School of Psychology and Speech Pathology

What Moves Children to Move?

Pre-adolescent Children's Motivation for Physical Education

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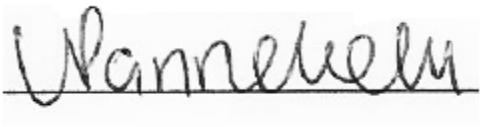
DECLARATION

I, Linda Pannekoek, declare to the best of my knowledge and belief this thesis titled: “What Moves Children to Move? Pre-adolescent Children's Motivation for Physical Education” contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree of diploma in any university.

Signature: 

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What moves children to move?

Pre-adolescent children's motivation for physical education

ABSTRACT

In response to the consistently low levels of physical activity observed in children, over the past decade research has focussed on the role of physical education in supporting motivation for physical activity behaviour. However, primary school-aged children are a largely underrepresented group in this research. The present research responded to this gap in the literature by investigating the quality and quantity of motivational orientations in pre-adolescent children, applying constructs of achievement goal theory and self-determination theory. This research consisted of five phases.

Phase 1-2 Preparation. As no developmentally appropriate questionnaires were available for use with pre-adolescent populations, three questionnaires were developed to assess achievement goals (in a trichotomous framework), need satisfaction (the need for competence, autonomy, relatedness), and motivation for physical education (intrinsic motivation, identified regulation, introjected regulation, external regulation and amotivation). These questionnaires were based on existing questionnaires suitable for assessing youth and adults. Items were extensively evaluated by means of pilot-testing and quantitative methods prior to application in the main part of the research, which involved the testing of a motivational model.

Phase 3 Statistical Modelling. Based on the responses of 429 pre-adolescent children between the ages of 9 and 12 years (*M* age = 10.72 y, *SD* = 1.06), a model of motivation in physical education was tested using variance-based structural equation modelling (applying SmartPLS 2.0 statistical software). The effect of age and gender on the structure of the model and the quality of children's motivation were evaluated. The results were largely consistent with theoretical postulations and empirical evidence from motivational research involving older populations. Mastery approach and performance goals were positively related to children's need satisfaction. Mastery approach goals were positively related to the two most self-determined forms of motivation and performance goals were positively related to the more controlled forms of motivation and amotivation. No statistically significant effects were observed for avoidance goals. The three needs were found to have specific effects on the different forms of self-determined motivation, partially mediating the effects of achievement

goals. Positive effects of need satisfaction emerged on self-determined forms of motivation, with some negative effects on controlled forms of motivation. No effects of the three needs on introjected regulation were observed. In conjunction, achievement goals and the three needs explained between 11 and 44% of the variance in the different forms of motivation.

Phase 4 Age and Gender Effects Model. Some effects of achievement goals and need satisfaction on the different forms of self-determined motivation were found to differ across age and gender groups. Two of the most consistent effects across age and gender were the positive effect of mastery goals on identified regulation, and of performance goals on introjected regulation. The main difference across gender was that the endorsement of performance goals was found to have a positive effect on identified regulation for girls uniquely. With respect to age, the positive effect of mastery goals on intrinsic motivation and identified regulation appeared to be larger for the older pre-adolescent participants. For the younger participants, satisfaction of the need for relatedness appeared to be more important to self-determined motivation than for the older pre-adolescents. The positive effect of performance goals on external regulation was found statistically significant for the younger pre-adolescent participants only.

Phase 4-5 Mean Differences. Some differences in mean scores based on children's individual characteristics (age, gender and level of motor proficiency) were observed for a number of constructs. Boys were found to score higher on performance goal endorsement and competence need satisfaction, and children with compromised levels of motor proficiency were found to score lower on competence and autonomy need satisfaction.

Conclusion. Results of the present research suggest that the relationships as previously identified between constructs derived from achievement goal theory and self-determination theory in older samples, are largely generalisable to pre-adolescent children in a physical education setting. The few differences that were observed in the interrelationship of constructs across age and gender, and dissimilarities in level of endorsement of the motivational constructs based on children's age, gender and level of motor proficiency stress the importance of taking the specific characteristics of the population in question into account when investigating motivation. Overall, the findings of this study may stimulate the downward extension of the age of motivational research in the physical activity domain. Insights derived from such research, including the present research, could inform the design of interventions to promote motivation for physical education over pre-adolescence.

