was not yet established. Additionally, only one of the studies included in their review was conducted with children and the remainder reported on adolescence, indicating a need for additional research during childhood. One recurring recommendation in this review literature is the need for additional longitudinal examination of these relationships (Holfelder & Schott, 2014; Lubans et al., 2010; Robinson et al., 2015).

Psychological person-level factors such as perceived physical competence and self-esteem also contribute to participation in physical activity (Harter, 2012a; Robinson et al., 2015; Stodden et al., 2008). Perceived physical competence in childhood has been shown to be a predictor of physical activity participation in adolescence (Barnett et al., 2008). Systematic review and meta-analysis evidence indicate a significant association between perceived competence and physical activity participation, more specifically citing that children and adolescents who demonstrate positive self-constructs are more likely to engage in physical activity relative to their peers who have negative self-constructs (Babic et al., 2014). It should be noted that, similar to the reviews conducted on motor skill proficiency and physical activity, the majority of evidence in Babic and colleagues' (2014) review comes from research conducted with adolescents.

'Context,' as conceptualized in the bioecological model (Bronfenbrenner & Morris, 2006), includes the ecological environment in which a child regularly interacts, interpersonal relationships, enjoyment of activities, and the nature of activities in which a child participates (e.g., formal versus informal) (Högman et al., 2020). A child's participation in physical activity can be influenced by a number of contextual factors including parental behavior, school physical education programs, afterschool and camp programs, built environments, and access to physical activity resources (Pate & Dowda, 2019). Children who regularly participate in physical activity tend to have strong parental influence, friends who also participate and believe active physical recreation is fun, attend schools that encourage active physical recreation, and participate in school and community-based active physical recreation programs (Pate & Dowda, 2019). In contrast, social relationships, such as peer interactions at school, can also decrease participation

in physical activity if a child feels they may be ridiculed or judged while participating (Wiltshire et al., 2017).

The final component of the PPCT model is 'time,' which can be thought of as chronological time as well as time spent interacting (Bronfenbrenner & Morris, 2006). It is recommended that children between the ages of 5-17 years of age engage in a minimum of 60-minutes of moderate-to-vigorous physical activity per day in order to achieve associated benefits (Tremblay et al., 2016). For many Canadian children, however, this is not the case, with only 35% of 5- to 17-year-olds meeting the recommended guideline (Colley et al., 2017). This is concerning as physical activity levels in childhood are indicative of physical activity in adulthood (Barnett, van Beurden, Morgan, Brooks, Zask, et al., 2009). As children move through middle childhood, participation in physical activity begins to compete with other activities such as household chores and school-related tasks (e.g., homework) (Hofferth & Sandberg, 2001).

It is possible, and likely, that there are a number of unique combinations of behaviors and characteristics exhibited by children who participate in regular physical activity and those who do not (De Meester, Maes, et al., 2016). It is therefore important to use statistical techniques that allow for unique groupings, or clusters, of behavioral patterns and characteristics in order to provide a comprehensive picture of the combination of person, context, and time components exhibited by different children. Understanding the unique clusters of children may help tailor active physical recreation and education programs for children who exhibit a unique combination of factors. For this reason, this study employed latent profile analysis to identify clusters of children from observed data (Oberski, 2016; Stata, 2017). Latent profile analysis is a person-centered statistical technique that uses a multidimensional perspective to empirically identify clusters, based on responses to multiple items of interest (e.g., active physical recreation, motor

competence, perceived competence) (Beets & Foley, 2010; Stata, 2017). This group identification will help to increase the effectiveness of health behavior interventions by informing the tailoring of individually-adapted interventions aimed at increasing physical activity participation (Kahn et al., 2002).

Aim and Research Questions

The aim of this study was to examine person, context, and time characteristics of children across grades 2, 3, 4, and 5 in regard to active physical recreation. In order to accomplish this aim, the following research question was addressed: What are the clusters of children in grades 2, 3, 4 and 5, based on levels of motor skills, accuracy of perceived physical competence, active physical recreation participation, and with whom and where participation occurs?

Method

A sequential design was used to examine clusters of children in grades 2, 3, 4, and 5. Approval for this study was granted by the University of Victoria Human Research Ethics Board (protocol number 10-246) and School District #61 in Victoria, British Columbia, Canada. Data were collected as part of a larger Motor Development Study that took place from 2010-2017.

Participants

All grade 2 students attending one of eight participating schools during the 2012-13 (cohort 1) and 2013-14 (cohort 2) school years were provided with an invitation to participate. Parents provided written consent and children provided written assent at the beginning of each data collection year. Children who consented annually were tracked in grades 2, 3, 4, and 5.

Children were eligible to participate in this study if they had complete data for motor skills, perceptions of physical competence, and active physical recreation for grades 2, 3, 4, and

5. Participants were n = 155 boys and girls (55% female; Mean age = 7.8 years). It should be noted that participants in this study are the same longitudinal sample as Chapter 3.

Measures

As per the measures section in Chapter 3, fundamental motor skills (FMS) were assessed using the TGMD-2 (Ulrich, 2000) and perceptions of physical competence using the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (Harter & Pike, 1984) for grade 2 participants and the Self-Perception Profile for Children (Harter, 2012b) for participants in grades 3, 4, and 5. Motor skills and perceptions of physical competence scores from these assessments were subsequently used to generate accuracy z-scores as per Chapter 3. Active physical recreation was measured using the Children's Assessment of Participation and Enjoyment (CAPE) (King et al., 2004).

Procedures

Data collection procedures for this study are consistent with chapters 3 and 4. All data were collected by research assistants trained in proper administration procedures as per the protocols outlined in administration manuals (Harter, 2012b; Harter & Pike, 1984; King et al., 2004; Ulrich, 2000).

Data Treatment and Analysis

Latent profile analysis, a statistical method used in Structural Equation Modeling (SEM), was used to generate clusters of children in grades 2, 3, 4, and 5 based on participants' motor skills, accuracy of perceived physical competence, active physical recreation participation, and with whom and where participation occurs. Latent profile analysis is used to test relationships between observed and unobserved (latent) variables, and identify unobserved subgroups from

those variables (Civelik, 2018). Although there is no formal consensus on the sample size required to effectively use latent profile analysis (Weston & Gore, 2006), a minimum sample size of N = 150-200 is recommended (Civelik, 2018). Latent profile analysis models the probability that an individual, based on their responses to input variables, belongs to a particular cluster (Hipson, 2019). There are a number of terms used in regard to the output of latent profile analysis, including 'clusters,' 'classes,' 'profiles,' and 'groups.' These terms are often used interchangeably in SEM literature (Hipson, 2019). In this chapter, I will use the term 'cluster' to refer to the groupings of children identified through latent profile analysis.

As per Chapter 3, active physical recreation values were calculated using the 17 organized sport and active physical recreation activities in the CAPE, and accuracy *z*-scores were generated using motor skills and perceived physical competence raw scores. In Stodden and colleagues' (2008) original model, spirals of engagement and disengagement are associated with high and low skill and perceptions of competence levels, respectively. However, as demonstrated in Chapter 3, it is not solely the levels of perceptions of competence, but also accuracy of those perceptions that is connected to participation; therefore, accuracy, rather than perceptions of competence, was used in this study.

Total (object control and locomotor skills) raw motor skill scores were used in the latent profile analysis. Additionally, percentage of maximum possible (POMP) scores were calculated for TGMD-2 scores to help in the interpretation of the clusters. The following formula for POMP was applied: [(observed score – minimum possible)/(maximum possible – minimum possible) x 100] (Cohen et al., 1999). *Z*-scores, rather than raw scores, were used to create figures, as *z*-scores allow for better visual comparison when examining clusters. A *z*-score is a value of an observed variable (e.g., motor skills) that is expressed in a standard deviation unit with a mean of

zero and a standard deviation of one (Field, 2013). Converting raw scores into *z*-scores allows for direct comparison between variables of different clusters. Accuracy was already represented as a z-score; however, motor skills, active physical recreation, with whom, and where were converted to *z*-scores to facilitate these visual comparisons.

A series of nine models were run per grade (2-class to 10-class in each grade) using the input variables listed above (e.g., active physical recreation, accuracy, etc.), with the understanding that additional models may have been required; however, 9 models were sufficient in each grade. Although latent profile analysis allows for modeling with covariates, when using sex as a covariate, the model consistently collapsed after four iterations as sex was represented as a binary variable. This precluded a final best fit model with sex as a covariate. Sex was removed from the cluster analysis and, instead, the proportion of boys and girls in each cluster was reported descriptively. Schwarz's Bayesian information criteria (BIC) and Akaike's information criteria (AIC) were selected as best fit indices to look for parsimony within the data (Stata, 2017). After running the models, three researchers (SF, JF, and VT) compared the fit data using BIC and AIC values to determine the most appropriate model (e.g., number of clusters) for each grade. Additionally, scree plots using AIC and BIC values were generated for each grade in Microsoft Excel (version 16) to identify the point of inflexion for each value set, which is the suggested point of cut-off (Field, 2013). In keeping with latent profile analysis interpretation, the BIC values were used as a primary fit and AIC was used as a supplementary value to further support the selection of the best fit model (Stata, 2017). The model with the smallest value of both BIC and AIC were considered to be the best fit. Profiling, the process of generating a description of the clusters with reference to the input variables, was then completed for each cluster.

