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Graduate Program in Kinesiology
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy
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**The importance of self-efficacy and basic psychological needs in children's physical
activity: Measurement, prediction and intervention**

(Spine title: Self-Efficacy and Psychological Needs in Children's Physical Activity)

(Thesis format: Integrated Article)

by

Casey Ellen Gray

Graduate Program in Kinesiology

A thesis submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

The School of Graduate and Postdoctoral Studies

The University of Western Ontario

London, Ontario, Canada

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THE UNIVERSITY OF WESTERN ONTARIO

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entitled:

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Measurement, Prediction and Behaviour**

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Abstract

The importance of physical activity in the overall health promotion and primary prevention of cardiovascular disease risk factors and metabolic diseases in children is well established. Nonetheless, interventions to increase physical activity among this population have been largely unsuccessful. The main objective of the research in this dissertation was to explore the suitability of self-efficacy and basic psychological needs for physical activity prediction and intervention in children. Item generation and psychometric evaluation of psychological questionnaires occurred in study 1 (Chapter 2). Using a prospective design, study 2 (Chapter 3) established task efficacy, barriers efficacy, competence, and autonomy as significant predictors of self-reported physical activity ($R^2 = 20.3\%$, $p < 0.05$). Examining objective minutes in physical activity, autonomy accounted for 8% of the variance associated with moderate activity, while competence accounted for 9.4% of the variance associated with vigorous activity. Relatedness was unrelated to any physical activity outcome. In study 3 (Chapter 4), salient predictors from study 2 were targeted to increase physical activity in a sample of under-active children via a novel motivational interviewing inspired intervention protocol. The intervention significantly increased autonomy and competence but not physical activity. Overall findings provide initial construct validity and reliability evidence for the measures, and describe relationships between self-efficacy, psychological needs and physical activity in children. The brief intervention shows promise for affecting competence and autonomy, however, appears insufficient to increase physical activity.

Keywords: physical activity, children, self-efficacy, self-determination theory, basic psychological needs

Co-Authorship

Harry Prapavessis

Supervisor and director of the Exercise and Health Psychology Laboratory where all equipment was obtained and analyses were carried out.

Dedication

For Penelope.

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Chapter 1 - General Introduction

Moderate to vigorous physical activity (MVPA) is integral to the psychological (Biddle & Mutrie, 2007) and physiological (Janssen & LeBlanc, 2010) health and well being of youth. Overwhelming cumulative evidence indicates a strong effect of physical activity on musculoskeletal health, aspects of cardiovascular health, adiposity in overweight youth, and blood pressure in mildly hypertensive adolescents (Strong, Malina, Blimke et al., 2005). A strong consensus suggests physical activity positively influences lipid profiles and adiposity in normal weight children and adolescents, blood pressure in normotensive youth, and self-concept, anxiety, and symptoms of depression (Strong et al., 2005). Finally, emerging evidence shows physical activity during childhood and adolescence is related to future activity in adulthood (Malina, 2001; Telama et al., 2005).

The amount, intensity and duration of physical activity believed to be necessary for children to accrue health benefits and avoid chronic illnesses were outlined in the Canada's Physical Activity Guides (CPAG) for children (ages 5 - 11) and for youth (ages 12 – 17) promoted by Health Canada (2002a, 2002b). The CPAG described a 5 month plan wherein young people were encouraged to increase their MVPA incrementally, aiming toward ≥ 90 more minutes of MVPA daily (Health Canada, 2002a; Health Canada, 2002b). Critics of CPAG for children and youth indicated that a concrete physical activity target was not specified, and that guidelines were based on adult literature (Katzmarzyk & Arden, 2004).

Updated, age-appropriate evidence-based guidelines recommend that all school aged children (ages 5 – 11) and youth (ages 12 – 17) accrue at least 60 minutes of MVPA every day for health benefits (Canadian Society for Exercise Physiology - CSEP, 2011), bringing Canada's guidelines for young people into line with the international community

(e.g., the World Health Organization - WHO, 2010). Guidelines further encourage the inclusion of vigorous activities, and activities that increase muscle and bone on at least 3 days of the week, and specify volitional activities such as sport, play, active transport, and employment, while excluding incidental activities of daily living (CSEP, 2011).

The Canadian Health Measures Survey (CHMS) collected objective physical activity data in a nationally representative (96%) sample of the population from 2007-2009. According to these data, just 7% of children and youth (9% of boys, 4% of girls) met the CSEP (2011) physical activity guidelines (Colley et al., 2011). Results show a significant decline in physical activity with age, the most dramatic occurring during the transition from late childhood to adolescence (Colley et al., 2011). Additional analyses examined adherence to the previous CPAG and accumulation of minutes in vigorous activities. Findings indicate that only 2% of children and youth were accumulating 90 minutes of MVPA every day, although 60% were able to reach this target at least one time per week. Only 50% of young people engaged in even 1 bout of vigorous activity lasting at least 5 minutes (Colley et al., 2011). Behavioural patterns uncovered by the CHMS are largely consistent with American (Troiano, Berrigan, & Dodd, 2008) and English (Riddoch, Mattocks, Deere et al., 2007) objective assessments of physical activity in children and youth. Cumulatively, these data are compelling as they indicate that school aged-children are engaging in activity far below the levels required to protect against the many lifelong inactivity related diseases and illnesses described above. Given that it is easier to prevent harmful health habits (e.g., physical inactivity) formed during childhood and adolescence than to try to intervene when they have become deeply ingrained as part of one's lifestyle (Bandura, 2004), the primary prevention of physical inactivity deserves urgent research attention.

Theoretical Considerations

The vital role of physical activity in health underscores the need for prospective and experimental studies to establish mechanisms of behaviour change (Sallis, Prochaska, & Taylor, 2000). While diverse factors contribute to children's physical activity behaviour (e.g., physical environment, socioeconomic status), psychosocial characteristics offer modifiable, thus desirable intervention targets. Consistent psychosocial correlates of children's and adolescents' physical activity have been identified (Sallis et al., 2000; Van Der Horst, Paw, Chin, Twisk, & Van Mechelen, 2007), however physical activity interventions guided by proposed mediators have produced small to no effects (Baranowski & Jago, 2005; van Sluijs, McMinn, & Griffin, 2007).

Self-Efficacy. Among adults, self-efficacy is one of the strongest, proximal cognitive predictors of behaviour in general (Bandura, 1986; 1997) and structured exercise in particular (McAuley & Blissmer, 2000; Sallis et al., 2000). As defined, self-efficacy refers to beliefs in one's ability to "organize and execute the course of action required to produce given attainments" (Bandura, 1997, p. 3). The utility of self-efficacy in explaining behaviour is reflected by its position at the core of several health behaviour models. For example Social Cognitive Theory (SCT, Bandura, 1986; 1997), among the most prominent frameworks for understanding physical activity behaviour (McAuley & Blissmer, 2000) places self-efficacy in a central role. Additionally, self-efficacy is an important variable in the theory of reasoned action (Dzewaltowski, 1989), the transtheoretical model (DiClemente, 2003; Prochaska, 1979; Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992), and the health action process approach (Schwartz, 1992; 2001). Irrespective of the theory in which it is investigated, self-efficacy reflects a consistent predictor of behaviour.

Theoretical advancements have led researchers to differentiate self-efficacy into task and self-regulatory forms to provide a better understanding of the means by which self-efficacy relates to physical activity (Maddux, 1995). The construct, task efficacy continues to reflect individuals beliefs pertaining to physical abilities and motor skills need to perform a specific task or behaviour in the exercise domain (Maddux, 1995; McAuley & Mihalko, 1998). In contrast, self-regulatory efficacy is assessed as a multi-faceted construct, relating to self-generated beliefs, feelings and actions regarding a person's ability to organise and overcome challenges in the face of performing tasks or behaviours (Woodgate & Brawley, 2008; Maddux & Gosselin, 2003; Maddux, 1995). Among the self regulatory self-efficacy beliefs, several sub-dimensions are described. Barriers efficacy is one sub-dimension and specifically addresses people's beliefs in their abilities to overcome identified obstacles (e.g., bad weather) in the face of specified tasks and behaviours (Bandura, 1996; Maddux, 1995).

In critical reviews of the literature self-efficacy is identified as a significant correlate of physical activity in adults, children and adolescents (Van Der Horst, et al., 2007; Sallis et al., 2000). Self-efficacy beliefs are developed continually through 4 theoretically proposed and empirically supported major sources of self-efficacy information: performance/mastery accomplishments, vicarious experience, verbal persuasion, and emotional arousal/physiological states (Bandura, 1986).

Much of the research in children and adolescents exploring self-efficacy in a physical activity contexts, while identifying that a relationship does exist, has not sufficiently described the nature of that relationship. This may be due to issues in the measurement of self-efficacy in children's research where the label "self-efficacy" or "physical activity self-efficacy" are often assigned to measures that predominately assess

barriers efficacy (e.g. Sallis, Simons-Morton, Stone, et al., 1992; Wilson, Kitzman-Ulrich, Williams, Saunders, et al., 2008).

Where studies have acknowledged the potential contribution of task efficacy to children's physical activity a single item representation has been included and a general self-efficacy score is tabulated. Moreover, self-efficacy is often measured dichotomously (yes/no) with children (e.g., Sallis et al., 1992). This is inconsistent with Bandura's (1986) guidelines for measurement which should capture the nature of self-efficacy which varies in terms of level, strength and sometimes generality (Bandura, 2006). Level refers to the specific task or aspect of behaviour being assessed. Strength refers to the degree of conviction for the efficacious belief and is usually measured on a scale ranging from 0% (not confident at all) to 100% (completely) confident in one's ability to execute the task. Finally, generality, when assessed refers to the individuals' beliefs that their efficacy for a task in a specific context carries over into other contexts. Dichotomous measures also increase the chances children will respond in a socially desirable manner (Harter, 1982) and general self-efficacy construct ignore the possible unique contributions of task and self-regulatory efficacy demonstrated in adult literature (e.g., Woodgate & Brawley, 2008).

Foley et al., (2008) adapted measures of task and barriers self-efficacy developed in accordance with Bandura's (1986) specifications by McAuley and Mihalko (1998) and found that each construct made a unique contribution to the prediction of physical activity intentions, subjective physical activity, and objectively assessed activity energy expenditure and minutes of MVPA. This research made an important contribution to the knowledge base concerning the importance of fostering children's beliefs for overcoming barriers and their perceptions of their capabilities to engage in specified amounts of

physical activity (Foley et al., 2008). Little is understood, however about the potential influences of various forms of self-efficacy on different aspects of physical activity (e.g., the contribution to various intensities of activity or sedentary behaviour and at various stages of behaviour change).

Several researchers have attempted to influence self-efficacy in intervention by manipulating the theoretical sources of self-efficacy (mastery experiences, verbal persuasion, vicarious experience, physiological and emotional states) identified by Bandura (1986). In at least 1 encouraging randomized controlled trial (Dishman, Motl, Saunders, et al., 2004) self-efficacy was targeted among various hypothesized social cognitive variables (e.g., outcome expectancy and goal setting) in a social-ecological model implementing changes in physical education classes, health education classes, leisure time PA and involving teachers, and parents. Self-efficacy emerged as a significant partial mediator of the effect of the intervention on adolescent girls' physical activity. While the intervention group showed modest increases in physical activity during school, none was seen outside of the school context. This trial provides strong evidence that self-efficacy can be manipulated and in turn influence children's physical activity behaviour and provides hope for further investigations.

Basic Psychological Needs. A second group of theoretical variables receiving increasing attention in children and adolescents' physical activity research are basic psychological needs for autonomy, competence and relatedness (Deci & Ryan, 1985; 2002). Individuals' perceptions of autonomy need satisfaction reflect people's beliefs that they are behaving in a manner consistent with their own deeply held interests and values, and that behaviours are volitional as well as self-initiated (Deci & Ryan, 1985; 2002). Perceived competence describes people's need to feel effective and the tendency toward

opportunities to demonstrate these capacities (Deci & Ryan, 1985; 2002, Harter, 1982). Lastly, relatedness need satisfaction is characterised by the attraction people feel toward experiencing close connections and belongingness with others (Beaumeister & Leary, 1995; Deci & Ryan, 1985; 2002).

Within SDT psychological needs are differentiated from motivations in that they have been demonstrated as innately held by all individuals, regardless of gender, age and culture (e.g., Chirkov, Ryan, Kim, & Kaplan, 2003). Furthermore, need satisfaction is assumed to be essential to growth and integrity, as well as psychological and physiological health (Ryan & Deci, 2000). Needs are satisfied by social contexts which, in turn, affect aspirations (Kasser & Ryan, 1993; 1996), personality integration (Grolnick & Ryan, 1989), intrinsic motivation (Vallerand & Losier, 1999), well being (Sheldon, Ryan & Reis, 1996; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), physical activity (Taylor, Ntoumanis, Standage, & Spray, 2010) and pro-social behaviours (Ryan, 1995). When need satisfaction is thwarted by social environments, negative consequences including personality fragmentation and ill-being will result (Deci & Ryan, 2000).

The directional relationships from need satisfaction to positive psychological and behavioural consequences are described within several sub-theories of self-determination theory (SDT: Deci & Ryan, 1985; 2000), including cognitive evaluation theory (Deci, 1975; Deci & Ryan, 1980), basic needs theory (BNT; Ryan & Deci, 2000), organismic integration theory (Deci & Ryan, 1985; Ryan & Connell, 1989), and the self-determination model of physical health (Williams, 2002). Evidence in exercise contexts supporting the various pathways to behaviour, personality integration and psychological well-being proposed within the above theories has been reviewed and summarised by Wilson and Rodgers (2008). These authors concluded there are mixed findings regarding

the assumption that satisfaction of needs is complimentary and not mutually exclusive. The evidence was much clearer in support of the assumption that need satisfaction leads to higher internalization of behavioural regulations for exercise. Finally, the assumption that need satisfaction promotes greater well-being in exercise was explored. In studies deemed to explicitly address this assumption (Wilson, Rodgers, Fraser, Murray, & McIntyre, 2004) the assumption was upheld with need satisfaction associated with positive well being, less psychological distress, greater positive affect, physical self-worth, and global self esteem.

Examinations of need satisfaction among children have been somewhat limited, potentially due to a lack of appropriate assessment instruments available for this age cohort. When needs were explored, although often not explicitly as a construct of SDT, a promising pattern of findings emerges. For example, children's adaptive peer relationships have been associated with higher perceived sport competence which may suggest that perceived relatedness and competence needs are correlated (Smith, Ullrich-French, Walker, & Hurley, 2006). Where needs have been assessed explicitly within an SDT framework, this has predominately occurred in physical education (Taylor, Ntoumanis Standage, & Spray, 2010; Ntoumanis, 2001) and sport (Gagne, Ryan, & Bargman, 2003) settings. Taylor et al (2010) showed that perceived competence, but not autonomy or relatedness, experienced within physical education class could predict physical activity reported outside of school. Gagne et al (2003) found that over the course of 4 weeks higher perceptions of autonomy support were related to need satisfaction and well being indices. Further, daily fluctuations in basic needs experienced during practice accounted for changes in indices of well-being post practice. These studies offer important insights into the complex nature of children's need satisfaction in physical

activity contexts and highlight the importance of fostering a need supportive environment in order to foster positive well-being and physical activity outcomes.

Need satisfaction research is an emergent area within children's physical activity domains, however there is vast research to indicate perceived competence is a direct predictor of physical activity. Physical competence is a variable that consistently predicts children's and adolescents' physical (Van Der Horst et al., 2007; Sallis et al., 2000). Measured extensively over the past several decades, evidence that children's beliefs in their abilities to engage in sports and outdoor games is related to their engagement in more physical activity during leisure time (Dempsey, Kimiecik, & Horn, 1993; Kimiecik & Horn, 1998) and greater quantity and intensity of physical activity outside of school (Carroll & Loumidis, 2001). Moreover, persuasive evidence indicates that parents beliefs in their children's physical competence influences the children's own competence beliefs and subsequently predicts increased engagement in physical activity (e.g., Bois, Sarrazin, Brustad, Troulloud, & Cury, 2005; Kimiecik, Horn, & Shurin, 1996). The physical subscale of the perceived competence scale for children has regularly been used to capture perceived competence in physical activity. Unfortunately this measure specifically assesses confidence for engaging in sports and games (Harter, 1982) and does not capture the nature of need satisfaction from a self-determination perspective. In order to increase children's physical activity it is important that we understand their competence beliefs in reference to all of the ways children are physically active. For this to occur further refinement of measurement instruments is required.

Additional correlates of youth physical activity appear consistent with aspects of psychological needs. For example, among the correlates deemed to be consistently predictive of youth physical activity, the need for autonomy may partially capture

physical activity preference, shown to be a constant predictor of children's physical activity (Sallis et al., 2000). Also, the need to feel that one is connected and supported by important others may be reflected by a number of physical activity correlates relating to support from significant others including friends and family. As is the case with competence need satisfaction, there is not currently a measure with which to assess basic psychological needs in children's physical activity.

Measurement Issues

Persuasive evidence indicates that self-efficacy and perceived competence are important correlates of physical activity (Sallis et al., 2000; Van Der Horst et al., 2007), yet interventions purportedly guided by these variables have largely not been able to increase children's physical activity in practice (van Sluijs, 2007). At least 2 general issues may have contributed to the breakdown between relationship testing research and intervention development. The first relates to the measurement of physical activity as a criterion variable. Physical activity has been inconsistently defined (e.g., leisure time, energy expenditure, minutes accumulated in various intensities) and measured (e.g., self-report, accelerometer, heart rate) in studies from which such conclusions are drawn. Variation among different self-reported measures are further confounded by children's tendencies to over-report their physical activity (Sallis, Buono, Roby, Micale, & Nieldson, 1993) calls conclusions based on these data into question. Even within a single measurement instrument such the accelerometer, the cut-points applied to differentiate between light, moderate, and vigorous intensity activity can have a significant effect. Guinhouya and colleagues (Guinhouya, Hubert, Soubrier, Vilhelm, Lemdani, & Durocher, 2006) determined that applying the Trost cut-points (Trost, Pate, & Sallis, 2002) versus the Puyau cut-points (Puyau, Adolph, Vohra, Zakeri, & Butte, 2004)

produces significantly different outcomes, with the Puyau derived values up to 5 times larger than those derived using the Trost cut-off value resulting in a large overestimation of children's physical activity. The ways in which physical activity has been defined and measured by researchers has likely contributed to a lack of clarity in the area of physical activity.

The second issue is potentially a product of the previous issues, and relates to theory. Ineffectiveness of physical activity interventions for children has been blamed on a poor understanding of true mediators of physical activity (Baranowski & Jago, 2005; Leventhal, Weinman, Leventhal, & Phillips, 2008; Van Sluijs et al., 2007), a general lack of an adequate framework (Motl, 2006), and failure to adequately target true mediators (Baranowski, Anderson, & Carmack, 1998). Theory provides an organized system of knowledge that describe assumptions, accepted principles, and rules to guide research (Motl, 2006). In addition, by enabling examination of the mediating effects of individual theoretical components, theory facilitates the translation of evidence to practice (Lerman, 2003).

Motivational Interviewing

Convincing evidence shows that nearly all Canadian school aged children are not sufficiently physically active to achieve good health (Colley et al., 2011). Certainly, a number of approaches are required to reverse these alarming statistics as there are inevitably individuals who will not be well served by public messaging or curriculum-based approaches. Motivational interviewing (MI; Miller, 1983; Miller & Rollnick, 1991) offers a promising means of helping young people to be more physically active at an individual level (Resnicow, Davis, & Rollnick, 2006). MI is a client centred method for

helping move people toward change by exploring and resolving ambivalence (Miller & Rollnick, 2002).

Practitioners of MI encourage individuals to make informed decisions about their behaviours, even if the decision is not to change (Resnicow et al., 2006; Rollnick, 2006). This is achieved through fostering a collaborative non-confrontational partnership, acknowledging the individual as knowledgeable and evoking his or her views, values and goals, and facilitating informed choice in an autonomous non-authoritative manner (Miller & Rollnick, 2002). A series of techniques (e.g., listening reflectively, agenda setting) underlie four general principles of MI (i.e., express empathy, develop discrepancy, roll with resistance, and support self-efficacy) intended to guide the practitioner's way of being with and for the individual that acknowledge the reactions of participants, clients and patients are largely determined by the counsellor's manner (Miller & Rollnick, 2002).

While a large evidence base supports the application of MI in substance abuse research, it has only been recently investigated in contexts of children and adolescent health behaviour change (Resnicow, et al., 2006). In older children and adolescents, trials have targeted BMI (Resnicow et al., 2005), diet and lipids (Berg-Smith, Stevens, Brown et al., 1999), hemoglobin A1c (Channon, Smith, & Gregory, 2008), and perceptions about diabetes mellitus (Knight, Morris, Bundy, et al., 2003). Number and duration of intervention sessions provided and engaged in varied among the trials. In the Dietary Intervention Study in Children (DISC) (Berg-Smith et al., 1999), a single MI based session attempted to improve adherence to a prescribed diet for a sample of participants already engaged in an RCT to decrease dislipidemia. The adolescents in the intervention participated in one face-to-face MI session and one follow up session that was conducted

either face-to-face or by telephone. Recall for the first 127 completers suggests the proportion of calories from fat and dietary cholesterol was greatly reduced at the 3 month follow-up assessment offering promising preliminary support for the use of a brief motivational interviewing based session on health behaviour change in adolescents.

Initially, evidence for MI in health contexts was equivocal (Miller & Rollnick 2002). For instance, Harland, White, Drinkwater, Chinn, Farr, and Howel (1999) showed that individuals who underwent a 6 MI session intervention and those who completed a single session significantly and comparably increased their exercise at 12 week follow up, however these gains were not maintained at the 1 year follow up. Two other studies (Smith, Heckemeyer, Kratt, & Mason, 1997; Woolard, Beilin, Lord, Puddey, MacAdam, & Rouse, 1995) conducted with clinical populations (e.g., obesity, diabetes, hypertension) also showed a number of significant improvements in health behaviours but failed to significantly increase in physical activity.

It was claimed that little empirical evidence indicates MI impacts motivational variables in these earlier trials (Burke, Arkowitz, & Dunn, 2002). Adopting theoretical perspectives during the early stages of study design has enabled researchers to explore important psychological processes that could mediate the effects of MI on successful treatment outcomes (Markland, Ryan, Tobin, & Rollnick, 2005). The frameworks offered by basic needs theory (Deci & Ryan, 2002) and self-efficacy (Bandura, 1986; 1997) provide an appropriate model to guide MI.

Self-efficacy, described within MI as analogous to having faith, or hope in one's ability to change (Miller & Rollnick, 2002) is afforded a position of importance within MI, and is named one of four key principles guiding the practice (Miller & Rollnick, 2002; Rollnick, Mason & Butler, 1999). Theoretical sources of self-efficacy are expressly

targeted during the counselling sessions. Setting personally-relevant goals and showing confidence in the participants' abilities to achieve them, providing individualized feedback on progress and comparing the current and desired outcomes of physical activity using imagery have been adopted to enhance self-efficacy in MI practice (Hardcastle & Hagger, 2010).

In drawing comparisons between the techniques and spirit of MI and those behaviours used to provide autonomy supportive environments, several parallels are obvious. In addition, several key components of MI are synonymous with the aspects of need supportive environments that foster satisfaction of autonomy, competence, and relatedness needs (Markland, Ryan, Tobin, & Rollnick, 2005; Markland & Vansteenkiste, 2007; Vansteenkiste & Sheldon, 2006). For example, the acts of helping the individual develop appropriate goals, and offering positive informational feedback provide structure. As such, perceptions of competence are fostered (Hardcastle & Hagger, 2011; Miller & Rollnick, 2002). In addition, the practitioner provides autonomy support by using MI client-centred techniques like rolling with resistance, exploring options, and enabling the client to make decisions, all fostering the individual's perception of autonomy need satisfaction (Hardcastle & Hagger, 2011; Miller & Rollnick, 2002). Lastly, providing an involvement supportive environment in terms of expressing empathy, demonstrating understanding and acceptance of the client's views and goals, and avoiding judgemental talk, in turn foster the individual's relatedness need satisfaction (Hardcastle & Hagger, 2011; Miller & Rollnick, 2002).

Indeed, efforts to ground MI in a health behaviour theory, specifically SDT, while continuing to support self-efficacy have positively influenced physical activity in sedentary adults (Fortier, Hogg, O'Sullivan, et al., 2007; Jolly, Duda, Daley, et al., 2009)

and overweight and obese women (Silva, Vieira, Coutinho, Matos, Sardinha, & Teixeira, 2009) in recent large randomized controlled trials. This recent evidence proliferation of support for the benefits of integrating MI practice with the theoretical frameworks offered with self-efficacy and self-determination theories deserves further research attention. The dearth of evidence investigating the potential application in adolescent contexts affords an opportunity to take initial steps toward exploring the feasibility of conducting theory guided MI for increasing children's physical activity.

Dissertation Objectives

This research program attempted to address the practical and theoretical issues associated with the development of physical activity interventions for children. The general scope of this research program was focused on self-efficacy (Bandura, 1986; 1997) and basic psychological needs (Deci & Ryan, 1985, Ryan & Deci, 2000) in the context of children's physical activity behaviour.

The specific aims of this series of dissertation studies were threefold:

- 1) To provide evidence of content validity for modified scales measuring physical activity specific task efficacy, barriers efficacy, perceived competence, perceived autonomy, and perceived relatedness for use with older children.
- 2) To examine the utility of task efficacy, barriers efficacy, perceived competence, perceived autonomy, and perceived relatedness as prospective predictors of self-reported physical activity and objectively assessed minutes of moderate and vigorous intensity physical activity.
- 3) To examine the feasibility and preliminary efficacy of a single physical activity counselling session targeting potential mediators uncovered in study 2 for increasing self-reported and objectively assessed physical activity.

It should be noted that this series of dissertation studies are presented in an integrated-article format. Although chapters 2, 3 and 4 reflect distinct studies, each study builds upon the results of the previous study. As such, some repetition with respect to rationale and background should be expected.

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Chapter 2 - Assessment of Physical Activity Specific Basic Needs Satisfaction and Self-Efficacy Measures for Children: Initial Construct Validity (Study 1)

Abstract

The purpose of this study was to examine the content validity of modified measures of basic psychological needs satisfaction and self-efficacy for children in physical activity. Measures were examined in two phases. Phase 1 was undertaken to ensure the language was appropriate for the targeted population. In phase 2, the content validity of modified scales was assessed by examining item content relevance and representativeness. An expert judging panel systematically reviewed the degree of match between each of the 31 items and each targeted construct, as well as the degree to which the items taken together completely capture the targeted constructs. With the exception of item 20 ($M = 2.33$) all mean content-relevance ratings indicated items were at least a 'good match' to their targeted construct. Twenty-four V-coefficients were significant (17, $V = .81 - .97$, $p < .01$; 7, $V = .72 - .78$, $p < .05$), while 7 V-coefficients ($V = .33 - .67$) were not. Expert comments were examined for the non-significant items suggesting modification of 6 items and the removal of 1. The final questionnaire included 15 basic psychological needs satisfaction items (4 autonomy, 6 competence and 5 relatedness items) as well as the complete 9-item task efficacy and 6-item barriers efficacy scales. Overall, the items were deemed adequate construct valid measures and are acceptable for use with children in physical activity settings.

Key words: Psychometrics; children; physical activity; self-determination theory; basic psychological needs; self-efficacy

Introduction

Moderate to vigorous physical activity (MVPA) is integral to the psychological (Biddle & Mutrie, 2007) and physiological (Janssen & LeBlanc, 2010) health and well being of youth. Recent epidemiological evidence of a dramatic decline in physical activity from childhood to adolescence is, therefore, a growing public health concern (Colley, Garriguet, Janssen, et al., 2011; Troiano, Berrigan, Dodd, et al., 2008). While Canadian and international guidelines recommend children engage in at least 60 minutes of MVPA every day (Canadian Society for Exercise Physiology, 2011; World Health Organization, 2010), only 7 % of Canadian children actually manage to do so (Colley et al., 2011). With physical activity in childhood tracking into adulthood (Malina, 2001; Telama, Yang, Viikari, Valimaki, Wanne, & Raitakari, 2005) the transitional between childhood and adolescence may be an especially appropriate time in development to intervene.

Among the potential contributors to the decline in physical activity levels, few are readily amenable to change (e.g., physical environment, socioeconomic status). In contrast, several modifiable psychosocial antecedents and correlates of children's physical activity have been uncovered and may be targeted in physical activity interventions. The cumulative body of evidence supports self-efficacy, parental support (Van Der Horst, Paw, Chin, Twisk, & Van Mechelen, 2007), physical activity preferences, and fewer perceived barriers (Sallis, Prochaska, & Taylor, 2000) as significant correlates of children's physical activity. Likewise, self-efficacy, family influences and support from friends, parents and significant others, as well as perceived competence (Van Der Horst et al., 2007; Sallis et al., 2000) are associated with the physical activity of adolescents.

Consistencies are apparent between correlated psychosocial constructs mentioned above and those outlined within two prominent theoretical models of health behaviour. Namely, self-efficacy (Bandura, 1986; 1997) and basic psychological needs (Deci & Ryan, 1985; Ryan & Deci, 2000) are constructs at the core of several health behaviour models. For example self-efficacy is central to social cognitive theory (SCT; Bandura, 1986, 1997), the theory of reasoned action (Dzewaltowski, 1989), the theory of planned behavior (Ajzen, 1991), the transtheoretical model (DiClemente, 2003; Prochaska, 1979; Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992) and the health action process approach (Schwarzer, 1992; 2001). Similarly, one or more basic psychological needs are described as pivotal constructs within cognitive evaluation theory (Deci, 1975; Deci & Ryan, 1980), basic needs theory (BNT; Ryan & Deci, 2000), organismic integration theory (Deci & Ryan, 1985; Ryan & Connell, 1989), and the self-determination model of physical health (Williams, 2002).

According to SCT, people's behaviours stem from the interaction between social, cognitive, and environmental factors (Bandura, 1986, 1997). Self-efficacy is reflective of people's cognitions concerning external social factors, or more specifically, of beliefs in one's ability to "organize and execute the course of action required to produce given attainments" (Bandura, 1997, p. 3). Theoretical advancements have differentiated self-efficacy into task and self-regulatory forms (Maddux, 1995). Task-efficacy focuses on motor skills, describing an individual's beliefs about his or her ability to perform a specified task or behaviour (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998). In contrast, self-regulatory efficacy is assessed as a multi-faceted construct, relating to self-generated beliefs, feelings, and actions pertaining to a person's ability to organise and overcome challenges (Woodgate & Brawley, 2008; Maddux & Gosselin, 2003; Maddux,

1995). Under the umbrella of self-regulatory efficacy, barriers efficacy specifically addresses children's beliefs in their abilities to overcome identified obstacles (e.g., bad weather) in the face of specified tasks and behaviours (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998).

A systematic review on correlates of physical activity among children and adolescents identified self-efficacy as a consistent variable (Van Der Horst et al., 2007); however, inspection of self-efficacy assessment instruments used by reviewed studies indicates a large bias toward the specific measurement of barriers efficacy in these studies. The negative relationship between perceived barriers and physical activity uncovered by systematic review (Sallis et al., 2000) further underscores the influence of youth's beliefs about barriers and their abilities to overcome them in order to be physically active. By contrast, task efficacy has received limited attention with younger populations, often measured with a single item of limited validity. Given the potential importance of task efficacy in the initiation of exercise and the maintenance of physical activity challenges, in addition to the role of barrier efficacy in the maintenance of exercise behaviour (McAuley & Blissmer, 2000; Sallis, Haskell, Fortnam, Vranizan, Taylor, & Soloman, 1986), further research is warranted.