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Chapter 1: Introduction

Advances in medicine, science and technology have greatly enhanced the health prospects of society as a whole. Worldwide populations are ageing as a result of successes in the prevention and treatment of infectious diseases (World Health Organisation, 2009). At the same time, people are increasingly facing non-communicable modern health risks due to overweight and obesity, other diet-related factors, and physical inactivity (World Health Organisation, 2009). In 2004 physical inactivity was among the leading global risks for mortality, accounting for an estimated 6% of all deaths, and affecting countries across all income groups (World Health Organisation, 2009). Insufficient physical activity is responsible for the aetiology of numerous chronic health problems, including cardiovascular disease (Anderssen et al., 2007; Boreham et al., 2002; Erikssen, 2001), certain cancers (Byers et al., 2002; Culos-Reed, 2002; Hardman, 2001), and obesity (Hills, King, & Armstrong, 2007; Steinbeck, 2001; Watts, Jones, Davis, & Green, 2005; Yang, Telama, Viikari, & Raitakari, 2006). Obesity can lead to further health issues such as Type II diabetes (Kahn, Hull, & Utzschneider, 2006; Sinha et al., 2002), coronary heart disease, and high blood pressure (Bray, 2004; Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001). Consequently, building adaptive lifestyles, which involve engagement in sufficient physical activity, is now at the root of the priorities for health promotion. Over childhood and adolescence, physically active lifestyles can already lead to multiple health benefits (for a review, see Janssen & LeBlanc, 2010; Strong et al., 2005). Nevertheless, numerous studies have stressed that, in addition to adults, both children and adolescents do not engage in sufficient activity for health purposes (e.g., Ekelund, Tomkinson, & Armstrong, 2011; Pate et al., 2006; Strong et al., 2005).

Individuals can influence their own health behaviours, including engagement in physical activity, which can have a substantial effect on their health status and prospects. However, with the abundance of attractive sedentary alternatives available in modern society and perceived barriers to physical activity (see Moore et al., 2010; Sequeira, Cruz, Pinto, Santos, & Marques, 2011), strong motivational orientations are needed to engage in adequate levels of physical activity. Researchers adopting socio-cognitive models of behaviour have identified motivation as a factor of critical importance for physical activity (Standage & Ryan, 2012). Motivation is an important target for interventions aiming to foster positive behaviour change, including change in physical activity behaviour (see Plotnikoff, Costigan, Karunamuni, & Lubans, 2013).

Interventions targeting motivation should start at a young age, to ensure that children develop a habit of engaging in sufficient physical activity, which persists over a lifetime. Longitudinal research has identified significant decreases in physical activity with increasing age, from childhood to adolescence, in developed countries (e.g., Dumith, Gigante, Domingues, & Kohl, 2011; Sallis, 2000). This occurs in parallel with declines in physical activity motivation (e.g., Marsh, Papaioannou, Martin, & Theodorakis, 2006; Ntoumanis, Barkoukis, & Thøgersen-Ntoumani, 2009; Sallis, 2000). Early intervention focussing on children's motivational orientations may help inhibit such declines. Accordingly, motivation for physical activity in child populations is an important area of health-related research. Knowledge derived from such research could inform the design of effective interventions.

Physical education has been proposed as an important site for enhancing public health. It provides a valuable setting for the implementation of interventions facilitating the development of adaptive motivational orientations, and positive attitudes toward physical activity in children (CDC, 2001; Naylor & McKay, 2009; Pate et al., 2006). In Australia, physical education is a compulsory school subject up to grade 10 (Barnett, Van Beurden, Morgan, Brooks, & Beard, 2009). Consequently, it provides a structured setting for fostering adaptive motivation, where all children can be reached over an extended period, and independent of their physical skills, background or life circumstances. Evidence has emerged that physical education interventions can be effective in positively influencing students' motivational orientations (e.g., Hastie, Rudisill, & Wadsworth, 2012; Jaakkola & Liukkonen, 2006). Furthermore, previous research has found students' motivation for physical education to be linked to their motivation for leisure-time physical activity (Bagøien, Halvari, & Nesheim, 2010; Hagger et al., 2009; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005), and actual leisure-time physical activity (Cox, Smith, & Williams, 2008; Standage, Gillison, Ntoumanis, & Treasure, 2012). Together, such reports suggest that the effects of students' motivation for physical education can extend beyond the school setting, and thus, that the implementation of adequately designed physical education classes is of vital importance.

The focus of motivational research in the physical activity domain has largely been on samples of healthy adults and youth. Research into motivation for physical education has generally concentrated on middle or high school populations, involving relatively uniform samples of (early) adolescent students. However, factors such as age and gender are likely to have an impact on motivation. Scholars have advocated the need for future studies to investigate the motivational orientations of more diverse populations, including younger

children (e.g., Craggs, Corder, van Sluijs, & Griffin, 2011; Koka & Hagger, 2010), and the need to develop adequate questionnaires for use in such samples (e.g., Spray, Warburton, & Stebbings, 2013). In response to this, the aim of the present investigation is to investigate the motivational orientations of pre-adolescent children in physical education. The manuscript starts with an overview of the existing literature relevant to children's motivation in physical activity settings (Chapter 2), predominantly focussing on physical education, and the rationale underlying the present research (Chapter 3). Subsequent chapters (Chapter 4 and 5) build up to, and report on, the evaluation of a statistical model on pre-adolescent children's motivation for physical education grounded in achievement goal theory and self-determination theory (Chapter 6). The model that is found to best describe pre-adolescent children's motivation is then further investigated, testing for age and gender differences in the interrelationship between the motivational constructs (quality of motivation). Also, age and gender differences in participants'; level of endorsement of the constructs (quantity of motivation) are evaluated (Chapter 7). This evaluation is followed by a comparison of the motivational orientations (quantity of motivation) of children with and without compromised levels of motor skills (Chapter 8). All findings are brought together and their practical implications are outlined in the final chapter, the general discussion (Chapter 9). This chapter also elaborates on the study limitations and directions for future research.