Results

Descriptive statistics (mean and standard deviation) were calculated by grade for all participants for motor skills, accuracy, active physical recreation, with whom, and where, and are presented in Tables 7-10. The best fit models for each grade, including coefficient values (Coef.) and 95% confidence intervals (CI) of the latent profile analysis are also presented in Tables 7-10 and visual representations of standardized coefficient values are presented in Figures 11-14. In grade 2, fit data indicated a final 3-cluster solution (BIC = 2585.641; AIC = 2518.686). Grade 3 latent profile analysis results indicated a 5-cluster solution (BIC = 2623.623; AIC = 2520.147). In grade 4, the best fit was a 4-cluster solution (BIC = 2562.866; AIC = 2477.65). Lastly, in grade 5, BIC (2599.181) and AIC (2477.444) values revealed a 6-cluster solution to be the best fit. In each grade, all variables significantly contributed to the clusters (significance level set at $p < .05$).

Table 7

Grade 2 Descriptive Statistics and Latent Profile Analysis Coefficient and Confidence Interval Results

	All participants (n = 155)		Cluster 1 (n = 29, 62% girls)		Cluster 2 (n = 29, 41% girls)		Cluster 3 (n = 97, 57% girls)	
Variable	M	*SD*	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Motor skills	60.50	8.47	49.84	[46.83, 52.84]	70.59	[67.18, 73.99]	60.24	[57.93, 62.58]
Accuracy	-1.0E-3	1.23	1.62	[1.18, 2.07]	-1.11	[-1.56, -.67]	-0.12	[-.44, -.21]
APR	1.90	0.78	1.74	[1.41, 2.06]	2.24	[1.89, 2.59]	1.83	[1.64, 2.01]
With whom	2.94	0.54	2.94	[2.70, 3.18]	3.01	[2.82, 3.29]	2.90	[2.77, 3.03]
Where	3.80	0.72	3.72	[3.42, 4.03]	4.01	[3.73, 4.29]	3.76	[3.59, 3.93]

Table 8

Grade 3 Descriptive Statistics and Latent Profile Analysis Coefficient and Confidence Interval Results

	All participants (n = 155)		Cluster 1 (n = 62, 63% girls)		Cluster 2 (n = 51, 41% girls)		Cluster 3 (n = 2, 50% girls)		Cluster 4 (n = 7, 71% girls)		Cluster 5 (n = 33, 58% girls)	
Variable	M	*SD*	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Motor skills	64.46	9.33	59.31	[57.05, 61.56]	71.84	[68.54, 75.14]	38.20	[28.43, 47.97]	69.34	[63.80, 74.89]	63.27	[59.98, 66.56]
Accuracy	-5.0E-4	1.22	0.73	[0.47, 1.00]	-0.87	[-1.21, -0.53]	4.13	[2.96, 5.31]	-1.68	[-2.35, -1.02]	0.10	[-0.41, 0.62]
APR	1.85	0.74	1.97	[1.78, 2.16]	2.03	[1.78, 2.29]	1.00	[0.04, 1.96]	1.55	[1.05, 2.06]	1.47	[1.15, 1.79]
With whom	3.03	0.62	2.87	[2.71, 3.03]	2.94	[2.74, 3.14]	3.57	[2.90, 4.24]	2.16	[1.78, 2.53]	3.66	[3.39, 3.94]
Where	3.85	0.69	3.55	[3.38, 3.73]	4.03	[3.86, 4.21]	4.45	[3.76, 5.14]	2.46	[2.01, 2.91]	4.44	[4.20, 4.68]

Table 9

Grade 4 Descriptive Statistics and Latent Profile Analysis Coefficient and Confidence Interval Results

	All participants (*n* = 155)		Cluster 1 (*n* = 9, 78% girls)		Cluster 2 (*n* = 52, 37% girls)		Cluster 3 (*n* = 6, 33% girls)		Cluster 4 (*n* = 88, 65% girls)	
Variable	M	SD	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Motor skills	65.02	8.17	56.83	[52.74, 60.92]	71.91	[68.44, 75.39]	51.88	[46.82, 56.94]	62.45	[59.62, 65.28]
Accuracy	2.0E-4	1.08	0.40	[-0.17, 0.96]	-0.77	[-1.10, -0.45]	2.21	[0.64, 3.78]	0.29	[-0.14, 0.72]
APR	2.07	0.82	1.24	[0.69, 1.79]	2.04	[1.78, 2.31]	2.11	[1.24, 2.98]	2.19	[1.98, 2.41]
With whom	3.18	0.61	2.27	[1.76, 2.77]	3.32	[3.10, 3.54]	3.64	[3.17, 4.11]	3.16	[2.97, 3.35]
Where	3.94	0.64	2.64	[2.20, 3.07]	4.07	[3.89, 4.25]	4.23	[3.76, 4.79]	3.99	[3.83, 4.15]

Table 10

Grade 5 Descriptive Statistics and Latent Profile Analysis Coefficient and Confidence Interval Results

	All participants (*n* = 155)		Cluster 1 (*n* = 17, 82 % girls)		Cluster 2 (*n* = 49, 53% girls)		Cluster 3 (*n* = 4, 75% girls)		Cluster 4 (*n* = 33, 52% girls)		Cluster 5 (*n* = 23, 52% girls)		Cluster 6 (*n* = 29, 45% girls)	
Variable	M	SD	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Motor skills	67.01	8.35	54.83	[51.21, 58.45]	74.34	[72.33, 76.35]	64.22	[58.83, 69.60]	61.99	[59.54, 64.45]	67.12	[64.05, 70.19]	68.09	[64.86, 71.32]
Accuracy	-9.0E-5	1.21	1.34	[0.82, 1.87]	-0.79	[-1.10, -0.47]	-0.87	[-1.71, -0.03]	1.19	[0.83, 1.54]	-0.53	[-1.08, 0.01]	-0.29	[-0.7, 0.14]
APR	2.00	0.82	1.48	[1.15, 1.80]	2.48	[2.22, 2.73]	0.63	[-0.03, 1.29]	2.39	[2.11, 2.70]	1.41	[1.00, 1.82]	1.71	[1.41, 2.02]
With whom	3.23	0.60	2.85	[2.64, 3.05]	3.34	[3.17, 3.50]	2.09	[1.69, 2.49]	3.60	[3.45, 3.76]	3.74	[3.51, 3.97]	2.59	[2.38, 2.80]
Where	4.04	0.67	3.24	[2.98, 3.50]	4.07	[3.89, 4.24]	5.10	[4.50, 5.70]	4.25	[4.06, 4.45]	4.72	[4.44, 5.01]	3.50	[3.27, 3.73]

Figure 11

Grade 2 Cluster z-scores for Motor Skills, Accuracy, Active Physical Recreation (APR), With Whom, and Where

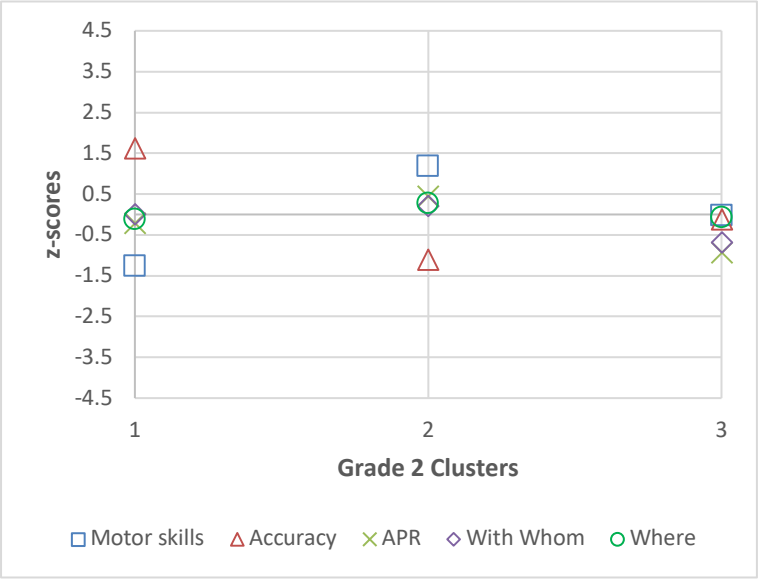


Figure 12

Grade 3 Cluster z-scores for Motor Skills, Accuracy, Active Physical Recreation (APR), With Whom, and Where