The second set of theoretical variables that has received increasing attention in children's physical activity literature includes autonomy, competence and relatedness. These constructs represent three basic psychological needs forwarded by SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). Competence refers to individuals' need to feel effective and to be driven to demonstrate these abilities (Deci, 1975). Although similar to task efficacy, which also places individuals' beliefs about their abilities of central importance, task efficacy and perceived competence differ in important ways. Specifically, perceived

competence is assumed to be an innate psychological need present at birth and that all people strive to satisfy whether or not they are aware of this drive (Deci & Ryan, 2000). Perceived competence need satisfaction is described within SDT as necessary for psychological well being and to energize behaviour. In contrast, self-efficacy is developed over the course of one's lifetime and is theorized to direct behaviour (Bandura, 1986; 1997). In terms of measurement, perceived competence is assessed according to how people generally feel while engaged in physical activity, whereas task efficacy assesses peoples' degree of certainty that they can engage in physical activity at a specific point in the future. Autonomy refers to a need people have to be the source of their own behaviour and that their actions are self-initiated and emanate from an internal locus of causality (Ryan, 1985). Lastly, relatedness describes the need to experience close connections, and to feel secure and supported in these relationships, and be important to and accepted by others (Beaumeister & Leary, 1995; Ryan, 1985). Psychological needs constructs are differentiated from motivations in that they have been demonstrated as innately held by all individuals, regardless of gender, age, and culture (e.g., Chirkov, Ryan, Kim, & Kaplan, 2003), and are assumed to be essential to growth and integrity, as well as psychological and physiological health (Ryan & Deci, 2000). Needs are satisfied by social contexts which, in turn, affect aspirations (Kasser & Ryan, 1993; 1996), personality integration (Grolnick & Ryan, 1989), intrinsic motivation (Vallerand & Losier, 1999), well being (Sheldon, Ryan, & Reis, 1996; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), physical activity (Taylor, Ntoumanis, Standage, & Spray, 2010) and pro-social behaviours (Ryan, 1995). When need satisfaction is thwarted by social environments, negative consequences including personality fragmentation and ill-being will result (Deci & Ryan, 2000).

Among the correlates deemed to be consistently predictive of youth physical activity, several share commonalities with the basic psychological needs outlined within SDT. In fact, perceived competence was identified as a correlate of adolescent's physical activity in 3 studies (Sallis et al., 2000). Although not explicitly named, the need for autonomy may be of importance as a related construct physical activity preference was shown to be a constant predictor of children's physical activity (Sallis et al., 2000). Finally, the need to feel that one is connected to and supported by important others may be reflected by a number of physical activity correlates relating to support from significant others including friends and family (Van Der Horst et al., 2007; Sallis et al., 2000).

Although the correlates of youth physical activity that have emerged from reviews appear to capture aspects of the self-efficacy and basic psychological needs constructs, the measures used to assess these qualities in reviewed studies are not consistent with the guidelines for measuring theoretical variables (e.g., task and barriers efficacy), nor do they completely capture the entire bandwidth or domain of the constructs as described within SCT (Bandura, 1986; 1997) and SDT (Deci & Ryan, 1985; Ryan & Deci, 2000). Recent attempts to more accurately assess relationships between needs and children's physical activity have specifically focused on physical education (Taylor et al., 2010; Ntoumanis, 2001) and sport (Gagne, Ryan, & Bargman, 2003) contexts. In these instances, measures implemented to evaluate basic needs have been cobbled together from multiple existing scales developed for other purposes (e.g., work and general life) and populations (e.g., adults), and modified to target children and adolescents in physical education and sport. In addition, few reports have outlined the assessment procedures that occurred prior to utilizing modified scales in their work. Where evaluation has occurred,

this seems to have been limited primarily to determining face validity, ensuring the language of the measures is appropriate for the younger population for whom the scales are being adapted (e.g., Hagger, Chatzisarantis, & Harris, 2006). Hambleton (1980) contends that a thorough assessment should occur before an instrument is used for measurement purposes. Certainly, the accurate assessment of study variables depends on the precise measurement of observed constructs, which is predicated on the sophistication with which measures are designed (Aiken, 1996). Before investigations into the self-efficacy and basic psychological needs of children in physical activity contexts can proceed, it is important that scales assessing these constructs are scrutinized with respect to their content validity for the intended population and context.

The purpose of this study is to systematically evaluate scales measuring self-efficacy and basic psychological needs constructs in response to Dunn and his colleagues' (Dunn, Bouffard, & Rogers, 1999) call for improving and reporting the adequacy and rigor of psychological test construction, evaluation processes, and procedures in physical activity research. The specific objective of this undertaking was to determine if the questionnaires modified by Foley and her colleagues (Foley, Prapavessis, Maddison, Burke, McGowan, & Gillanders, 2008) from instruments developed by McAuley and Mihalko (1998), and modified from Richer and Vallerand (1996), Ryan (1982), Blais, Vallerand, and Lachance (1990) and Ntoumanis (2001) in the present study exhibit acceptable content validity for measuring task and barriers efficacy, as well as perceived autonomy, competence and relatedness need satisfaction in children's physical activity.

Methods

Item Generation

Self-efficacy items evaluated in the present study were previously drawn from measures of exercise efficacy for walking (McAuley & Mihalko, 1998) and modified for children's physical activity (Appendix B) by Foley et al. (2008). In initial work using these adapted task (9 items) and barriers (6 items) efficacy measures in children, the scales demonstrated internal consistency and correlated as expected with physical activity intentions, as well as with both objective and subjective physical activity (Foley et al., 2008). Prior to use however, the scales were not scrutinized with respect to their content validity following the fairly substantial modifications.

To assess basic need satisfaction, an initial pool of 16 items was generated for inclusion in the instrument, which was named "the basic needs satisfaction in physical activity scale for children". Items were selected to reflect children's perceptions of competence, autonomy, and relatedness experienced while engaging in physical activity. All of the initial items were borrowed from other studies investigating basic needs satisfaction, and all but one item were developed specifically for adults. Relatedness items were adapted from the acceptance subscale of Richer and Vallerand's (1996) need for relatedness scale. Competence items were drawn from the perceived competence scale of the Intrinsic Motivation Inventory (Ryan, 1982). Finally, autonomy items were gathered from the perceived autonomy in life domains scale (Blais et al., 1990) as well as 1 item created by Ntoumanis (2001) for use with adolescents in physical education. Wording of the item set was modified to target physical activity. Additional alterations were made to ensure children would be able read and comprehend items.

Ethics approval from the host institution was obtained prior to contacting participants (Ethics Review #15069E). A preliminary assessment was undertaken to ensure the language used in the modified composite of basic needs scales was age

appropriate for a sample of 10-14 year old children. A purposive sample of children ($N = 5$) was recruited based on age (ages 10-14 years) and familiarity to the researcher.

Participants met with the researcher to read and respond to each item aloud. Children in this phase were instructed to alert the researcher to difficult or confusing items as they occurred. In turn, the researcher prompted each participant to justify or elaborate on a response to an item if it was suspected the meaning was not clear. Following each interview item wording was adjusted when deemed necessary prior to conducting subsequent interviews.

To evaluate the initial content validity of the age appropriate items included in the basic needs satisfaction in physical activity scale for children, and the previously modified task and barriers efficacy in physical activity scales (Foley et al., 2008), the relevance and representation of items for each content domain were examined. Item content-relevance describes how well the content of a test item represents the construct it is intended to measure (Dunn et al., 1999). Item content-representation discusses the degree to which a set of content relevant items captures the entire domain of the construct under investigation (Messick, 1989). Accordingly, a panel of judges with expertise in self-efficacy and SDT were recruited to evaluate the item content-relevance and representation of items using the mixed method procedures advocated in both the scale construction and psychometric literatures (Crocker & Algina, 1986; Dunn et al., 1999).

Expert Judges

Thirty potential judges for the panel of content experts were recruited to participate using a letter of information delivered via e-mail, along with instructions to reply to the investigator if interested. Researchers in sport, exercise, and physical activity with expertise in self-determination theory and self-efficacy were sought due to their

understanding of the theoretical variables under consideration, as well as the context within which variables will be investigated. The final panel consisted of nine PhD's (7 faculty and 2 post-doctoral fellows) from accredited universities in Canada, England, and New Zealand. Self-efficacy was a primary research area of 4 experts, SDT was the primary focus of 3 of the experts, and 2 experts would consider both SDT and self-efficacy to be their primary research focus. Among them, 3 judges were specifically engaged in research involving children and adolescents, satisfying the recommendation of including judges with expert familiarity of the targeted population (Crocker & Algina, 1986). Experts were asked to evaluate each item using the structured item-content review form (ICRF) delivered to them by e-mail, and to return completed ICRFs to the researcher in the same manner. Returned and completed ICRF's were considered evidence of informed consent to participate.

Rating Scale Procedures

Experts were asked to familiarize themselves with the construct descriptions or domain of content for each of the five constructs under examination (i.e., autonomy, competence, relatedness, task efficacy, and barriers efficacy). Construct descriptions were adapted from the constructs defined within SDT (Deci & Ryan, 1985; Ryan & Deci, 2000) and SCT (Bandura, 1986; 1997) and targeted toward physical activity and are presented here:

Autonomy. These items are intended to capture whether the participant perceives that he/she is the source of his/her own behaviour.

Competence. These items are intended to capture whether the participant perceives that he/she is able to effectively produce desired outcomes and prevent undesired outcomes.

Relatedness. These items are intended to capture whether the participant perceives that he/she is meaningfully connected with others during physical activity.

Task Efficacy. These items are intended to capture whether the participant perceives that he/she is able to exercise control over task demands in order to do physical activity.

Barriers Efficacy. These items are intended to capture whether the participant perceives that he/she is able to exercise control over events that effect daily life in order to do physical activity.

After carefully reading over the provided construct descriptions, experts independently evaluated the content relevance of the 31 items using a rating scale procedure described by Hambleton (1980) and modified by Dunn et al. (1999). In this procedure judges indicated how well the content descriptions were reflected by each item by rating the degree of match between the item and the construct (1 = Poor Match; 5 = Excellent Match) on a 5-point Likert-type scale contained within the ICRF. For each item, experts rated the degree of match for each of the five constructs in an attempt to “blind” the expert judges to the matches targeted and reduce the potential for rating bias. Following each item a space was provided for comments. These were used to interpret problematic ratings and to amend the item pool.

Results

Judges’ ratings were entered into PASW Statistics v 18.0 and comments following item content-relevance and representativeness ratings were transcribed verbatim. The raw data file was screened for extreme or discrepant judge ratings and missing cases. Evaluations on an item would be considered discrepant if a rating was extreme relative to those provided by the other judges, as such adversely affecting the “validity” of the

numerical procedures used to evaluate the item-domain matches (Hambleton, 1980). To accomplish this, each judge's distance from the median rating (JDM) was calculated. JDM values closer to zero indicated consistent agreement among judges. On item content relevance, 7 JDM scores ranged between 13.5 and 20.0, with 2 JDM scores (25.5 and 29) outside of this range. Inspection of written comments on item evaluations indicated extreme judges provided valuable insight for improvement of items and as such were retained in the analysis. Raw data were subsequently screened for missing values. One missing value was located and replaced by the series mean. On content representativeness two self-efficacy judges were removed from further analysis due to failing to provide ratings. In the remaining pool of 7 judges, JDM values ranged between 2.0 and 7.0 on 10 ratings.

Descriptive statistics were calculated to quantify the degree of ambiguity in expert ratings on relevance scores. Calculations of the range (R ; highest minus lowest rating plus 1) provided by the total sample, and by the relevant expert group are presented in Table 1. R values closer to 1 indicate minimal ambiguity associated with item content match ratings provided by experts while R values ≥ 4 indicate lack of consensus among experts. Inspection of R values indicated 9 of the 31 items had ambiguous ratings, raising concerns specifically regarding the lack of clarity expressed by experts regarding autonomy and competence items (4 and 3 ambiguous items, respectively). Inspection of the mean content-relevance ratings (Table 1) indicated 30 of 31 items were at least a 'Good Match' to their targeted construct according to the expert panel. Aiken's (1985) item content-validity coefficient (V) was used to examine the statistical significance of judges' ratings for each targeted construct (Dunn et al., 1999). To calculate V -coefficients, the formula $V = S / [n(c - 1)]$ was used. To arrive at these values,

$s = r - lo$ (Aiken, 1985, p.133) was calculated for each judge's rating. In this equation, r reflects the judge's rating on the item, and lo was entered as 1, given that it was the lowest possible score on the ICRF. To arrive at an S value, the sum of s scores across n judges was calculated and the value of c integers on the rating scale was determined for each item. V -coefficient values range from 0 to 1, with values closer to 1 indicating greater agreement between the content of the item and the targeted construct description. Each V -coefficient was compared against a right-tailed binomial probability table to ascertain significance (Aiken, 1985, p.134). In total, 24 V -coefficients were significant (17, $V = 0.81 - 0.97$, $p < .01$; 7, $V = 0.72 - 0.78$, $p < .05$) while 7 of the basic psychological needs V -coefficients ($V = 0.33 - 0.67$) were not (Table 2).

These procedures were repeated to assess expert evaluations of the *content representation* of items included in the SDT and self-efficacy scales. Item ambiguity of expert ratings was assessed by inspecting R -values. The results (Table 3) indicated item ambiguity on expert judges' evaluations of the representativeness of autonomy (R 's = 4 and 3). Descriptive statistics on content-representation ratings are presented in Table 3 and show all items are at least a "good representation" of their intended constructs, and are at least "somewhat" appropriate for use in physical activity research in terms of the degree to which they capture the targeted constructs. Inspection of Aiken's V -coefficients on representativeness ratings indicates 5 of 10 values were statistically significant, with none of the 10 items falling below the theoretical midpoint (Table 4). Overall 55.5% of the total sample indicated there were additional items that should be included to capture targeted items (Table 5), and only 22.2% indicated that there are items that capture more than the intended constructs (Table 6).

Inspection of the written feedback provided by experts revealed concern with the autonomy items, suggesting these items fail to capture the broader construct domain (sample quote: “it’s about choice, but also about endorsing behaviours completely, feeling as if one is the origin of the behaviour, that you do it because it reflects your true sense of self etc. Needs to be more broad.” J02). Additionally experts indicated a degree of overlap between competence and self-efficacy items (sample quote: “I feel that these variables are to some extent correlated. I don’t think that you can, at least in one study, tease apart this, and that some overlap is ok.” J06). This was expected as there was some degree of overlap present in the description of each dimension provided in the ICRF. Expert comments for the non-significant items informed the modification of 6 items and the removal of 1. The final questionnaire consisted of 15 basic psychological needs satisfaction items (4 autonomy, 6 competence and 5 relatedness items) as well as the complete 9 item task efficacy and 6 barriers efficacy scales. These modified measures of task and barriers efficacy, as well as basic psychological needs satisfaction possess acceptable content validity for use with school aged children in physical activity settings.

Table 1

R-Ratings assessing item ambiguity amongst judges' ratings on the targeted domains

Item	Content Domain	Judges				
		SDT (n = 5)	Self-Efficacy (n = 6)	M	SD	R
16	[a]	4		3.67	1.41	4
19	[a]	3		4.22	0.97	3
20	[a]	3		2.33	1.41	5
24	[a]	5		3.89	1.54	5
26	[a]	5		3.89	1.54	5
3	[c]	3		3.33	1.12	4
4	[c]	4		3.67	1.22	4
11	[c]	5		3.44	1.51	5
12	[c]	2		4.22	0.67	3
17	[c]	2		4.33	0.71	3
27	[c]	2		4.22	0.44	2
1	[r]	3		4.00	0.71	3
2	[r]	4		3.89	1.05	4
15	[r]	3		4.11	0.93	3
6	[r]	3		3.33	1.50	3
23	[r]	2		3.89	0.60	3
5	[t]		2	4.56	0.53	2
7	[t]		2	4.56	0.53	2

14	[t]	2	4.44	0.53	2
18	[t]	2	4.33	0.71	2
21	[t]	2	4.33	0.71	3
22	[t]	3	4.33	0.71	3
28	[t]	2	4.44	0.53	2
29	[t]	2	4.44	0.53	2
30	[t]	4	4.22	0.97	4
8	[b]	2	4.89	0.33	2
9	[b]	2	4.89	0.33	2
10	[b]	2	4.89	0.33	2
13	[b]	3	4.56	0.73	3
25	[b]	2	4.78	0.44	2
31	[b]	3	4.44	0.73	3

Note. Item numbers refer to the order presented in the ICRF. Designated keyed domains: [a] = autonomy; [c] = competence; [r] = relatedness; [t] = task efficacy; [b] = barriers efficacy. Ratings were scored on a 5 point Likert scale ranging from 1 = “Poor Match” to 5 = “Excellent Match”.

Table 2

Aiken's V-Coefficients for content relevance for each targeted domain

item	Content domain	Judges ratings (S)			Total Sample
		Total sample	SDT	SET	Aiken's V
		N = 9	n = 5	n = 6	$V = S/[n(c-1)]$
1	[r]	27	15	-	.75*
2	[r]	26	14	-	.72*
3	[c]	21	11	-	.58
4	[c]	24	13	-	.67
5	[t]	32	-	22	.89**
6	[r]	28	19	-	.78*
7	[t]	32	-	22	.89**
8	[b]	35	-	23	.97**
9	[b]	35	-	23	.97**
10	[b]	35	-	23	.97**
11	[c]	22	13	-	.61
12	[c]	29	18	-	.81**
13	[b]	32	-	18	.89**
14	[t]	31	-	21	.86**
15	[r]	21	11	-	.58
16	[a]	24	13	-	.67

17	[c]	30	18	-	.83**
18	[t]	32	-	21	.89**
19	[a]	24	16	-	.67
20	[a]	12	9	-	.33
21	[t]	30	17	-	.83**
22	[t]	30	-	20	.83**
23	[r]	26	14	-	.72*
24	[a]	26	13	-	.72*
25	[b]	34	-	22	.94**
26	[a]	26	15	-	.72*
27	[c]	29	17	-	.81**
28	[t]	31	-	21	.86**
29	[t]	31	-	21	.86**
30	[t]	29	-	19	.81**
31	[b]	26	18	-	.72*

Note. Designated keyed domains: [a] = autonomy; [c] = competence; [r] = relatedness; [t] = task efficacy; [b] = barriers efficacy. *V*-coefficients were calculated using the *S* from the total sample of judges. The statistical significance of each *V* coefficient was obtained by using the right-tailed binomial probability table provided in Aiken (1985). *V*-coefficients $\geq .72$ were statistically significant at $p=.038$. *V*-coefficients $\geq .81$ were statistically significant at $p = .006$.

Table 3

Mean item content-representation ratings and R-values for SDT and self-efficacy items

item	Content Domain	SDT			Self-Efficacy			Total Sample		
		M	SD	R	M	SD	R	M	SD	R
1	[a]	2.8	1.48	4	-	-	-	3.00	1.29	4
1	[c]	3.8	.84	2	-	-	-	3.57	.79	2
1	[r]	3.0	.71	2	-	-	-	3.00	.82	2
1	[t]	-	-	-	4.0	0	0	4.14	.38	1
1	[b]	-	-	-	3.75	0.5	2	4.00	.58	2
2	[a]	3.4	1.14	3	-	-	-	3.43	.98	3
2	[c]	3.8	.45	1	-	-	-	3.86	.38	1
2	[r]	3.6	.89	2	-	-	-	3.43	.98	2
2	[t]	-	-	-	4.00	0.00	0	4.29	.49	1
2	[b]	-	-	-	4.00	0.82	2	4.14	.69	2

Note. Ratings were done on a 5 point Likert scale ranging from 1 = “Poor Representation” to 5 = “Excellent Representation”. R = Range (highest minus lowest plus 1) evaluating item ambiguity evident amongst SDT and self-efficacy items on the basis of expert ratings.

Table 4

Aiken's V Coefficients for content representativeness of variables for 7 judges

item	Content domain	Judges ratings (S)			Aiken's V (total) V = S/[n(c-1)]
		Total sample	SDT	SET	
1	[a]	14	9	-	.52
1	[c]	18	14	-	.67
1	[r]	14	10	-	.52
1	[t]	22	-	12	.81*
1	[b]	21	-	11	.78*
2	[a]	17	12	-	.63
2	[c]	20	14	-	.74
2	[r]	17	13	-	.63
2	[t]	23	-	12	.85*
2	[b]	22	-	12	.81*

Note. Designated keyed domains: [a] = autonomy; [c] = competence; [r] = relatedness; [t] = task efficacy; [b] = barriers efficacy. The statistical significance of each V coefficient was obtained by using the right-tailed binomial probability table provided in Aiken (1985). V-coefficients $\geq .75$ were statistically significant at $p < .041$. Of the 7 judges, 3 were SDT experts only, 2 were self-efficacy only and 2 were considered both.

Table 5

Expert appraisal of content representation evident in SDT and self-efficacy items

Item	Group 1 (n = 5)	Group 2 (n = 6)	Total Sample (N = 9)
Yes	3	3	5
No	2	2	3
Missing	0	1	1

Note. Ratings were done on a dichotomously scored question that read “Are there any additional items that you feel should be included to represent perceived autonomy, competence, relatedness, task-efficacy, and barriers-efficacy?” Group 1 = SDT experts; Group 2 = self-efficacy experts.

Discussion

This study was an attempt to systematically evaluate two measures reflecting self-efficacy and basic psychological needs constructs for use with children in the context of physical activity. The study aimed to make a contribution to literature and to future research endeavors by taking this preliminary step to rigorously assess scales, such that investigators relying upon these measures can have confidence in the degree to which items capture the intended constructs. To accomplish this aim, this study specifically sought to determine if measures intended to assess task and barriers efficacy modified by Foley et al. (2008), as well as perceived autonomy, competence, and relatedness need satisfaction modified from Richer and Vallerand (1996), Ryan (1982), Blais, et al. (1990), and Ntoumanis (2001) in the present study, have acceptable levels of content validity for use in children's physical activity research. The results of the expert review procedures indicated that, overall items demonstrated some evidence of content relevance indicating items captured the constructs they were intended to. As such, the scales are considered acceptable for use in children's physical activity research in terms of the degree to which they assess task and barriers efficacy, autonomy, competence, and relatedness.

Expert evaluations indicated items as a whole items were at least a good match to the content each was intended to capture. On closer inspection, *R* values indicated some disagreement among judges on ratings for 3 competence items, 1 relatedness item and 3 autonomy items. This inconsistency was further reflected in the lack of statistical significance associated with *V*-coefficients for these item evaluations. Shedding some light on problem ratings, accompanying comments indicated experts were in agreement that autonomy items were overly focused on choice. Although choice is an aspect of autonomy, the degrees to which individuals feel volitional and self-directed are

considerations as well. Furthermore, one expert cited Reeve, Nix, and Hamm (2003) whose work experimentally isolated the influence of choice and found that provision of choice was unrelated to volition, internal locus, or intrinsic motivation. As such, focusing items solely on choice without capturing volition or internal locus may be problematic. An additional issue with one autonomy item was raised by an expert with substantial experience in children's research who expressed concern for including negatively worded items citing that children have difficulty interpreting negatively worded items. The item was removed from the final version of the scale. Comments on competence items largely identified a need to further modify item wording in order to be more concrete. For example, experts recommended replacing the words "pretty confident" with "confident" in one instance. As with the negatively phrased autonomy item, a similar competence item was also decidedly problematic and was also thought to capture incompetence and not competence at all. In response, this item was removed and remaining items were modified as per expert suggestions. Finally, experts voiced concern with a relatedness item which stated "I feel safe." Citing the word "safe" as having multiple possible interpretations, experts recommended its removal or replacement. Thus, the word "safe" was replaced with the word "connected", taken directly from the theoretical definition of relatedness.

When considering each set of items as a whole, experts were largely in agreement in their assessment of relatedness, competence and both self-efficacy items in terms of content representativeness. Inspection of *R* values indicated however, a lack of consensus regarding the representativeness of the set of autonomy items. Descriptive statistics showed all items were believed to be at least a "fair representation" of the focal constructs of interest, and were thought to be at least "somewhat" appropriate for use in physical

activity research in terms of representing the entire constructs intended, however only task and barriers efficacy ratings were statistically significant. This lack of consensus regarding the degree to which these items capture the entire domain of the intended constructs limits the ability to which conclusions about the representativeness of basic need satisfaction items can be drawn. Additional summary items indicated that more than half of judges felt additional items should have been included to fully capture the targeted constructs. Moreover, nearly a quarter of judges believed there were items that captured more than the intended constructs. This is not surprising as task efficacy and competence reflect very similar constructs and, as such, some overlap is unavoidable. Amendments to the item pool were made in accordance with expert guidance, resulting in a strengthened assessment tool.

The current study employed and reported a variety of assessment techniques advocated within test construction and psychometric literatures. In doing so, this work attempted to overcome the limitations associated with other test evaluation undertakings in the field of sport and exercise psychology that either failed to systematically assess the content validity of new or modified scales, or failed to report these assessments (Dunn et al., 1999). In line with recommendations (Dunn et al., 1999; Haynes, Richard, & Kubany, 1995), judges were experts in the theoretical and contextual domains under investigation, as well as having demonstrated expertise conducting research in the population for whom these scales are intended. Moreover, the structured item evaluation format strengthened this study. Systematic assessment of scales was heavily recommended by psychometricians for the evaluation of content relevance as it provides the opportunity to evaluate and summarize ratings using quantitative statistical procedures (Hambleton, 1980; Haynes et al., 1995; Messick, 1989; Yalow & Popham, 1983). The application of

procedures to statistically assess the significance of judge's ratings (i.e., Aiken's V-coefficient) was considered an additional strength of this study as it allowed the test developer to make and justify decisions regarding item selection, modification, or deletion based on objective information (Dunn et al., 1999). Moreover, the opportunity to comment on ratings provided test developers with valuable information for modifying problems identified by the quantitative evaluations.

As with any study, there were a number of weaknesses to acknowledge in the present work. First, items were not created specifically for the targeted audience of 10-14 year old children, but were modified from existing adult measures. This may have been problematic as there was no opportunity to explore and acknowledge the specific types of events that occur in physical activity settings which children perceive as need satisfying. To address this issue, items were kept fairly general, reflecting need satisfaction during physical activity rather than while performing specific tasks that may occur during physical activity.

Second, prior to distributing ICRF's to expert judges, the construct definitions adapted from theoretical definitions were not scrutinized by a second source to ensure they were consistent with theory. The description provided to judges regarding autonomy was criticized within the comments of one expert judge who indicated the focus of items on choice was too narrow. As autonomy items were taken directly from scales used regularly in SDT research this may have implications regarding the conclusions drawn from previous research that has relied on these scales. The measurement of perceived autonomy deserves to be revisited. Based on the comments received from one judge in the current study, new items may be needed to supplement, or replace current items in order to more completely capture the construct.

Overall, the statistical outcomes taken together with the qualitative comments provided by judges indicated the items are adequate for use with children in physical activity settings. Following modifications to the item set, as informed by statistical and qualitative feedback, the resulting self-efficacy and basic psychological needs questionnaires are acceptable measures of the intended domains. It should be noted however, that “validity is an evolving property and validation is a continuing process” (Messick, 1989, p.13). Additional work is needed to further establish the validity as well as the reliability of the measures presented here. Implementation in future research with children will allow opportunities to convergent validity of scales.

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Chapter 3 - Toward an Integrated Model of Children's Physical Activity: The
Contribution of Psychological Needs Satisfaction and Self-Efficacy (Study 2)

Abstract

The purpose of this study was to examine a model of children's physical activity behaviour that integrated variables from social cognitive theory (SCT; Bandura, 1986; 1997) and self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000). Children's task and barriers efficacy beliefs about engaging in physical activity, and their usual perceptions of autonomy, competence, and relatedness basic psychological need satisfaction during physical activity were hypothesized to prospectively predict physical activity behaviour. Children ($N = 83$; 11-14 years) provided demographic and anthropometric information and completed relevant measures of self-efficacy and psychological needs variables. Self-reported and objectively measured physical activity were assessed the following week. Separate multiple regression analyses were conducted for each physical activity outcome. In model one, task and barriers self-efficacy, perceived competence, and autonomy psychological need satisfaction explained 20.3% of the variance associated with self-reported moderate to vigorous physical activity. In model two, perceived autonomy contributed 8% to the prediction of time spent engaged in objectively assessed moderate intensity activity. In model three, perceived competence accounted for 9.4% of the variance associated with objective vigorous physical activity. These data provide preliminary support for the unique manner in which forms of self-efficacy and need satisfaction differentially relate to various conceptualisations and intensities of children's physical activity.

Key words: children; physical activity; self-efficacy; self-determination theory

Introduction

Recent evidence clearly indicates that only 7% of Canadian children are engaging in physical activity of a sufficient intensity, frequency, and duration to incur associated physiological (Janssen & LeBlanc, 2010) and psychological (Biddle & Mutrie, 2007) health benefits (e.g., Canadian Society for Exercise Physiology; CSEP, 2011).

Amendments to the national physical activity guidelines now recommend that Canadian children engage in at least 60 minutes of moderate to vigorous physical activity (MVPA) every day to maintain optimal health (CSEP, 2010). With physical activity (and inactivity) tracking into adulthood (Malina, 2001; Telama, Yang, Viikari, et al., 2005), strategies to bolster youth physical activity levels are important undertakings in the prevention of inactivity related diseases that include metabolic disorders and risk factors of cardiovascular disease (Strong, Malina, Blimke, et al., 2005). Although multiple factors contribute to children's physical activity participation, behavioural scientists have attempted to understand the psychosocial factors that underpin behaviour given these factors may provide practically relevant (i.e., modifiable) determinants of MVPA.

Self-Efficacy

Self-efficacy is one of the most widely acknowledged psychosocial determinants of physical activity behaviour (Bandura, 1986; 1997). Outlined in Social Cognitive Theory (SCT; Bandura, 1986, 1997), self-efficacy reflects individuals' confidence in their abilities to behave in ways that will lead to intended outcomes. Indeed, this construct has been broadly supported with regard to its role in affecting behaviour directly and indirectly (Bandura, 2004). In terms of an indirect role, individuals with high efficacious beliefs are assumed to set higher goals, demonstrate greater commitment to their goals, expect more favourable outcomes to result from their efforts, and persist longer when

faced with barriers compared to their low-efficacious counterparts (Bandura, 1986). Since its initial conceptualisation, self-efficacy has been differentiated into task and self-regulatory efficacy (Maddux, 1995). Task efficacy maintains a focus on motor skills, describing beliefs about one's abilities to complete specified requirements of a task or behaviour (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998). In contrast, self-regulatory efficacy is assessed as a multi-faceted construct, relating to beliefs about capacities to organise and overcome challenges to performing tasks or behaviours (Maddux, 1995; Maddux & Gosselin, 2003; Woodgate & Brawley, 2008). Among the self-regulatory beliefs, barriers efficacy specifically addresses individuals' beliefs in their abilities to overcome identified obstacles (e.g., if I am sore) in the face of particular behaviours (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998).

Reviews reveal self-efficacy is consistently related to physical activity in adults (Troost, Owen, Bauman, Sallis, & Brown, 2002) and youth (Sallis, Prochaska, & Taylor, 2000; Van Der Horst, Paw, Chin, Twisk, & Van Mechelen, 2007). Adult studies have shown task efficacy exerts the most influence during the adoption and adaptation stages of an exercise program, as well as during particularly challenging activities (e.g., vigorous exercise), whereas barriers efficacy appears most important for exercise maintenance (McAuley & Blissmer, 2000; Sallis, Haskell, Fortnam, et al., 1986). Self-efficacy has also been correlated with physical activity behaviour in children and adolescents, however closer inspection of frequently used questionnaires reveals three issues.

First, in attempting to draw links between self-efficacy and physical activity, self-reported measures of behaviour have been the dominant means of assessment. The tendency for children to over-report their physical activity on self-report measures (Sallis, Buono, Roby, Micale, & Nieldson, 1993) calls conclusions based on these data into

question. With advancements in the development of valid and objective physical activity assessment tools that lend themselves to field settings (e.g., accelerometry; Trost, 2001), previously accepted relationships between self-efficacy and physical activity should be revisited.