Chapter 2: Literature Review: Motivation to be Physically Active

2.1 Motivational Theories

Motivation relates to what moves individuals to act and why individuals think and do what they do (Weiner, 1992), and concerns both the direction and intensity of effort (Kilpatrick, Hebert, & Jacobsen, 2002; Sage, 1977). Existing literature provides evidence that motivation plays an essential role in human behaviour, including physical activity behaviour. Specifically, motivation exerts an influence on physical activity initiation, participation, performance and adherence (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Eccles, Wigfield, & Schiefele, 1998; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Standage, Duda, & Ntoumanis, 2003a; Vallerand & Losier, 1999). A rich tradition of research has sought to explain human motivation, together with its antecedents and outcomes. Various motivational theories have been developed, describing the constructs and processes playing a role in motivation. Two of the most widely applied theories in motivational research in physical education settings are self-determination theory (Deci & Ryan, 2000), and achievement goal theory (Elliot, 1997; Nicholls, 1984a).

2.1.1 Self-Determination Theory

Self-determination theory is an organismic-dialectical meta-theory of motivation. A principal tenet of the theory is the conception of people as active organisms, actively seeking the satisfaction of innate human needs. There is a continuous dialectic between people's innate psychological needs and the social context, which either fulfils or frustrates these needs (Deci & Ryan, 2000). As a result of this process, individuals have different styles of behavioural regulation, or motivation. Ultimately, all individuals have a natural tendency toward (psychological) growth, engagement, mastery, and the integration of new experiences into a coherent sense of the self, referred to as intrinsic motivation (Ryan & Deci, 2000b). Consequently, predictions regarding motivated behaviour are based on the interaction between the individual, with innate tendencies toward activity and optimal challenge, and the social environment.

According to self-determination theory, it is not sufficient for an individual to be highly motivated for adaptive processes and outcomes to emerge, including positive behavioural patterns. Besides quantity, also the quality of individuals' motivation is posited to play an important role (Deci & Ryan, 2000). A distinction is made between self-determined (or autonomous) forms of motivation and non-self-determined (or controlling forms) of motivation. Many positive outcomes have been linked to self-determined forms of

motivation. Consequently, empirical research based on self-determination theory has largely focussed on the identification and analysis of the social conditions and processes through which an individual acquires and maintains these adaptive forms of motivation. Different motivation-related observations resulted in five different sub-theories of self-determination theory; (1) cognitive evaluation theory (Deci, 1975), (2) organismic integration theory (Deci & Ryan, 1985b), (3) causality orientations theory (Deci & Ryan, 1985a), (4) basic psychological needs theory (Ryan, Sheldon, Kasser, & Deci, 1996), and (5) goal content theory (Vansteenkiste, Niemiec, & Soenens, 2010). Together, these sub-theories facilitate an understanding of contextual influences on motivation and the origin of inter-individual differences in motivational orientations.

The first sub-theory, cognitive evaluation theory, is aimed to specify the determinants of intrinsic motivation, the most self-determined form of motivation. The focus of this sub-theory is largely on the effect of socio-environmental factors on intrinsic motivation. Individuals' perceptions of competence and autonomy are posited to play an important role herein. Deci and Ryan (1985b) recognised that not all activities are inherently interesting or enjoyable, prompting intrinsic motivation, and that individuals often engage in activities for reasons that are less self-determined. In the second sub-theory, organismic integration theory, four qualitatively different forms of extrinsic motivation are described; integrated, identified, introjected and external regulation. The third sub-theory, causality orientations theory, focuses on differences in individuals' general tendency to orient themselves toward their social environment, and to regulate their behaviour. In this sub-theory, the different forms of motivation are applied at the personality level, aiming to describe how individuals typically perceive the source of their behaviour, as this has an effect on their psychological health and well-being. The fourth sub-theory, basic psychological needs theory, was later added to self-determination theory to account for the positive effects associated with the satisfaction of the needs for competence, autonomy and relatedness. These three innate, universal psychological needs were proposed to mediate effects of the social environment on the individual. More recently, the fifth sub-theory, goal content theory, was formulated. This sub-theory distinguishes intrinsic and extrinsic goals, which impact on individuals' motivation and well-being. In contrast to causality orientations theory, which describes the 'why' of motivation, goal content theory delineates the 'what' of motivation (Deci & Ryan, 2000; Vansteenkiste, Lens, & Deci, 2006). In the present thesis, the focus is on the cognitive evaluation theory, organismic integration theory and basic psychological needs theory. These sub-theories are the most widely applied in research in the physical activity domain, and are all inherently

connected to competence (Ryan & Deci, 2000b). That the three sub-theories are closely linked will become evident from the following paragraphs.