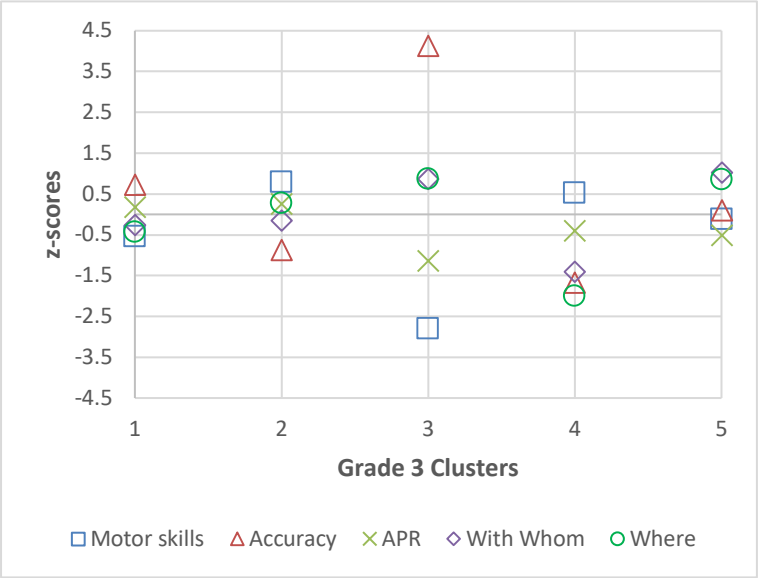


Figure 13

Grade 4 Cluster z-scores for Motor Skills, Accuracy, Active Physical Recreation (APR), With Whom, and Where

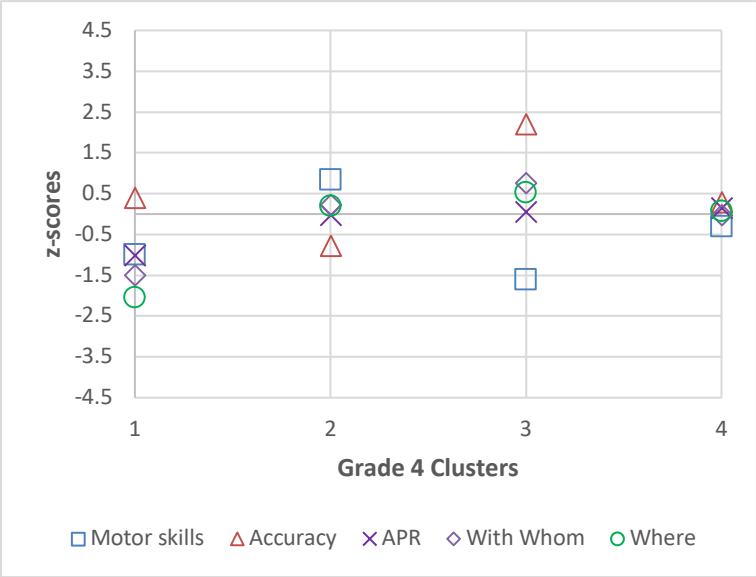
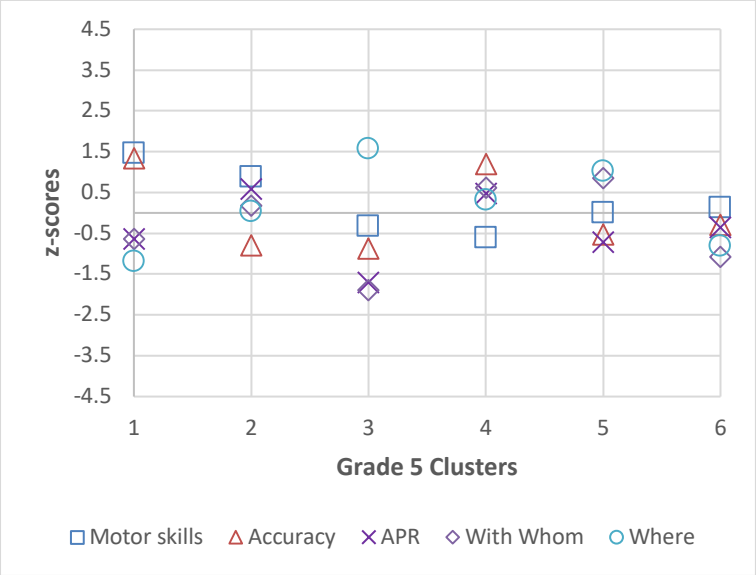


Figure 14

Grade 5 Cluster z-scores for Motor Skills, Accuracy, Active Physical Recreation (APR), With Whom, and Where



Discussion

The aim of this study was to identify variation in patterns of person, context, and time characteristics of children in grades 2, 3, 4, and 5 based on their motor skills, accuracy of perceived physical competence, active physical recreation, and with whom and where active physical recreation occurs. Examination of how these variables congregated highlighted the diversity of children's needs that must be considered when designing and delivering programs and learning experiences. Latent profile analysis results revealed a general trend of an increasing number of clusters in the higher grades; with a 3-cluster solution in grade 2, a 5-cluster solution in grade 3, a 4-cluster solution in grade 4, and a 6-cluster solution in grade 5. The variation in the number of clusters across grades is indicative of increased variation in children's abilities, self-appraisals, what children are doing, and with whom and where they are doing it.

In this discussion, I examine patterns of clusters both within and between grades. It is important to be mindful when comparing clusters that score interpretations (e.g., low, high, narrow, connected) are relative to other clusters and not to normative results or other findings, with the exception of using POMP scores to aid in the description. Additionally, although participants in this study are part of a longitudinal sample, cluster reclassification is occurring in each grade; therefore, it is possible children who were in one cluster (e.g., Cluster 1) in one grade could be in another cluster (e.g., Cluster 2) in a subsequent grade. The changing proportions within the clusters confirm the presence of this reclassification. As the aim of this study is centered around active physical recreation participation, the following cluster selections have been driven by the active physical recreation scores in each cluster.

The 'Clusters 1': Low, Low, Over, and Narrow

There were several distinct within- and across-grade consistencies in the cluster formations. In each grade, there was a cluster of children (named Cluster 1) who seemed to be on a path toward a spiral of disengagement (Stodden et al., 2008) from active physical recreation. Children in Cluster 1 in each grade had low motor skills, low participation rates, and inaccurate perceptions, with a tendency to overestimate their abilities. Additionally, these children participated in more narrow social contexts than children in the other clusters. In each grade, the proportion of girls in Cluster 1 was higher than that of boys, with girls comprising between 62-82% of the cluster. As Cluster 1 is partially characterized by low motor skill levels, the distribution of boys and girls in Cluster 1 may be partly explained by the low skill levels of girls in this sample. Descriptive statistics presented in Chapter 3, which used the same sample as the present study, indicate that girls have lower skill scores than do boys. Of primary concern for Cluster 1 children are the low motor competence and inaccurately high perception levels of these children, as these are important predictors of activity participation (Barnett et al., 2008; Barnett et al., 2015; Robinson et al., 2015).

Relatively narrow social networks are also a characteristic of Cluster 1, especially in grades 4 and 5. Coefficient values for Cluster 1 in grades 4 and 5 indicate that children in these clusters spend their active physical recreation time with their family and in narrow social environments. Regarding where, coefficient values in Cluster 1 in grades 4 and 5 correspond to at a relative's home, although, as revealed in Chapter 4, minimal active physical recreation took place in that context. Instead, these coefficient values are likely the mean representation between participation occurring at home and in your neighborhood. Regarding social involvement for those in the low cluster, establishing positive relationships with parents, coaches, teachers, and

peers can be a key motivational tool for physical activity participation (Stuntz & Weiss, 2010). Strategies for building positive relationships in active physical recreation contexts will be discussed later in this discussion.

The 'Clusters 2': High, High, Under, and Connected

There was also a consistent cluster of children, named Cluster 2, who appeared to be in a spiral of engagement (Stodden et al., 2008). Children in Cluster 2 had relatively high motor skill proficiency, high participation rates, and participated in more distal social contexts. But, similar to the low cluster, children in Cluster 2 also had inaccurate perceptions, with a tendency to underestimate their abilities. Although children in this cluster appeared to be in a cycle of engagement as evidenced by their relatively high active physical recreation scores, underestimators had lower participation rates and less skill development relative to their average and overestimating peers as seen in Chapter 3. Therefore, it would benefit these children to increase their perception levels to more accurately match their skill level. Strategies for development of accurate perceptions are discussed below. It should be noted that determining which cluster should be labelled as 'Cluster 2,' was challenging for grade 4. The differences between active physical recreation scores were negligible between two clusters in grade 4 (cluster 2 and cluster 4); therefore, I examined other differences and found motor skills emerged as a differentiating variable. As such, the cluster that had both high active physical recreation and the highest motor skills scores was selected as Cluster 2 in grade 4.

Clusters 3, 4, 5, and 6

The remaining clusters (3, 4, 5, and 6) had varied composition and less consistent patterns across the grades than clusters 1 and 2. From grade 2 to grade 5, the number of clusters

doubled. The three clusters in grade 2 were relatively tidy, with approximately one-quarter of participants in Cluster 1 (low, low, over, and narrow), one-quarter in Cluster 2 (high, high, under, and connected), and roughly half of the participants in the remaining cluster (Cluster 3). By grade 5, however, the six clusters, particularly clusters 3, 4, 5, and 6, revealed a more complex picture with different cluster combinations emerging from the data, and cluster membership that ranged from approximately 3% to 32%. The increase in the number of clusters is indicative of greater variation in children's responses to the continuous input variables (e.g., with whom, where, participation). Although speculative, a partial explanation for increased cluster numbers may include children having different opportunities for participation, competing interests in other activities (e.g., music), or priorities that inhibit participation in active physical recreation (e.g., responsibilities at home). The reason for increased cluster numbers was not measured in this study, however, the cluster numbers do reinforce that, particularly toward the end of the middle childhood, children are becoming more diverse in their active physical recreation participation patterns. As participation and skill development are cyclically related (Stodden et al., 2018), this suggestion is consistent with evidence that environmental affordances such as practice and experience lead to greater differentiation in motor ability with age (Hands et al., 2018). Future research should examine participation patterns in multiple CAPE activity categories (i.e. social activities, quiet recreation activities, self-improvement activities) to help identify if children are moving toward participation in other areas.