Second, there has been a strong bias toward the measurement of barriers efficacy in children's research. A consistent negative relationship uncovered between perceived barriers and physical activity (Sallis et al., 2000) may justify the overwhelming attention afforded to examining young people's confidence in their abilities to overcome obstacles to physical activity. However, this narrow focus described under the broad construct of self-efficacy has overshadowed consideration of task efficacy, which may be an important determinant of children's vigorous activity.

Finally, where studies have acknowledged the potential contribution of task efficacy, a single item representation has been included among the barriers efficacy items (e.g., Sallis, Simons-Morton, Stone, et al., 1992; Wilson, Kitzman-Ulrich, Williams, Saunders, et al., 2008). This is problematic as single item measures have no discriminant validity and preclude the consideration of the multifaceted means by which self-efficacy beliefs operate in physical activity (Bandura, 2006). Moreover, general physical activity self-efficacy measures do not permit investigation of the unique contributions of barriers and task efficacy. This information is imperative for informing the development and evaluation of effective and efficacious physical activity intervention strategies. Despite accumulating evidence that self-regulatory efficacy may be more important in the maintenance of physical activity for adults (e.g., Woodgate & Brawley, 2008), it seems likely that children's beliefs in their physical abilities are salient contributors to their physical activity decisions during this time of physical maturation and skill development.

Preliminary findings where task and barriers efficacy were assessed individually with children found strong relationships between both efficacy forms with physical activity (Foley, Prapavessis, Maddison, Burke, McGowan, & Gillanders, 2008), thus supporting the importance of children's beliefs in their abilities to be physically active and in overcoming barriers to activity.

Basic Psychological Needs

It has been acknowledged that despite the strong support self-efficacy has received in literature for its relationship with behaviour, other variables should be considered in order to strengthen our understanding of the psychological determinants of physical activity (McAuley & Blissmer, 2000). A second set of determinants that have been explored in physical activity are autonomy, competence and relatedness - basic psychological needs forwarded by self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000). *Autonomy* is described as the need to believe that one's behaviour is completely in line with his or her own interests and values (Ryan, 1993). *Competence* is described as the need and propensity to effectively engage with the environment (Deci, 1975). Finally, *Relatedness* is described as the need to feel a connection and sense of belongingness with others in a meaningful and secure way (Baumeister & Leary, 1995; Deci & Ryan, 1985). Within SDT, the pursuit of autonomy, competence, and relatedness are described as innate and relatively stable motivating forces that are universal across age, gender, and culture (Deci & Ryan, 1985; Chirkov, Ryan, Kim, & Kaplan, 2003).

According to SDT, and as described in the motivational sequence proposed by Vallerand (2001), the satisfaction of basic needs leads to increased psychological well being directly, and to positive behavioural consequences indirectly as mediated by intrinsic motivation and identified regulation. These mediational paths have been well

established with children at home, at school, with friends (e.g., Veronneau, Koestner, & Abella, 2005), during physical education class (e.g., Standage, Duda, & Ntoumanis, 2005) and in sport settings (e.g., Gagne, Ryan, & Bargman, 2003). Unfortunately, insufficient attention has been paid to the direct role of need satisfaction in children's physical activity. This route is formally proposed within the self-determination model of health behaviour change (Williams, Minicucci, Kouides, Levesque, Chirkov, & Ryan 2002). Therein the pivotal role of perceived competence for behaviour change is identified, positing that it predicts maintained behaviour directly (Williams, 2002). In adult research, competence need satisfaction has predicted continuous abstinence from cigarettes (Williams, Gagne, Ryan, & Deci, 2002), and decreased glucose levels in patients with diabetes (Williams, Freedman, & Deci, 1998). Where they have been assessed in children, basic needs have shown strong positive relationships with physical activity (Bo, McAughtry, & Jeffrey, 2007). Furthermore, when followed longitudinally, higher autonomy, relatedness, and competence need satisfaction experienced during physical education have directly predicted greater effort during physical education classes (Taylor, Ntoumanis, Standage, & Spray, 2010). Additionally, higher competence need satisfaction has also shown to be directly predictive of self-reported physical activity (Taylor, et al., 2010), further supporting the importance of need satisfaction in physical activity.

Encouraging evidence for these relationships supports continued exploration of the role of need satisfaction, and especially competence need satisfaction within the context of physical activity in children. The transition from childhood to adolescence represents an important stage in growth and development where perceptions of individuals' autonomy, relationships as well as ability are all changing (Williams, 2002).

In light of evidence that competence need satisfaction at a global level dramatically declines during puberty, with larger decreases evident in girls (Hankin, Abramson, Moffitt, Silva, McGee, & Angell, 1998) competence satisfaction in the context of physical activity may be of particular importance to this population. The timing of competence satisfaction changes relative to reported declines in physical activity (Colley, Garriguet, Janssen, Craig, Clarke, & Tremblay, 2011) raise important questions about the role of psychological need satisfaction in the maintenance of youth physical activity behaviour during the transition from childhood to adolescence.

Integrating the Constructs

The integration of self-efficacy and basic psychological needs constructs offers a complementary and comprehensive explanation for the behavioural consequences of children's physical activity related beliefs and affect. From a practical point of view, the specification of readily modifiable features of self-efficacy (i.e., the sources of self-efficacy: mastery experiences, physiological states, vicarious experiences, and verbal persuasion; Bandura, 1986; 1997), and of basic psychological needs (i.e., need supportive environments: autonomy support - Deci & Ryan, 1985, structure, and interpersonal involvement - Reeve, 2002) make these constructs particularly desirable to investigate for purposes of planning future interventions.

From a theoretical perspective, one key area where basic needs and self-efficacy constructs may provide a more inclusive description of the psychological underpinnings of children's physical activity concerns hypothesized mechanisms of behaviour change. Self-efficacy is considered to represent socially and cognitively based beliefs that *direct* behaviour. As such, individuals are more likely to engage in a specific behaviour if they believe they can be successful in it (Bandura, 1986). This is in contrast with basic

psychological needs, which are affectively-based motivational characteristics that *energize* behaviour (Elliot, McGregor, Thrash, 2002). Accordingly, individuals high in competence need satisfaction for example, are drawn to activities because of the pleasure that results from engaging in an effective manner and autonomous manner. A second contrast pertains to the formation of each variable. Self-efficacy beliefs are described as evaluations of ability that form as a result of specific experiences with the environment. In contrast, basic psychological needs are structural elements of the self that are present at birth and become consolidated over time as a function of maturation, biological makeup, as well as experiences with the social and physical environment (White, 1963).

Certainly, there exists some degree of overlap between self-efficacy and basic need satisfaction, particularly with regard to the common attention to the central role of capability addressed by task efficacy and competence concepts. Assessed together however, these variables may provide an enhanced understanding of how perceptions of autonomy, relationships, and abilities to engage in and overcome barriers associated with physical activity translate to actual behaviour.

Purposes and Hypotheses

In recent years, governments and academics alike have prioritised increasing children's physical activity behaviour as a public health target. In taking a person centred approach to addressing this goal, the present study proposes an integrated model of psychosocial variables whereby the joint contribution of self-efficacy and basic psychological needs on health enhancing, moderate to vigorous physical activity are considered. The primary objective therefore, was to determine whether children's specific and general confidence for engaging in physical activity (i.e., task efficacy and perceived competence, respectively) and for overcoming barriers to being active (i.e., barriers

efficacy), together with feelings of personal agency (i.e., perceived autonomy), and interconnectedness (i.e., perceived relatedness) can directly predict both subjectively and objectively assessed physical activity.

Based on previous evidence it was expected that task efficacy and barriers efficacy (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998) as well as the need for competence (Deci, 1975) would independently contribute to these predictions. Given that direct relationships from autonomy and relatedness need satisfaction to physical activity are largely exploratory in nature, hypotheses were not formulated for these predictions.

Methods

Participants

Participants were 90 (42 girls) sixth through eighth grade primary school students recruited through the local public school board. All were aged between 10 and 14 years ($M = 12.16$, $SD = 1.14$) and were predominately Caucasian.

Instruments

Task efficacy was assessed using 9 items from the task self-efficacy for treadmill walking scale (McAuley & Mihalko, 1998) modified and validated for children by Foley and colleagues (2008). Modified items specified children's confidence to engage in up to 60 minutes of physical activity on 3 *days* next week. Further modifications made in study 1 of this dissertation specifically targeted confidence to be physically active on 5 *or more days* of the next week. Participants indicated confidence to engage in physical activity for increasing durations (10, 30 and 60 minutes) and increasing intensities (light, moderate, and hard) on 5 or more days of the week on a scale anchored at the extremes by 0%, no confidence at all, and 100%, complete confidence, (Sample item: "How confident are you that you can complete 30 minutes of physical activity at a hard intensity level on 5 or

more days next week?”). Scores for each item were summed and an overall average was obtained with higher scores indicating greater confidence for engaging in physical activity. This scale demonstrated excellent reliability (Nunally, 1978) in this study and in previous research with α 's = 0.96, 0.95, respectively (Foley et al., 2008).

Barriers efficacy was assessed using the 6 item barriers efficacy scale for exercise (McAuley & Mihalko, 1998) as modified and validated for children's physical activity by Foley et al. (2008). Items asked participants to indicate confidence in their ability to engage in 60 minutes of MVPA on five or more days of the week when confronted by 6 salient barriers (sample item: “even if the weather is bad”). Scores were indicated on a scale anchored at the extremes by 0% (no confidence at all) and 100% (complete confidence) and summed. An average was calculated with higher scores indicating greater barriers self-efficacy. This scale demonstrated excellent internal consistency in previous research with an alpha of 0.86 (Foley et al., 2008) and in the present study ($\alpha = 0.86$).

Basic psychological needs satisfaction in physical activity was assessed using a 15-item composite measure adapted from existing scales (Blais, Vallerand, & Lachance, 1990; Ntoumanis; 2001; Richer & Vallerand, 1996; Ryan, 1982) in study 1. Modifications were pilot tested using individual face-to-face interviews with individuals from the target population to ensure face validity, and were subjected to expert review procedures using a structured item content review to establish item-content validity of scales (See study 1). Participants recorded perceptions of their autonomy (4 items; sample item: “I feel free to do physical activity in my own way.”), competence (6 items; sample item: “I do well at physical activity compared to others.”) and relatedness (5 items; sample item: “In my relationships with people I am physically active with I feel valued.”) need satisfaction in terms of how they typically feel during physical activity. Responses

were recorded on a 7 point Likert-type rating scale anchored at the extremes by 1 (do not agree at all) and 7 (very strongly agree). Scores were summed and an average was taken for each scale, with higher scores indicating greater perceptions of need satisfaction. Items demonstrated acceptable reliability (α 's = 0.71 - 0.95) in this study.

Self-reported physical activity was determined using the physical activity questionnaire for older children (PAQ-C; Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). The PAQ-C is a 9-item, 7 day recall measure that was designed to assess children's physical activity during the school year. Physical activities were defined as "sports, games or dance that make you breathe hard, make your legs feel tired, or make you sweat." Items targeted times of day relevant to children during the school year (i.e., P.E., recess, lunch time, right after school, in the evening and on the weekend). For each of nine items, scores were converted to a 5-point scale. A composite score was calculated as the mean of the 9 items, with higher scores indicating higher levels of physical activity. The PAQ-C has demonstrated reliability and validity in previous research with children, with alpha's ranging from 0.79 - 0.89 (Crocker et al., 1997) and 0.79 in this study.

Objectively assessed physical activity was recorded using Actical® Active Energy Expenditure monitor (Mini Mitter Co., Inc., Bend, OR). Time spent engaged in sedentary, light, moderate, and vigorous physical activity was assessed using the omni-directional accelerometer. The small (2.8 x 2.7 x 1.0cm³), lightweight (17g), waterproof accelerometer measures whole body physical activity and is most sensitive to movement of the torso (Puyau, Adolph, Vohra, Zakeri, & Butte, 2004). The Actical® is sensitive to movement frequencies in the 0.5 to 3.2 Hz range, can discriminate between sedentary, light, moderate, and vigorous intensities (Puyau et al., 2004) and has demonstrated acceptable reliability and validity in previous research with children (Heil, 2006). Devices

were customized for each participant by study identifier, sex, age, weight, and height, and were set to collect data at 15 second epochs. Devices were secured above each participant's iliac crest of the right hip with a buckled nylon belt. Children were instructed to wear the Actical® for 8 days (including day 0) except while asleep or showering.

Data were uploaded to a computer and analyzed using the software accompanying the devices. Quality control and data reduction procedures followed those outlined for use in the National Health and Nutrition Examination Survey (Troiano, Berrigan, Dodd et al., 2008). Valid wear time was defined a priori as a minimum of 4 valid days of device wear including at least 1 weekend day. A day was considered valid if the Actical® was worn for 10 or more hours in a 24 hour period. Activity counts were visually examined for spurious data using the upper threshold of 20,000 counts per minute (Colley, Connor Gorber, & Tremblay, 2010). The first day of wear time (day 0) was excluded from the analysis to decrease the influence of reactivity (Standage, Sebire, & Loney, 2008). For each valid day, time spent engaged in sedentary, light, moderate, and hard intensity activity was computed by the Actical® software according to the cut points provided by Trost, Pate, and Sallis (2002) and exported to an Excel spreadsheet. Average daily time spent in moderate and heavy intensity physical activity was determined taking the sum of daily average minutes for valid days in both activity intensities, and dividing by the number of valid days.

Procedure

Prior to recruiting participants, approval for the study protocol was received from the host institution (Ethics Review # 15464E) and the regional public school board, as

well as from the principals of the two elementary schools who responded to a recruitment letter distributed by the regional school board. Teachers of grades 6, 7, and 8 classes allowed the principle investigator to provide an oral and written description of the study purpose and protocol to eligible students. Participants who returned signed student assent and parental consent forms completed a self-administered questionnaire package and had their height and weight recorded to the nearest 0.5 cm and 0.1 kg using a Health o Meter Professional height and weight scale (Health-O-Meter® 500KL, Boca Raton, FL). Researchers returned to the Exercise and Health Psychology Laboratory (EHPL) to program and initialise Actical® devices to begin recording the following morning which was called day 0. Students were fitted with the Acticals® and provided oral and written wear instructions, which also included a space for participants to record the beginning and end of each wear day. After the 8 day activity monitoring period devices were returned and participants completed the PAQ-C. One participant who did not respond to the psychological questionnaires and five who did not provide any physical activity data were removed from further analysis. In total 52 participants (61.9%) provided valid objective PA and 79 (94%) provided valid subjective PA data.

Results

Treatment of the Data

Practical issues associated with the use of parametric tests were addressed prior to main analyses (Tabachnick & Fidell, 2007). Data were screened for compliance to the assumptions of multiple regression (Tabachnick & Fidell, 2007) and unless otherwise specified data adhered to these criteria. Fewer than 5% of values were missing on items assessing the main study variables and were replaced with the group mean for the item. Distributions for time spent in vigorous physical activity differed significantly from

normal as indicated by K-S tests. Box plots identified the presence of 2 extreme univariate outliers. Raw data for the outliers were inspected and deemed to be physiologically plausible. As such cases were retained and the substantial positive skewness was corrected for using a logarithm transformation.

The Pearson product moment correlation coefficient was used to establish relationships between the predictor variables (i.e., the 2 self-efficacy measures and the 3 need satisfaction measures) and the criterion variables (i.e., self-reported and objectively measured physical activity). If bi-variate relations were found between the variables of interest, they were subsequently analysed using a standard regression analysis.

Main Analyses

Descriptive statistics and bi-variate correlations for all study variables are presented in Table 6. From the correlation findings in Table 6, 3 regression analyses were computed. In the first regression, perceived competence, barriers efficacy, perceived autonomy and task efficacy significantly predicted subjectively assessed physical activity ($F(4, 71) = 4.52, p < .01$), explaining 20.3% of the variance. Table 7 shows the unique contribution each variable made to prediction. In the second regression perceived autonomy significantly predicted objective average daily minutes of moderate intensity physical activity ($F(1, 50) = 4.23, p < .05$) accounting for 7.8% of the variance. In the third regression perceived competence significantly predicted average daily minutes of vigorous intensity physical activity ($F(1, 48) = 5.0, p < .05$) accounting for 9.4% of the variance.

Table 6. Bivariate correlations among the study variables

	M	SD	1	2	3	4	5	6	7
Task efficacy (1)	77.67	17.36	-						
Barriers efficacy (2)	62.73	19.61	.66*	-					
Autonomy (3)	5.64	1.03	.33*	.38**	-				
Competence (4)	5.44	1.33	.52*	.44**	.57**	-			
Relatedness (5)	5.55	1.10	.39**	.39**	.42**	.43**	-		
Time Moderate (6)	157.31	44.44	.12	.26	.28*	.23	.07	-	
Time Vigorous (7)	3.70	5.04	.19	.11	.26	.31*	-.09	.32*	-
PAQ-C (8)	3.28	.61	.37**	.35**	.27*	.39**	.17	.31*	.17

Note. Logarithm transformed data were used in the correlation analyses for TVig. Non transformed TVig mean and SD values are presented, Time Moderate is average minutes per day engaged in moderate intensity physical activity, Time Vigorous is average minutes per day spent in vigorous intensity physical activity, * $p < .05$, ** $p < .01$.

Table 7

Multiple regression analysis examining the relationship between PAQ-C, autonomy, competence, task efficacy and barriers efficacy

	<i>b</i>	t	R	² <i>R</i>
			.451	.203
Competence	.22	1.56		
Autonomy	.04	0.36		
Task efficacy	.16	1.03		
Barriers efficacy	.12	0.80		

Table 8

Multiple regression analysis examining the relationships between time in moderate intensity physical activity and perceived autonomy

	<i>b</i>	t	R	<i>R</i> ²
autonomy	.28	2.06*	.28	.08

Note: *p < 0.01.

Table 9

Multiple regression analysis examining the relationship between time in vigorous intensity physical activity and perceived competence

	<i>b</i>	<i>t</i>	<i>R</i>	<i>R</i> ²
Competence	.307	2.24*	.307	.094

Note: * $p < .05$. Logarithm transformed data were used for time spent in vigorous physical activity.

Discussion

Children's participation in regular, health enhancing MVPA has decreased dramatically in recent years with the largest declines evident upon transition to adolescence (Active Healthy Kids Canada, 2010). Taking a person centred perspective to behaviour change, modifiable psychosocial variables from self-efficacy and self-determination theory have been previously related to physical activity behaviour in this population and thus represent potentially valuable mediators of behaviour on which to base intervention efforts. To our knowledge, this study is the first to examine the joint contributions of self-efficacy and basic needs satisfaction on prospective MVPA in children.

As expected, task efficacy, barriers efficacy, perceived competence, and the exploratory variable, perceived autonomy predicted approximately 20% of prospective self-report physical activity. However, no single variable made a significant contribution to the model on its own. The amount of variance explained is in line with other studies (e.g., Foley et al., 2008; Motl, Dishman, Saunders, et al., 2007), and highlights the importance of theory integration in predicting physical activity in youth. These findings underscore the utility of theory integration by contributing further evidence that compatible theoretical frameworks may overcome the limitations of each model alone in the explanation of children's physical activity.

When examining objective estimates of time spent in moderate and vigorous physical activity, only basic needs variables were significantly related. The potential utility of assessing need satisfaction under the environmental conditions (e.g., physical activity) in which needs are considered to predict behaviour has been previously highlighted (Vallerand & Ratelle, 2002). In other work, competence assessed during P.E.

was predictive of leisure time physical activity while autonomy and relatedness were not (Taylor et al. 2010). In the current study, where needs and behaviour were assessed in the same context, perceived autonomy prospectively predicted approximately 8% of objective moderate physical activity. Perceived competence explained a significant portion (e.g., 9.4%) of the variability associated with objective vigorous physical activity. This result supports the path from perceived competence to physical activity reported previously for subjective physical activity behaviour (e.g., Bo et al., 2007; Carroll & Loumidis, 2001; Taylor et al., 2010) and described in the self-determination model of health behaviour. Thus it appears that although autonomy may not be sensitive enough to cross contexts in prediction of behaviour, perceiving overall physical activity as self-initiated and self-directed is important for children's moderate physical activity, but not for vigorous activity which is better predicted by a tendency toward opportunities to demonstrate competence.

These findings highlight the importance of examining moderate and vigorous intensities of physical activity separately. That constructs related to objective moderate and vigorous physical activity differently speaks to the distinct function psychosocial constructs carry out in various aspects of physical activity behaviour. As evident from the current findings, children's perceived autonomy is important to the accumulation of moderate intensity physical activity. This would suggest children's beliefs that physical activity gels with their values and that the decision to be active is self-initiated is an important aspect of a regularly physically active lifestyle. The important function of perceived competence in vigorous physical activity suggests when children believe they possess a high degree of ability while engaging in activities they are more likely to engage at a vigorous intensity. This is congruent with the definition of competence, in

that greater perceived competence is indicative of a greater propensity to seek out opportunities to demonstrate these capacities.

The larger amount of variance accounted for in self-reported behaviour than in objectively assessed behaviour may be an artefact of measurement congruence than effect size differences. The integrated model measures prompted children to consider their need satisfaction or efficacy beliefs that are consciously processed. Similarly, children's recall of their physical activities over the previous week depended on the extent to which they processed and remembered events over the previous week. This is distinguished from objective measures of physical activity for which no cognitive processing on the part of children was necessary to produce data. The closer congruence in measures may explain the greater variance explained in the subjective physical activity model. It is possible that had implicit need satisfaction and self-efficacy been captured, these variables would have had a greater opportunity to account for a larger portion of the variance in objective behaviour.

Among the limitations of the study, the degree to which findings may be generalised is a concern. The non-random recruitment of study participants increases the potential that results are affected by a self-selection bias. Moreover, the small sample size may have stifled relationships from reaching statistical significance. For example, the medium sized, non significant relationship between time in moderate intensity physical activity and barriers efficacy ($r = 0.26$) suggests the study was underpowered. Indeed, there are many rules of thumb pertaining to adequate sample sizes, Green (1991) recommends that when the aim is to test the overall fit of the model, and the individual contributions made by each variable, a minimum of 104 participants plus the number of predictor variables under examination is needed.

Overall, the present study provides initial evidence that perceptions of competence and autonomy are salient determinants of PA for children. Findings contribute to the extant literature where children's competence perceptions are consistently correlated with increased physical activity (e.g., Carroll & Loumidis, 2001). As discussed within SDT, individuals inherently strive for need satisfaction and need satisfying social situations whenever possible, without prior reflection of the broader internal or external motivations, whether or not they are aware of it (Ryan & Deci, 2002; Elliot et al., 2002). This is consistent with dual processing models that consider social behaviour to originate as either deliberate or impulsive (Fazio, 1990; Strack & Deutsch, 2004). The prospective prediction of both subjective and objective physical activity in this study offers support for these previous contentions and suggests further exploration of these variables in physical activity is warranted.

Relatedness need satisfaction was unrelated to physical activity. This is somewhat surprising considering the influence of peers on adolescent behaviours has been described as more influential than parents' influence (Beets, Vogel, Forlaw, Pitetti, & Cardinal, 2006; Harter, 1999). Further, children's best friends were as, or more important than peers and social groups in influencing behaviour in physical activity contexts (Berndt & Keefe, 1995; Weiss & Stuntz, 2004). In exploratory work, participants indicated participation was largely driven by a desire to participate with friends who shared an interest in being active, and who encouraged their participation (Jago, Brockman, Fox, Cartwright, Page, & Thompson, 2009). Although children cite their relationships with friends and peers as reasons for acting, the failure of relatedness to predict behaviour in this study may indicate other relationships are potentially more important drivers of behaviour. This may indicate a lack of specification of the relevant social relationships

targeted by relatedness items. In responding to relatedness items, individuals were asked to consider the individuals with whom they usually participate in physical activities. Children are physically active in a variety of contexts (e.g., sports, household chores, and unstructured play) and there are presumably multiple people with whom they are active. It is conceivable that this led to difficulties in accurately assigning an overarching perception of relatedness across all physical activity settings. It may have been more appropriate to assign parent(s) or guardian(s) as a target since they represent children's most influential social associations (Bois, Sarazzin, Brustad, Trouillard, & Cury, 2009) and, parent encouragement and support is a key mechanism influencing youth physical activity and sport behaviour (Ornelas, Perreira, & Ayala, 2007; Trost et al., 2003). Accordingly, perceptions about relatedness to parents may be the most important source of relatedness information supporting children's engagement in physical activity and may have been a more appropriate target.

The finding that self-efficacy was unrelated to objectively assessed minutes of health enhancing physical activity contrasts with a growing body of literature (e.g., Lawman, Wilson, Van Horn, Resnicow, & Kitzman-Ulrich, 2011; Foley et al., 2008; Trost, Pate, Ward, Saunders, & Riner, 1999). Inconsistencies in the assessment of self-efficacy and the failure to adhere to Bandura's (1986) measurement recommendations in terms of magnitude, generality, and strength may contribute to the different result found in the current investigation. In a previous study in which self-efficacy was assessed appropriately in accordance with Bandura's specifications (i.e., Foley et al., 2008) confidence to engage in physical activity on three days the following week was evaluated. Noticeable differences between average self-efficacy are evident between this study and Foley et al. (2008) with the latter reporting larger means. It is possible that the low target

of 3 days per week which is inconsistent with health enhancing physical activity recommendations, affected the emergent relationship with physical activity outcomes. This was avoided in the current study where confidence to be physically active on 5 or more days next week was assessed.

There were a number of strengths associated with the present study design. First, unlike most physical activity research conducted where self-report methods provide the principle source of information, physical activity behaviours were measured objectively in addition to subjectively (i.e., self-report). This is a strong point of the study design as each method makes up for the weakness in the other. For example, accelerometry gathers time sequenced data on the patterns (intensity, frequency, duration) of children's behaviour, which is often characterised by sporadic, intermittent bouts. Accelerometry cannot provide information about the type of activity (sport, physical education) in which these patterns occurred, however self-report measures such as the PAQ-C allow children to specify their activities. The use of self-report in children is associated with social desirability of responses and is challenged by the inability of developing children's minds to accurately recall the previous 7 days, issues overcome by accelerometry. Finally, compliance issues are associated with the use of accelerometry in children. The use of questionnaires can ensure that some information about physical activity is gathered in the absence of valid accelerometry data. In this study, a modest correlation ($r = 0.27$) was found between time spent in moderate physical activity and PAQ-C scores, which is consistent with previous research reported with children (Pate, 1993). This finding is not surprising given that the PAQ-C is designed to assess structured leisure time physical activity whereas the Actical® captures any free living ambulatory movement.

A second related strength pertains to the consideration of all of the opportunities children have for physical activity. The bulk of psychosocial literature in this realm has been limited to physical education and sport domains. Certainly these contexts represent important targets of research attention, being specifically designated settings for physical activity. However with only 2% of children's waking hours spent in physical education, and less than 20% of that time actually spent engaged in MVPA (Fox & Harris, 2003) it is clear that alternative targets for intervention are warranted. By encouraging children to reflect on the opportunities they have for physical activity in multiple domains it was attempted to overcome this limitation of previous work.

The striking contrast between objective MVPA in this study and evidence from large epidemiological data deserves discussion. Data from the Canadian Health Measures Survey (CHMS; Colley et al., 2011) and the National Health and Nutrition Examination Survey (NHANES; Troiano et al., 2008) indicate that fewer than 10% of children accumulate at least 1 hour of MVPA every day. In the present study participants were, on average, active for 157.31 minutes every day ($SD = 44.44$), in line with other work in a similarly constructed sample using the Actical® (Foley et al., 2008). There are at least 2 sources of this discrepancy: (1) the cut-points used to classify light, moderate, and vigorous activity, and (2) the calculation of physical activity outcomes. First, in this study cut-points provided by Trost, Pate, and Sallis (2002) specified the counts per minute (cpm) that determine activity intensity (T MVPA) as these values were pre-programmed by the manufacturer (*Mini Mitter Co., Inc., Bend, OR*). In contrast, the CHMS and NHANES used more stringent cut-points provided by Puyau (P MVPA) and others (Puyau, Adolph, Vohra, Zakeri, & Butte, 2004) which provided a much more strict determination of what constitutes moderate behaviour versus light behaviour than Trost et al (2002). In their

study comparing outcomes derived from each set of cut-points using the same data Guinhouya and colleagues (Guinhouya, Hubert, Soubrier, Vilhelm, Lemdani, & Durocher, 2006) determined significant differences between ^TMVPA and ^PMVPA, and a lack of agreement of 113 minutes/day. As such, it is possible the present data represent an overestimation of actual MVPA. Second, the total minutes engaged in moderate and vigorous physical activity on valid days were divided by the total number of valid days to arrive at average daily minutes. In contrast, NHANES and CHMS outcomes did not take an overall average. Rather, guideline adherence on each day was determined, and missing days were estimated to provide an overall estimate of population level adherence to guidelines.

Although the present findings indicate a significant pattern of relationships from needs and self-efficacy to physical activity appear to exist, it could be considered a limitation of the current study that motivational regulations, proposed by Vallerand (2001) to mediate the relationship between need satisfaction and physical activity, were not considered. Taylor et al. (2010) have argued that Vallerand's (2001) motivational sequence has been investigated extensively in this context, and as such inclusion of these additional variables may not have contributed new knowledge. However, this may have enabled the examination of potential direct relationships from needs to behaviour by modelling them together in a path analysis. Based on these limitations it can only be concluded that autonomy and competence predicted behaviour, but the potential role of motivational regulations cannot be excluded.

In summary, the current study describes unique contributions made by perceived competence and autonomy to the prediction of self-reported physical activity extends research that found task and barriers self-efficacy to significantly predict this criterion

(e.g., Foley et al, 2008). However, the failure of self-efficacy variables to account for a portion of the variance in objective time spent engaged in moderate or vigorous physical activity is perplexing and contrasts with previous literature (e.g., Van Der horst et al., 2007; Foley et al., 2008). It is suggested that future studies integrate self-efficacy with basic needs using a more direct test of an SDT mini-theory including motivational regulations as a guiding framework. Moreover, it is recommended that future psychosocial research continues to explore the utility of examining moderate and vigorous objective activity separately.

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Chapter 4 - A preliminary test of a brief adapted-motivational interviewing intervention
guided by an integrated model to increase children's physical activity (Study 3)

Abstract

Background: Preliminary evidence supports the utility of integrating concepts drawn from self-efficacy and self-determination theory to predict physical activity in children and adolescents. The present study extended these findings to determine if an intervention based on these concepts utilising motivational interviewing techniques could increase children's task efficacy, barriers efficacy, perceived competence, perceived autonomy, and both subjectively and objectively measured physical activity. **Methods:** Using accelerometry (Actical®) a sample of children were screened for adherence to physical activity guidelines (90 minutes of daily MVPA). In a 3 week proof of concept trial insufficiently active children ($N = 12$; ages 11-13) participated in a brief telephone intervention. Data were analysed using paired samples t-tests; **Results:** The intervention positively influenced perceived autonomy and competence but failed to increase self-efficacy variables or physical activity outcomes; **Conclusions:** The results did not support the ability of a single telephone intervention inspired by motivational interviewing and grounded in self-efficacy and self-determination theory constructs on increasing children's physical activity.