The four qualitatively different forms of extrinsic motivation described in organismic integration theory reflect varying degrees to which the value and regulation of the behaviour at hand have been internalised and integrated into an individual's belief system. As such, these forms of extrinsic motivation can be conceptualised on a continuum of relative autonomy. From more to less self-determined, these are integrated, identified, introjected and external regulation. An individual's motivation can move along the continuum to become more autonomous. During this internalisation process, the individual assimilates the value and regulation of a behaviour. As a result, the regulation of the behaviour starts to emanate more from within the individual, becoming less dependent on external pressures. Integration takes place when the regulation of the behaviour is further transformed, and incorporated within the individual's sense of self, and personal values and goals (Deci & Ryan, 2000; Ryan & Deci, 2000b). Ultimately, this process results in intrinsic motivation, which is the central focus of cognitive evaluation theory. With intrinsic motivation, behavioural engagement is driven by internal motives, such as enjoyment and interest, in the absence of external contingencies. Intrinsic motivation can be regarded as the apex of the continuum of the different forms of extrinsic regulation.

On the more autonomous end of the continuum, integrated and identified regulation represent advanced stages of the internalisation process. Similar to intrinsic motivation, these forms of regulation are energised from within the individual, and thus, self-determined in character (Deci & Ryan, 2000). With *integrated regulation*, individuals regard behavioural engagement as an important part of their identity, consistent with personal values, goals and needs. For example, when students see themselves as athletic, and engagement in physical education helps them define who they are, they are considered to be motivated for integrated reasons. *Identified regulation* entails behavioural engagement based on an individual's understanding of the behaviour's relevance, and valuing of its anticipated outcomes (Deci & Ryan, 2000). Children with identified motivational regulation participate in physical education, for example, because they value the development of physical skills. The other two forms of extrinsic motivation, introjected and external regulation, are based on incentives that are external to the individual (e.g., extrinsic rewards or support). These forms of extrinsic motivation are, therefore, considered to be controlled in character (Deci & Ryan, 1985b). With *introjected regulation,* positive outcomes such as approval and contingent self-esteem are sought, while negative outcomes such as feelings of shame or guilt are avoided. For

example, children who do not enjoy physical education, but who participate in order to avoid letting their parents down, are considered to be motivated for introjected reasons. Under the least self-determined form of motivation, *external regulation*, feelings of pressure do not emerge from within the individual, as with introjected regulation, but instead from the environment or significant others. Behaviours are performed exclusively for external reasons, such as fulfilling an external demand, achieving a reward, or avoiding punishment. Externally motivated children, for example engage in physical education solely to get a good grade. Individuals can simultaneously hold multiple motives to engage in a behaviour (Ryan & Connell, 1989; Ryan & Deci, 2007). The regulation of new behaviours does not inevitably start at the least self-determined end of the motivational continuum, but can start at any point along the continuum, and over time the perceived autonomy in the regulation of a behaviour can move along the continuum in either direction.

An individual who is neither intrinsically, nor extrinsically motivated, but has a lack of intention to act, is considered amotivated. Amotivation can emerge when a person believes that a behaviour will not result in the desired outcomes, or when engagement is not valued, which can result in feelings of incompetence (Ryan & Deci, 2000a). In leisure-time physical activity settings, amotivated individuals are likely to drop out. Physical education, in contrast, is typically a compulsory subject over the primary and early secondary school years. Even though amotivated children are thus unable to choose not to take physical education, other negative consequences have been related to amotivation, such as low levels of involvement, efforts to avoid attendance, and limited intention to be physically active in the future (Ntoumanis, Pensgaard, Martin, & Pipe, 2004).

Vallerand (2000, 2007) proposed that the different forms of motivation described in self-determination theory occur at different levels of generality; global, contextual and situational. Motivation at the global level reflects individuals' disposition to be motivated for more or less self-determined reasons. At the contextual level, motivation concerns engagement in behaviours in a given context, such as physical education. Lastly, motivation at the situational level concerns specific activities within a certain context. This framework, in which motivational orientations are differentiated at different levels of generality, is referred to as the hierarchical model of intrinsic and extrinsic motivation. An important hypothesis based on this model is that motivation can transfer from one level of generality to another, but also from one context to another (Vallerand, 2007). This review of the literature, as well as the following chapters of the thesis, will predominantly focus on motivation at the contextual level, and the physical education context specifically.

When children's engagement in physical education is driven by self-determined motives, adaptive outcomes are likely to result. Such children are likely to exhibit high levels of engagement in physical education as well as leisure-time physical activity (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2013; Standage et al., 2012), persist in their behaviours (Ntoumanis, 2005), and have positive intentions to engage in leisure-time physical activity (Hagger et al., 2003). Self-determination theory offers hypotheses regarding the social conditions that are likely to facilitate or thwart the emergence of high levels of self-determined motivation. These hypotheses largely focus on the three psychological needs outlined in basic psychological needs theory (Ryan, Patrick, Deci, & Williams, 2008). Specifically, the need for competence describes people's desire to interact successfully with the environment, producing the anticipated outcomes (Deci & Ryan, 1985b; White, 1959). The need for autonomy reflects people's aspiration to initiate and regulate one's own actions, with a sense of personal choice, free will, and ownership of actions (deCharms, 1968). Lastly, the need for relatedness signifies people's yearning for satisfying and secure relationships with others, and related hereto their propensity to feel connected to, and understood by, others in the environment (Baumeister & Leary, 1995; Deci & Ryan, 1985b). Research has evidenced the significance of the three needs in children's motivation for physical education (Barkoukis, Hagger, Lambropoulos, & Tsorbatzoudis, 2010; Standage et al., 2003a; Standage, Duda, & Ntoumanis, 2006). In line with the tenets of self-determination theory, children who feel competent, in control, and connected to others in the class have been found to be more likely to have self-determined motives for engagement in physical education (e.g., Ntoumanis, 2001b; Standage et al., 2012). Furthermore, children reporting high levels of need satisfaction have been identified as more likely to elect participation in optional physical education in subsequent school years (Ntoumanis, 2005), signifying the important role need satisfaction may play in behavioural persistence.