The proportion of children in each cluster also fluctuated across the grades. Encouragingly, the proportion of children who presented with relatively high motor skills, active physical recreation levels, and social contexts (Cluster 2), increased from 19% of participants in grade 2 to 32% in grade 5. This indicates that some participants are reclassified from clusters that

are considered more at risk for active physical recreation disengagement (e.g., Clusters 1) into the 'high' cluster as they move through the grades.

There were a number of small clusters (≤ 4%) of children. Cluster 3 in grade 3 is particularly unique. The two children in this cluster, one boy and one girl, had extremely poor motor skills, wildly overestimated their abilities, had low participation rates, and yet participated in distal environments with their family. As the children in this cluster had noticeably inaccurate perceptions which were represented by high *z*-scores, it was possible to trace the individual active physical recreation CAPE item responses for these two children. In particular, I found that these children participated in activities that required skills not assessed by the TGMD-2; for example, each of the children swam, rode bikes, and played on equipment (e.g., climbing) in distal environments. This cluster, as with the other small clusters, give pause for methodological considerations.

Firstly, the CAPE measures 17 active physical recreation items; however, it is not known if children were participating in physical activities not measured by the CAPE. Secondly, during childhood "skill specificity in task performance seems clearer with increasing age" (Hands et al., 2018, p. 222). Although the TGMD-2 was designed to measure general motor abilities (Ulrich, 2000), it does assess 12 specific locomotor and object control skills, which may not be sensitive to skills associated with some motor tasks, such as swimming and riding bikes. Although some clusters demonstrate very low levels of skill proficiency, and overall the sample has low levels, there may be some children who have a greater generalized motor proficiency than is measured here. In order to maximize participation, it is necessary for children to become proficient in fundamental motor skills as these 'building block' skills contain general movement patterns that can be transferred between contexts (e.g., overhand throw movement can be used in a tennis

serve or overhead badminton clear) (Clark & Metcalfe, 2002) and would allow more opportunities for engagement. Motor development and physical activity experts have put forth a recommendation for new terminology to include not only locomotor and object control skills, but movement patterns such as swimming and cycling, that are necessary for engagement in a number of physical activities (Hulteen et al., 2018). Future research would benefit from measuring an increasing variety of movement patterns to gain a better understanding of a child's overall movement proficiency.

An examination of cluster membership was approached through the lens of the PPCT model (Bronfenbrenner & Morris, 2006). Although this study did not test the PPCT model per se, the interactions between individual (e.g., motor skills, accuracy) and environmental factors (e.g., social contexts) were considered. As indicated, Clusters 1 and 2 had patterns of consistent interaction between individual and environmental factors across the grades, while clusters 3 through 6 had much more varied interactions. Particularly in grade 2, there was a clear pattern between individual and environmental factors, although it was one of no interaction. From grade 3 onward, however, with whom and where became more differentiated between the clusters and, with the exception of Clusters 1 and 2, there were fewer clear interactions between individual and environmental factors in the later years. A possible explanation for these patterns of interaction may be found by drawing upon Chapter 4 findings. In Chapter 4, it was found that, by grade 2, children were already participating in more distal social environments. This suggests a shift in interaction between individual and environmental factors may have already taken place prior to grade 2. Examining these interactions from early to middle childhood may help to highlight a change during those years. Additionally, Chapter 4 findings show changes in with whom children spend their time during middle childhood, shifting toward more time spent with

friends. As children move toward adolescence and move along the parent-to-peer pathway (Berk, 2013), they may experience increasingly stronger interactions between individual and environmental factors. It may be that the middle childhood years are a time of relative stability in regard to individual and environmental interactions.

Approaches to Facilitate Individual Development in Diverse Environments

My findings highlight that across middle childhood, children have increasingly diverse participation backgrounds and personal resources (e.g., motor competence). To optimize children's development, instructional approaches need to accommodate this diversity. Two related instructional approaches that will be helpful when instructing children in the middle years are differentiated instruction (Ellis et al., 2009) and the inclusion style of teaching (Mosston & Ashworth, 2002). Differentiated instruction is a pedagogical approach designed to meet the needs of individual children within a group context (e.g., physical education, camp, and sports programs) (Ellis et al., 2009). Paramount in differentiated instruction is learning about each child. An important first step to achieve this is to conduct a needs assessment prior to, or at the beginning of, a program, class, or practice season (Ellis et al., 2009). This involves "…taking into account what each child needs from this climate in order to feel comfortable, motivated, and successful" (Ellis et al., 2009, p. 19). Both children and parents can contribute to the discovery of the child's areas of interest, feelings toward an activity, goals, and/or skill level. In terms of the bioecological model, this is about finding out about the 'person' (i.e. skills, attitude, motivation, past experiences, etc.) (Bronfenbrenner & Morris, 2006). This information can then be useful to provide a tailored learning environment where each child can succeed. Once we learn about a child's individual needs, instructors are better equipped to construct learning environments that cater to varied interests and strengths.

As mentioned, my cluster analysis results revealed considerable diversity in both motor skill levels and accuracy of perceptions. Participants with the highest motor skills consistently underestimated their abilities, while those with the lowest motor skills overestimated. These contrasting clusters require assistance to develop in different areas, which presents a challenge to the instructor, coach, or teacher who may have children with these differing profiles in one context. Instructional approaches that protect children's self-concept while encouraging the development of their motor competence will be helpful for children in Clusters 1 (overestimators with low skills). Harter (2012a, p.264) argues that "…promoting more realistic self-evaluations among overraters [sic] should be a first step" of interventions to promote skill development. This, she suggests, is because children who overestimate their abilities tend to select 'easier' activities that ensure success in an effort to protect confidence. As a result, children may choose activities that are not especially challenging, and thus, do not develop their skills optimally. Yet, as the same time, their inflated perceptions are reinforced. Promoting more realistic self-evaluations for overestimators may be an appropriate recommendation based on cluster findings from this study. However, when also considering the findings for overestimators in Chapter 3, it is important to recall that these children experienced the most skill improvement of their peer groups from grade 3-5. While the cluster analysis provided evidence that overestimation is associated with poor motor skill levels, the trajectory of skill development for this group from grade 3-5 suggests that overestimating is associated with some benefits in middle childhood. Although I advocate that promoting realistic self-evaluations is important for overestimators, it may not necessarily be the 'first step' when intervening to promote skill development for this group. As Albert Bandura said, if people did not err toward overestimation in their self-appraisals, then their self-efficacy beliefs will only reflect what they can do, and they may "not

mount the extra effort needed to surpass their ordinary performance" (Bandura, 1990, p. 343). For underestimators, I suggest the promotion of realistic self-appraisals should be prioritized as, seen in Chapter 3 results, underestimators demonstrated the least skill improvement across grades and had lower participation rates than their average and overestimating peers. Coaches and instructors can help underestimators recognize their actual skill level by helping a child identify and affirm their actual abilities. Addressing inaccuracy for this group may be more complex. As Harter (2012a) mentions, underestimating at an early age may be reflective of larger problems (e.g., emotional abuse) and may require a more profound examination (e.g., personal counselling) to address the root cause of underestimation.

The inclusion style of teaching (Mosston & Ashworth, 2002) is one approach that instructors and teachers may find particularly useful to operationalize differentiated instruction as it can be used to reduce the fear of failure and allow children to try out the interplay between self-aspiration and reality. This teaching style is characterized by providing learners with multiple options of the same task with varying degrees of difficulty. For example, when teaching a child to juggle, the instructor may provide options of the type of equipment that can be used e.g., scarves, beanbags, or pins. The learner is then tasked with performing a self-assessment and selecting one of the choices as an entry point, for example, the beanbags. After an attempt with the initial selection, the learner assesses their performance against criteria provided by the instructor, and makes a choice: to continue to use the bean bags, to select the scarves (an easier challenge), or to select the pins (a more difficult challenge). "The objective is to teach the learner to make appropriate decisions about which level…[they are] most capable of performing" (Mosston & Ashworth, 2002, p. 162). This selection process has important physical, social, cognitive, and emotional implications. Physically, although not the primary objective of this

style, a child may work toward skill mastery by selecting an optimally challenging skill. Socially, the inclusion style helps children learn to accept individual differences; and, cognitively, to develop more accurate perceptions through increased actual competence and internal information (e.g., ease of learning with a particular object). Emotionally, this style engages an aspect of a child's self-concept (i.e. perceptions of competence) as they are required to perform a self-evaluation and decide on, what they feel, is an appropriate level of challenge. As Mosston and Ashworth (2002) state, "…it is almost like a bargaining session with oneself" (p. 159). This interplay between self-aspirations and reality is a key feature of Mosston and Ashworth's (2002) inclusion style of teaching.