Key words: Self-efficacy; self determination theory; children; physical activity; motivational interviewing

Introduction

Interventions supporting increases in young people's physical activity can significantly improve the health of Canadians. Indeed, regular physical activity is crucial to the primary prevention of metabolic disorders and risk factors of cardiovascular disease manifested in childhood (e.g., Froberg & Andersen, 2005; Strong, Malina, Blimke et al., 2005). When undertaken regularly, physical activity during youth contributes to psychological health (Biddle, Fox, & Boutcher, 2000; Biddle & Mutrie, 2007), fundamental movement skill development (Okely, Booth, & Patterson, 2001), fitness, endurance, strength, and skeletal health (Janssen & LeBlanc, 2010; Strong et al., 2005). Unfortunately, only 7% of Canadian children aged between 5 and 17 adhere to the 60 daily minutes of moderate- to vigorous-intensity physical activity (MVPA) recommended for achieving health benefits (Canadian Society for Exercise Physiology - CSEP, 2010; Colley, Garriguet, Janssen, Craig, Clarke, & Tremblay, 2011). Increased physical activity has, therefore, been identified as one of the key actions in the promotion of health and the primary prevention of chronic diseases in children (Strong et al., 2005).

Although increasing the habitual MVPA of children and adolescents is an important public health priority, how to accomplish this objective is not well understood. Past interventions yielding weak to no effects (Baranowski & Jago, 2005; Van Sluijs, McMinn, & Griffin, 2007) demonstrate that behaviour change is a complex undertaking. Theorists have advocated for the importance of grounding intervention efforts in a proven theoretical framework (Rothman, 2000). A focus on the mediating effects of individual theoretical variables allows research to be translated for practice in community and clinical settings (Lerman, 2003). In the wake of evidence that large school-based and

community-based trials have largely failed to show positive effects (Van Sluijs et al., 2007) alternative approaches seem warranted.

An Integrated Conceptual Model

From the abundance of theoretical health behaviour models, self-efficacy (Bandura, 1986, 1997) and perceived competence (Deci, 1975) have emerged as particularly relevant variables, listed among the most frequently cited cognitive correlates of children's and adolescents' physical activity (Van Der Horst, Paw, Chin, et al., 2007; Sallis, Prochaska, & Taylor, 2000). Self-efficacy is described as people's beliefs in their abilities to make and execute the plans needed to produce particular outcomes at an explicit future time (Bandura, 1986, 1997). It is theorized that increased self-efficacy positively predicts the types of tasks people approach and whether they will persist when faced with challenges; outcomes of particular relevance to physical activity initiation and persistence. Self-efficacy was further differentiated into task and self-regulatory forms to distinguish between the types of cognitive control needed for various aspects of behaviour (Maddux, 1995). Task efficacy maintains a focus on the beliefs people have about their capabilities to engage in physical activities (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998). Self-regulatory efficacy, in comparison, is a multi-faceted construct that deals with people's beliefs about their abilities to organise and overcome challenges in the face of performing physical activities (Maddux, 1995; Maddux & Gosselin, 2003; Woodgate & Brawley, 2008). Among the self-regulatory beliefs, barriers efficacy specifically addresses people's beliefs in their abilities to engage in physical activities despite identified obstacles (e.g., bad weather) to the behaviour (McAuley & Blissmer, 2000; McAuley & Mihalko, 1998).

Self-efficacy researchers have acknowledged that consideration of other variables may strengthen our understanding of the psychological determinants of physical activity (McAuley & Blissmer, 2000). Constructs housed within SDT represent compatible determinants of physical activity that have contributed to our understanding of behaviour beyond that provided by self-efficacy alone (study 2) and offer promising targets for intervention. Specifically, perceived autonomy and perceived competence predicted significant variance associated with subjective and objective physical activity.

Highlighted among three basic psychological needs (Deci & Ryan, 2002), the perceived satisfaction of competence and autonomy are posited to be universal needs shared by all people regardless of culture, age, or gender. The need for competence is described as an innate, motivational drive to feel that one is able to effectively engage with his or her environment, and to seek ongoing opportunities to exercise these abilities (Deci, 1975; Deci & Ryan, 2002; Harter, 1983; White, 1959). The need for autonomy is described as the desire to behave in a manner that is congruent with one's own deeply held beliefs, to be volitional, and for behaviours to be self-initiated (deCharms, 1968; Deci & Ryan, 1985; Ryan & Connell, 1989).

The satisfaction of competence and autonomy needs is understood to be a necessary precursor to psychological wellbeing (Deci & Ryan, 2000) while competence satisfaction and autonomy support are vital to health behaviour change (Williams, 2002). In terms of a role in physical activity behaviour, perceived competence has received a great deal of support as a consistent correlate of physical activity in children's and adolescents' literature. For example perceived competence in physical education class has been predictive of higher self-reported physical activity (Taylor, Ntoumanis, Standage, & Spray, 2010), and greater quantity and intensity of physical activity outside of school

(Carroll & Loumidis, 2001). Similarly mothers' role modelling behaviour was predictive of children's increased competence and physical activity (Bois, Sarrazin, Brustad, Troulloud, & Cury, 2005). Consideration of perceived autonomy and competence need satisfaction in study 2 provided encouraging evidence for the importance of these concepts in physical activity research, and thus, they may warrant inclusion in intervention studies (study 2). Support for the inclusion of self-efficacy variables (i.e., task and barriers) in the prediction of subjective physical activity was consistent with previous evidence however, relationships were somewhat less clear when considering objective physical activity. In an integrated conceptual model, task efficacy, barriers efficacy, perceived autonomy, and perceived competence prospectively predicted 20% of the variance associated with self-reported physical activity in a sample of 10-14 year old children. Moreover, perceived autonomy accounted for 8% of the variance associated with accelerometer derived estimates of time spent in moderate intensity physical activity, while perceived competence accounted for 9.4% of the variance associated with time in vigorous activity. Positive results of prediction studies support implementation of an integrated self-efficacy and psychological needs model in intervention efforts to increase children's physical activity. A description of the means by which change in self-efficacy and psychological needs can be affected have been described in detail. Self-efficacy is heightened or undermined through the manipulation of sources of self-efficacy information: mastery experiences, vicarious experiences, social persuasion, and physiological states (Bandura, 1986, 1997). Furthermore, competence and autonomy are supported or thwarted by aspects of motivationally supportive environments: structure, autonomy support, and involvement.

Motivational Interviewing (MI)

MI is a “client centred directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence” (Miller & Rollnick, 2002). Practitioners of MI encourage individuals to make informed decisions about their behaviours, even if the decision is not to change (Resnicow, Davis, & Rollnick, 2006). Evidence for the efficacy of adapted MI (AMI) with adults in the substance abuse domain is overwhelming (i.e., Dunn, DeRoo, & Rivara, 2001; Miller & Rollnick, 2002; Noonan & Moyers, 1997). Results of the few trials assessing AMI for physical activity among adults are less conclusive (Miller & Rollnick, 2002), typically reporting short term effects with small to moderate effect sizes (Resnicow et al., 2006). Despite the limited research targeting children’s physical activity specifically, positive findings in other health domains such as dietary behaviour change (Berg-Smith, Stevens, Brown, et al., 1999) have led some to suggest that MI might be a feasible and promising means of increasing physical activity behaviour in children and adolescents (Resnicow et al., 2006).

MI and the Integrated Conceptual Model. It has been noted that key components of MI closely align with the sources of self-efficacy (Miller & Rollnick, 2002; Rollnick, Mason, & Butler, 1999) and the environmental supports for psychological needs (Markland, Ryan, Tobin, & Rollnick, 2005; Markland & Vansteenkiste, 2007; Vansteenkiste & Sheldon, 2006). Indeed, many of the techniques employed within MI (e.g. provision of positive feedback) specifically target self-efficacy, which is proposed as a key mechanism through which MI brings about behaviour changes (Miller & Rollnick, 2002). Although not formally mentioned within MI literature, the “spirit” of MI evoked by the practitioner (Miller & Rollnick, 2002) corresponds with dimensions of the need supportive environment described in SDT (Hardcastle & Hagger, 2011). For instance, satisfaction of the psychological need for competence is supported through MI techniques

that provide structure (e.g., help the individual develop appropriate goals, provide positive informational feedback). Support for the need for autonomy is achieved through the use of client centred strategies (e.g., rolling with resistance, exploring options, and providing choices).

Three large randomized controlled trials (i.e., The Physical Activity Counselling trial (PAC) - Fortier, Hogg, O'Sullivan et al., 2007; the Empower trial - Jolly, Duda, Daley, et al., 2009, and the Promotion of Exercise in Health and Obesity trial (PESO) - Silva, Markland, Minderico, et al. 2008; Silva, Virira, Coutinho, et al., 2009) implemented MI techniques and counselling styles to increase physical activity in adults. The PAC trial, which targeted sedentary adults, showed that an intensive bi-weekly physical activity counselling intervention and a brief (2-4 sessions) physician delivered intervention increased week 6 and 13 physical activity above that achieved by a brief physician delivered intervention alone. Moreover, the intensive intervention group increased week 6 perceived competence, task and barriers self-efficacy, which were significantly predictive of week 13 physical activity (Blanchard, Fortier, Sweet et al., 2007; Fortier, Hogg, et al. 2007). However, physical activity differences between intensive and brief counselling groups were not evident at 19 and 25 week follow-up (Fortier, Hogg, et al., 2007). The PESO trial, which was targeted toward overweight and obese women, implemented MI inspired techniques described by Markland, Ryan, Tobin, and Rollnick (2005) to provide a need supportive intervention environment over the course of a 1 year physical activity and weight loss intervention. Compared with a control group, the experimental condition had significantly higher moderate, vigorous, and lifestyle physical activity compared with controls at 1 year and at 2 year follow-up (Silva et al., 2010). The effect of fostering a need supportive environment on moderate and

vigorous physical activity was mediated by competence and autonomy need satisfaction, and intrinsic motivation, while the effect of the intervention on lifestyle physical activity was mediated by competence and autonomy need satisfaction (Silva et al., 2010).

Purposes and Hypotheses

While MI has proven to be an effective tool influencing behaviour change in addiction research, there is little empirical evidence that psychosocial variables are the mechanism for change (Burke et al., 2002). Task efficacy, barriers efficacy, autonomy and competence were significant prospective predictors of physical activity (study 2), and are compatible with the key elements of MI (Markland et al., 2005; Markland & Vansteenkiste, 2007; Vansteenkiste & Sheldon, 2006). As such, self-efficacy and psychological needs could plausibly mediate the efficacy of MI on physical activity behaviour. Prior to embarking on large effectiveness trials, the feasibility and efficacy of a novel intervention guided by the integrated conceptual model constructs and utilising techniques of MI should be examined. Thus, the main objectives of the present study are to (1) to demonstrate the feasibility and (2) provide initial evidence of the efficacy of an integrated model guided, MI inspired intervention for increasing physical activity in under-active children and adolescents. A secondary objective was to re-examine relationships between integrated conceptual model variables and physical activity in study 2. Three hypotheses address the study purposes. First, it was hypothesized that the intervention would lead to increases in the frequency, duration, and intensity of physical activity. Second, it was hypothesized that the intervention would improve barrier efficacy, task efficacy, competence, and autonomy of participants. Third, it was hypothesized that the integrated conceptual model variables (i.e., task efficacy, barriers efficacy,

competence and autonomy) would be positively related to and predictive of physical activity variables.

Methods

Participants

Participants were 7th and 8th grade primary school students who were invited to participate in a study asking them about their physical activity levels. At this time they were informed that some of them may be telephoned at home by the researcher and asked to speak more about their physical activities. Individuals in the initial pool were 28 (20 = girls) 7aged between 11 and 13 years ($M = 12.32$, $SD = 0.55$). Their average BMI was 20.3 for girls and 24.3 for boys and a majority ($n = 18$) were Caucasian.

Instruments

Basic Psychological Needs Satisfaction in Physical Activity Scale for Children.

Items used to assess perceived competence (6 items) and autonomy (4 items) need satisfaction were modified from existing scales (Ryan, 1982; Blais, Vallerand, & Lachance, 1990; Ntoumanis, 2001) and subjected to face and content validity assessment (study 1) prior to use in the present study. Participants responded to items in terms of their agreement with statements regarding their typical feelings during physical activity. Responses were recorded on a 7 point Likert-type scale with possible scores ranging from 1 (do not agree at all) to 7 (very strongly agree). An average of summed scores for each scale was computed, with higher scores indicating greater perceptions of psychological need satisfaction. The modified measure was found to have acceptable internal consistency (competence $\alpha = .95$; autonomy, $\alpha = .71$; Study 2).

The Task Efficacy in Physical Activity Scale; the Barriers Efficacy in Physical Activity Scale (adapted from McAuley & Mihalko, 1998). Task efficacy was assessed

using 9 items adapted for children and physical activity by Foley, Prapavessis, Maddison, Burke, McGowan, and Gillanders (2008) from the Task Self-Efficacy for Treadmill Walking scale (McAuley & Mihalko, 1998). Further modifications were made to specify confidence to engage in PA every day next week, in accordance with Canadian and international physical activity guidelines (Canadian Society for Exercise Physiology, 2011; WHO, 2010). Participants rated their confidence to engage in PA for increasing durations (10 minutes, 30 minutes, 60 minutes), at three intensities (light, moderate, hard) on a scale from 0% (no confidence at all) to 100% (complete confidence). Scores for each item were summed and an average was obtained with higher scores indicating greater task efficacy.

The barriers efficacy scale, adapted by Foley et al. (2008) from the Barriers Efficacy Scale for Exercise (McAuley & Mihalko, 1998), asked participants to indicate confidence in their ability to engage in 60 minutes of PA every day the next week at a moderate to vigorous intensity in the face of 6 salient barriers (e.g., “even if the weather is bad”). Scores were summed and an average was calculated with higher scores indicating greater barriers efficacy. Both self-efficacy scales have shown excellent internal consistency in previous work by Foley et al. (2008; α 's = .95 and .86 respectively) and in study 2 (α 's = .96 and .86 respectively).

The Physical Activity Questionnaire for older Children (PAQ-C; Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). The PAQ-C is a self-report measure of children's levels of moderate to vigorous PA over the last 7 days. Physical activities were defined as “sports, games or dance that make you breathe hard, make your legs feel tired, or make you sweat.” Items targeted segments of the day relevant to children during the school year (i.e., physical education class, recess, lunch time, right after school, in the

evening and on the weekend). Scores for the 9 items were converted to a 5-point scale. A composite score was calculated as the mean of the 9 items, with higher scores indicating higher levels of physical activity.

Actical® (Mini Mitter Co., Inc., Bend, OR). Time spent engaged in moderate and vigorous physical activity was assessed using the Actical® omni-directional accelerometer. This device is small (2.8 x 2.7 x 1.0cm³), lightweight (17g), waterproof, and measures whole body physical activity being most sensitive to movement around the torso in the 0.5 to 3.2 Hz range of frequencies (Puyau, 2004). The Actical can discriminate between sedentary, light, moderate and vigorous physical activity intensities (Puyau, 2004). Devices were customized for each participant by sex, age, weight, and height. The magnitude of the digitized filtered acceleration signal was set to record the sum of data collected in 15 second epochs. Each device was secured above the iliac crest of the right hip with a buckled nylon belt. Children were instructed to wear the Actical® for 8 days (including the distribution day which was regarded as day 0) except while asleep or showering and to return devices to school after the last day of collection. Actical® has demonstrated acceptable reliability and validity in previous research with children (Heil, 2006).

Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Ryan,, & Deci, 1996). Intervention fidelity was evaluated at post test using the 6-item short version of the HCCQ. Items gauged how autonomy supportive participants found the interventionist during the intervention. Participants indicated their agreement with six statements ([interventionist name] provided me with choices and options, understood me, encouraged me to ask questions, listened to me, conveyed confidence in my ability to make changes, and listened to how I would like to do things before suggesting

alternatives) on a 7 point Likert type scale (1 = strongly disagree, 7 = strongly agree). This scale has been validated to assess support for various health behaviours including regular exercise (Williams, Freedman, & Deci, 1998). The short 6-item version used in the present study typically demonstrates high levels of internal consistency ($\alpha = .82$) (Williams & Ryan, 2010)

Development of Intervention Guide. A structured intervention guide (Appendix I) was developed based on examples provided by Berg-Smith et al., (1999) and Emmons and Rollnick (2002) keeping in mind the sources of self-efficacy and aspects of a needs supportive climate. The script was guided by the principles of MI and aimed to raise awareness of the need for change during the “not ready” stage, build confidence for change during the “unsure” stage, and ultimately negotiate a plan for change during the “ready” stage. The intervention guide was designed to lead the conversation based on each participant’s stage of readiness and was flexible, acknowledging that some may have needed longer in the earlier stages than others, and some could have decided against advancing to the subsequent stage. The flow of participants through the intervention session is displayed in figure 1.

The purpose of step 1 was to establish rapport. The development of a relationship in which the participant feels acknowledged, important and listened to (i.e., perceived relatedness, Beaumeister & Leary, 1995; Ryan, 1985) is an important precursor to the development of autonomy supportive environments (Ryan, 1985). In step 2 physical activity was brought up by the interventionist and an outline for the conversation was proposed. The interventionist asked if the outline was acceptable, or if there were other topics to include. The participant’s current MVPA was discussed in step 3. Each participant rated his or her perceived adherence to the physical activity guidelines using

the adherence ruler (Appendix I). A series of open-ended questions about this rating followed (e.g., “Why do you think you’re at a 5 and not at a 2?”). In step 4 the interventionist gave feedback on the participant’s Actical® data, and contrasted these against physical activity guidelines, encouraging the participant to express his or her thoughts about the feedback. Readiness for change was assessed during step 5 by asking the participant to indicate on a readiness ruler (Appendix I) the degree to which he or she felt ready to include more moderate to vigorous physical activity in his or her life. Participants were asked to elaborate on why they chose the particular rating.

The direction for the duration of the intervention was tailored to the individual based on ratings on the readiness ruler. Accordingly, participants were identified as either *not ready*, *not sure*, or *ready*, to take steps to increase their physical activity, while acknowledging that individuals may change their readiness multiple times over the course of the intervention. The goal for those identified as *not ready* was to raise awareness by informing and encouraging. The aim for individuals who were *not sure* was to build motivation and confidence by exploring ambivalence. The purpose for participants who were *ready* was to negotiate a plan for change by facilitating decision making.

Figure 1. *Interview Guide Flow.*



Intervention Support for Integrated Model Variables. Intervention dimensions aimed to support integrated model constructs in several key ways. To support structure, participants were helped to develop clear and realistic expectations about the benefits of increasing their physical activity behaviour. Differences between baseline and recommended levels of physical activity and outcomes were described. Finally, participants in the *ready* stage were helped to formulate realistically achievable goals and were encouraged to believe that they were capable of following through with their plans. This encouragement also served as social persuasion to support task efficacy. Task efficacy was also supported by encouraging participants to recall past successes (mastery experiences) in physical activity, including activity domains like active transport. Autonomy support entailed helping participants recognize they have a choice regarding their behaviour and by helping them to clarify their own reasons for behaviour change. Pressure to change was minimized by making it clear that the decision to increase physical activity or not was ultimately up to the participant. Barriers efficacy was supported by encouraging participants to identify salient barriers to their physical activity and then brainstorming realistic ideas for overcoming them. Solutions were based on previous successes in overcoming similar barriers both within and outside of the context of physical activity (mastery experiences). Participants were asked if they could describe how other kids deal with these barriers (vicarious experience). The interventionist offered genuine praise for ideas and expressed belief in participants' abilities to follow through with plans (social persuasion).

Interventionist Training. The intervention was delivered by a doctoral student in Kinesiology specialising in the psychological bases of physical activity. To prepare for this study the interventionist read "Motivational interviewing: Preparing people for

change” (Miller & Rollnick, 2002). An associate professor of Health Studies with expertise in MI for health behaviour change provided 4 hours of instruction, demonstrations, and supervised practical experience. An additional cumulative 4 hours of practical experience was gained through practicing with a second student receiving training in MI, and through conducting 6 telephone based AMI sessions for an unrelated physical activity study. To connect the training in MI with the theory proposed, the interventionist attended a conference meeting on the topic of MI where experts in MI and in the application of SDT to physical activity counselling presented research and discussed future directions. It is reasonable to expect that a similar amount of training could be undertaken by physical activity practitioners in community organizations, and as such, a certain amount of ecological validity is inferred.

Procedure and Design

Ethical approval was obtained from the ethics committees of the host institution (Ethics Review #17104E) and the regional public school board prior to recruiting participants. With consent from the school principal, the primary investigator made contact with interested students through a designated teacher at the participating school. The procedures and protocol of the study were clearly explained to each student via written documentation and verbal explanation prior to study participation. Each participant provided written assent and evidence of parental consent prior to participation.

To screen participants for intervention inclusion criteria and collect psychometrics and baseline measures (fewer than 90 minutes of MVPA) investigators made contact with participants 3 times over 10 days. At time 1, 28 participants completed the questionnaire package which included personal and demographic information, self-efficacy, and psychological needs questionnaires. Upon completion participants removed shoes and

heavy items of clothing, and had their height and weight measured to the nearest 0.5 cm and 0.1 kg using a Health o Meter Professional height and weight scale (Health-O-Meter® 500KL, Boca Raton, FL). The following day (time 2) participants were provided written and verbal wear instructions, and were equipped with an Actical® device which was worn for 8 consecutive days. Additionally, participants were provided reminder materials to improve compliance to the protocol. Following the 8-day Actical® monitoring period researchers returned to the school (time 3) to collect the monitors. At this time, participants completed the 7 day physical activity recall and indicated their availability to receive an intervention phone call during the allotted time frame.

Participants who failed to adhere to physical activity guidelines (i.e., 90 minutes MVPA per day) and passed quality control screening procedures were screened into the intervention. Over the next five days the interventionist called ‘screened in’ participants at home to reconfirm their interest in participating. At that time, the researcher guided interested participants through the intervention session following the script described previously. At the conclusion of the conversation the participant was reminded that the researchers would be returning to the school to distribute follow-up questionnaires and physical activity assessment over the next days (1 to 5 days post-intervention).

Intervention participants completed the questionnaire package (self-efficacy, basic psychological needs, and health care climate questionnaires) and were fitted with Actical® devices the following week. Upon returning devices participants completed the physical activity recall questionnaire.

The raw accelerometer data were analyzed using custom software KineSoft version 2.0.95 (KineSoft, Saskatchewan, Canada) to produce a series of standardized outcome variables similar to the procedures of Esliger, Copeland, Barnes, and Tremblay

(2005) and Esliger and Tremblay (2007). Quality control and data reduction procedures were consistent with those used in the National Health and Nutrition Survey (Troiano, Berrigan, Dodd et al., 2008). Wear time was defined a priori as a minimum of 4 valid days, including at least 1 weekend day. A valid day was defined as 10 or more hours of device wear. Wear time was determined by subtracting non-wear time from a 24 hour day. Non-wear time was defined as 60 minutes of consecutive zero counts, with allowance for 2 minutes of counts between 0 and 100. Spurious data were identified using the upper threshold of 20,000 activity counts per minute (Colley, Connor Gorber, & Tremblay, 2010). The first day of wear time (day 0) was excluded from the analysis to decrease the influence of reactivity (Standage, Sebire, & Loney, 2008). For participants whose Actical® data passed quality control procedures (time 1 $n = 12$, time 2 $n = 6$) time spent engaged in moderate and vigorous intensity activity was computed using the KineSoft Software using the cut points provided by Puyau et al. (2004) which were then exported to an Excel spreadsheet. All data were entered in PASW statistics v. 18.

Results

Treatment of the data

Practical issues associated with the use of parametric tests were addressed prior to main analyses (Tabachnick & Fidell, 2007) and unless otherwise specified, data adhered to these criteria. Perceived autonomy at baseline, $D(28) = 0.17$, $p < 0.05$, perceived autonomy at post-test, $D(12) = 0.28$, $p < 0.05$, and perceived competence at post-test, $D(12) = 0.25$, $p < 0.05$ were significantly non normal. Box-plots highlighted 2 outliers whose removal resulted in approximately normal distributions for all study variables. Paired samples t-tests were conducted to examine change from pre intervention to post intervention on predictor and criterion variables. Pearson correlation coefficients were

computed to examine relationships among predictor variables (i.e., task efficacy, barriers efficacy, perceived competence, perceived autonomy) and criterion variables (i.e., self-reported physical activity, minutes per day in moderate physical activity, minutes per day in vigorous physical activity) for the total sample at baseline, and for intervention participants at both baseline and post test. Multiple regression analyses were conducted to further assess relationships between predictor integrated model variables and criterion physical activity outcomes.

Overall, of the initial 28 participants, 26 were retained in the analysis following removal of the 2 extreme cases. Of those, 14 provided valid objective physical activity data at baseline and were all engaging in fewer than 90 minutes of MVPA per day and were thus eligible for the intervention. Among them, 12 participated in the intervention, 6 of whom provided valid Actical® data at post-test.

Main Analyses

Descriptive statistics for participants at baseline and at post-test are presented in Table 10. Bi-variate correlations for integrated model variables and physical activity outcomes for all participants at baseline and post-test are presented in Table 11.

Change in self-reported physical activity. Children's self-reported physical activity did not significantly change baseline to post-test ($t(9) = 0.49, p = 0.64, \eta^2 = .03$).

Change in Objectively Assessed Physical Activity. Participants engaged in fewer daily minutes of moderate intensity physical activity at post-test than they did at baseline. While this difference was not statistically significant ($t(5) = 2.36, p = 0.07$), it was associated with a large effect size ($\eta^2 = .53$, Cohen, 1988, 1992). Participants also accumulated fewer minutes of vigorous physical activity on average each day from

baseline to post-test. Although not statistically significant ($t(5) = 1.70, p = 0.15$), this decrease represented a medium sized effect ($\eta^2 = .37$).

Change in Integrated Model Variables. Overall, integrated model variables increased from baseline to post-test. Results showed that perceived autonomy and competence increased from baseline to post-test. Differences between baseline and post-test autonomy ($t(10) = -2.42, p < 0.05, \eta^2 = 0.37$), and competence ($t(10) = -2.47, p < .05, \eta^2 = 0.33$) were each significant and represented medium effect sizes. Increases from baseline task and barriers self-efficacy to post-test task and barriers self-efficacy were however, not significant (task efficacy ($t(10) = -1.43, p = .18, \eta^2 = 0.17$), barriers efficacy ($t(10) = -0.66, p = 0.53, \eta^2 = .04$), although task efficacy represented a medium sized effect.

Relationships Between Integrated Model Variables and Physical Activity.

Correlations among baseline and post-test integrated model variables and physical activity outcomes are presented in table 11 and indicated only competence correlated with a proximal physical activity outcome. Specifically, there was a significant relationship between baseline average daily minutes of vigorous physical activity and baseline perceived competence, $r = .61, p < .05$. Post-test PAQ-C was significantly correlated with baseline scores on perceived autonomy ($r = 0.67$), competence ($r = 0.67$) and task efficacy ($r = 0.69$) (all $ps < .05$). Finally, at post-test barriers efficacy was significantly related to average minutes of moderate daily physical activity ($r = 0.87, p < 0.05$).

Regression analysis showed that baseline perceived competence accounted for 37% of the variance associated with baseline moderate time in physical activity, $F(1,12) = 6.94, p < .05$ (Table 12). The sample size retained in this study at post-test was

insufficient to permit examination of correlations between integrated model variables and post-test physical activity outcomes.

Table 10. Descriptive statistics for integrated model variables and physical activity for the intervention group and the total sample

	Intervention group			Total sample		
	Mean	Standard Error	N	Mean	Standard Error	N
Baseline TSE	74.34	4.71	11	75.21	2.88	26
Baseline BSE	68.33	5.79	11	61.54	4.08	26
Baseline autonomy	5.50	.32	11	5.39	0.26	26
Baseline competence	5.44	.28	11	5.09	0.21	26
Baseline PAQ-C	3.06	.24	10	2.86	0.16	23
Baseline MPA (min/day)	54.21	7.46	6	53.21	4.25	14
Baseline VPA (min/day)	2.41	.51	6	2.14	0.28	14
Post-test TSE	80.61	3.31	11			
Post-test BSE	72.12	5.22	11			
Post-test autonomy	6.20	0.24	11			
Post-test competence	5.91	0.21	11			
Post-test PAQ-C	3.01	0.24	10			
Post-test MPA (min/day)	44.76	7.89	6			
Post-test VPA (min/day)	1.79	0.46	6			

Note. TSE = task efficacy, BSE = barriers efficacy, MPA = objective moderate physical activity, VPA = objective vigorous physical activity. Min/day = average minutes of physical activity per valid days.

Table 11. Inter-correlations for the integrated model variables and physical activity

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. pre autonomy	-	.44*	.39*	.13	.37	.19	-.12	.50	.70*	.27	.13	.67*	.44	.58
		26	26	26	23	14	14	11	11	11	11	10	6	6
2. pre competence		-	.60**	.65**	.36	.30	.61*	.43	.74**	.65*	.40	.67*	.66	.76
			26	26	23	14	14	11	11	11	11	10	6	6
3. pre TSE			-	.55**	.21	.25	.45	.43	.67*	.45	.33	.69*	.75	.67
				26	23	14	14	11	11	11	11	10	6	6
4. pre BSE				-	.21	.31	.69**	.70*	.74**	.49	.45	.13	.75	.61
					23	14	14	11	11	11	11	10	6	6
5. pre PAQ-C					-	.32	-.03	.41	.38	.42	.43	.43	.44	.35
						12	12	11	11	11	11	10	6	6
6. pre MPA (min/day)							-	.48	.86*	.93**	.85*	.76	.90**	.87*
								14	6	6	6	6	10	6
7. pre VPA (min/day)								-	.44	.68	.83*	.82*	.64	.80
									6	6	6	6	6	6
8. post autonomy									-	.84**	.68*	.79**	.02	.62
										6	6	6	6	6

	11	11	11	6	6	6
9. post competence	-	.79**	.64*	.40	.76	.72
		11	11	10	6	6
10. post TSE		-	.84**	.44	.77	.55
			11	10	6	6
11. post BSE			-	.41	.87*	.62
				10	6	6
12. post PAQ-C				-	.56	.61
					6	6
13. post MPA(min/day)					-	.90*
						6
14. post VPA(min/day)						-

Note. Below each r value, the number of participants contributing to the correlation is presented below. TSE = task efficacy, BSE = barriers efficacy, MPA = objective moderate physical activity, VPA = objective vigorous physical activity. Min/day = average minutes per valid days. ** $p < .001$, * $p < .05$

Table 12. Prediction of baseline objective time in moderate intensity physical activity

	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Pre competence	0.65	0.25	.61*	2.64

Note. $R^2 = .37$. * $p < .05$.

Discussion

Intervention Efficacy. The main objective of the present study was to examine the efficacy of a brief telephone intervention grounded in self-efficacy and psychological needs for increasing physical activity in a sample of under-active children. Contrary to the study hypothesis, participants did not increase their physical activity following the intervention. It was also hypothesized that participants would report higher levels of task efficacy, barriers efficacy, competence and autonomy after the intervention than they did previously. This hypothesis was partially supported, with increases from baseline to post-intervention evident for all integrated model variables. Increases on autonomy and competence were statistically significant and were associated with a medium effect size. Although the change in task efficacy was not statistically significant it reflected a small effect suggesting that despite being underpowered, change occurred. It is encouraging that while the sample size was quite small, positive changes in task, autonomy, and competence were present. This speaks to the ability of a single physical activity counselling session to influence short term changes in variables previously shown to be important predictors of physical activity engagement in previous research with sedentary adults (Blanchard, Fortier, Sweet, O’Sullivan, Hogg, Reid, & Sigal, 2007; Fortier, Hogg, O’Sullivan, et al., 2007; Fortier, Hogg, O’Sullivan, Blanchard, Reid, Sigal, Pipe, & Sweet, 2006) and overweight and obese women (Silva, Vieira, Coutinho, Matos, Sardinha, & Teixeira, 2009) in recent large randomized controlled trials.