Within self-determination theory, satisfaction of the need for relatedness is considered an important factor in facilitating motivation to engage in behaviours that are not typically regarded as interesting. The likelihood that individuals are motivated to engage in uninteresting behaviours generally increases when these behaviours are prompted, modelled, or valued by significant others to whom they (want to) feel attached or related (Ryan & Deci, 2000b). However, feelings of relatedness are not sufficient for the emergence of self-determined forms of motivation. Satisfaction of the need for competence is regarded as imperative for the internalisation of motivational regulations. It is important that individuals feel proficient in the execution of a behaviour, for them to adopt it, and to be motivated for

identified reasons (Vallerand, 1997). However, for individuals to fully integrate the regulation of a behaviour, and for intrinsic motivation to emerge, also satisfaction of the need for autonomy is considered essential (Deci & Ryan, 1985b). Without a sense of personal agency, individuals are unlikely to fully immerse themselves in an activity, and engage in it purely for the sake of enjoyment and interest.

The extent to which the environment allows the experience of feelings of competence, autonomy, and relatedness affects individuals' motivation toward a given activity (Vallerand, Pelletier, & Koestner, 2008). Deci and Ryan (1985b) recognised that the impact of each of the three needs on motivation may depend on the needs' functional significance in specific settings or contexts. In physical education, children's physical competencies are of central importance, and are continuously on public display. In contrast, children's autonomy is generally limited due to the compulsory character of the class. In physical education settings, satisfaction of the need for competence may, therefore, represent a more important antecedent of self-determined motivation than satisfaction of the need for autonomy. In line with this, previous research in physical education settings has found satisfaction of the need for competence to have a more pronounced effect on self-determined motivation than satisfaction of the need for autonomy (e.g., Cox & Williams, 2008; Koka & Hagger, 2010; Ntoumanis, 2001b; Standage et al., 2003a). Furthermore, in a sample of British adolescent physical education students, Ntoumanis (2001b) was unable to confirm any significant effect of the need for autonomy on students' self-determined forms of motivation, contrasting self-determination theory's hypothesis regarding this need's vital importance to intrinsic motivation. The need for relatedness, on the contrary, may play a more pronounced role in physical education, compared to other settings (Deci & Moller, 2005).

Relative to the other two needs, the need for relatedness has often been considered of lesser importance to the prediction of motivation. However, research in physical education has found the need for relatedness to have a stronger effect on self-determined motivation than the need for autonomy, and in some instances even the need for competence. This signifies the importance of perceptions of relatedness in this particular setting (e.g., Ntoumanis, 2001b; Standage et al., 2003a). When children feel connected with, and accepted by their peers and teacher in physical education, they are more likely to internalise the value and importance of skills related to the context, and to become motivated for identified reasons (Niemiec & Ryan, 2009). Furthermore, under such circumstances children are more likely to regard physical education as enjoyable (Cox, Duncheon, & McDavid, 2009), which may ultimately result in intrinsic motivation.

In achievement settings, including physical education, competition is often prevalent. Competition is likely to have a negative impact on need satisfaction (Standage & Vallerand, 2007, p.186). In such settings, the achievement goals an individual endorses play an important role in determining whether his or her needs are satisfied. How achievement goals are defined, and how they affect need satisfaction and motivation is discussed in the following sections of the thesis.

2.1.2 Achievement Goal Theory

Like self-determination theory, achievement goal theory (Elliot, 1997; Nicholls, 1984a) has been an influential theory in motivational research in physical education. The theory originated from research in school settings, focussing on the effect of perceptions of success and failure on children's motivation (Nicholls, 1984b, 1989). Over the years, achievement goal theory has undergone considerable modifications and innovations. The most recent conceptualisation of a goal within the achievement goal literature is "an aim that one is committed to that serves as a guide for future behaviour" (Elliot & Murayama, 2008, p. 614). As such, achievement goals guide behaviour toward, or away from, particular competence-related outcomes, serving a directional role in motivation (Elliot & Niesta, 2009). Achievement goal theory describes different ways how individuals can define competence. As competence has been identified as the conceptual core of motivation (Elliot & Dweck, 2005), the theory thereby plays an important role in explaining motivation. Achievement goal are relatively dispositional in character (Dweck, 1986; Nicholls, 1989), and the theory can as such be applied to investigate motivation on a contextual level.