Conclusions

In this study, latent profile analysis was used to generate clusters of children in middle childhood based on motor skills, accuracy of perceptions, active physical recreation participation, and with whom and where that participation occurred. Latent profile analysis revealed a range of clusters across the grades, with an increasing number of clusters from grade 2 to grade 5, reflecting greater variation in skills, perceptions, participation, and the social contexts where participation occurred. Clusters of children with 'low, low, over, and narrow' and 'high, high, under, and distal' scores were consistent in each grade, suggesting some children are at risk of disengagement from active recreation while others are on a path to continued participation. Regardless of which cluster participants belonged to, the primary use of these findings is to help identify the diversity of children within communities, whether it be at school, on a sports team, or at a summer camp. Knowing this, teachers, instructors, and coaches can, at the outset, plan to deliver programs using instructional strategies that meet all children's needs. In this way, we can increase the effectiveness of programs and help each child maximize participation.

Chapter 6 – General Discussion

The overall aim of my dissertation was to better understand the development of selected physical, cognitive, and social factors that influence physical activity participation in middle childhood. To achieve this aim, I conducted three inter-related longitudinal studies that examined: (a) the extent to which accuracy of perceived physical competence influenced active physical recreation participation, (b) patterns of participation and social networks of recreation and leisure activities, and (c) cluster profiles of children's active physical recreation related behaviors. I have discussed many findings arising from each study, but two in particular stand out: the role of accuracy and patterns of social contexts. In this chapter, I will discuss these key findings in terms of children's development, contribution to the literature, implications for individuals interacting with children in various contexts, and future research recommendations.

The Role of Accuracy

Change in Perception Levels

It is expected that children's perceptions of competence decrease around age 7 from the inflated perceptions held in younger years (Harter, 2012a; Horn, 2004). In Chapter 3 it is evident that girls' perceptions of physical competence decreased from grade 2 to grade 3, yet even so, girls' perception levels remained relatively positive. Girls' perceptions decreased at approximately 8.5 years of age (slightly later than developmentally expected), which is consistent with other recently published work on perceptions of physical competence that saw perceptions drop later than 7 years of age (De Meester, Stodden, et al., 2016; van Veen et al., 2019). Boys did not demonstrate as much movement in regard to perceptions as girls. Whereas girls' scores decreased significantly each year, boys only experienced a significant decrease in perceptions between grades 3 and 4. This decrease for boys, however, was less pronounced than the girls. Girls' perceptions decreased from ~21 to ~17 across the years, whereas boys'

perception levels hovered around ~19 in each year, with approximate mean score gains and losses of 0.5. For boys, these findings are inconsistent with theory that perceptions will drop in middle childhood; however, these more stable and positive perceptions for boys are consistent with evidence that boys' perceptions of physical competence tend to be higher than girls' perceptions during middle childhood (Liong et al., 2015; Pesce et al., 2018).

While it is unclear why there are different trajectories of perceptions for boys and girls, I offer the following suggestions. Firstly, although not statistically significant, boys in my studies had higher motor skill scores than girls, which is a well-established finding in motor development literature (e.g. Barnett et al., 2015; Liong et al., 2015). The range of percent of maximum possible scores (Cohen et al., 1999) for total motor skills across the grades was 65 – 72% for boys and 61 – 68% for girls. As motor competence is believed to be a factor that influences a child's perceptions of physical competence (Stodden et al., 2008), it is possible this higher average level of motor competence among the boys may account for their consistently higher perceptions of physical competence, at least in part.

Secondly, social comparison informs perceptions of competence development during middle childhood (Berk, 2013; Harter, 2012a; Horn, 2004). Theoretically, girls may be influenced by, and more sensitive to, social relationships (Harter, 2012a), and may therefore have internalized social comparison more than boys. Although Shapiro and Ulrich (2001) did not find sex-based differences for with whom 10- to 13-year-old children compared themselves in the contexts of physical education, recess, and home (both sexes reported drawing comparisons with classmates, family members, and self), it is possible that the girls and boys internalized these comparisons differently.

Improved Accuracy

It is theorized that children will develop more accurate self-perceptions around age 7, coinciding with the above-mentioned decrease in perceptions as well as improvement in motor skills. When examining my sample as a whole, there was no change in accuracy of perceptions across the grades; however, once I split the sample into under-, average, and overestimators in grade 2, there was a substantial convergence toward accuracy for the under- and overestimators from grade 3 to grade 5. The children who became more accurate (i.e. under- and overestimators) exhibited different paths to achieving accuracy. For overestimators, they had a relatively 'textbook' path toward more accurate self-perceptions, with a significant decrease in perceptions that coincided with a significant increase in motor skills. Underestimators had a more nuanced trajectory and, further, underestimating boys and girls had different paths. Although there were no significant changes in motor skills or perceptions across the grades for the underestimating boys, there was a significant improvement in accuracy. As the following effect sizes show, the significant change in accuracy occurred because there were small, but consistent, non-significant convergence via increases in motor skills ($\eta_p^2 = 0.91$ grade 2-3, $\eta_p^2 = 0.50$ grade 3-4, $\eta_p^2 = 0.22$ grade 4-5) and decreases in perceptions ($\eta_p^2 = 0.21$ grade 2-3, $\eta_p^2 = 0.74$ grade 3-4, $\eta_p^2 = 0.83$ grade 4-5). Beginning in grade 2, boys' higher skill levels (compared to girls) meant the boys had less of a gap between their actual and perceived scores, and therefore, did not require a substantial decrease in perceptions to become more accurate. Like the underestimating boys, the motor skill levels of underestimating girls did not significantly change across grades, but there was a significant decrease in perceptions. The underestimating girls began (in grade 2) with higher motor skills than either the average or overestimating girls, but with lower perceptions of physical competence, that further declined. This pattern for the

underestimating girls suggests that their low perceptions at the outset negatively influenced their motor skill development. These results are really quite shocking when you consider that the underestimating boys and girls did not improve their motor proficiency from 7- to 10-years of age. When reporting on the percentage of children in a standardized sample demonstrating mastery on TGMD-2 skills, Ulrich (2000) reported increases in every skill from 7-10 years. For example, the proportion of children showing mastery at age 7 and age 10, for the hop were 42% and 53% and for the stationary dribble were 39% and 74%, respectively.

Research and Accuracy: Where Does My Work Fit in?

Developmental experts began to explore the concept of accuracy as a predictor of participation more than 30 years ago (Harter & Pike, 1984; Phillips & Zimmerman, 1990; Weiss & Horn, 1990). At that time, researchers posited that accuracy was related to motivation for participation (Phillips & Zimmerman, 1990), activity, and skill choice, and, as evidenced by Weiss and Horn (1990), to achievement-related characteristics for sports and physical activity. Weiss and Horn (1990) suggested that underestimators may withdraw from physical activity and Harter (2012) indicated that overestimators would not develop their skills optimally.

The early exploration of the concept of accuracy seemed to pause, and researchers moved toward examining the level of a child's self-perceptions in relation to participation, as well as a child's motor skill level in relation to participation (e.g. Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Robinson et al., 2015). As perceptions of physical competence and motor skill proficiency (or another comparative measure such as teacher ratings) are foundational to the computation of accuracy (Phillips & Zimmerman, 1990), it is reasonable that these variables were examined separately. Such separate evaluation, however, has methodological limitations. As I mentioned in Chapter 3, researchers (e.g., Chan et al., 2019) have expressed concerns in

experimental studies that perception levels did not rise, despite improvement in skill levels. As my work shows, however, there is a decrease in perceptions of physical competence during middle childhood as well as an increase in accuracy among the children who over- or underestimate their abilities. The absence of temporal change in perceptions of physical competence in an experimental (intervention) study where researchers have hypothesized change, may be an indication children's perceptions at this age are becoming more accurate, rather than a cause for concern. For this reason, having a measure of accuracy, in addition to level of perceptions of competence, can provide a more complete story about the child's developmental path.

Stodden and colleagues (2008) suggested that children who have high levels of both motor skills and perceptions, or low levels of both, will enter into differing participation patterns. Although these authors did not include accuracy as a factor in their developmental model, this expert group did acknowledge that children in younger years tend to have inflated self-perceptions, which are replaced by more accurate perceptions in middle childhood. The gap between early studies that included accuracy as a variable (e.g. Phillips & Zimmerman, 1990; Weiss & Horn, 1990), and more recent studies that used levels of perceptions of competence and motor skills separately, has been bridged to some degree by researchers who have examined the relationships between motor skills and perceptions longitudinally (e.g. Crane et al., 2017; Spessato et al., 2013) and by a study using these variables in a cluster analysis (De Meester et al., 2016). De Meester and colleagues compared the participation of children with combinations of high and low motor skills and high and low perceptions. Although they did not include a specific measure of accuracy, the authors stated that using a person-centered approach such as cluster analysis "may provide additional insights into children's alignments of their actual and perceived

motor competence as well as their collective association to other variables" (p. 3). Building on both the longitudinal relationship and the cluster analysis studies, my work has returned to earlier thoughts about accuracy and participation (Harter, 2010; Phillips & Zimmerman, 1990; Weiss & Horn, 1990). In Chapter 3, I tracked the developmental trajectory of accuracy, and examined active physical recreation levels in cluster groups based on combinations of high and low perception levels and motor skills; and, in Chapter 5, accuracy was a person-level variable in the profile analysis.