Despite these encouraging findings, physical activity did not increase. In fact, non-statistically significant large and medium sized decreases in objectively assessed minutes engaged in moderate and vigorous physical were recorded. Although discouraging, these findings may be interpreted in various ways. First, the intervention

caused children in this study to decrease their physical activity. Second, something occurred extrinsically to the study that was not reflective of intervention efficacy. Several considerations such as weather, homework load, and illness as examples, contribute to children's physical activity levels at any given time. In the present study, where the small number of participants were drawn from the same school and assessed over the same time frame, it is likely that they were all subjected to the same external influences leading to decreased physical activity at post-test. Alternatively, minutes engaged in MVPA at baseline may have similarly been inflated and the decline following intervention simply represented a return to usual levels. This is probable given that when considering updated physical activity guidelines recommending 60 minutes of MVPA daily, only 50% of participants failed to meet physical activity guidelines in this study, compared with 93% who failed to achieve these guidelines in the Canadian Health Measures Survey (Colley et al., 2011). Unfortunately, the lack of a comparison group prevents such conclusions from being drawn. The stability of subjective physical activity data speaks to this interpretation, and might suggest that incidental physical activity declines that were not easily recalled led to the decrease in overall minutes of moderate physical activity.

Although the physical activity findings are discouraging, they should not lead researchers to abandon further attempts to include integrated model variables and MI in physical activity intervention strategies for children and adolescents. There were a number of factors inherent to the present proof of concept trial that likely contributed to the null findings but may be overcome. One factor in particular should be addressed prior to conducting further trials; namely, the training of the interventionist. Although the amount of training gained by the interventionist could be achievable for community practitioners and as such was thought of as a potential strength of the study, it is possible

that additional supervised practice would have been beneficial. Although high ratings on the HCCQ were received from participants indicated the provision of an autonomy supportive environment ($M = 5.98$, $SD = 1.09$), it is possible that the quality of the MI counselling was not sufficient in this study. Support for MI is predominately found in the addiction field with trained psychologists or counselling professionals have tended to implement MI (Resnicow, DiIorio, Soet, Borrelli, Hecht, & Ernst, 2002). In contrast, of the paucity of research conducted in physical activity behaviour change with MI (the present study included) are often delivered by health professionals with supplemental training in MI and may explain the inconsistent findings in this field (Resnicow et al., 2002). It is further suggested that while the techniques of MI may be learned within a few hours of training, increased supervision and practice are required to master the spirit of MI (Resnicow et al., 2002). By providing ongoing support and consultation following training this limitation may be overcome (Berg-Smith, 1999; Resnicow, Taylor, & Baskin, 2005).

A second factor that should be acknowledged is the intervention length. In this study, the efficacy of a single MI INSPIRED INTERVENTION session was evaluated on its ability to affect increases in proximal physical activity behaviour. Positive initial evidence suggests an influence on integrated model variables. It is likely that a single session does not offer a strong enough dose to increase physical activity behaviour. Some have suggested brief sessions may be sufficient to encourage initial physical activity behaviour changes (Harland, White, Drinkwater, Chinn, Farr, & Howel, 1999). However, more intensive interventions may be necessary for actual change to occur. Nonetheless, future research should be undertaken prior to ruling single session interventions out.

Relationships Among Variables. Despite the intervention failing to increase both subjectively and objectively measured physical activity behaviour, significant positive correlations were seen between several integrated model variables and physical activity outcomes providing evidence that these variables are related constructs. The positive relationship between competence and vigorous physical activity at pre-test, in addition to the significant prediction demonstrated by the regression was somewhat stronger than in this study than in study 2. Nonetheless, these findings support the consistent relationships demonstrated between moderate objective activity and perceived competence. The lack of a relationship between integrated model variables and proximal PAQ-C is somewhat surprising given the findings in study 2 which showed both self-efficacy and needs constructs were significant positive correlates. These predictor variables at baseline, with the exception of barriers efficacy, were however significantly correlated with post-test PAQ-C, although an insufficient sample size prevents further analyses of these relationships. Finally, the significant correlation between post-test barriers efficacy and moderate physical activity highlights the importance of building confidence for overcoming barriers to physical activity in intervention efforts. Considering the non-significant increase in barriers efficacy, it is conceivable to expect that had the intervention managed to influence barriers efficacy in a statistically meaningful way, moderate physical activity would similarly have increased following the intervention. It is possible that this would have been achievable with a larger sample size. Certainly, it is more likely that due to the nature of barriers efficacy, one or more subsequent intervention sessions would have been more successful in targeting this variable. At a cognitive level, it has been suggested that individuals may not be able to accurately assess their own abilities to accurately engage in behaviours or overcome barriers that they have

not previously attempted. As such, it is likely that insufficient opportunities were available for considering salient barriers to participants' physical activity prior to developing strategies to overcome them.

There were a number of strengths associated with the present study that should be highlighted. First, the attempt to test theoretically specified mechanisms of change (i.e., sources of self-efficacy and aspects of motivationally supportive environments) addressed speculations implicating a lack of congruity between intervention components and targeted psychosocial constructs in the failure of previous studies to significantly influence targeted constructs. Several of the intervention techniques outlined above were directly drawn from theoretical recommendations and have been empirically tested (i.e., Bandura, 1986, 1997; Markland et al., 2005) in sport and exercise.

Second the assessment of physical activity was undertaken using valid and reliable subjective and objective measures. Accelerometry overcomes several limitations associated with self-reported measures, chiefly related to the tendency for children to grossly overestimate their physical activity (Sallis, Buono, Roby, Micale, & Nieldson, 1993). Access to the Kinesoft data analysis software made important contributions to the sophistication with which Actical @accelerometry data were screened and outcomes were computed. This overcame many limitations of human error likely to occur when screening data visually. The Kinesoft software showed that for the 14 participants in this study who provided valid baseline data and were retained in the analysis, of the Mean total minutes they were engaged in moderate intensity physical activity ($M = 329.5$, $SE = 26.55$), nearly all ($M = 317.16$, $SE = 24.49$) were accumulated sporadically in bursts shorter than 5 minutes in duration. Furthermore, of time spent in vigorous intensity physical activity, all 13.27 of the Mean minutes ($SE = 1.81$) were accumulated in sporadic

bursts. Critics of self-reported measures focus on difficulties young people have recalling their unplanned, irregular patterns of behaviour. It is therefore considered a strength that an objective measure was included. Recent evidence indicates that self-reported and objective measures of physical activity are uncorrelated with each other and related varyingly with different antecedents of physical activity behaviour. As such additional information may be gathered from self-report when included as a supplement to objective measures alone.

As with any study, there were several limitations of the present proof of concept trial. Most notable was the lack of a control group. This study represents a preliminary step in the intervention development process, and provides valuable information about feasibility. Unfortunately, without a comparison group it is not possible to rule out alternative explanations for the potential efficacy of the intervention on increasing integrated model constructs, nor can we conclude the intervention was not effective because of some factor outside of the intervention. Additionally, as previously mentioned, the small sample size was potentially problematic as these few participants may not be reflective of the population from which they were sampled. The minimal compliance with the Actical® protocol led to the exclusion of much of the sample. Although several strategies were employed to improve compliance, the criteria mandating that the device must be worn on at least 1 weekend day was particularly poorly adhered to. Compliance difficulties are commonplace within children's physical activity literature (Sallis, Buono, Roby, Micale, & Nelson, 1993) and should be considered during initial participant recruitment in future studies with this population. Given that this was a proof of concept trial, a small sample was not detrimental to gathering important practical information for future feasibility studies.

A second limitation similarly concerns compliance to study protocol and may be difficult to resolve. Reaching participants by telephone was a challenge and may be inevitable with the population under investigation. A reversed strategy whereby the participant is responsible for contacting the interventionist may be more effective (J. Irwin, personal communication, Feb 10, 2011), while having the added benefit of supporting participant autonomy by minimizing pressure and allowing the participants to decide if they are ready to talk. Considering the age of the population of interest and their high usage of various online communication methods (i.e., twitter and facebook), it may be worth exploring the potential of social media rather than or in addition to telephone mediated interventions in order to improve adherence. This could be autonomy supportive by allowing participants to engage at their volition. Moreover it could be structurally supportive by enabling interventionists to provide a visual display of participant Actical® data, allowing participants to clearly see their behaviour and contrast this with recommended levels. This forum may be particularly useful for novice interventionists who would benefit from having time to formulate a response and gather feedback from an expert if necessary.

Prior to conducting further research on the utility of an MI INSPIRED intervention for implementing the integrated model to increase physical activity, the limitations discussed here should be addressed. In light of these weaknesses, failure to support study hypotheses should not be used to indicate that MI is not effective for physical activity intervention, rather this preliminary work should be used to inform future research and be considered a stepping stone in intervention development.

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Summary, Implications, and Future Directions

The overarching purpose of the studies presented in this dissertation was to explore the suitability of an integrated model for guiding physical activity prediction and intervention research. The aim of study 1 (Chapter 2) was to enable studies 2 and 3 to address this dissertation aim. Given that “the value of scientific data depends on the precision with which the variables under consideration are observed and measured” (Aiken, 1996, p. 8), study 1 was a rigorous, systematic psychometric evaluation of integrated model questionnaires. In the final appraisal, scales contained within the integrated questionnaire were deemed to possess acceptable construct validity for use with children and adolescents in physical activity settings.

Construct valid measures were implemented in studies 2 (Chapter 3) and 3 (Chapter 4) to provide evidence of the scales’ reliability and to address the dissertation aim. Using a prospective design, study 2 established task and barriers efficacy, and perceived competence and autonomy as significant predictors of self-reported (PAQ-C) physical activity ($R^2 = 20.3\%$, $p < 0.05$). Additionally, perceived autonomy accounted for 8% of the variance associated with objective moderate physical activity and perceived competence accounted for 9.4% of the variance associated with objective vigorous physical activity while perceived relatedness dropped out of the model.

In study 3 salient integrated model variables were targeted in a physical activity intervention for under-active children and adolescents via a novel motivational interviewing inspired intervention protocol. The intervention significantly increased perceived autonomy and competence at post-test, but did not increase self-efficacy or physical activity outcomes.

The findings emerging from the dissertation studies have several potential implications worth noting. First, from a measurement perspective, the integrated model questionnaires modified and scrutinized in study 1 offer a valuable resource for investigators embarking on need satisfaction and self-efficacy research with older children in physical activity contexts. The procedures utilized here represent two among multiple types of validity and therefore further research should continue to examine the validity scales with respect to forms such as discriminate and criterion validity.

Second, the discovery that relationships between individual psycho-social variables and physical activity depended on the measure of physical activity (i.e., self-report vs. objective) is not surprising given evidence that subjective and objective physical activity have shown only small to medium inter-correlations (e.g., Pate, 1993). Closer examination of objective physical activity intensity differences in this study sheds light on the complex nature of physical activity engagement. The differential functions of task efficacy and barriers efficacy on stages of exercise adoption and maintenance in the adult exercise domain are accepted within self-efficacy literature (e.g., Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002).

In this spirit, in study 2, perceived autonomy was a significant prospective predictor of time in moderate intensity physical activity, while perceived competence was a significant predictor of vigorous physical activity. The finding concerning psychological need satisfaction and moderate versus vigorous activity offers an important contribution to the SDT literature and should be further studied to provide confirmation. This may have further intervention implications as a focus on autonomy promotion appears to be relevant for helping insufficiently active children achieve physical activity

guidelines while bolstering competence may help relatively active children work toward including vigorous activity into their day.

Third, the brief MI inspired intervention appears to be a promising vehicle for affecting change in children's physical activity related perceptions of autonomy and competence. There is a great deal of further research needed before such claims can be definitively concluded. It seems a single intervention session *may* be sufficient to influence perceptions of need satisfaction in the short term. Judging from the medium sized effect with change in task efficacy it seems that in a sufficiently powered study, task-efficacy would have had more of an opportunity to demonstrate significance. Regardless, the single session intervention did not increase physical activity, and may have actually led to decreased participation. Without a comparison group against which to contrast these findings, we have no way of ascertaining the effectiveness (or harmfulness) of the intervention session.

Given that this was a proof of concept trial, a small sample was not detrimental to gathering important practical information for future feasibility studies. Nonetheless, future efforts should attempt to recruit a larger sample, as well as incorporate a control group to enable more appropriate statistical procedures in evaluating the efficacy of subsequent interventions stemming from study 3.

Furthermore, there is an opportunity to explore the potential of social media as a mediator of the integrated conceptual model intervention. A website delivered intervention inspired by motivational interviewing could be autonomy supportive by allowing participants to be volitional and engage when they are ready rather than when dictated by the interventionist. It could provide need support in the form of structure by enabling interventionists to provide a visual display of participant Actical® data, allowing

participants to clearly see their behaviour and contrast this with recommended levels. This forum may be particularly useful for novice interventionists who would benefit from having time to formulate a response consistent with the principles of motivational interviewing and gather feedback from an expert if necessary, while also enabling participants and practitioners alike to respond at their convenience. A review of internet-mediated health behaviour change interventions showed incorporating a health behaviour change theory to a health intervention forum improved traffic to websites significantly (Webb, Joseph, Yardley, & Michie, 2010). Moreover, factors contributing to higher length and number of visits to the website such as provision of peer support, counsellor support, email or phone contact with visitors (Webb et al., 2010) are autonomy supportive (interpersonal support) in themselves. A social media mediated INTERVENTION targeting the integrated model variables could prove an exciting next step in the development of physical activity interventions for children.

The present dissertation presents an adapted measure of self-efficacy and basic psychological need satisfaction measures that will contribute to future studies investigating determinants of physical activity in children. Support for previously accepted relationships between competence, self-efficacy and physical activity is offered (Van Der Horst et al., 2007; Sallis et al., 2000), while contributing uniquely to the knowledge base by further specifying the important role of autonomy and competence in moderate and vigorous intensity activity, respectively (study 2). The application of the integrated model using techniques from MI represents an initial attempt to influence children's physical activity via a single intervention session. Further development is required to establish the effectiveness of MI techniques grounded in salient self-efficacy and psychological needs constructs.

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Appendix A: Letter of information / Consent form for Children



*Exercise & Health
Psychology Laboratory*



Letter of Information
Evaluating the content validity of self-efficacy and basic psychological need satisfaction scales targeting children in physical activity contexts.

Study Introduction:

You are invited to participate in a research study that seeks to evaluate the readability and comprehension of a questionnaire that will be used in future studies to measure how people feel about their participation in physical activity. The pronouns *you* and *your* should be read as referring to the participant rather than the parent/guardian/next of kin who is signing the consent form from the participant. The purpose of this study is to adapt a questionnaire designed for adults for use with children so that we can better understand physical activity patterns of children. At least 5 children will be recruited to have an individual, face-to-face interview that will take place at the Exercise and Health Psychology Lab, room 408, in the Arthur and Sonia Labatt Health Sciences Building at the University of Western Ontario. At a later date 20 psychology experts will evaluate the questionnaires to ensure the scales continue to measure what they are intended to following the changes suggested by the interviews with children.

During the interview, you will be invited to read the Integrated Self-Efficacy and Basic Psychological Need Satisfaction questionnaire out loud to determine if it is written at an age appropriate reading level. You will be invited to respond to each item on the questionnaire out loud while the researcher records your responses to determine comprehension of each question. Further, any questions or concerns pertaining to the wording of the questionnaire items will be recorded by the researcher. The interview session should last approximately 30 minutes. Breaks will be provided if you feel tired at any time during the interview. This tool is intended for use in future research to measure children's feelings of confidence in their ability to be physically active on a regular basis, feelings about the people they are physically active with, and beliefs about the degree to which they are able to choose the physical activities they engage in. When the researchers are confident that children are able to understand the questions, experts in exercise psychology will determine if the questions continue to measure what they were originally intended to measure after being modified for use with children.

Confidentiality:

Your participation in this study is completely voluntary and your data will be held confidential. The information that we collect from you will only be seen by the study investigators. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published without your explicit

consent to the disclosure. The data will be stored in the lab in locked filing cabinets for the required 6 years. Following this period, all paper copies of the data will be shredded and the computer files will be deleted according to the university guidelines.

Voluntary Participation:

Participation in this study is voluntary. You may refuse to answer any questions, or withdraw from the study at any time without consequence. However, please be aware that the information that will be collected will be de-identified and as a result, your data may not be withdrawn following completion of the interview. Please note that you do not waive any legal rights by signing the consent form. There are no risks or benefits of participating. You will not be compensated for your participation. Parking costs will be covered by the EHPL.

Contacts:

This letter is for you to keep. If you have any concerns, please feel free to contact one of the researchers below. You may request the general findings of this research study from the researchers after the study is complete. If you have any questions about the conduct of this study, or your rights as a participant, you may contact the Office of Research Ethics, The University of Western Ontario, 519-661-3036.

Casey Gray, BHK, MA
Ph.D. Student
School of Kinesiology
University of Western Ontario

Dr. Harry Prapavessis
Professor
School of Kinesiology
University of Western Ontario



*Exercise & Health
Psychology Laboratory*



Informed Consent

EVALUATING THE CONTENT VALIDITY OF SELF-EFFICACY AND BASIC PSYCHOLOGICAL NEED SATISFACTION SCALES TARGETING CHILDREN IN PHYSICAL ACTIVITY CONTEXTS

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Consenting Signature:

Participant Name (print): _____

Participant Signature: _____ Date: _____

Parent or Guardian Name (print): _____

Parent or Guardian Signature: _____ Date: _____

Researcher Name (print): _____

Researcher's Signature _____ Date: _____

Appendix B: Integrated Model Questionnaire initial item pool



PHYSICAL ACTIVITY

*WHAT YOU THINK &
WHAT YOU DO??*



QUESTIONNAIRE BOOK

Study identifier: _____



QUESTIONNAIRE BOOK INFORMATION SHEET

The researcher/s you have met and who will be helping you fill in this booklet are from the University of Western Ontario. We are doing some research to look at the type and amount of physical activity in school-aged children.

You have been asked to take part in this study which will look at how much physical activity you do in a week and what your thoughts are about that.

In this booklet, there are some simple questionnaires that will take about 30 minutes to complete. This will be done during school time and one of the researchers will help you complete these. If you have any questions you can ask them.

You do not need to tell anyone else what you write on the questionnaires.

On the following pages are a letter of information and a consent form. Please take the blue letter of information and the yellow consent form home for your parents and ask them to sign the yellow consent form. Please do not sign the consent form until the researcher explains the study to you and asks you to fill it in.

If you are worried about anything or have any questions, please let your teacher, parents, or the researchers know.

The researchers' contact information is on the last page (green page) of this questionnaire book.

WHAT IS PHYSICAL ACTIVITY?

WHEN YOU ANSWER THE FOLLOWING QUESTIONS, KEEP IN MIND THAT PHYSICAL ACTIVITY INCLUDES THINGS SUCH AS:

ORGANIZED SPORTS LIKE – HOCKEY, TRACK & FIELD, BASKETBALL, TENNIS, GOLF, VOLLEYBALL, BASEBALL.

ORGANIZED ACTIVITIES LIKE – SWIMMING LESSONS, DANCING, AEROBICS.

OTHER PHYSICAL ACTIVITIES YOU DO IN YOUR SPARE TIME LIKE SKATING, SKATEBOARDING, RIDING YOUR BIKE, WALKING THE DOG, GOING FOR A WALK, GOING FOR A RUN, SKIPPING.

THESE ARE NOT ALL THE PHYSICAL ACTIVITIES YOU CAN DO. YOU WILL PROBABLY BE ABLE TO THINK OF MORE.

WHAT IS REGULAR PHYSICAL ACTIVITY?

○ **DOING ANY OF THE PHYSICAL ACTIVITIES THAT ARE EITHER MODERATE OR HARD (LIKE THOSE ON THE PREVIOUS PAGE), INCLUDING PLAYING ON A SPORTS TEAM, RIDING YOUR BIKE, WALKING TO AND FROM SCHOOL, PLAYING GAMES WITH FRIENDS**

○ **THESE ARE ACTIVITIES THAT SHOULD MAKE YOU SWEAT, MAKES YOUR LEGS FEEL TIRED OR THAT MAKES YOU BREATHE HARDER THAN NORMAL,**

○ **THESE ACTIVITIES SHOULD BE DONE FOR AT LEAST 60 MINUTES IN TOTAL PER DAY**

○ **YOU SHOULD DO THEM ON MOST DAYS OF THE WEEK (PREFERABLY EVERY DAY)**

YOU DON'T HAVE TO DO THE SAME ACTIVITIES EVERY DAY: YOU MIGHT PLAY A SPORT ONE AFTERNOON, ON ANOTHER YOU MIGHT GO ROLLER BLADING WITH A FRIEND AND YOU COULD WALK HOME FROM SCHOOL ONE DAY.

THIS WOULD COUNT AS REGULAR PHYSICAL ACTIVITY.

GENERAL INFORMATION SHEET

PLEASE FILL IN YOUR INFORMATION BELOW



DATE OF BIRTH _____
(day/month/year)

GENDER (Circle correct answer) MALE FEMALE

HEIGHT _____ inches

WEIGHT _____ pounds

ADDRESS _____

TELEPHONE NUMBER _____

WHAT WERE THE ETHNIC OR CULTURAL ORIGINS OF YOUR ANCESTORS?
An ancestor is usually more distant than a grandparent

(circle **one or more** that **best** describe you)

Canadian English French Chinese Italian German
Scottish

East Indian Irish Somali Cree Mi'kmaq (Micmac) Métis Inuit
(Eskimo)

Ukrainian Dutch Filipino Polish Portuguese Jewish Greek
Jamaican

Vietnamese Lebanese Chilean Salvadorean

OTHER _____

WHAT ARE LIGHT / MODERATE / HARD ACTIVITIES?

Below is the description of what light, moderate and hard activities are:

LIGHT ACTIVITIES: Are when you are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these unless the weather is really hot. You would be able to talk easily through the activity.



MODERATE ACTIVITIES: Are when your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.



HARD ACTIVITIES: Are when your heart beats very fast, your breathing is fast and you start sweating. You may feel exhausted and out of breath. Your legs would probably feel heavy. It would be very hard to talk during the activity.

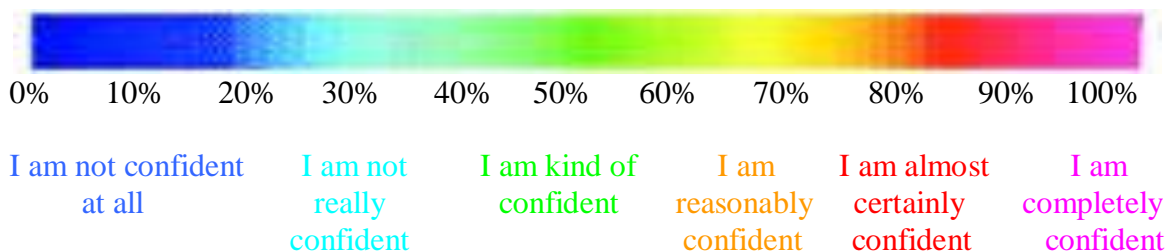


In answering the following questions you will be asked to think about how confident you are that you can participate in physical activities that are described as light / moderate / hard. The word “confident” refers to the belief that you have in yourself that you can do something well.

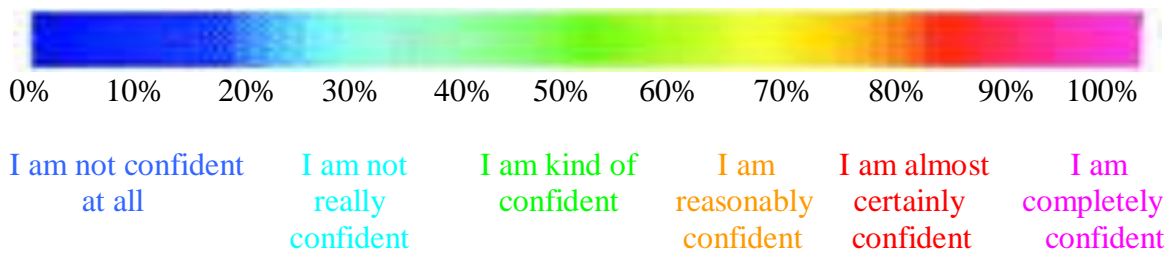
LIGHT ACTIVITIES: Are when you are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these unless the weather is really hot. You would be able to talk easily through the activity.



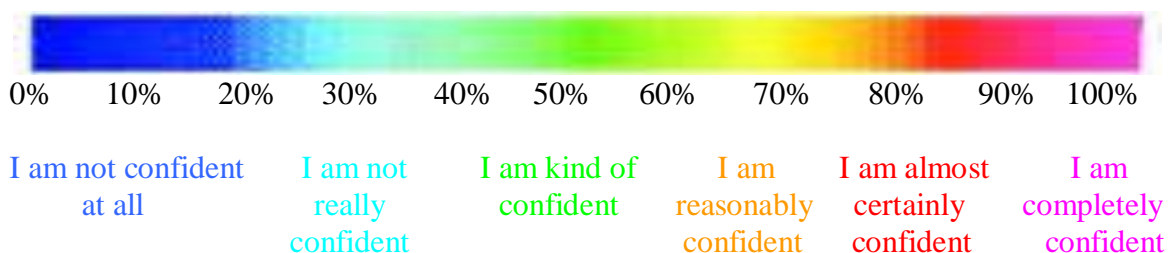
1. How confident are you that you can complete **10 minutes** of physical activity at a **light** intensity level **three** days next week?



2. How confident are you that you can complete **30 minutes** of physical activity at a **light** intensity level **three** days next week?



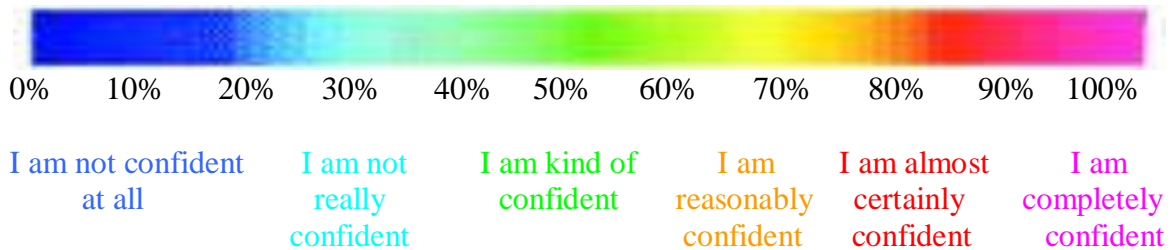
3. How confident are you that you can complete **60 minutes** of physical activity at a **light** intensity level **three** days next week?



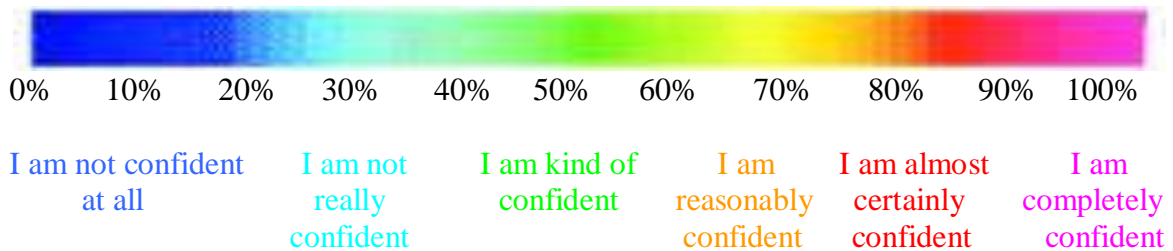
MODERATE ACTIVITIES: Are when your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.



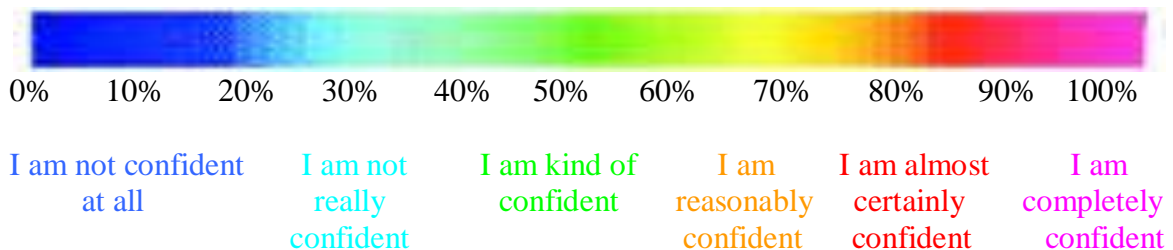
4. How confident are you that you can complete **10 minutes** of physical activity at a **moderate** intensity level **three** days next week?



5. How confident are you that you can complete **30 minutes** of physical activity at a **moderate** intensity level **three** days next week?



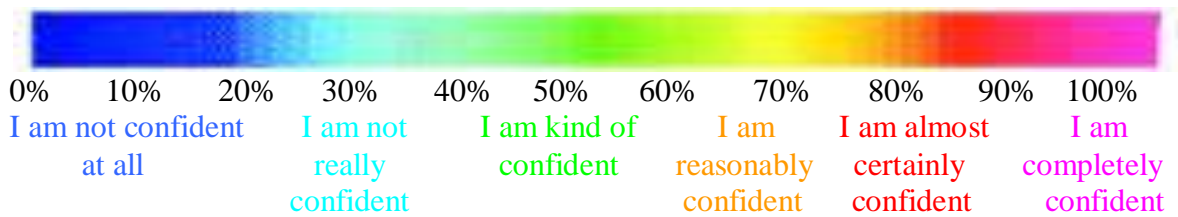
6. How confident are you that you can complete **60 minutes** of physical activity at a **moderate** intensity level **three** days next week?



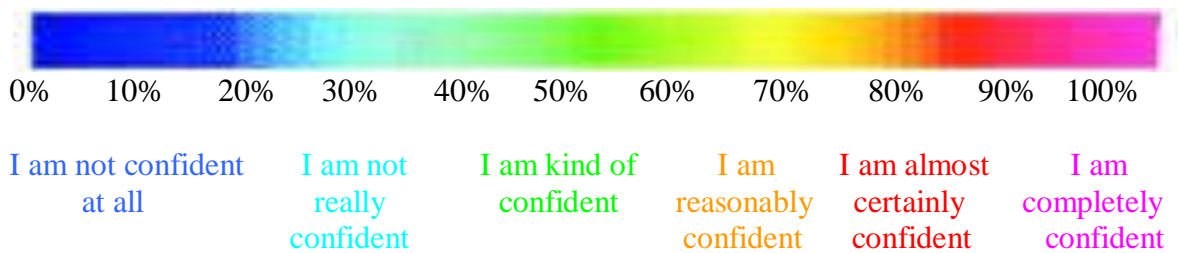
HARD ACTIVITIES: Are when your heart beats very fast, your breathing is fast and you start sweating. You may also feel exhausted and out of breath. Your legs would probably be feeling pretty heavy. It would be very hard to talk during the activity.



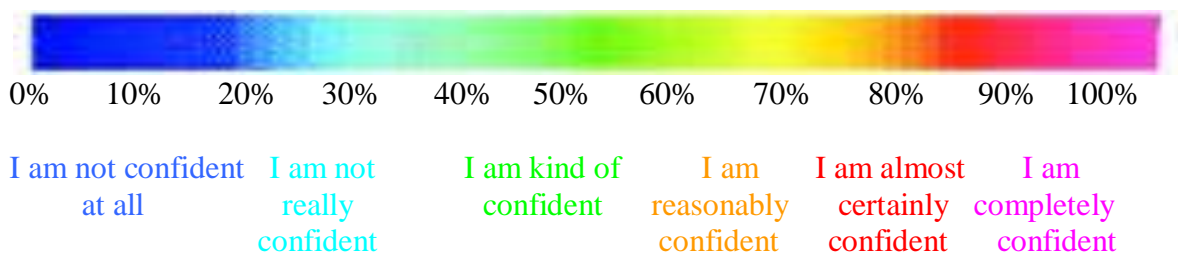
7. How confident are you that you can complete **10 minutes** of physical activity at a **hard** intensity level **three** days next week?



8. How confident are you that you can complete **30 minutes** of physical activity at a **hard** intensity level **three** days next week?