Achievement goal theory differentiates competence based on absolute standards that are inherent in a task, intrapersonal standards, and interpersonal standards. Individuals applying absolute or intrapersonal standards typically focus on learning, understanding and self-improvement, while individuals relying on interpersonal standards generally seek to outperform others in order to validate their competence. These two strivings have been labelled respectively *mastery* and *performance* (Ames & Archer, 1988), *learning* and *ability* (Dweck & Leggett, 1988), or *task* and *ego* (Nicholls, 1984a) goals. The similarities between these different conceptions are assumed to outweigh the differences (see Pintrich, 2000a). Throughout the following text, achievement goals will be referred to as mastery and performance goals, as these terms have become the most commonly used in current literature (Pintrich, Conley, & Kempler, 2003).

Mastery goals have consistently been reported to result in the most adaptive outcomes in physical education, including positive patterns of behaviour and affect such as persistence, effort, enjoyment, and engagement in physical activity outside of school (Biddle, Wang, Kavussanu, & Spray, 2003; Thomas & Barron, 2006). Children endorsing mastery goals are likely to find personal satisfaction in the performance of the activity itself, and from task-mastery. This is likely to facilitate self-determined motivation, perceptions of competence, and enjoyment (Cumming, Smith, Smoll, Standage, & Grossbard, 2008; Mouratidis, Lens, & Sideridis, 2010; Standage & Treasure, 2002; Thomas & Barron, 2006).

In contrast to the predominant focus on "improving" that characterises mastery goals, children who endorse performance goals are more likely to focus on ''proving'' their level of skill. This focus can be motivating when perceptions of competence are high and success is experienced in attaining normative goals (see Standage, Duda, & Ntoumanis, 2003b). However, particularly when failure is encountered, less adaptive outcomes are likely to result from the normative focus that is central to performance goals. Perceptions of incompetence, together with feelings of a lack of control over the desired outcome are likely to result, which may result in amotivation (Deci & Ryan, 2000). Consequently, performance goals have been characterised as "valuable, yet vulnerable forms of regulation" (Elliot & Moller, 2003, p. 345).

An important assumption of achievement goal theory is that individuals can concurrently endorse different levels of mastery and performance goals, that is, the two goals are assumed to be orthogonal (Nicholls, 1989). Some researchers have argued that the simultaneous endorsement of both mastery and performance goals is beneficial (Barron & Harackiewicz, 2001; Pintrich, 2000b). Different hypotheses on the interplay of mastery and performance goals in determining outcomes have been tested. For example, a specialised and an interactive goal hypothesis have been proposed, respectively reflecting specialised effects of the two goals on different outcomes, and the interaction of the two goals in determining outcomes, resulting in a benefit for individuals endorsing both goals (Barron & Harackiewicz, 2001). No clear consensus on the interplay of both goals has yet been reached. More clarity regarding the goals' effects may emerge as a result of theory developments that have taken place over the past decade, including the addition of a focus on avoidance goals.

2.1.2.1 The 2 x 2 achievement goal framework.

Focussing on mastery and performance goals, achievement goal research was originally based on a dichotomous framework. This framework does not differentiate

approach tendencies from avoidance tendencies, a distinction that has a long tradition in motivational research (see Elliot & Covington, 2001). Elliot and colleagues recognised that approach and avoidance tendencies are integral to people's strivings in achievement settings. They suggested that apart from describing individuals' achievement goals exclusively based on how competence is defined (mastery vs. performance goals), the goal construct should also capture how competence is valanced (e.g., Elliot, 1997; Elliot & Church, 1997; Elliot & Covington, 2001). Individuals' goals can be focussed on a positive possibility to approach, such as success, or a negative possibility to avoid, such as failure (Elliot & Harackiewicz, 1996). An approach-avoidance dimension was added to the mastery-performance goal dichotomy, initially only for performance goals (Elliot, 1999), resulting in a trichotomous framework. Later, the approach-avoidance distinction was also introduced for the mastery goal construct, to account for the entire range of competence-based strivings. This resulted in a 2 x 2 achievement goal framework (Elliot & McGregor, 2001). Mastery approach goals are defined as the striving to achieve task-based or intrapersonal competence, whereas mastery-avoidance goals are delineated as the aim to avoid task-based or intrapersonal incompetence (Elliot & Murayama, 2008). On the other hand, performance approach goals are defined as the striving to attain normative competence, and performance avoidance goals as the aim to avoid normative incompetence. Avoidance goals are not to be mistaken for the avoidance of behaviour, but rather, they concern behaviour that is driven by the anticipation of an undesirable, negative experience or outcome, which people want to avoid (Elliot, 1999).