Accuracy and Participation

In Chapter 3, accuracy emerged as a predictor of active physical recreation participation for children in grades 3, 4, and 5. Participants with accurate perceptions in the high-high group participated in significantly more active physical recreation than participants with accurate perceptions in the low-low group. These findings support the patterns of participation posited by Stodden and colleagues (2008) in their developmental model for children in middle childhood. These findings support the inclusion of accuracy of self-perceptions as a construct influencing participation in physical activities. Accuracy, or more specifically inaccuracy, also influenced participation for those who under- or overestimated their skills. Children who underestimated their skills participated in less active physical recreation than those who overestimated their skills, suggesting that overestimation during middle childhood is more beneficial than underestimation. My findings are consistent with those of Weiss and Horn (1990), who found that children who underestimated their abilities were at greater risk for decreased participation in physical activity. Although I did not include a measure of motivation in my studies, it seems that, based on their decreasing participation and lack of skill development, underestimators may experience decreased motivation; however, this is yet to be determined. De Meester and

colleagues (2016) found that children with low perceptions exhibit lower motivation for physical education and physical activity participation in adolescence, which may be the path these underestimators are moving toward.

Ultimately, for participants in my dissertation, accuracy was discriminating in regard to participation. Theoretically, children should develop accurate perceptions in middle childhood. It is not sufficient, however, to assume that because a child has accurate perceptions during these years, they are on a more positive developmental trajectory than those with inaccurate perceptions. In the case of participants in my study, there is a group of accurate children (high motor skills-high perceptions) and inaccurate children (low motor skills-high perceptions) who are in a positive spiral of engagement. There is also a group of accurate (low motor skills-low perceptions) and inaccurate (high motor skills-low perceptions) entering into a negative spiral of disengagement. Each combination has a unique trajectory in regard to participation that is influenced by accuracy.

Implications

I believe that revisiting accuracy of children's self-perceptions as a variable in the complex web of factors influencing participation in physical activities is timely. From the modicum of literature, and my own findings, I feel the most salient 'take-away' message for all significant adults involved in a child's physical development journey during middle childhood, is the importance of learning about the individual needs of each child. Children who underestimate, overestimate, or have an accurate sense of their abilities benefit from somewhat different instructional strategies. Studies 1 and 3 demonstrated that positive self-perceptions, whether accurate or inaccurate, are beneficial for participation and motor skill development. Whether it is beneficial for children who overestimate their abilities to become more accurate is not clear.

Harter (2012) and Phillips and Zimmerman (1990) suggest that children who overestimate their abilities may seek opportunities that do not expose their lack of skill, and by choosing 'easy' activities, stifle optimal development. This is not apparent in my data, so I advocate providing multiple levels of difficulty in learning tasks from which the children can choose, without pressuring children to choose activities that the instructor feels are most appropriate. Encouraging children to challenge themselves, however, should also be integral. This approach is also appropriate for the majority, that is, the average estimators.

The underestimators are another kettle of fish. Of great concern for this group was the lack of improvement in motor skills from grade 2 to grade 5 (Study 1). This outcome is consistent with what Stodden and colleagues (2008) conceptualized as a compounding spiral of disengagement. With poor motor skills leading to low perceptions of competence (or vice versa), this paves the way to low engagement with, or withdrawal from, physical activities. Underestimation of abilities is also associated with adverse psychological states such as anxiety (Miserandino, 1996), lower intrinsic motivation and negative attitudes toward effort (Bouffard et al., 2003), depressive symptoms (Cole et al., 1998), and negative treatment of positive information (Vaillancourt & Bouffard, 2009). Instructors need to point out, affirm, and confirm the children's actual abilities. Additionally, as Harter (2012a) mentions, instructors may need to refer some underestimating children for counselling if their efforts do not help.

Future Recommendations

My studies have demonstrated that children who began grade 2 with accurate perceptions of physical competence remained accurate across middle childhood, and those with inaccurate perceptions of physical competence developed more accurate perceptions in middle childhood; further, children's accuracy influenced participation. These findings, however, generate

additional research questions. Firstly, more research is needed on sources that inform perceptions, and subsequently accuracy, in middle childhood. I recommend a mixed-methods design to address this topic. With a move toward person-centered research in this field, it seems the inclusion of qualitative narratives (in addition to existing quantitative measures) is important to develop a complete understanding of accuracy. Specifically, I want to know from children, in their own words, what is informing their perceptions. When conducting a cluster analysis to examine profiles of children based on age, motor competence, perceived motor competence, and accuracy, Weiss and Ambrose (2005) assessed the importance with which children attach various sources of feedback that inform perceptions (e.g., coach feedback, parent feedback, peer comparison, ease of learning, etc.). Their quantitative cluster analysis revealed that "children with varying profiles exhibit distinct patterns in the value they place on different sources for judging physical ability" (p. 237). For example, children who were deemed 'overestimators' indicated placing high importance on peer evaluation, enjoyment, and effort. I would like to extend Weiss and Ambrose's method to include a mixed-methods evaluation of the importance children place of sources of feedback. I would like to engage in qualitative discussions with children and ask questions related to how they feel about their physical abilities and why they feel that way. I feel the addition of qualitative data will provide a more complete picture of how children develop an accurate sense of perceptions in middle childhood. Additionally, qualitative methods may help researchers understand how children internalize the feedback information they receive.

Secondly, generating an accuracy score is an involved process. Both an objective measure of motor skills and a subjective measure of perceptions are required (Phillips & Zimmerman, 1990), which may have deterred researchers examining accuracy in the past.

Additionally, previous research on accuracy, or combinations of high/low motor skills and perceptions (De Meester, Stodden, et al., 2016; Field, Crane, et al., 2020; Weiss & Horn, 1990) to determine if a child is accurate, used scores relative to peers in the same sample. Recently, at the 2020 National Assembly of International Motor Development Research Consortium, where I presented my Chapter 3 Part B findings, a conversation arose around the creation of an accuracy scale that would allow researchers to determine a child's accuracy without relying on the relative scores of others. While I do not yet have a concrete vision for how to create this scale, including such a scale as part of a needs assessment for a program, would allow for more specific tailoring of instruction.

Patterns of Social Contexts

Expanding Social Contexts

I had expected that both with whom and where children participate in active physical recreation would expand as children moved from grade 2 to grade 5. This supposition was largely predicated on the expectation that during middle childhood, children enter a school environment which often coincides with participation in additional activities such as after-school programs and organized sports (Eccles, 1999). While I found significant expansion for both with whom and where children participated overall, there was not a significant expansion of where children participated in formal activities such as team sports. As discussed in Chapter 4, this indicates that children had already begun participating in formal activities away from home by grade 2, earlier than expected. For example, as early as grade 2, over 70% or participants reported taking swimming lessons in the community, exposing children to somewhat distal social contexts at this age. The engagement in swimming lessons increased to 77% over the years, which directly aligns with Canada's 2018 Report Card on Physical Activity for Children and

Youth, where parents report that 77% of Canadian children participate in formal physical activity (Barnes et al., 2018). This level of participation in formal activities at an early age may be indicative of a move toward formal activity registration by families seen in other Canadian and international communities (Holt et al., 2016; Skår & Krogh, 2009). There has also been a dramatic upswing in parents' belief that physical activity must be supervised for safety concerns (Holt et al., 2016; Mâsse et al., 2017), and the necessity exists for after-school care associated with parents' work commitments (Skår & Krogh, 2009). Both of these factors put pressure on families to register their children in programs in younger years.

In contrast to formal activities, there was significant expansion of where children participated in informal activities (particularly 'hanging out') in each grade. However, there were groups of informal activities such as 'quiet recreation' and many 'jobs and chores' that were consistently undertaken at home.

Social Contexts and Motor Skill Development

With whom and where children participate in active physical recreation was not associated with the children's physical development as expected. Children in my studies did not have optimal motor skill levels at the outset, and unfortunately, over the years, these levels did not improve in a meaningful way. While this is disappointing, it is consistent with findings that children in middle childhood have generally low motor competence (Bardid et al., 2016; De Meester, Stodden, et al., 2016; Temple & Foley, 2017). As the majority of children participated in formal activity contexts across the grades, including over 60% participation in team sports, I would expect children's motor skills to improve as these they should be receiving skills instruction from teachers and coaches, including opportunities for structured practice in organized sports contexts. This, however, does not appear to be the case. It is concerning that the

children appear to be plateauing at this age in their motor skill development with motor skills at such a low level. This may limit the children's ability to apply these skills in a variety of activity environments as they enter into their middle school years, potentially constraining participation.

In the Chapter 5 results, it is noteworthy that children who participated in the most distal social contexts, corresponding to formal activity participation in the CAPE, were not the same children who have the strongest motor skills. This suggests to me that formal environments, outside of school curricula, are not those where most skill development is occurring. It is possible children are developing skills (although somewhat minimally) in other contexts such as during physical education classes and informal activities such as pick-up soccer and basketball. This finding may have a number of repercussions for participation in formal activities. As children continue to participate in formal activities, but do not develop optimal levels of motor competence, children may become frustrated with skill challenges or embarrassed about their abilities. Both of these circumstances may lead to poor perceptions and ultimately, activity withdrawal (Stodden & Goodway, 2007; Stodden et al., 2008). It is important for parents, in particular, to be aware of this when registering children for activities, particularly those activities that are age-related. For example, if a child was on an Under-8 soccer team the previous year, the following year they would move to the Under-10 based on age alone. If that child had not developed the necessary skills before that transition, the experience on the Under-10 team would likely not be positive as the skill demands would only increase. If a child has poor motor skills yet is consistently placed in environments where their skills are on display, this could result in a negative experience for the child.