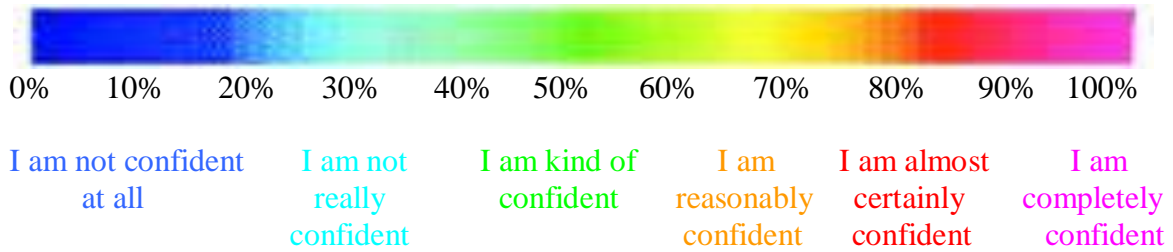


9. How confident are you that you can complete **60 minutes** of physical activity at a **hard** intensity level **three** days next week?

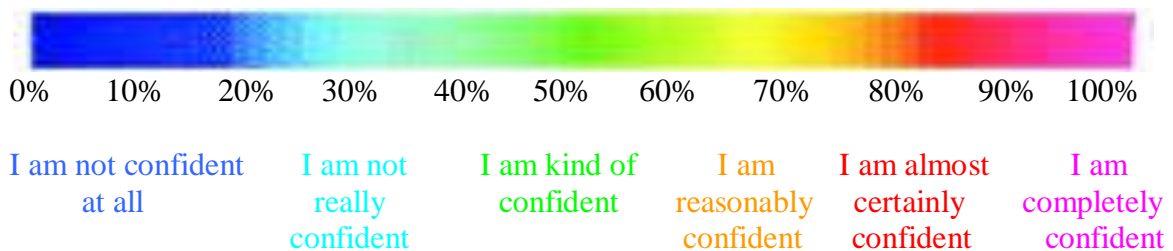


Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of CUMMULATIVE physical activity FIVE OR MORE DAYS next week.

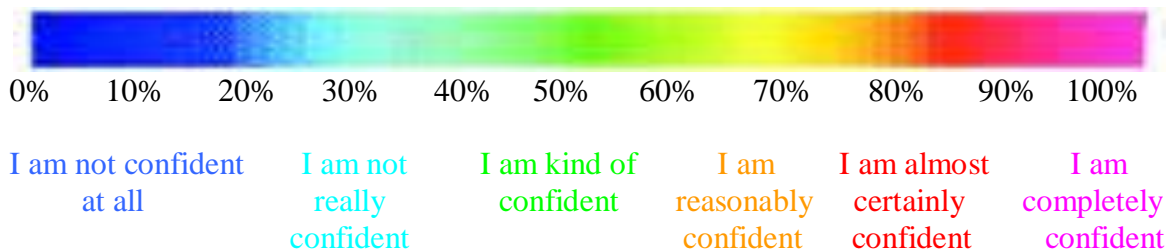
1. If it is bad weather.



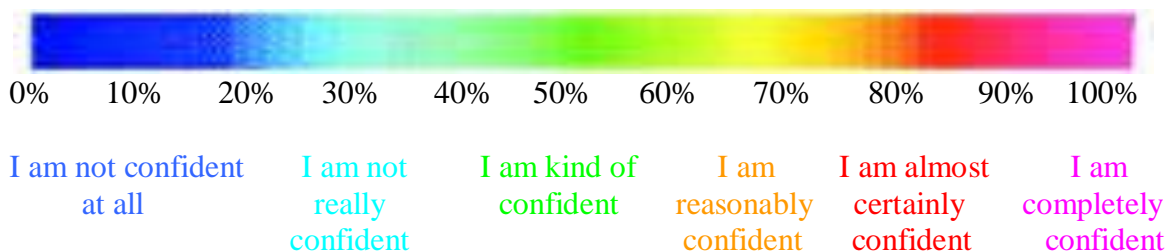
2. If I have a lot of school work to do.



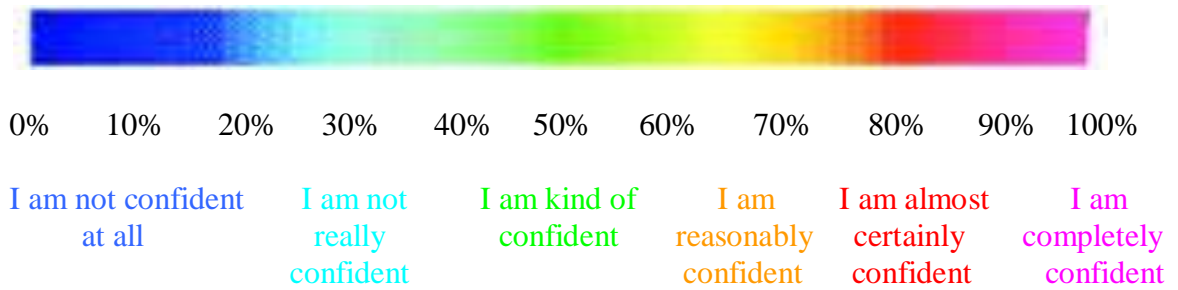
3. If there are good T.V. programs on.



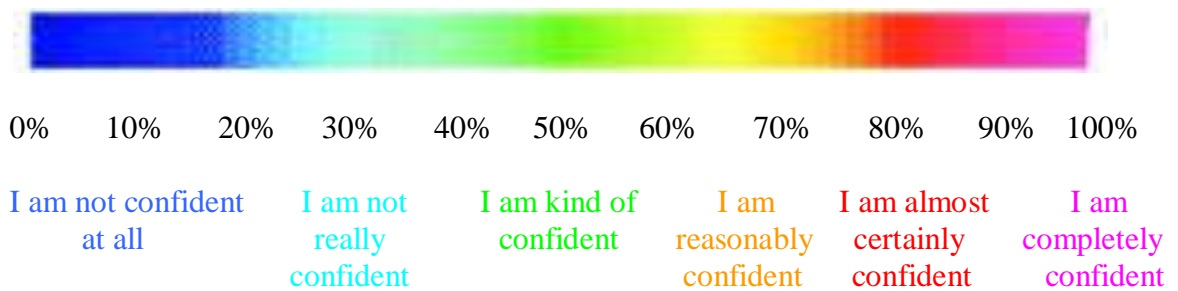
4. If I have a lot of activities to do with my friends and/or family.



5. If I am tired.



6. If I am sore.



Are there any other things that might stop you from taking part in physical activity regularly next week? If there are please write them below:

BASIC NEED SATISFACTION IN PHYSICAL ACTIVITY

The following statements represent how people typically feel when they engage in physical activity. Physical activities include activities such as riding your bike, playing sports or dancing. They are activities that make you sweat, make your legs feel tired, or that make you breathe harder.

Please answer the following questions by considering how YOU TYPICALLY feel when participating in physical activity using the scale provided.

	Do not Agree At All		Slightly Agree		Agree		Strongly Agree
I think I am pretty good at physical activity.	1	2	3	4	5	6	7
I think I do well at physical activity compared to others.	1	2	3	4	5	6	7
Physical activity is not something I can do very well.	1	2	3	4	5	6	7
After working at physical activity for a while I feel pretty competent.	1	2	3	4	5	6	7
I am skilled at physical activity	1	2	3	4	5	6	7
I feel good about my ability to do physical activity.	1	2	3	4	5	6	7
I am satisfied with my performance at physical activity	1	2	3	4	5	6	7

	Do not agree At All		Slightly Agree		Agree		Strongly Agree
I do the physical activities I choose to do.	1	2	3	4	5	6	7
During physical activity I pursue my own goals.	1	2	3	4	5	6	7
When I am physically active I feel I can really do what I want.	1	2	3	4	5	6	7
During physical activity I feel pressured.	1	2	3	4	5	6	7
I feel free to do physical activity in my own way.	1	2	3	4	5	6	7

Here is a list of statements about what you may feel towards the people you engage in physical activity with. Please indicate to what extent you agree with each of the following items.

In my relationships with people I am physically active with I feel...

	Do Not Agree At All	Very Slightly Agree	Slightly Agree	Moderate ly Agree	Agree	Strongly Agree	Very Strongly Agree
Supported	1	2	3	4	5	6	7
Understood	1	2	3	4	5	6	7
Listened to	1	2	3	4	5	6	7
Valued	1	2	3	4	5	6	7
Safe	1	2	3	4	5	6	7

Appendix C: Letter of Information for Experts



*Exercise & Health
Psychology Laboratory*



Letter of Information

Evaluating the Content Validity of Self-Efficacy and Basic Psychological Need Satisfaction Scales Targeting Children in Physical Activity Contexts.

You are invited to participate in a research study that seeks to examine the item content validity of self-efficacy and basic psychological need satisfaction scales that have been modified for use with children in physical activity contexts. You are being asked to participate because you are considered an expert in either self-determination theory or self-efficacy theory, and as such can provide valuable information around the content validity of items developed to measure these constructs. Your participation is voluntary and would require the completion of a questionnaire that will take approximately 30 minutes of your time.

Should you choose to participate you will receive an Item Content Review Form questionnaire by email. The items included have been evaluated by 5 children to ascertain items are of an age appropriate reading and comprehension level, given that the original items were developed for use with adults. You will be asked to read each self-efficacy and basic psychological need satisfaction item and assess the degree to which each item reflects the target variables on a 5-point Likert type scale, as well as the degree to which each of the target variables are represented by all of the items together. Following each response you will have the opportunity to include comments on each item and your overall impression of the scales. Upon completion we ask that you save your responses and return the survey by email as an attachment.

Confidentiality:

Your participation in this study is completely voluntary and your data will be held confidential. The information that we collect from you will only be for the use of the study investigators. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published. The data will be stored in the lab in locked filing cabinets for the required 6 years. Following this period, all the paper copies of the data will be shredded and the computer files will be deleted according to the university guidelines.

Voluntary Participation:

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time without consequence. Following completion of the questionnaire we ask that you save your responses and email them to

the researchers as an attachment. Please note that email responses are not considered to be secure unless de-identified. By completing and returning this questionnaire you indicate your consent to participate in this study. Please note that you do not waive any legal rights by consenting to participate. There are no risks or benefits associated participating in this study, nor will you be compensated for your participation.

Contacts:

This letter is for you to keep. If you have any concerns, please feel free to contact one of the researchers below. You may request the general findings of this research study from the researchers after the study is complete. If you have any questions about the conduct of this study, or your rights as a participant, you may contact the Office of Research Ethics, The University of Western Ontario.

Casey Gray, BHK, MA
Ph.D. Student
School of Kinesiology
University of Western Ontario

Dr. Harry Prapavessis
Professor
School of Kinesiology
University of Western Ontario

Appendix D: Item Content Review Form

Directions for experts completing the ICRF

Please rate the degree to which you feel *each item matches* the content descriptions (see below) defining each basic psychological need and self-efficacy variable. Also, feel free to make any additional comments in the space provided about the relevance of the item to school-aged children or the meaning interpreted from the wording of each item. These comments will be used to refine and improve the item pool.

When you have rated all the items and provided any additional comments you feel necessary, please save the ICRF to your computer before returning it to the researcher by e-mail.

Description of Content Areas

Autonomy: These items are intended to capture whether the participant perceives that he/she is the source of his/her own behaviour.

Competence: These items are intended to capture whether the participant perceives that he/she is able to effectively produce desired outcomes and prevent undesired outcomes.

Relatedness: These items are intended to capture whether the participant perceives that he/she is meaningfully connected with others during physically activity.

Task-Efficacy: These items are intended to capture whether the participant perceives that he/she is able to exercise control over task demands.

Barriers-Efficacy: These items are intended to capture whether the participant perceives that he/she is able to exercise control over events that effect daily life.

Description of rating scale anchors:

Please indicate the degree to which you feel each item listed below matches each of the five content areas defined above on the scale provided. Please feel free to add any additional comments where necessary.

Example

The following box contains an example of how to complete the ICRF.

In my relationships with people I am physically active with, I feel listened to.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Task-Efficacy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Participants in the next phase of this study will be given the following instructions that include operational definitions of physical activity, light intensity physical activity, moderate intensity physical activity, and hard intensity physical activity from which to base their responses to each survey item:

PHYSICAL ACTIVITY INCLUDES:

Organised sports like – hockey, track & field, basketball, tennis, golf, volleyball, baseball

Organised activities like – swimming lessons, dancing, aerobics

Other physical activities you do in your spare time like – skating, skateboarding, riding your bike, walking the dog, going for a walk, going for a run, skipping

These are not all the physical activities you can do. You will probably be able to think of more.

LIGHT ACTIVITIES: Are when you are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these unless the weather is really hot. You would be able to talk easily through the activity

MODERATE ACTIVITIES: Are when your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.

HARD ACTIVITIES: Are when your heart beats very fast, your breathing is fast and you start sweating. You may also feel exhausted and out of breath. Your legs would probably be feeling pretty heavy. It would be very hard to talk during the activity.

Please keep these “definitions” in mind as you respond to the following questions. There are no right or wrong answers to these questions and it is YOUR experiences that we are interested in.

In my relationships with people I am physically active with, I feel understood.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

In my relationships with people I am physically active with, I feel supported.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I am satisfied with my performance at physical activity.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Physical activity is not something I can do very well.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 30 minutes of physical activity at a light intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

In my relationships with people I am physically active with, I feel listened to.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 10 minutes of physical activity at a moderate intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of physical activity most days next week
If I have a lot of school work to do.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of physical activity most days next week.
If there are good T.V. programs on.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of physical activity most days next week.
If it is bad weather.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

After working at physical activity for a while I feel pretty competent.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I am pretty skilled at physical activity.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of physical activity most days next week. If I have a lot of activities to do with my friends and/or family.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments					

How confident are you that you can complete 30 minutes of physical activity at a moderate intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

In my relationships with people I am physically active with, I feel safe.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I can decide which activities I want to do during physical activity.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I think I am pretty good at physical activity.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 60 minutes of physical activity at a light intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Physical activities I do really correspond to my choices and interests.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

When I do my physical activities, I feel I should probably be doing something else.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 10 minutes of physical activity at a light intensity three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 60 minutes of physical activity at a hard intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

In my relationships with people I am physically active with, I feel valued.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I feel I can really do what I want in my physical activities.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of physical activity most days next week. If I am tired.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I do the physical activities I choose to do.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

I think I do pretty well at physical activity compared to others.					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 10 minutes of physical activity at a hard intensity level three times next week?					
Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 60 minutes of physical activity at a moderate intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

How confident are you that you can complete 30 minutes of physical activity at a hard intensity level three times next week?

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of physical activity most days next week.
If I am sore.

Content Area	Poor Match	Fair Match	Good Match	Very Good Match	Excellent Match
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers-Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

Content Relevance Form (CRF)

I would now like to get your **OVERALL** impression of the items that have been included in the initial item pool to measure perceived autonomy, competence, relatedness, task-efficacy and barriers-efficacy within the context of physical activity for school-aged children.

1. How well do you feel all of the items included in the initial item pool represent the constructs of perceived autonomy, competence, relatedness, task-efficacy and barriers-efficacy?

	Poor Representa ntation	Fair Representati on	Good Representati on	Very Good Representati on	Excellent Representati on
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Do you think the items are appropriate for use with people in physical activity contexts in terms of the degree to which they represent the constructs of perceived autonomy, competence, relatedness, task-efficacy and barriers-efficacy?

	Not at All	Not really	Somewhat	Yes	Yes, absolutely
Autonomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Competence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relatedness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Task Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barriers Efficacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Are there any additional items that you feel should be included to represent perceived autonomy, competence, relatedness, task-efficacy and barriers-efficacy?

Yes

No

If yes, please indicate what these items are in the space provided:

4. Are there any items in the initial item pool that you feel measure more than perceived autonomy, competence, relatedness, task-efficacy and barriers-efficacy?

Yes

No

If yes, please indicate what these items are and why you feel this way in the space provided:

CONTACT INFORMATION

Researcher: Dr. Harry Prapavessis

School of Kinesiology
University of Western Ontario

Assistant Researcher: Casey Gray

School of Kinesiology
University of Western Ontario

Assistant Researcher: Joy Elkayam

School of Kinesiology
University of Western Ontario
London, ON

Assistant Researcher: Erin McGowan

School of Kinesiology
University of Western Ontario

Assistant Researcher: Nerissa Podolinsky

School of Kinesiology
University of Western Ontario

Appendix E: Transcribed expert responses

J01

1. I found this item very difficult to interpret. The wording could be changed to facilitate understanding.

2. As above

4. The wording is negative and it may be better to focus on positive wording

5. with this and the other similar questions, does this mean continuously as a single bout or does this mean intermittently as in a game of hockey etc?

8. May be useful to identify salient barriers of your age groups to enhance barrier efficacy scale

31. sore is a general term and may not be a barrier to the given activity. A person may have a sore back and cannot play or run, versus a headache or sore finger. For girls sore may be related to menstrual pain but may not be a barrier.

crf3. With the self-efficacy items, you may want to specify the physical activity (e.g. walking, running) if appropriate.

I do not have a lot of experience with relatedness but I think the questions should be reworded . Maybe, ‘when taking part in physical activity do you feel other talk with you ?’

Do you have friends that you are physically active with.

You might want to ask an anchor question like the one above and then ask are you listened to, valued etc...

With respect to competence, you may want to have comparison type questions....such as

I can do physical activity as well as other people I know

I am as good at physical activity as others

J02

3. Not sure that 'satisfied' really captures competence
5. Perhaps should be 'at least three times a week'
7. 'at least three times a week?'
11. somewhat ambiguous do I need to work at it *for a while* to feel capable?
14. at least three times a week?
16. What about in school or PE or other organized activities? I might not be able to decide what I want to do but still feel autonomous
20. I assume this is meant to be autonomy? I don't think it captures that. It is more like importance
21. 'at least three times a week?'
22. 'at least three times a week?'
24. Again, what about in school in PE? I might not be able to do what I want but still feel autonomous
26. Again, in school PE I might not be able to do what I choose but still feel autonomous
28. At least three times?
29. At least three times?
30. At least three times?

Crf3. In general, I think the 'choice' items do not reflect autonomy well particularly in the context of children's physical activity. See the Reeve, Nix and Ham (2008) paper I have attached to my email.

Crf4. I noted on the rating scale that one item appears to represent importance

J03

Cr3. You really need to capture the essence of autonomy more effectively – its about choice, but also about endorsing behaviours completely, feeling as if one is the origin of the behaviour, that you do it because it reflects your true sense of self etc. Needs to be more broad.

Cr4. I think there was some overlap of between the competence and task self-efficacy items – but that is to be expected because they are generally conceptualized more or less the same thing, with one being a more specific form than the other!

J04

14. Not as easy statement to rate. Not sure what it really means

Cr4. I have answered ‘no’ to both of the above because it would take some time and effort to think this through. I have not had time to do this, hence ‘no’ response. Sorry.

J05

2. The sentence structure is not great but possibly this is not critical with this age group

3. I have difficulty with all the competence items... other than the fact that you might use a different scale (0-100%) task efficacy is a form of perceived competence

6. Again, not a well constructed sentence

10. If the weather is bad

15. I’m really puzzled by what safe means... Maybe the children won’t read as deeply into the question though. Psychological safety might be relatedness, physical safety it seems to me is not.

19. This question definitely is not good for young children “correspond” The physical activities I do really correspond to my choices and my interests

20. Is this a filler item?

23. Another poorly constructed sentence

26. I have trouble with this one... hard for me to see children understanding it

CRF2. I don't see any difference in what's asked of me between Q1 and Q2

J06

Just a thought.... Could a salient example for these kids be wii? Other interactive computer games?

1. what about "..., I feel like they understand me"??

6. Maybe... "I feel like they listen to me???"

11. Hmm... how long is "a while"? Maybe kids would get this and I don't, but I don't know exactly what you're getting at here

CrF4. Yes... only because I feel that these variables are to some extent correlated. I don't think that you can, at least in one study, tease apart this, and that some overlap is ok.

J07

1. Fair match with autonomy since exerciser may have some control over how well they are understood. A very good match with relatedness, but not excellent because an exerciser could feel they are understood by others without being entirely connected.

2. Would be a better fit with relatedness if the item read "with, I feel supported in my exercise participation."

3. A very good match with competence; would even be better if it was more a more specific outcome and not just performance. A good match with task efficacy since satisfied with performance would be related to having control.

4. Is a fair with task efficacy because not doing physical activity every week should be related to less control over task demands.

5. Fair match with competence since item indicates completing a desired outcome.
6. A good item; relatedness and being listened to go hand in hand.
7. Fair match with competence since item indicates completing a desired outcome.
8. Fair match with autonomy since there is some control over whether the person is physically active or does school work. Also fair match with competence since person is achieving a desired goal, participating in physical activity for 60 minutes on most days. Finally, fair match with task efficacy since the amount of physical activity is specified.
9. Fair match with autonomy since there is some control over whether the person is physically active or watches TV. Also fair match with competence since person is achieving a desired goal, participating in physical activity for 60 minutes on most days. Finally, fair match with task efficacy since the amount of physical activity is specified.
10. Fair match with autonomy since there is some control over whether the person is physically active or not. Also fair match with competence since person is achieving a desired goal, participating in physical activity for 60 minutes on most days. Finally, fair match with task efficacy since the amount of physical activity is specified.
11. Only a good match with competence; would be a better match if the item was more specific (i.e., 'for a while' and 'pretty capable' are rather vague terms – open to considerable interpretation). A fair match with task efficacy since feeling pretty capable would be related to having control.
12. Would be a better match with competence if the item was a little more specific (i.e., 'pretty skilled' is open to considerable interpretation). A fair match with task efficacy since feeling pretty skilled would be related to having control.
13. Fair match with autonomy since there is some control over whether the person is physically active or not. Also fair match with competence since person is achieving a

desired goal, participating in physical activity for 60 minutes on most days. Finally, fair match with task efficacy since the amount of physical activity is specified.

14. Fair match with competence since item indicates completing a desired outcome.

15. I'm not really sure what feeling safe means. Could easily be taken to mean I feel secure in the typical surroundings in which I exercise with others and the concept of relationships with people gets overlooked.

16. May have relationship with task efficacy since a person will probably choose to do those activities they have some confidence in completing.

17. Would be a better match with competence if the item was a little more specific (i.e., 'pretty good' is open to some interpretation). A fair match with task efficacy since feeling pretty good at physical activity would be related to having control.

18. Fair match with competence since item indicates completing a desired outcome.

19. I really like this item.

20. Only a good match with autonomy and would be better if the item was more strongly worded (e.g., I know I should be doing other things). Also a fair match with task efficacy since item suggests a person has low control over their overall activities.

21. Fair match with competence since item indicates completing a desired outcome.

22. Fair match with competence since item indicates completing a desired outcome.

23. Would be a better item if it was specified what the person was being valued for (e.g., being physically active).

24. May have relationship with task efficacy since a person will probably choose to do those activities they have some confidence in completing.

25. Fair match with autonomy since there is some control over whether the person is physically active or not. Also fair match with competence since person is achieving a

desired goal, participating in physical activity for 60 minutes on most days. Finally, fair match with task efficacy since the amount of physical activity is specified.

26. May have relationship with task efficacy since a person will probably choose to do those activities they have some confidence in completing.

27. I like this item.

28. Fair match with competence since item indicates completing a desired outcome.

29. Fair match with competence since item indicates completing a desired outcome.

30. Fair match with competence since item indicates completing a desired outcome.

31. Fair match with autonomy since there is some control over whether the person is physically active or not. Also fair match with competence since person is achieving a desired goal, participating in physical activity for 60 minutes on most days. Finally fair match with task efficacy since the amount of physical activity is specified.

Crf3. I would revise some of existing items, especially some of the relatedness ones.

Crf4. There are items, however, that tap into more than one of the five constructs listed (as I have indicated above), but most of these fall into the 'fair match' category and so these may not be too problematic (perfect items are almost impossible to construct).

J08

1. Lack of understanding would be a relevant barrier to participation

3. Is the term 'performance' too [ridiculous] – U mean sport performance yes (win: loss vs play overall) but how will N gauge performance @ play activity

4. This is an assessment of incompetence, not competence per se.

5. time could be perceived as a barrier in the item/ and duration

6. not [?] want = barrier

The wording is 'awkward' – 'I feel like they listen to me'

7. Time could be perceived as a barrier in the item/ and duration
12. Skill = task efficacy in terms of “demands”
13. mean = double barreled item > what if no stuff with friends but tons with family >
how do I respond then
15. does safety (or lack of) present a barrier? Q: safe from what?
16. good item!
19. choices + interests = double barreled item. See Devellis (2001) for clarity
20. feelings of control/obligation?
23. will target pop comprehend ‘valued’?
- CRF1. The aut and relatedness ones are tough – the relatedness items are from [?] and
vallerand and have extrinsic [?] but I’m not sure they capture the essential meaningful
connections in activity with others for youth.
- CRF3. But this is a never ending process of item generation and subsequent evaluation
(Messick, 1995). _ with what I have _ use the _ to _ informal decisions.

Appendix F: Letter of Information for principals, teachers, participants/consent form



*Exercise & Health
Psychology Laboratory*



Information Sheet for Principals

Title: PREDICTING AND ASSESSING PHYSICAL ACTIVITY IN SCHOOL-AGED CHILDREN

Researchers: Dr. Harry Prapavessis, Casey Gray, Nerissa Podolinsky, Erin McGowan, Joy Elkayam

To: [insert name]

My name is Casey Gray and I am a PhD student in Kinesiology at the University of Western Ontario. My PhD research involves understanding the daily physical activity behaviours of children. Your school has been chosen because your students fit the age criteria that we are interested in. I would like to ask for your permission to request your school's participation in this novel study. This research is completely voluntary and you do not have to take part and you do not have to agree to let your school participate. I would like to emphasize that this research will involve minimal to no involvement on the part of you or your teaching staff.

The purpose of this study is to better understand how much physical activity school aged children do in a week and what factors contribute to this activity. The reason we are interested in performing this study is that, although the benefits of a physically active lifestyle among children are well established, there is a documented decline in physical activity levels among young people between the ages of 5 and 13 years. For these reasons it is important that we attempt to identify and further understand the physical activity determinants of children.

To gain this information, children will be asked to complete a series of questionnaires at the end of the school week assessing their thoughts about physical activity. The questionnaires will be completed (at a time deemed convenient by you and the class teacher) under the supervision of the study investigator(s) and class teacher. This will take approximately 30 minutes to complete. At the beginning of the following week, children will be asked to wear a device called an Actical[®] Active Energy Expenditure monitor. This device will be worn on the child's hip for one full week (7 days) and will monitor their physical activity patterns throughout the day.



There is no physical discomfort associated with wearing this device and children will be asked to remove the device while showering or sleeping. Upon returning the Actical[®] device children will be asked to complete a brief questionnaire assessing their physical activity over the previous week.

The Actical[®] will be worn and the brief activity questionnaire will be completed again 6 weeks later to establish if their initial thoughts about physical activity are still related to their actual physical activity at this later time. It will also provide insight into how stable physical activity is from week 1 to week 6 assessments. The investigators will provide the students and teachers with information, support, and guidance to any questions they may have about the study. The only role of the class teacher is to provide the study investigator(s) with access to the students during class time.

Students who do not wish to participate in the study can continue their own school-work during periods of data collection. Participation/non-participation will not affect school grades or the relationship with the school. Students, their parents and the school will not be held responsible for lost, stolen or damaged Actical[®] devices.

The research is not anticipated to cause the student any stress or concern, nor is it associated with any direct benefits to the student (other than providing them with an awareness of how active they are in a typical week). Indirectly however, we will provide a lay summary as well as informal presentation of our general findings for those interested. These results could easily be incorporated into a health or measurement class module for educational purposes.

Thank you very much for considering participating in this study. This letter is yours to keep. If you have any questions about the conduct of this study you may contact:

*Office of Research Ethics
The University of Western Ontario*

Also, please feel free to address any questions or concerns to the investigators listed below.

Thank you.
Dr. Harry Prapavessis
School of Kinesiology
University of Western Ontario

Casey Gray
School of Kinesiology
University of Western Ontario



Exercise & Health Psychology Laboratory



Information Sheet for Teachers

Title: PREDICTING AND ASSESSING PHYSICAL ACTIVITY IN SCHOOL-AGED CHILDREN

Researchers: Dr. Harry Prapavessis, Casey Gray, Nerissa Podolinsky, Erin McGowan, Joy Elkayam

To: The Teacher,

My name is Casey Gray and I am a PhD student in Kinesiology at the University of Western Ontario. My PhD research involves understanding the daily physical activity behaviours of children. Your class has been chosen because your students fit the age criteria that we are interested in. I would like to ask for your permission to request your students' participation in this novel study. This research is completely voluntary and you do not have to take part and you do not have to agree to let your students participate. I would like to emphasize that this research will involve minimal to no involvement on your part.

The purpose of this study is to better understand how much physical activity school aged children do in a week and what factors contribute to this activity. The reason we are interested in performing this study is that, although the benefits of a physically active lifestyle among children are well established, there is a documented decline in physical activity levels among young people between the ages of 5 and 13 years. For these reasons it is important that we attempt to identify and further understand the physical activity determinants of children.

To gain this information, children will be asked to complete a series of questionnaires at the end of the school week assessing their thoughts about physical activity. The questionnaires will be completed at your convenience under your supervision and that of the study investigator(s). This will take approximately 15 to 20 minutes to complete.

At the beginning of the following week, children will be asked to wear a device called an Actical[®] Active Energy Expenditure monitor. This device will be worn on the child's hip for one full week (7 days) and will monitor their physical activity patterns throughout the day. There is no physical discomfort associated with wearing



this device and children will be asked to remove the device while showering or sleeping. Upon returning the Actical[®] device children will be asked to complete a brief questionnaire assessing their physical activity over the previous week.

The investigators will provide you and the students with information, support, and guidance to any questions you may have about the study. Your only role is to provide the study investigator(s) with access to the students during class time.

Students who do not wish to participate in the study can continue their own school-work during periods of data collection. Students, their parents and the school will not be held responsible for lost, stolen or damaged Actical[®] devices.

The research is not anticipated to cause the student any stress or concern, nor is it associated with any direct benefits to the student (other than providing them with an awareness of how active they are in a typical week). Indirectly however, we will provide a lay summary as well as informal presentation of our general findings for those interested. These results could easily be incorporated into a health or measurement class module for educational purposes.

Thank you very much for considering participating in this study. This letter is yours to keep. If you have any questions about the conduct of this study you may contact:

*Office of Research Ethics
The University of Western Ontario*

Also, please feel free to address any questions or concerns to the investigators listed below.

Thank you.

Dr. Harry Prapavessis
School of Kinesiology
University of Western Ontario

Casey Gray
School of Kinesiology
University of Western Ontario

Nerissa Podolinsky, Erin McGowan & Joy Elkayam
School of Kinesiology
University of Western Ontario



*Exercise & Health
Psychology Laboratory*



Informed Consent

AN INTEGRATED MODEL TO PREDICT PHYSICAL ACTIVITY BEHAVIOR IN
SCHOOL-AGED CHILDREN

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Consenting Signature:

Participant Name (print): _____

Participant Signature: _____ Date: _____

Parent or Guardian Name (print): _____

Parent or Guardian Signature: _____ Date: _____

Researcher Name (print): _____

Researcher's Signature _____ Date: _____

Appendix G: Integrated model scales (task efficacy, barriers efficacy, perceived competence, perceived barriers, perceived relatedness); PAQ-C (study 2 & 3)



PHYSICAL ACTIVITY



*WHAT YOU THINK &
WHAT YOU DO??*

QUESTIONNAIRE BOOK

Study identifier: _____



QUESTIONNAIRE BOOK INFORMATION SHEET

The researcher/s you have met and who will be helping you fill in this booklet are from the University of Western Ontario. We are doing some research to look at the type and amount of physical activity in school-aged children.