The four goals have been associated with a unique set of antecedents, processes, and psychosocial, motivational and behavioural outcomes (e.g., Elliot & McGregor, 2001; Moller & Elliot, 2006; Nien & Duda, 2008). Research applying the trichotomous framework has provided support for the existence of three distinct goals in physical education settings (e.g., Carr, 2006). The most adaptive outcomes have been found to result from mastery goal endorsement, while performance avoidance goals have been related to the least adaptive outcomes, such as low perceptions of competence (Cury, Da Fonseca, Rufo, & Sarrazin, 2002; Spray & Warburton, 2011). With a physical education specific adaptation of the Achievement Goal Questionnaire (AGQ, Elliot & McGregor, 2001), Wang, Biddle, and Elliot (2007) found support for the factor structure of the 2 x 2 achievement goal framework, both in male and female Singaporean adolescents. Based on similarities in individuals' scores on constructs such as motivation and need satisfaction, four goal clusters were identified. Clusters characterised by high levels of endorsement of all four goals, or high levels of mastery goal endorsement accompanied by moderate levels of performance goal

endorsements (both approach and avoidance) were found to score high on adaptive outcomes such as self-determined motivation, competence and relatedness, and low on maladaptive outcomes such as amotivation. Relative to these clusters, more negative outcomes were observed for clusters defined by low or medium levels of endorsement of all four goals. These findings suggest that avoidance goals may not result in maladaptive outcomes when accompanied by approach goals. Nevertheless, the general conjecture in the literature is that approach goals are associated with positive, while avoidance goals are associated with negative processes and outcomes (Elliot & Church, 1997). In line with this, mastery and performance avoidance goals have been related to children's use of self-handicapping strategies in physical education, such as making excuses and reducing effort, with performance avoidance goals being most strongly linked to these maladaptive strategies (Chen, Wu, Kee, Lin, & Shui, 2009).

However, research investigating avoidance goals in physical education settings is still scarce, particularly with respect to mastery avoidance goals. The multitude of studies has applied a dichotomous framework, with a unique focus on approach motivation. Mirroring Nicholls, Patashnick, Cheung, Thorkildsen, and Lauer (1989), these studies have omitted avoidance altogether. The achievement goal questionnaires commonly applied in physical education research applying the dichotomous framework, such as the Task and Ego Orientation in Sport Questionnaire (TEOSQ, Duda & Nicholls, 1992), contain items that uniquely tap approach goals. An exclusive focus on approach goals, while omitting avoidance goals, limits the explanatory value of achievement goal theory and may result in inconsistencies in findings based on differences between the samples in the endorsement of (unmeasured) avoidance goals (Wang et al., 2007). Various researchers have advised that when the approach-avoidance distinction is not taken into account, and the focus is on omnibus or approach mastery and performance goal constructs, the effects identified for these goals are likely to be confounded. However, also in research applying the 2 x 2 framework, inconsistencies have not been entirely resolved. The application of different methods to assess achievement goals, or the impact of other constructs, such as varying levels of competence perceptions may contribute to inconsistencies in outcomes that have been related to the endorsement of the four goals. This underlines the importance of taking multiple factors into account simultaneously to increase explanatory value.

2.2 Integration of Theories

No single theory can be expected to fully explain the complex construct of motivation. Therefore, rather than considering the different motivational theories as competing, there is a need theoretical integration in the field of motivational research (Bong, 1996; Eccles & Wigfield, 2002; Hagger, 2009). Theoretical integration would facilitate a more holistic understanding of the antecedent factors and processes that foster, or undermine adaptive motivation (Schwarzer, 2008). This would result in a deeper insight into the reasons why individuals choose to engage in behaviours, such as physical activity. Although common variance may be shared between motivational constructs forwarded by different theories, the constructs also bear unique qualities. The uniqueness of each of the constructs and the interrelationship between different constructs contribute information that is valuable for the generation of a more complete account of motivation. The following section will outline how self-determination theory and achievement goal theory (respectively concerning the 'why' and 'what' question) provide complementary explanations of human motivation.

Since the early days of self-determination theory and achievement goal theory research, academics have contemplated the interrelationship of constructs of the two theories, and how combining the two theories could enrich understanding of motivation and behaviour (Butler, 1987, 1989; Nicholls, 1984b; Ryan & Deci, 1989). For example, Butler (1987) argued that taking achievement goal theory into account, alongside self-determination theory, would provide an enhanced framework for analysing the effect of socio-contextual factors on motivation, interest, and behaviour. In response to Butler's argument, Ryan and Deci (1989) contended that achievement goals are closely linked to cognitive evaluation theory. Also, in more recent years, theoretical bridges have been drawn between the two theories (e.g., Deci & Ryan, 2000). Theory, and empirical evidence stemming from physical activity-related research, including research in physical education, have supported the relationship between achievement goals and the different forms of motivation forwarded by self-determination theory (e.g., Moreno, Gonzalez-Cutre, Sicilia, & Spray, 2010; Ntoumanis, 2001a; Standage et al., 2003b; Wang, Liu, Lochbaum, & Stevenson, 2009).