In addition to motor skill development not being associated with formal contexts, the highest participation rates are also not associated with the most distal environments. It is

important to remember that only 17 activity environments were measured and that the age-range of children was from approximately 7-10 years of age. It is possible that children in my studies may still be too young for dramatic change in where they participate. These changes may become more prominent during adolescence, when young people begin to fill their free time with activities that take them away from home, such as part-time jobs, a variety of leisure activities, volunteer work, and time with friends (Berk, 2013). These changes in adolescence are often facilitated by the ability for independent transportation (e.g., driver's license, public transportation) as well an increasing desire for autonomy. It is encouraging, however, that children in my studies continue to participate in a combination of formal and informal activities across middle childhood, as successful experiences in a variety of environments encourages healthy development in multiple aspects (e.g., physical, social, cognitive) (Eccles, 1999).

Social Contexts and Cognitive Development

I had anticipated that children who participated in broader social contexts (e.g., with others and in the community or beyond) would have more accurate perceptions than those who participated in narrow contexts. I thought that as children expanded their contexts they would use new sources of information (e.g., social comparison and feedback) to inform their self-appraisals (Harter, 2012a; Horn, 2004), with a resulting increase in the accuracy of their perceptions. Surprisingly, this is not what I found. As referenced above, social comparison influences perceptions of competence development and the accuracy of those perceptions (e.g. Berk, 2013; Harter, 2012a); however, it may be that proximal or close social relationships (e.g., sibling, best friend) influence accuracy more than social comparison with others who are not as close (e.g., team member, classmate). As previously mentioned, it has been found that clusters of children with differing levels of accuracy (e.g., overestimators) placed varying degrees of importance on

sources that inform perceptions (e.g., peer comparison) (Weiss & Ambrose, 2005). This finding may indicate that those closer to the individual have a greater impact on development of accuracy at this age. Evidenced in Chapter 4, during the period when children are developing more accurate self-perceptions, I found a concomitant increase in participation with friends, decrease in participation with family, and no change in participation with others, which may support this explanation.

Connections Between Person-related and Context-related Factors

My overarching aim was to examine the influence of selected individual-level and contextual factors on physical activity participation in middle childhood. At one level, physical activity is a personal behavior; but it is strongly influenced by physical, social, and cultural contextual factors (Bronfenbrenner & Morris, 2006; Cairney et al., 2019; Mâsse et al., 2017; Poulsen & Ziviani, 2004).

As can be seen in Chapter 4, neither participation in the domains of formal organized sports nor informal active physical recreation differed by grade level, which in this longitudinal study, is analogous with the children's age. There was also little change in where those activities occurred over time. Nevertheless, there were distinct relationships between specific activities and where those activities occurred. With the exception of track and field, which occurred largely at school, organized sports occurred in the community. In contrast, informal active physical recreation occurred in far more diverse locations. From dancing at home or riding a bicycle in the neighborhood, to playing on equipment at school, and skiing beyond the child's community, there were distinct patterns of where activities occurred. Those distinct contextual patterns were also closely linked to with whom the children participated, an overall pattern that is evident in the Chapter 5 cluster figures. When at home, children most commonly participated with family

or alone; at school they participated with friends; and in community, children engaged with people beyond their families and friends. These findings are not surprising, but they show that engaging in the community (e.g., team sports) is important for participation in the activity itself, but also broadens children's exposure to diverse environments and a range of people. As formal recreation can place financial and logistical burdens on families, it is important to ensure these opportunities are accessible to all.

There was growth in participation with friends in the neighborhood and at school across grades. These findings are consistent with the expectation that friends have a more significant role in development in middle childhood compared to early childhood (Berk, 2013; Eccles, 1999) and are likely indicative of growth in the child's independence and co-regulation by parents, at a time when there is some shift in control from parents to the child (Berk, 2013).

How children's social contexts interacted with their motor skills, participation in active recreation, and the accuracy of their perceptions of physical competence is still somewhat unclear. There was a group of children in each grade with relatively narrow social contexts, low motor skills, low participation rates, inaccurate perceptions, and a tendency to overestimate their abilities. In contrast, there was a group in each grade with more distal social contexts, relatively high motor skill proficiency and high participation rates; however, this group tended to underestimate their abilities. Collectively, these groups accounted for between 38% and 73% of all children across the grades, meaning there were many other combinations of these factors among the children. Indeed, the combinations as represented by the cluster analyses doubled from grades 2-5.

Implications

Although the interactions between the expanding social contexts and the personal factors examined were not clear-cut, it is evident that children were participating in physical activities in diverse contexts. In terms of formal physical activities, these contexts were quite distal from the beginning of middle childhood. It is very important that those instructing children in all physical activity contexts, from home to beyond, recognize that middle childhood is a turbulent time in the development of children's self-appraisals. This awareness may help to inform instructional practices as discussed in Chapter 5. As participation in formal activities appears to be both high and stable throughout middle childhood, it is important for those in formal activity settings to recognize they have young participants that are experiencing this transition. Alongside that recognition, is the need to improve the children's motor competence, which was not optimal and overall showed little improvement in four years. This was especially true for children who underestimated their abilities. A challenge in terms of mobilizing this knowledge is to find ways to help teachers, coaches, and parents identify and help children who do not feel they are as physically competent as they are.

Future Recommendations

As I did not capture when children started to participate in formal active physical recreation, I recommend a longitudinal examination of participation patterns that spans the transition into formal schooling from early into middle childhood. Participants in my studies had been in formal schooling for two years prior to the commencement of data collection, and it is likely a more dramatic change in where children participate occurred during these earlier years. As it was clear that children participate in formal activities earlier than expected, locating when that participation begins would help to complete the story and also illuminate some of the

interactions between individual and contextual factors (e.g., when do parents start registering children for formal activities).

Evaluating participation in multiple communities is also warranted as children's participation patterns across multiple cultural and socio-economic statuses may differ (Goodway & Smith, 2005; O'Driscoll et al., 2014). Formal activity participation rates were high in my studies; however, participants in my studies come from relatively advantaged communities. Those rates may differ for communities with varying socio-economic status (Chang & Kim, 2017). Additionally, as Victoria is an island community, geography may influence participation in activities (e.g., swimming lessons may be deemed important due to extensive coastline). It is important to examine how children from other communities spend their free time in order to be more able to generalize results.

It is clear, particularly from Chapter 4, that families continue to play an important role in a child's social world; however, it is unclear in exactly what way. Future research should examine if families are contributing to a child's accuracy of perceptions through either feedback or social comparison, if parents are encouraging participation, and if they are fostering the social relationships with friends that are increasing across the middle childhood years.

Conclusions

Middle childhood is a time rich in development. During middle childhood, children notionally have the physical maturity to master fundamental motor skills if provided with appropriate affordance (Gallahue et al., 2012), and the cognitive ability to develop accurate self-appraisals (Field, Crane, et al., 2020; Harter, 2012a), all while engaging in new social experiences outside of the home (Eccles, 1999). I sought to examine the interactions between selected individual and contextual factors that influence a child's participation in active physical

recreation. Sadly, I discovered that children with low motor skill competence and low perceptions of their physical competence participated in less active physical recreation than any other combinations of low and high motor skills and perceptions. Having high perceptions of physical competence, despite relatively low motor competence, appears to be advantageous to motor skill development compared to children who underestimate their abilities.

The findings from my studies confirm that middle childhood is a dynamic time where children experience a multitude of changes. Longitudinally, I found that children are developing cognitively as evidenced by improvements in accuracy, and socially, as evidenced by expanding social networks. Physically, in terms of motor skill development, children are not optimally developing, which is greatly concerning. These findings related to children's physical, cognitive, and social development in middle childhood have implications for the children, their families, and their communities-at-large. Three concrete recommendations arising from this work relate to (a) children who underestimate their abilities, (b) the early engagement of many children in organized sports, and (c) how perceptions of physical competence are used in physical activity research during middle childhood. Approximately one-quarter of children underestimated their physical abilities, and of great concern was their lack of motor skill improvement from grade 2 to grade 5. Along with opportunities to develop their motor proficiency, children who underestimate their abilities need instructors in active recreation contexts to point out, affirm, and confirm their actual abilities. The second recommendation relates to the early participation of a majority of children in organized sports in the community. Children were participating in formal physical activities, such as team sports, during a turbulent time in the development of their self-appraisals. Leaders and family members need to ensure that the expectations they convey to children are realistic. Further, children will benefit from activities and learning

opportunities that are meaningful and provide choices that are suited to their current skill and confidence levels. Finally, researchers examining children's physical self-perceptions during middle childhood should consider the expected developmental trajectory of the accuracy of those self-perceptions. A drop in perceptions of physical competence levels among children with inflated self-perceptions at the beginning of middle childhood is expected as these perceptions become more accurate. Overlooking this expected developmental trajectory may confound research findings, particularly if self-perceptions are an outcome measure.