You have been asked to take part in this study which will look at how much physical activity you do in a week and what your thoughts are about that.

In this booklet, there are some simple questionnaires that will take about 30 minutes to complete. This will be done during school time and one of the researchers will help you complete these. If you have any questions you can ask them.

You do not need to tell anyone else what you write on the questionnaires.

On the following pages are a letter of information and a consent form. Please take the blue letter of information and the yellow consent form home for your parents and ask them to sign the yellow consent form. Please do not sign the consent form until the researcher explains the study to you and asks you to fill it in.

If you are worried about anything or have any questions, please let your teacher, parents, or the researchers know.

The researchers' contact information is on the last page (green page) of this questionnaire book.

WHAT IS PHYSICAL ACTIVITY?

WHEN YOU ANSWER THE FOLLOWING QUESTIONS, KEEP IN MIND THAT PHYSICAL ACTIVITY INCLUDES THINGS SUCH AS:

ORGANIZED SPORTS LIKE – HOCKEY, TRACK & FIELD, BASKETBALL, TENNIS, GOLF, VOLLEYBALL, BASEBALL.

ORGANIZED ACTIVITIES LIKE – SWIMMING LESSONS, DANCING, AEROBICS.

OTHER PHYSICAL ACTIVITIES YOU DO IN YOUR SPARE TIME LIKE SKATING, SKATEBOARDING, RIDING YOUR BIKE, WALKING THE DOG, GOING FOR A WALK, GOING FOR A RUN, SKIPPING.

THESE ARE NOT ALL THE PHYSICAL ACTIVITIES YOU CAN DO. YOU WILL PROBABLY BE ABLE TO THINK OF MORE.

WHAT IS REGULAR PHYSICAL ACTIVITY?

- **DOING ANY OF THE PHYSICAL ACTIVITIES THAT ARE EITHER MODERATE OR HARD (LIKE THOSE ON THE PREVIOUS PAGE), INCLUDING PLAYING ON A SPORTS TEAM, RIDING YOUR BIKE, WALKING TO AND FROM SCHOOL, PLAYING GAMES WITH FRIENDS**
- **THESE ARE ACTIVITIES THAT SHOULD MAKE YOU SWEAT, MAKES YOUR LEGS FEEL TIRED OR THAT MAKES YOU BREATHE HARDER THAN NORMAL,**
- **THESE ACTIVITIES SHOULD BE DONE FOR AT LEAST 60 MINUTES IN TOTAL PER DAY**
- **YOU SHOULD DO THEM ON MOST DAYS OF THE WEEK (PREFERABLY EVERY DAY)**

YOU DON'T HAVE TO DO THE SAME ACTIVITIES EVERY DAY: YOU MIGHT PLAY A SPORT ONE AFTERNOON, ON ANOTHER YOU MIGHT GO ROLLER BLADING WITH A FRIEND AND YOU COULD WALK HOME FROM SCHOOL ONE DAY.

THIS WOULD COUNT AS REGULAR PHYSICAL ACTIVITY.

GENERAL INFORMATION SHEET

PLEASE FILL IN YOUR INFORMATION BELOW



DATE OF BIRTH _____
(day/month/year)

GENDER (Circle correct answer) MALE FEMALE

HEIGHT _____ inches

WEIGHT _____ pounds

ADDRESS _____

TELEPHONE NUMBER _____

WHAT WERE THE ETHNIC OR CULTURAL ORIGINS OF YOUR ANCESTORS?

An ancestor is usually more distant than a grandparent

(circle **one or more** that **best** describe you)

Canadian English French Chinese Italian German

Scottish East Indian Irish Somali Cree Mi'kmaq (Micmac)

Métis Inuit (Eskimo) Ukrainian Dutch Filipino Polish

Portuguese Jewish Greek Jamaican Vietnamese Lebanese

Chilean Salvadorean

OTHER _____

WHAT ARE LIGHT / MODERATE / HARD ACTIVITIES?

Below is the description of what light, moderate and hard activities are:

LIGHT ACTIVITIES: Are when you are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these unless the weather is really hot. You would be able to talk easily through the activity.



MODERATE ACTIVITIES: Are when your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.



HARD ACTIVITIES: Are when your heart beats very fast, your breathing is fast and you start sweating. You may feel exhausted and out of breath. Your legs would probably feel heavy. It would be very hard to talk during the activity.

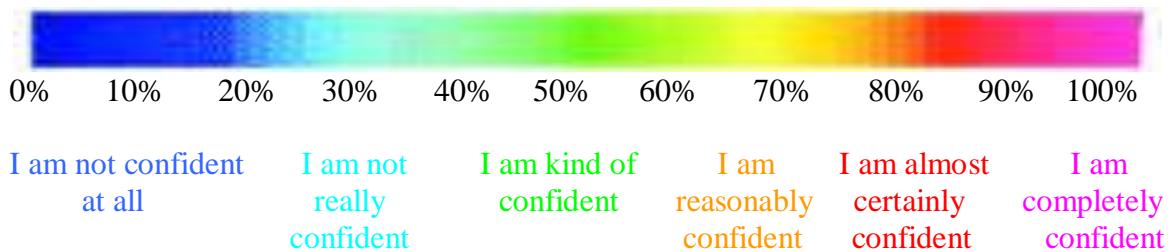


In answering the following questions you will be asked to think about how confident you are that you can participate in physical activities that are described as light / moderate / hard. The word “confident” refers to the belief that you have in yourself that you can do something well.

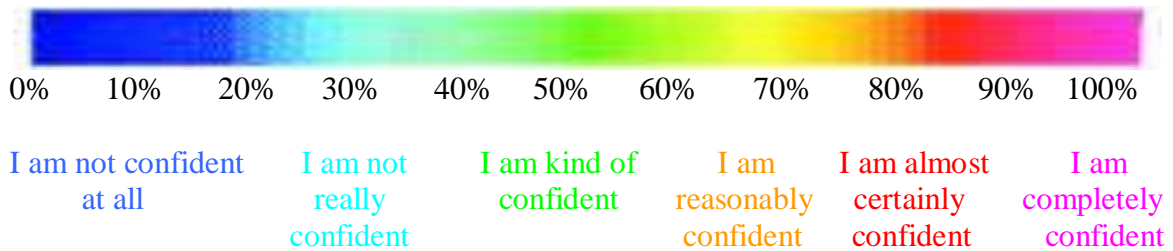
LIGHT ACTIVITIES: Are when you are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these unless the weather is really hot. You would be able to talk easily through the activity.



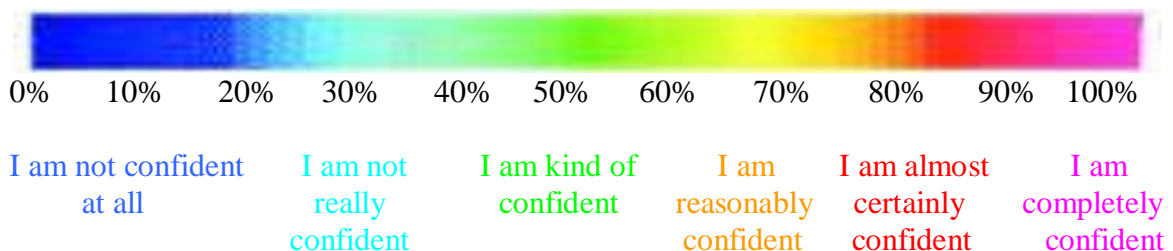
1. How confident are you that you can complete **10 minutes** of physical activity at a **light** intensity level **five or more** days next week?



2. How confident are you that you can complete **30 minutes** of physical activity at a **light** intensity level **five or more** days next week?



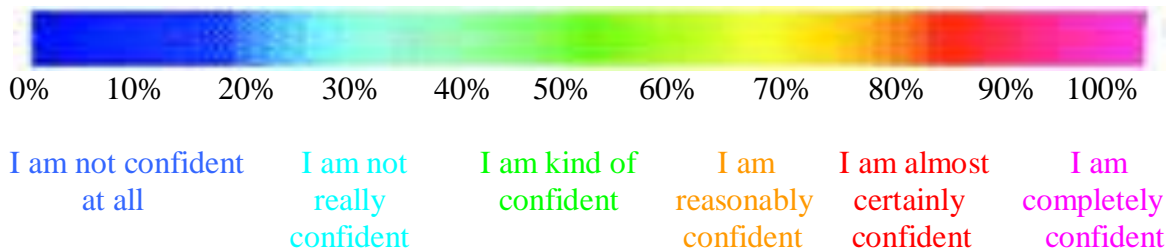
3. How confident are you that you can complete **60 minutes** of physical activity at a **light** intensity level **five or more** days next week?



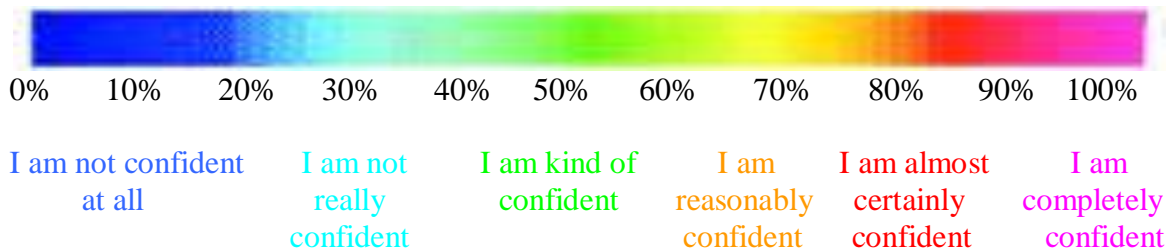
MODERATE ACTIVITIES: Are when your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.



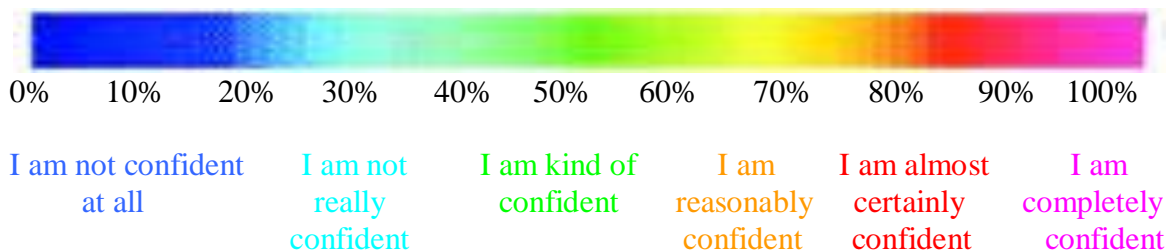
4. How confident are you that you can complete **10 minutes** of physical activity at a **moderate** intensity level **five or more** days next week?



5. How confident are you that you can complete **30 minutes** of physical activity at a **moderate** intensity level **five or more** days next week?



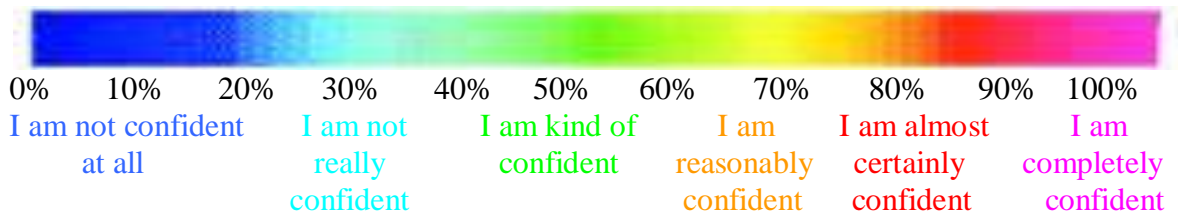
6. How confident are you that you can complete **60 minutes** of physical activity at a **moderate** intensity level **five or more** days next week?



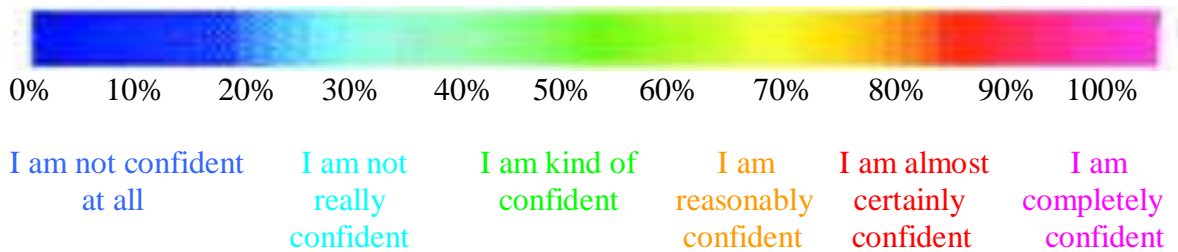
HARD ACTIVITIES: Are when your heart beats very fast, your breathing is fast and you start sweating. You may also feel exhausted and out of breath. Your legs would probably be feeling pretty heavy. It would be very hard to talk during the activity.



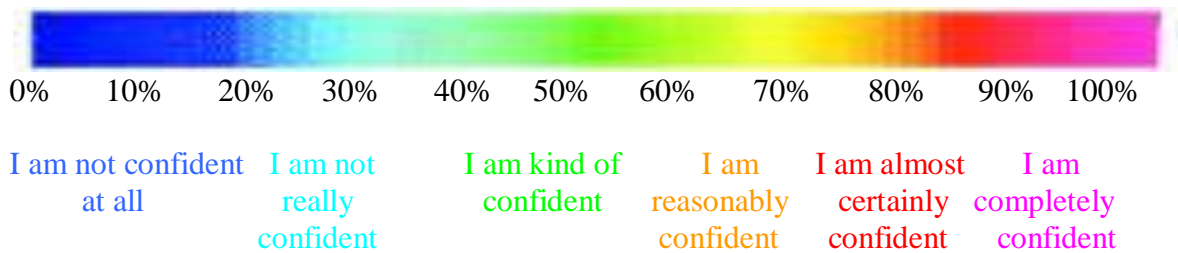
7. How confident are you that you can complete **10 minutes** of physical activity at a **hard** intensity level **five or more** days next week?



8. How confident are you that you can complete **30 minutes** of physical activity at a **hard** intensity level **five or more** days next week?

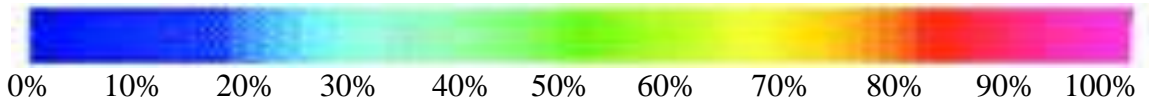


9. How confident are you that you can complete **60 minutes** of physical activity at a **hard** intensity level **five or more** days next week?



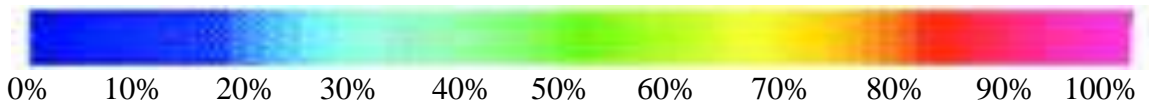
Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in 60 minutes of CUMMULATIVE physical activity FIVE OR MORE DAYS next week.

1. If it is bad weather.



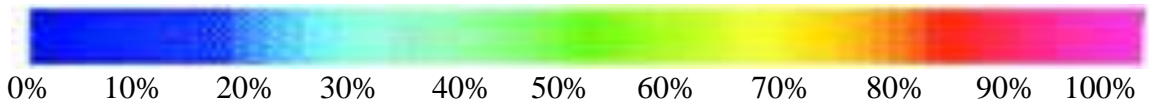
I am not confident at all	I am not really confident	I am kind of confident	I am reasonably confident	I am almost certainly confident	I am completely confident
---------------------------	---------------------------	------------------------	---------------------------	---------------------------------	---------------------------

2. If I have a lot of school work to do.



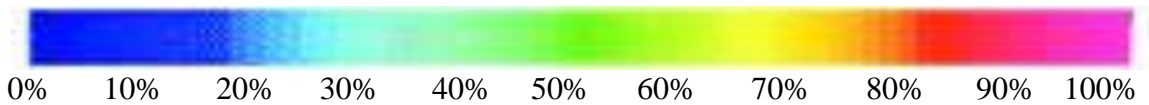
I am not confident at all	I am not really confident	I am kind of confident	I am reasonably confident	I am almost certainly confident	I am completely confident
---------------------------	---------------------------	------------------------	---------------------------	---------------------------------	---------------------------

3. If there are good T.V. programs on.



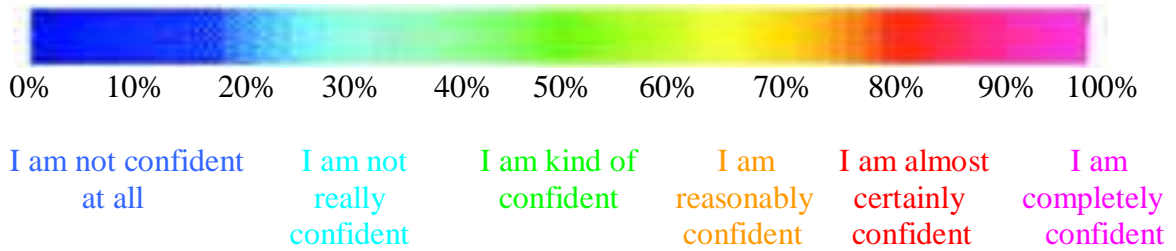
I am not confident at all	I am not really confident	I am kind of confident	I am reasonably confident	I am almost certainly confident	I am completely confident
---------------------------	---------------------------	------------------------	---------------------------	---------------------------------	---------------------------

4. If I have a lot of activities to do with my friends and/or family.

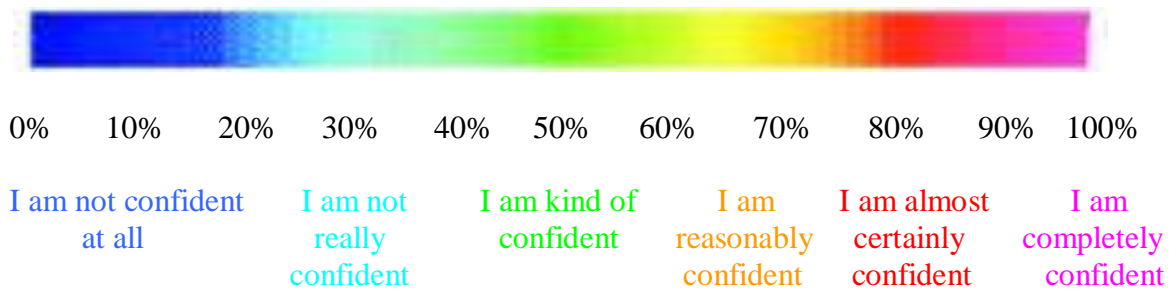


I am not confident at all	I am not really confident	I am kind of confident	I am reasonably confident	I am almost certainly confident	I am completely confident
---------------------------	---------------------------	------------------------	---------------------------	---------------------------------	---------------------------

5. If I am tired.



6. If I am sore.



Are there any other things that might stop you from taking part in physical activity regularly next week? If there are please write them below:

BASIC NEED SATISFACTION IN PHYSICAL ACTIVITY

The following statements represent how people typically feel when they engage in physical activity. Physical activities include activities such as riding your bike, playing sports or dancing. They are activities that make you sweat, make your legs feel tired, or that make you breathe harder.

Please answer the following questions by considering how YOU TYPICALLY feel when participating in physical activity using the scale provided.

	Do not Agree At All	1	2	Slightly Agree	3	4	5	6	7	Agree	Strongly Agree
I am good at physical activity.	1	2	3	4	5	6	7				
I do well at physical activity compared to others.	1	2	3	4	5	6	7				
I feel capable while doing physical activity.	1	2	3	4	5	6	7				
I am capable of completing physical activity challenges.	1	2	3	4	5	6	7				
I am skilled at physical activity.	1	2	3	4	5	6	7				
I feel good about my ability to do physical activity.	1	2	3	4	5	6	7				

	Do not agree At All	1	2	Slightly Agree	3	4	5	6	7	Agree	Strongly Agree
I do the physical activities I choose to do.	1	2	3	4	5	6	7				
During physical activity I pursue my own goals.	1	2	3	4	5	6	7				
When I am physically active I feel I can really do what I want.	1	2	3	4	5	6	7				
I feel free to do physical activity in my own way.	1	2	3	4	5	6	7				

Here is a list of statements about what you may feel towards the people you engage in physical activity with. Please indicate to what extent you agree with each of the following items.

In my relationships with people I am physically active with I feel...

	Do Not Agree At All	Very Slightly Agree	Slightly Agree	Moderately Agree	Agree	Strongly Agree	Very Strongly Agree
Supported	1	2	3	4	5	6	7
Understood	1	2	3	4	5	6	7
Listened to	1	2	3	4	5	6	7
Valued	1	2	3	4	5	6	7
Connected	1	2	3	4	5	6	7

NAME:

SCHOOL:

PHYSICAL ACTIVITY: WHAT DO YOU DO?

We are trying to find out about your level of physical activity from *the last 7 days* (in the last week). These includes activities like sports or dancing that make you sweat, make your legs feel tired, or that make you breathe hard.

***Remember: There are no right and wrong answers — this is not a test.**

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If no, check the 'No' circle. If yes, check how many times you have done the activity in the past week. (Check only one circle per row.)

	No	1-2	3-4	5-6	7 times or more
Skipping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rowing/canoeing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roller blading	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Walking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bicycling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jogging or running	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aerobics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Swimming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Baseball, softball	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rugby	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Badminton	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skateboarding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soccer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hockey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lacrosse.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tennis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Basketball	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Touch football.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Field hockey.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Football.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other:					
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. In the last 7 days, during your **physical education (PE) classes**, how often were you very active (playing hard, running, jumping, throwing)? (Tick one only.)

- I don't do PE
- Hardly ever
- Sometimes
- Quite often
- Always

3. In the last 7 days, what did you do most of the time **at recess**? (Tick one only.)

- Sat down (talking, reading, doing schoolwork)...
- Stood around or walked around
- Ran or played a little bit
- Ran around and played quite a bit
- Ran and played hard most of the time

4. In the last 7 days, what did you normally do **at lunch** (besides eating lunch)? (Tick one only.)

- Sat down (talking, reading, doing schoolwork)..
- Stood around or walked around
- Ran or played a little bit
- Ran around and played quite a bit
- Ran and played hard most of the time

5. In the last 7 days, on how many days **right after school**, did you do sports, dance, or play games in which you were very active? (Tick one only.)

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

6. In the last 7 days, on how many **evenings** did you do sports, dance, or play games in which you were very active? (Tick one only.)

- None
- 1 time last week
- 2 or 3 times last week
- 4 or 5 last week
- 6 or 7 times last week

7. On **the last weekend**, how many times did you do sports, dance, or play games in which you were very active? (Tick one only.)

- None
- 1 time
- 2 — 3 times
- 4 — 5 times
- 6 or more times

8. Which **one** of the following describes you best for the **last 7 days**? Read *all five* statements before deciding on the *one* answer that describes you.

- A. All or most of my free time was spent doing things that involve little physical effort
- B. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics)
- C. I often (3 — 4 times last week) did physical things in my free time
- D. I quite often (5 — 6 times last week) did physical things in my free time...
- E. I very often (7 or more times last week) did physical things in my free time

9. Tick how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

	None	Little bit	Medium	Often	Very often
Monday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tuesday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wednesday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thursday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Saturday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sunday	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Tick one.)

- Yes
- No

If Yes, what prevented you?

Appendix H: Information letter for principals and students/consent form/re-consent script



Exercise & Health Psychology Laboratory



Title: A brief motivational intervention to increase physical activity in adolescents
Researchers: Casey Gray, Nerissa Campbell and Dr. Harry Prapavavessis

To: [The Principal]

My name is Casey Gray and I am a PhD student in Kinesiology at the University of Western Ontario. My research is focused on physical activity behaviour in 11-14 year old children. I would like to ask for your permission to involve your school in this novel study. This research is completely voluntary and you do not have to take part. I would like to emphasize that this research will involve minimal to no involvement on the part of you or your staff.

The purpose of this study is to determine if a brief motivational and action based intervention will be able to increase physical activity levels of children not currently meeting guidelines (60 minutes of moderate and 30 minutes of vigorous physical activity daily). The reason we are conducting this research is that there is a documented decline in physical activity levels among these ages. Previous research suggests that a brief session with a physical activity counsellor has been able to elicit positive behavioural changes for adolescents in previous health related research.

To gain information about their feelings about physical activity children will be asked to complete a brief questionnaire and then have their height and weight measured. This will take approximately 15-20 minutes and will occur at a time deemed convenient by you or their classroom teacher (possibilities could include during class time, at the beginning of lunch, during an assembly).

One week later the students who have indicated they are not meeting physical activity guidelines will be invited to wear a device called an Actical[®] Active Energy Expenditure monitor. This device will be worn on the child's hip for 8 days (returned on the 9th day) and will monitor their physical activity patterns throughout the day. When children return the device they will be asked questions about their activity over the previous week which will take about 5 minutes. There is no physical discomfort associated with wearing this device and children will be asked to remove the device while showering or sleeping. One week later the children who engage in fewer than 60 minutes of moderate and 30 minutes of hard daily physical activity will be invited to participate in the intervention.



Children who take part in the intervention will be randomized to either the physical activity counseling group, or a nutrition counseling group. They will not know that there are two possible groups. All participants will receive a telephone call at home from a

study investigator. If it is not a good time the participant will be asked to choose a more convenient time for a phone call that could last up to 45 minutes.

For children in the physical activity counseling group, during the phone call the investigator will provide feedback about the child's Actical[®] physical activity data provided earlier. Together they will discuss the child's perceived barriers to regular physical activity and strategies to overcoming these barriers. For children in the healthy lifestyle group the investigator will provide information about healthy eating other healthy behaviours. The purpose of this control group is to provide contact with the investigator to ensure that any changes in the physical activity for the physical activity counseling group are due to the intervention, and not merely a result of receiving personal attention.

Within 2 days of the phone call participants will be asked to complete a brief questionnaire (10 minutes) at school about their feelings about physical activity, and about the counseling session, and will be outfitted with the Actical[®] accelerometer (worn for 8 days) to determine if physical activity has changed and then respond to a few questions about the previous weeks physical activity (5 minutes). The investigators will provide the students and teachers with information, support, and guidance to any questions they may have about the study. The only role of the class teacher is to provide the study investigator(s) with access to the students to distribute questionnaires and to fit the Actical[®] devices.

Students, their parents and the school will not be held responsible for lost, stolen or damaged Actical[®] devices. The research is not anticipated to cause the student any stress or concern. If successful the student could benefit by learning to incorporate recommended amounts of physical activity into their lives which could have positive health implications. If the intervention is successful, participants in the healthy lifestyle group will be offered the opportunity to undergo the physical activity counselling intervention if they wish.

Thank you very much for considering participating in this study. This letter is yours to keep. If you have any questions about the conduct of this study you may contact:

*Office of Research Ethics
The University of Western Ontario*

Also, please feel free to address any questions or concerns to the investigators listed below.

Thank you.

Dr. Harry Prapavessis
School of Kinesiology
University of Western Ontario

Casey Gray
School of Kinesiology
University of Western Ontario



Exercise & Health Psychology Laboratory



LETTER OF INFORMATION

The pronouns ‘you’ and ‘your’ should be read as referring to the participant rather than the parent/guardian/next of kin who is signing the consent form for the participant.”

You are being invited to participate in a research study, “**A brief motivational intervention to increase physical activity in adolescents,**” carried out by Casey Gray, Nerissa Campbell and Dr. Harry Prapavessis.

PURPOSE OF THE STUDY

The purpose of this study is to examine the effects of a telephone counselling session on physical activity behaviour.

PROCEDURE

Participation in this study is voluntary. If you volunteer to participate in the study the following will occur:

A researcher will come to your school and ask you to complete a questionnaire asking questions about yourself (e.g. age, gender) and your feelings about physical activity. When you return the questionnaire the researcher will measure your height and weight. This will all take about 15-20 minutes. The next day you will be visited at school by the researcher who will fit you with an Actical® physical activity monitor. This device will record your activity intensity and duration throughout the day. You will be instructed to wear the Actical® on a belt around your waist for the next 8 days except when showering or sleeping. When you return the device you will be asked to answer a few questions about your physical activity over the previous week which will take about 5 minutes)



Based on the physical activity information gathered by the Actical® you may be invited to participate in part 2. Participants in part 2 will receive a phone call at home to talk about their health. Within the next 1 to 2 days the researcher will come back to your school and ask you to complete a questionnaire about your feelings about physical activity which will take about 10 minutes. The researcher will then take your weight, and fit you with an Actical® which you will be asked to wear for 8 more days and then return to your teacher. When you return the device you’ll be asked a few questions about your physical activity over the previous week which will take about 5 minutes. If you do not participate in the study you may continue with your school work while study participants are involved in research activities.

POTENTIAL RISKS AND DISCOMFORTS

There are no known risks associated with taking part in this study.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

You may benefit from participating in this program by gaining information on how to become more active. Scientists may benefit from this program by gaining knowledge about strategies to help youth become more physically active.

COMPENSATION FOR PARTICIPATION

There is no compensation for participation in this study

CONFIDENTIALITY

Any information that is obtained in connection with this program and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. The questionnaires that you complete over the telephone are completely private and will be kept in a locked filing cabinet in Dr. Harry Prapavessis' laboratory. The only people who will read the surveys are the three researchers listed above. Your personal identity will never be revealed in any reports regarding this program.

PARTICIPATION AND WITHDRAWAL

You can choose whether to participate in this study or not. If you volunteer to be in this study, you may withdraw yourself or your data at any time without consequence. If you withdraw before the end of the study you have the right to remove your data from the analysis. You may also refuse to answer any questions you don't want to answer and still remain in the study. You are not waiving any legal claims, rights or remedies because you are participating in this research program. When the data has been analysed and submitted for publication withdrawal of data will no longer be an option.

INFORMATION ABOUT THE STUDY RESULTS

You may obtain information about the results of the study by asking the researcher when your participation has concluded. If you wish to be sent general research findings provide your name and address on a separate piece of paper and these will be mailed to you upon your request.

INFORMATION ABOUT PARTICIPATING AS A STUDY PARTICIPANT

If you have questions or require more information about the study itself, please contact Casey Gray. This letter is for you to keep. If you have any concerns, please feel free to contact one of the researchers below. You may request the general findings of this research study from the researchers after the study is complete.

If you have any questions about the conduct of this study, or your rights as a participant, you may contact the Office of Research Ethics at the University of Western Ontario by emailing ethics@uwo.ca or by calling.

CONTACT INFORMATION

Casey Gray
School of Kinesiology
The University of Western Ontario

Dr Harry Prapavessis
School of Kinesiology
The University of Western Ontario



*Exercise & Health
Psychology Laboratory*



Consent Form

A brief motivational intervention to increase physical activity in adolescents

I have read the Letter of Information, (have had the nature of the study explained to me) and I agree to participate. All questions have been answered to my satisfaction.

Consenting Signature:

Participant Name (print): _____

Participant Signature: _____

Date: _____

Parent or Guardian Name (print): _____

Parent or Guardian Signature: _____

Date: _____

Researcher Name (print): _____

Researcher's Signature _____

Date: _____

Telephone re-confirming script

Hello,

Am I speaking with [*insert name*]? This is Casey Gray, a researcher calling from the University of Western Ontario. I am calling in regards to the research study that you agreed to participate in. Today we will talk about your physical activity levels and physical activity intentions. Before we begin however, I just want to confirm - do you still consent to participate? Do you have any questions about the study?

Appendix I: Motivational Interview Guide & Tools

ESTABLISH RAPPORT

“How’s it going?”

RAISE SUBJECT

We have up to an hour to talk. This is what I thought we might do:

- hear about how physical activity usual fits into your day and how you feel about what you’ve been doing;
- give you some information gathered by the Actical you wore about your physical activity last week;
- talk about what, if anything you might want to change with your physical activity schedule.

“How does this sound? Is there anything else you want to go over?”

ASSESS CURRENT PHYSICAL ACTIVITY BEHAVIOUR

-Briefly explain physical activity guidelines

-90 minutes MVPA every day

-60 moderate, 30 vigorous.

-Show adherence ruler

Ask open ended question to explore current physical activity behaviour

“Choose the number that best describes how closely his/her physical activity behaviour matched the physical activity guideline”

“Tell me about the number you chose.”

“Why did you choose a _ and not a 1?”

“At what times do you follow the physical activity guidelines and at what times don’t you?”

Continue asking open ended questions that explore in detail his/her current physical activity patterns and to describe positive behaviours he/she feels good about.

GIVE FEEDBACK

Describe participant feedback from Actical® physical activity monitoring, and self report data

“this is where you stand compared to what the guidelines recommend”

elicit participants overall response: “what do you make of all this information?”

Offer information about the meaning of the results (only if the participant shows interest)

“For most kids your age who do the same amount and intensity of physical activity as you, they may feel more tired, have difficulty keeping up with other kids...”

ASSESS READINESS TO CHANGE

Introduce change ruler

“On a scale of 1-12 (1 = not at all ready, 12 = very ready), how ready are you right now to make any new changes in your life to do more moderate to vigorous physical activity?”

Ask participant to explain choice of number

“What are all the reasons you chose a _?”

TAILOR INTERVENTION APPROACH

- **Stage 1 (not ready)**
- Goal: raise awareness
- Major task: Inform and encourage
-
- *ask key open ended questions*
- "that's interesting, why did you give yourself a 3 and not a 1?"
- "What would need to be different for you to consider increasing your physical activity?"
- "You say you're a _ on the confidence ruler. What would have to happen to move you from a _ to a _?" "How could I help to get you there?"
- *Introduce wheel of life exercise (if participant still seems resistant)*
- *Respectfully acknowledge their decisions.*
- "I respect your decision not to make any changes in your physical activity. You're the best judge of what's right for you."
- *Offer professional advice*
- "As you might guess, my recommendation is that you __. But of course, it's your decision."
- **Stage 2 (Unsure)**
- Goal: To build motivation and confidence
- Major Task: to explore ambivalence
- *Explore ambivalence*
- "what are some of the things you like (and dislike) about the your physical activity patterns?"
- "what are some of the things that make it easy (and hard) for you to do physical activity?"
- "What are some of the good (and less good) things about making a new or additional change?"
- *Look into the future*
- "I can see why you're unsure about making new or additional changes in your activity. Let's just stand back for a moment and imagine that you decided to change. What would it be like? Why would you want to do this?"
-
- *Determine a list of values*
- "If you had to list 5 or six values that you have what would they be?" (e.g. friends, family, health, school.. only offer suggestions if probed).

- “Tell me about X” (pick one or two that could be used to tie into PA)
-
- *Build on these eg. if the participant lists ‘friends’:*
- "What do your friends do?"
- "what would your friends think if you started doing more PA?"

- *Ask about the next step*
- "Where does this leave you now?"
- *(Let the patient raise the topic of change)*

- **Stage 3 (Ready)**

- Goal: to negotiate plan
- Major task: facilitate decision making

- *Identify change options*
- “What do you think needs to change?”
- “What are your ideas for making a change?”
- “Which option makes the most sense to you?”

Help participant set a realistic and achievable short-term goal.

- Develop an action plan.
- Discuss existing and potential barriers
- Brainstorm solutions to barriers (new solutions, past experiences, similar others)
- Summarize the plan
- Document the plan

CLOSE THE ENCOUNTER

Summarize the session

“Did I get it all?”

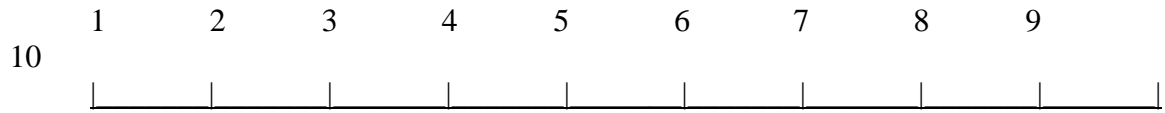
Support Self-Efficacy

“Again, I applaud your efforts and I know you can do it. If this plan doesn’t work out, I’m sure there are other options that might work better.

TOOLS

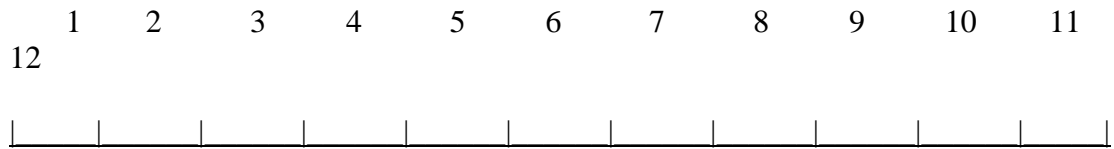
Adherence ruler

Never
Always

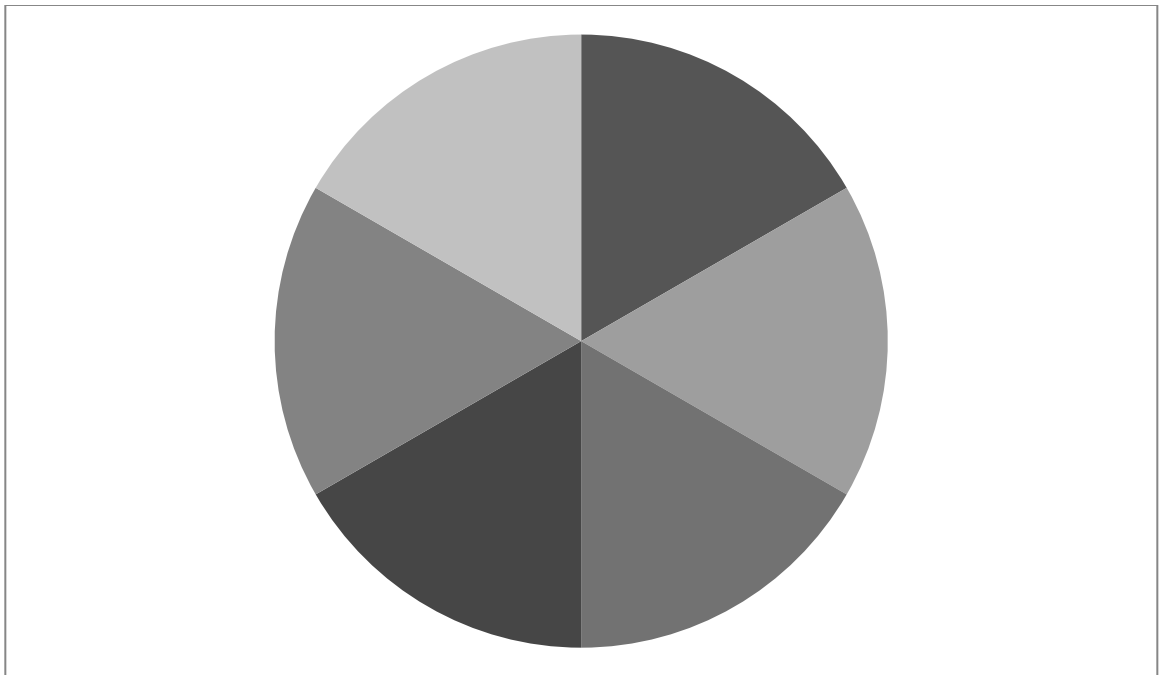


Readiness to Change Ruler

Not at all...
Very...



Wheel of Life

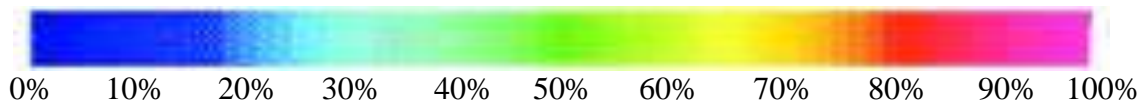


Appendix J: Integrated model scales (task-efficacy, barriers efficacy, perceived competence, perceived autonomy) & HCCQ

LIGHT ACTIVITIES: Are when you are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these unless the weather is really hot. You would be able to talk easily through the activity.

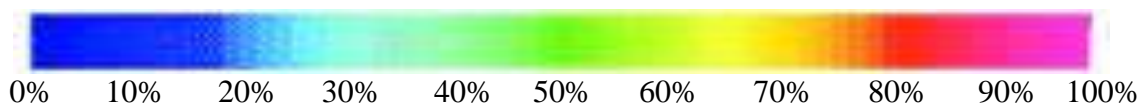
(Circle the %)

1. How confident are you that you can complete **10 minutes** of physical activity at a **light intensity everyday** next week?



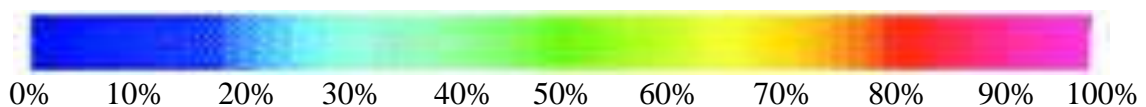
I am not confident at all I am not really confident I am kind of confident I am reasonably confident I am almost certainly confident I am completely confident

2. How confident are you that you can complete **30 minutes** of physical activity at a **light intensity level everyday** next week?



I am not confident at all I am not really confident I am kind of confident I am reasonably confident I am almost certainly confident I am completely confident

3. How confident are you that you can complete **60 minutes** of physical activity at a **light intensity level everyday** next week?

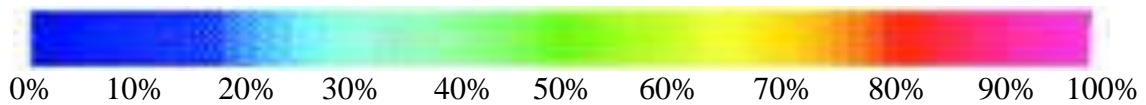


I am not confident at all I am not really confident I am kind of confident I am reasonably confident I am almost certainly confident I am completely confident

MODERATE ACTIVITIES: Are when your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.

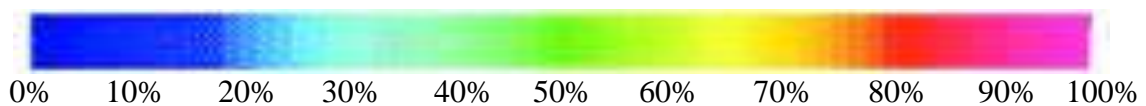
(Circle the %)

4. How confident are you that you can complete **10 minutes** of physical activity at a **moderate** intensity level **everyday** next week?



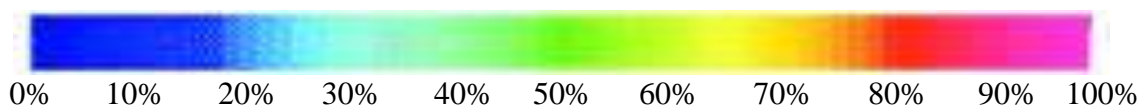
I am not confident at all I am not really confident I am kind of confident I am reasonably confident I am almost certainly confident I am completely confident

5. How confident are you that you can complete **30 minutes** of physical activity at a **moderate** intensity level **everyday** next week?



I am not confident at all I am not really confident I am kind of confident I am reasonably confident I am almost certainly confident I am completely confident

6. How confident are you that you can complete **60 minutes** of physical activity at a **moderate** intensity level **everyday** next week?

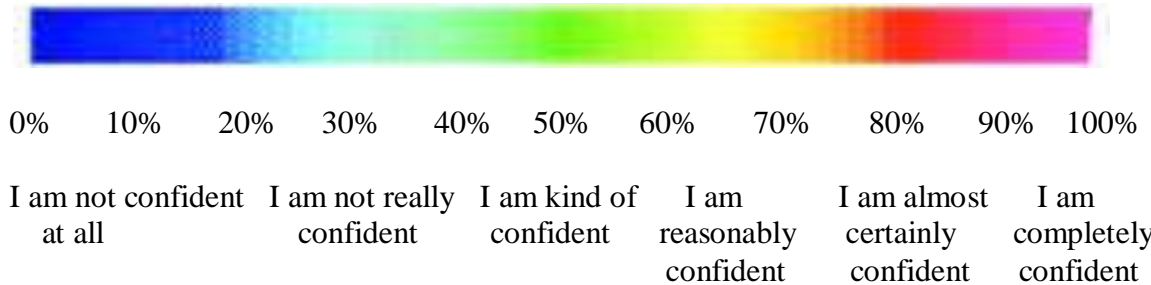


I am not confident at all I am not really confident I am kind of confident I am reasonably confident I am almost certainly confident I am completely confident

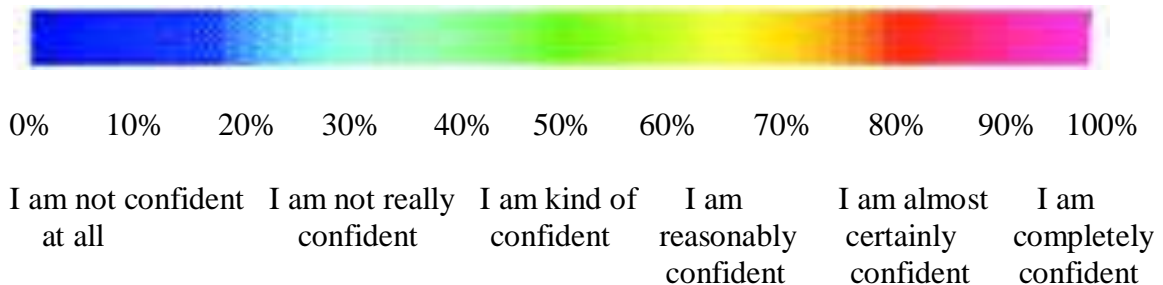
HARD ACTIVITIES: Are when your heart beats very fast, your breathing is fast and you start sweating. You may also feel exhausted and out of breath. Your legs would probably be feeling pretty heavy. It would be very hard to talk during the activity.

(Circle the %)

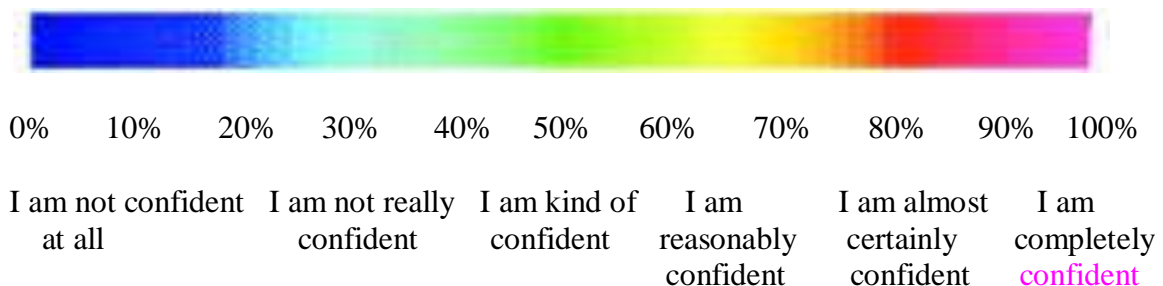
7. How confident are you that you can complete **10 minutes** of physical activity at a **hard** intensity level **everyday** next week?



8. How confident are you that you can complete **30 minutes** of physical activity at a **hard** intensity level **everyday** next week?



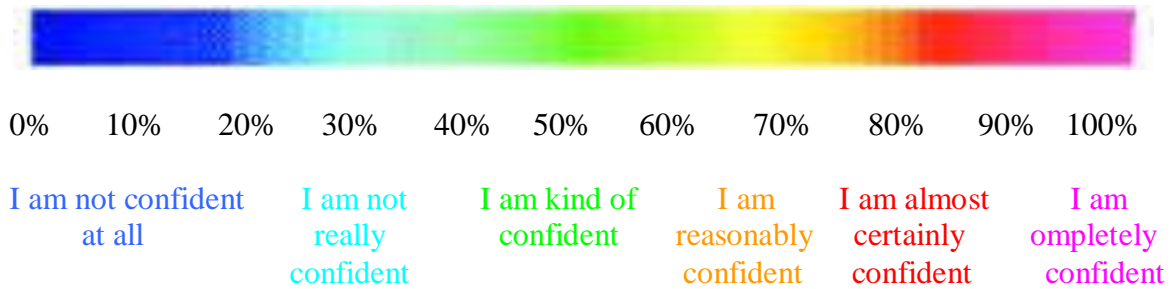
9. How confident are you that you can complete **60 minutes** of physical activity at a **hard** intensity level **everyday** next week?



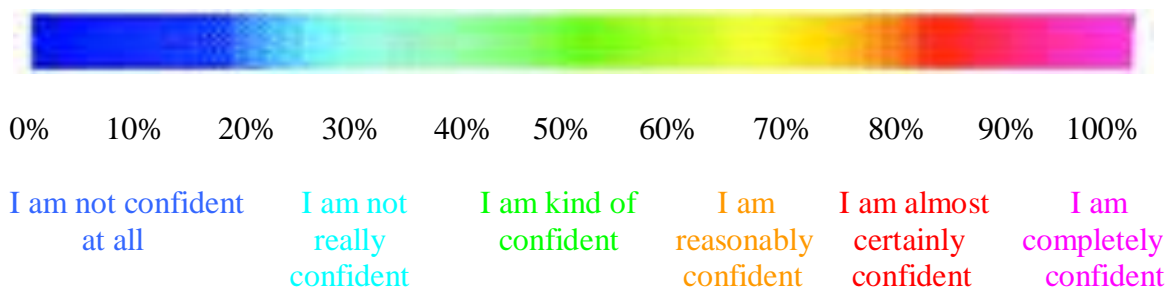
Rate on the line from 0 – 100% how confident you are that when faced with one of the situations given below, you will still be able to participate in **90 minutes of CUMMULATIVE physical activity EVERY DAY next week.**

(Circle the %)

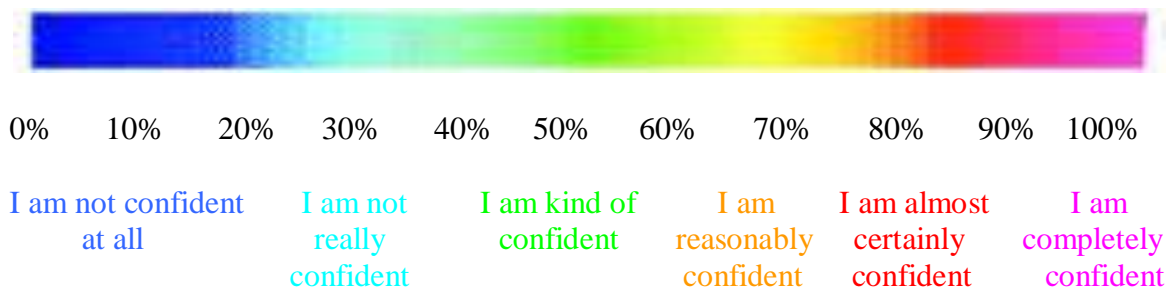
1. If it is bad weather.



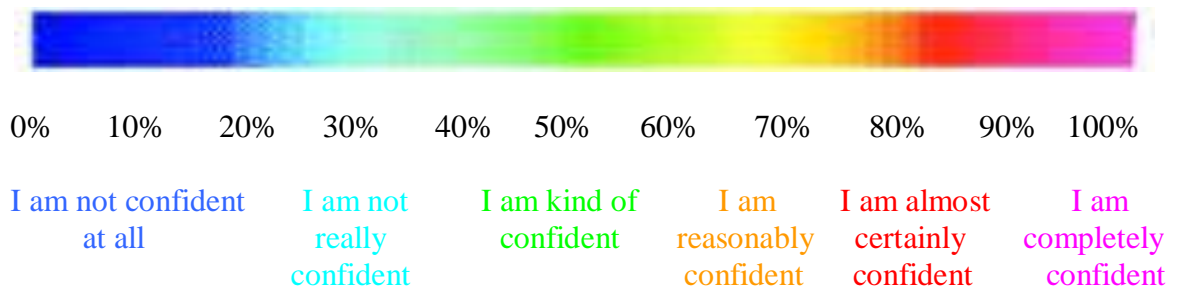
2. If I have a lot of school work to do.



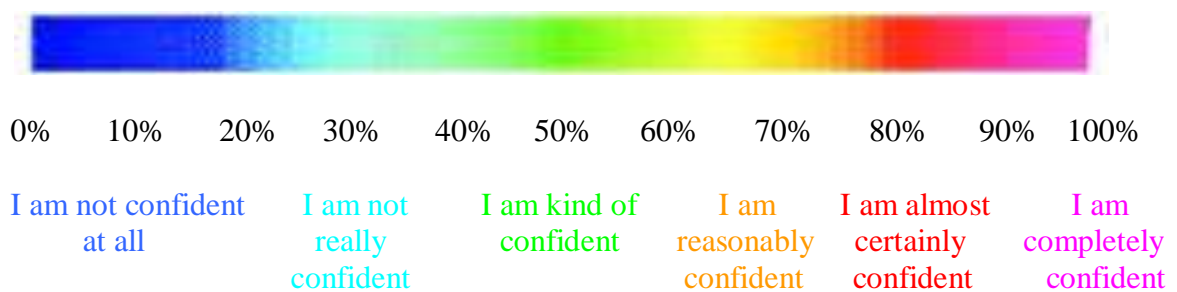
3. If there are good T.V. programs on.



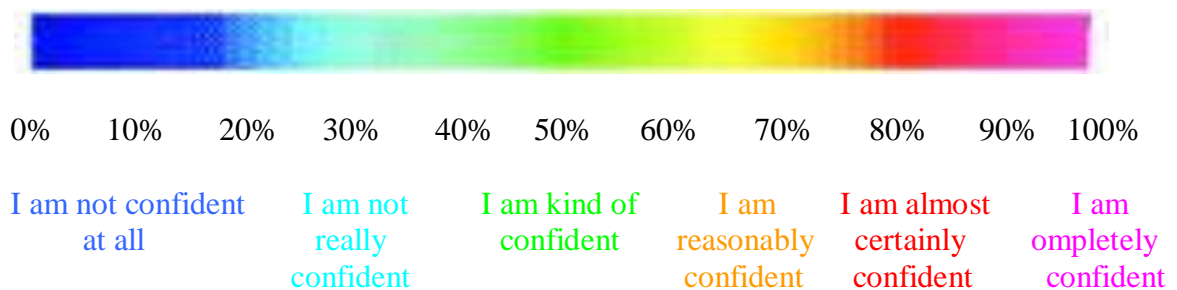
4. If I have a lot of activities to do with my friends and/or family.



5. If I am tired.



6. If I am sore.



These statements represent how people usually feel when they engage in physical activity. Please answer the following questions by considering how YOU TYPICALLY feel when participating in MODERATE to HARD physical activity using the scale provided.

	Do not Agree At All		Slightly Agree		Agree		Very Strongly Agree	
I am good at physical activity.	1	2	3	4	5	6	7	
I do well at physical activity compared to others.	1	2	3	4	5	6	7	
I feel capable while doing physical activity.	1	2	3	4	5	6	7	
I am capable of completing physical activity challenges.	1	2	3	4	5	6	7	
I am skilled at physical activity.	1	2	3	4	5	6	7	
I feel good about my ability to do physical activity.	1	2	3	4	5	6	7	

	Do not Agree At All		Slightly Agree		Agree		Very Strongly Agree	
I do the physical activities I choose to do.	1	2	3	4	5	6	7	
During physical activity I pursue my own goals.	1	2	3	4	5	6	7	
When I am physically active I feel I can really do what I want.	1	2	3	4	5	6	7	
I feel free to do physical activity in my own way.	1	2	3	4	5	6	7	

CURRICULUM VITAE

Name: Casey Ellen Gray

Post-Secondary Education

University of Windsor
Windsor, Ontario, Canada
1999-2003

Brock University
St Catharines, Ontario, Canada
2003-2006

University of Western Ontario
London, Ontario, Canada
2007-2011 Ph.D.

Honours and Awards:

Social Sciences and Humanities Research Council
(SSHRC) Doctoral Fellowship
2010-2011

Ontario Graduate Scholarship
2010-2011 (declined), 2009-2010

North American Society for the Psychology of Sport
and Physical Activity (NASPSPA), graduate student
international conference travel award
2010

International Association for the Study of Obesity
(IASO), student registration award
Canadian Obesity Network (CON) continuing
education travel award
2010

Faculty of Health Sciences, University of Western
Ontario, Western Graduate Research Scholarship
2007-2008, 2008-2009

Canadian Obesity Network (CON), student obesity
summer boot camp
2009

Faculty of Health Sciences, University of Western
Ontario, graduate student conference travel award
2009

Brock University Graduate Student Fellowship
2003-2004, 2004-2005

Related Work Experience

01/09-04/09 09/08 – 12/08	<i>Graduate Teaching Assistant</i> , the University of Western Ontario Research Design (Kin 22032 & Kin 332a)
09/05 – 12/05	<i>Graduate Teaching Assistant</i> , Brock University Psychology of Physical Activity (PEKN 2P95)
09/04 – 12/04	<i>Graduate Teaching Assistant</i> , Brock University Sport Event Management (SPMA 3P08)
01/04 – 04/04	<i>Graduate Teaching Assistant</i> , Brock University Motor Behaviour (PEKN 2P05)
01/03 – 04/03	<i>Undergraduate Teaching Assistant</i> , the University of Windsor Sociology of Sport and Physical Activities (95-230)

Refereed Publications

- Wilson, P., Mack, D., Blanchard, C., & **Gray, C.** (2009). The role of perceived psychological need satisfaction in exercise-related affect. *Hellenic Journal of Psychology*, 6, 183-206.
- Gray, C.** & Wilson, P. (2008). The relationship between organizational commitment, perceived relatedness, and intentions to continue in Canadian track and field officials. *Journal of Sport Behavior*, 31(1), 44-64.

Published Abstracts

- Gray, C.**, Prapavessis, H., Campbell, N., McGowan, E., Rivas, D., Wilson, J. (2010). Barrier-efficacy prospectively predicts children's self reported and objectively measured physical activity. *Obesity Reviews*, 11 (Supp. July), s1.
- Gray, C.**, Prapavessis, H., Campbell, N., McGowan, E., Rivas, D., Wilson, J. (2010). Barrier-efficacy prospectively predicts children's self reported and objectively measured physical activity. *Journal of Sport and Exercise Psychology*, 32 (Supp. July), s169.
- Gray, C.**, McGowan, E., Pearson, E., Hall, C., Prapavessis, H., Shapcott, K., Gorczynski, P., Newnham-Kanas, C., Wikman, J. (2009). Do behavioral regulations drive Physical activity behavior in "action" stage exercisers? *Journal of Sport and Exercise Psychology*, 31 (Supp. July), s122.
- McGowan, E., Prapavessis, H., Podolinsky, N., **Gray, C.**, & Elkayam, J. (2009). The utility of a self-efficacy intervention on exercise adherence in relatives of colon cancer patients. *Annals of Behavioral Medicine*, 37 (Supp. April), s172.

Articles Under Review

- Gray, C.**, Cramp, A., Fitzgeorge, L., & Prapavessis, H. Disease Management. In the Encyclopedia of Behavioral Medicine. (Submitted to Springer Reference for review)
- McGowan, E., Prapavessis, H., Campbell, N., **Gray, C.**, & Elkayam, J. Examining the effect of an efficacy intervention on objective physical activity in first- and second-degree relatives of colon cancer patients in a 9-month home-based physical activity program. (Under review by the International Journal of Behavioral Medicine)

Conference Presentations (Peer reviewed)

- Gray, C.**, Campbell, N., Jung, M. & Prapavessis, H. (June, 2011). A brief motivational interview increases perceived competence for physical activity in children. Presented to the North American Society for the Psychology of Sport and Physical Activity, Burlington, Vt.
- Campbell, N., Prapavessis, H., Maddison, R., & **Gray, C.** (June, 2011). The Short Questionnaire to Assess Health-Enhancing Physical Activity (SQUASH) in Adolescents: A Doubly Labeled Water Validation. Presented to the International Society of Behavioral Nutrition and Physical Activity, Melbourne, Australia.
- Gray, C.**, Prapavessis, H., Campbell, N., McGowan, E., Rivas, D., Wilson, J. (July, 2010). Barrier-efficacy prospectively predicts children's self reported and objectively measured physical activity. Presented at the 11th International Congress on Obesity, Stockholm, Sweden.
- Gray, C.**, Prapavessis, H., Campbell, N., Rivas, D., McGowan, E., Wilson, J. (June, 2010). An integrated self-efficacy and basic psychological needs satisfaction in physical activity scale for children: Factor structure and composition. Presented to the North American Society for the Psychology of Sport and Physical Activity, Tuscon, Arizona.
- McGowan, E., Prapavessis, H., Podolinsky, N., **Gray, C.**, & Elkayam., J. (November, 2009). An examination of the influence of energy expenditure on body composition. Presented to the Canadian Society for Psychomotor Learning and Sport Psychology, Toronto, Ontario.
- McGowan, E., Prapavessis, H., Podolinsky, N., **Gray, C.**, & Elkayam, J. (June, 2009) Examining the relationships between self-efficacy and objective measures of physical activity behavior in first- and second-degree relatives of colon cancer patients. Presented at the 11th World Congress of Psycho-Oncology, Vienna, Austria.
- McGowan, E., Prapavessis, H., Podolinsky, N., **Gray, C.**, & Elkayam, J. (June, 2009). The utility of a self-efficacy intervention on objective measures of exercise behavior in first-and second-degree relatives of colon cancer patients. Presented at the 11th World Congress of Psycho-Oncology, Vienna, Austria.
- Gray, C.**, Prapavessis, H., McGowan, E. (June, 2009). Self efficacy and basic psychological needs instrument validation. Presented to the International Society for Behavioral Nutrition and Physical Activity, Lisbon, Portugal.

- McGowan, E., Prapavessis, H., Podolinsky, N., **Gray, C.**, & Elkayam, J. (June, 2009). Examining the relationships between self-efficacy and exercise adherence in first- and second-degree relatives of colon cancer patients. Presented to the International Society for Behavioural Nutrition and Physical Activity, Lisbon, Portugal.
- Podolinsky, N., Prapavessis, H., Maddison, R., McGowan, E., & **Gray, C.** (June, 2009). Validation of the actiheart for the measurement of activity energy expenditure in adolescents. Presented to the International Society for Behavioral Nutrition and Physical Activity, Lisbon, Portugal.
- Gray, C.**, McGowan, E., Pearson, E., Hall, C., Prapavessis, H., Shapcott, K., Gorczynski, P., Newnham-Kanas, C., Wikman, J. (June, 2009). Do behavioral regulations drive physical activity behavior in “action” stage exercisers? Presented to the North American Society for the Psychology of Sport and Physical Activity, Austin, Texas.
- Gray, C.**, Prapavessis, H., McGowan, E., Podolinsky, N., Holland, C., & Haase, A. (August, 2008). Perfectionism and eating attitudes in elite athletes. Presented at the 10th International Congress of Behavioural Medicine, Rissho University, Tokyo, Japan.
- Gray, C.** & Wilson, P.M. (November, 2007). Motivations to officiate track and field. Presented to the Canadian Society for Psychomotor Learning and Sport Psychology, University of Windsor, Windsor, Ontario.
- Gray, C.** & Wilson, P.M. (November, 2005). Organizational commitment and perceived relatedness as correlates of the intention to continue officiating in track and field. Presented to the Canadian Society for Psychomotor Learning and Sport Psychology, Brock University, Niagara Falls, Ontario.

Membership in Academic Societies

North American Society for the Psychology of Sport and Physical Activity (NASPSPA)
Canadian Society for Psychomotor Learning and the Psychology of Sport (SCAPPS)
the Canadian Obesity Network (CON)
International Association for the Study of Obesity (IASO)