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Appendix A – Human research ethics board approval notice

University of Victoria | 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:	**Viviene Temple**	**ETHICS PROTOCOL NUMBER** Minimal Risk - Delegated	**10-246**
UVic STATUS:	**Faculty**	ORIGINAL APPROVAL DATE:	23-Jun-10
UVic DEPARTMENT:	**EPHE**	RENEWED ON:	22-May-20
		APPROVAL EXPIRY DATE:	22-Jun-21

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);
Student/Research Assistants (UVic): Stephanie Field

DECLARED PROJECT FUNDING: **None**

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: 22-May-20

10-246 Temple, Viviene

Appendix B – Consent form sample (Grade 2)

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 Drs Viviene 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 Viviene 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 2 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 Viviene 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.

Child's Name	*Child's Signature*

Parent Name	*Parent/Guardian Signature*	*Date*

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.

University of Victoria | School of Exercise Science, Physical & Health Education

Physical activity and motor skills: A study of child development

A complete copy of this consent form is available to download as a PDF at http://www.educ.uvic.ca/faculty/temple/pages/research.htm.

If you have any questions you may call or email the following people in the School of Exercise Science, Physical and Health Education at the University of Victoria.

Dr Viviene Temple	PH: 250-721-7846	vtemple@uvic.ca
Dr Rick Bell	PH: 250-721-8373	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).

Appendix C – Descriptive statistics of boys' and girls' motor skills, perceptions of physical competence, and active physical recreation by cluster group for grade 3, 4, and 5

	FMS					PPC					APR				
	Boys		Girls			Boys		Girls			Boys		Girls		
Cluster	Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*
								Grade 3							
All	67.33	10.79	62.09	7.17	<.001	19.33	3.77	17.26	4.35	<.001	1.81	0.68	1.89	0.69	.348
Low-low	59.07	7.24	56.44	4.46	.219	14.13	2.62	11.69	2.24	.001	1.21	0.55	1.51	0.62	.235
High-high	73.87	6.78	65.18	5.02	<.001	22.63	1.25	21.06	1.97	.003	2.01	0.68	1.93	0.65	.695
Low FMS-high PPC	54.50	7.56	54.00	5.50	.828	19.67	3.77	18.73	2.52	.243	1.77	1.03	2.15	0.85	.273
High FMS-low PPC	73.62	6.70	67.33	4.49	.003	17.38	1.61	14.48	2.60	<.001	2.07	0.78	1.92	0.60	.531
								Grade 4							
All	67.97	8.08	62.59	7.45	<.001	18.71	3.82	17.72	3.74	.001	1.97	0.84	2.16	0.81	.159
Low-low	61.07	6.33	55.16	4.79	<.001	13.43	2.24	12.74	2.35	.308	1.39	0.71	1.76	0.88	.181
High-high	77.00	4.58	70.00	4.54	<.001	22.16	1.43	20.96	1.77	.039	2.03	0.77	2.42	0.73	.101
Low FMS-high PPC	61.37	5.12	56.78	4.22	.003	21.25	1.92	19.78	1.93	.027	2.28	0.92	1.99	0.75	.292
High FMS-low PPC	69.43	3.57	64.76	2.90	.001	17.19	2.04	16.29	1.71	.129	2.06	0.77	2.13	0.77	.300
								Grade 5							
All	69.51	8.25	64.95	7.89	<.001	19.07	3.67	17.94	3.79	.004	1.88	0.74	2.09	0.88	.155
Low-low	58.44	4.00	53.00	5.94	.004	14.89	2.57	14.25	2.70	.494	1.25	0.56	1.38	0.60	.690
High-high	77.46	4.27	71.72	4.34	<.001	21.75	1.70	20.59	1.62	.048	1.94	0.66	2.46	0.74	.014
Low FMS-high PPC	62.61	4.71	59.73	3.21	.032	21.22	1.83	20.41	2.20	.228	2.32	0.68	2.09	0.87	.332
High FMS-low PPC	71.26	3.66	67.77	3.99	.009	15.63	2.52	14.00	2.29	.015	1.68	0.73	2.00	0.97	.174

Appendix D - Count of with whom children (n = 203) participate in each context by grade level

Where and With Whom	Hobbies				Social				Quiet Recreation				Organized Sport				Skill-based				Clubs				Active Rec				Entertainment				Chores			
	Grade				Grade				Grade				Grade				Grade				Grade				Grade				Grade				Grade			
	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5
At Home																																				
Alone	81	132	141	131	54	52	59	54	113	143	134	128	2	4	3	2	35	42	65	76	0	0	1	0	42	48	43	51	107	157	167	176	122	144	159	172
Family	92	157	150	152	80	72	80	69	84	90	90	86	10	8	6	9	26	30	26	23	3	1	4	1	93	94	79	65	149	153	151	141	144	160	150	150
Relatives	8	10	13	11	22	30	36	20	3	5	5	7	1	1	1	0	0	1	1	0	0	0	0	0	6	3	0	3	7	4	2	1	5	2	6	2
Friends	26	39	57	51	70	73	94	111	53	34	36	26	3	2	6	3	3	4	0	5	0	0	0	2	30	24	20	17	24	10	16	15	1	2	6	5
Others	5	5	7	2	6	6	4	7	2	2	6	2	0	1	0	0	9	11	9	9	0	0	0	0	1	2	5	1	0	2	1	2	1	2	5	1
Relatives																																				
Alone	0	0	8	2	0	0	0	1	4	3	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	4	1	0	0	1	0	1	1	3	1
Family	7	3	8	11	19	15	13	18	2	2	5	3	0	2	1	0	1	0	3	0	1	0	0	2	4	1	1	3	4	1	2	2	5	5	1	0
Relatives	4	18	4	13	16	26	25	29	2	4	2	2	1	1	0	0	1	1	1	1	0	1	0	0	6	6	3	1	2	2	0	1	2	6	4	0
Friends	3	0	2	3	1	5	3	1	2	2	3	2	0	1	1	1	0	0	0	0	0	0	0	0	1	0	2	0	1	0	1	2	0	0	0	0
Others	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Neighborhood																																				
Alone	5	14	13	5	2	4	4	0	0	0	6	3	1	6	1	0	4	3	5	1	0	1	0	0	9	26	30	28	0	3	2	7	3	2	9	4
Family	7	8	7	5	8	10	8	4	4	6	3	5	13	8	8	7	2	0	1	0	4	4	11	5	99	93	87	78	13	12	9	11	33	11	29	35
Relatives	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0
Friends	18	18	19	24	58	52	54	66	21	16	31	28	15	9	15	12	4	4	3	1	5	9	5	6	31	3	55	64	5	4	5	6	6	1	5	10
Others	0	0	1	3	2	4	2	2	2	3	1	0	14	13	11	12	7	13	9	10	3	2	2	3	2	7	15	3	1	0	0	0	1	0	1	3

School																																					
Alone	2	2	7	7	4	3	2	4	9	3	8	9	10	1	0	0	1	0	0	2	0	0	1	0	9	7	16	7	3	2	6	10	0	0	1	3
Family	0	2	1	5	3	1	3	1	2	0	2	1	2	0	0	1	2	1	0	1	2	0	0	0	23	9	9	5	4	1	0	0	5	1	1	5
Relatives	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Friends	10	19	21	20	36	37	36	43	21	18	15	13	12	26	23	22	14	7	12	14	26	29	46	42	98	118	129	127	4	3	0	0	2	4	7	9
Others	2	7	1	6	2	2	0	0	3	1	0	0	7	15	17	19	13	19	13	27	17	27	26	42	7	9	17	9	0	0	0	0	2	2	3	3
Community																																				
Alone	8	17	17	14	3	7	10	11	3	1	1	6	17	9	7	6	9	12	10	13	2	3	1	1	7	12	37	12	4	2	6	9	2	4	3	4
Family	14	14	17	14	22	40	30	27	0	1	4	5	54	66	55	44	12	6	10	4	19	23	21	15	93	100	83	80	125	139	156	130	103	79	114	102
Relatives	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0
Friends	13	10	17	24	67	96	118	114	18	14	19	22	50	59	64	72	19	15	12	16	9	16	10	18	52	33	59	69	30	40	49	57	4	6	9	23
Others	1	5	5	3	13	13	12	6	4	1	1	0	85	93	98	105	41	37	13	50	13	12	22	17	13	20	38	30	8	10	9	9	4	2	6	9
Beyond community																																				
Alone	1	4	1	3	0	2	0	4	0	0	2	1	0	1	2	1	0	1	1	1	0	0	0	0	3	1	1	4	0	1	1	3	0	1	1	0
Family	3	6	13	10	19	17	4	9	1	1	2	3	16	8	13	9	1	1	0	0	1	1	1	3	49	57	42	67	34	38	59	46	5	4	12	16
Relatives	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Friends	1	3	1	5	13	11	22	27	2	1	5	8	4	6	7	15	0	0	2	2	0	2	0	1	13	12	19	24	7	8	13	22	1	0	1	4
Others	0	2	0	1	0	5	1	0	1	0	1	0	8	9	11	18	4	3	1	4	1	1	1	2	7	3	7	5	1	1	1	5	0	1	1	0