Both Nicholls (1989) and Deci and Ryan (2000) considered mastery goals to bear considerable relation to intrinsic motivation. When endorsing mastery goals, people largely focus on personal improvement and skill mastery. Such outcomes are intrinsic to the task at hand, and unlikely to be related to a preoccupation with extrinsic outcomes, such as the avoidance of guilt (introjected regulation) or the attainment of extrinsic rewards (external regulation). While mastery goals have typically been associated with adaptive motivational

outcomes, performance goals have been ascribed a dual nature (Elliot & Moller, 2003). The engagement in social comparison that is characteristic of performance goals, together with a focus on expected outcomes such as social approval, rewards, and the demonstration of superior ability, are likely to control behaviour (Ntoumanis, 2001a). This is, in turn, likely to result in extrinsic forms of motivation (Deci & Ryan, 2000). However, the striving to outperform others concomitant with performance goals can be accompanied by extrinsic motives that are more or less self-determined, which influences the goals' consequences (Deci & Ryan, 2000). In line with theoretical propositions, previous research in sport (e.g., Cumming et al., 2008; Ntoumanis, 2001a), and physical education settings (Ferrer-Caja & Weiss, 2002; Standage & Treasure, 2002) has found performance goals to be unrelated to intrinsic motivation. However, other studies have identified a negative (Ferrer-Caja & Weiss, 2000), or a positive effect of performance goals on intrinsic motivation (Shen, McCaughtry, & Martin, 2007). In physical education, performance goals have generally been related to less self-determined forms of motivation (e.g., Standage & Treasure, 2002). Similarly, performance avoidance goals have typically been related to less optimal motivational consequences, however the goals' effects are not consistent across research (e.g., see Law, Elliot, & Murayama, 2012; Nien & Duda, 2008). From these mixed findings it becomes clear that knowing that an individual endorses performance goals is not sufficient to predict the related outcomes (see Deci & Ryan, 2000; Midgley, Kaplan, & Middleton, 2001)

Self-determination theory proposes that individuals' goals impact upon their motivation through the satisfaction of the need for competence, autonomy and relatedness. In other words, the three needs give achievement goals their psychological tenacity, and influence which regulatory processes result from individuals' goal pursuits (Deci & Ryan, 2000). The four achievement goals are likely to lead to different levels of need satisfaction. Focussing on the sport context, Ntoumanis (2001a) offered hypotheses on the effects of mastery and performance goals on need satisfaction. The intrapersonal standards applied to evaluate competence by individuals with mastery goals result in personal control over their competence perceptions. Ntoumanis (2001a) hypothesised that this would facilitate competence and autonomy need satisfaction. In case of a setback, individuals with mastery goals focus on learning from mistakes and finding strategies to overcome the encountered issues (see Senko & Harackiewicz, 2005). In contrast, performance goals have been regarded to have an "all-or-nothing quality" (Dweck & Elliott, 1983, p. 656). To perceive themselves as competent, individuals endorsing performance goals must outperform others with equal or lesser effort (Nicholls, 1989). High levels of actual competence are, thus, needed to meet

performance goals. As a result, satisfaction of the need for competence is less likely when performance goals are endorsed rather than mastery goals. As competence is evaluated based on others' performance, individuals with performance goals have very limited control over their goal attainment and competence perceptions. Also satisfaction of the need for autonomy is, therefore, less likely to result from the endorsement of performance goals. Lastly, the constant comparison with others with performance goals is likely to result in feelings of rivalry, which could undermine social relationships, and satisfaction of the need for relatedness (Ntoumanis, 2001a).

Very little empirical research has been devoted to investigating these hypotheses regarding the effect of achievement goals on the three needs, particularly in physical education settings. The needs for autonomy and relatedness are not tapped by achievement goal theory, and consequently the focus of studies integrating achievement goal theory and self-determination theory has generally been on competence, a construct shared by both theories. The omission of the need for autonomy and relatedness limits the theories' explanatory value. For example, Benita, Roth, and Deci (2014) observed that mastery goals were more strongly related to enjoyment and interest, factors that are closely related to intrinsic motivation, when students' experienced a sense of autonomy in physical education. The goals' positive effect on behavioural engagement was also found to be more pronounced under conditions of perceived choice. This suggests that autonomy need satisfaction plays a role in determining the effect of achievement goals on affective and behavioural outcomes.

In contrast to the effect of achievement goals, the effect of the motivational climate on need satisfaction has received more attention in physical education research. The motivational climate represents contextual cues, including affective and social conditions, which influence achievement-related cognitions, behaviour and affect (Ames, 1992b). A performance climate is characterised by the promotion of interpersonal competition, social comparison and public evaluation, stimulating the adoption of performance goals. In contrast, a mastery climate is characterised by an emphasis on task mastery, learning, effort and improvement, stimulating the endorsement of mastery goals (Ames, 1992b). Higher levels of need satisfaction have been observed when students experience the motivational climate to be mastery-oriented (Cox & Williams, 2008; Ntoumanis, 2001b; Standage et al., 2003b). Similar positive effects on need satisfaction have been found to result from autonomy support by the physical education teacher (Barkoukis, Ntoumanis, & Thøgersen-Ntoumani, 2010; Standage, Duda, & Ntoumanis, 2005; Standage & Gillison, 2007). Ferrer-Caja and Weiss (2000) found that achievement goals mediated the effects of the motivational climate on students'

autonomy and competence perceptions, and intrinsic motivation. These findings suggest that achievement goals may be regarded as an internally set motivational climate, influenced by the external motivational climate, both affecting motivation.

Research investigating the relationship between achievement goals in a 2 x 2 framework and need satisfaction is virtually absent. In their cluster analysis involving a sample of 12 to 16 year old students, Wang et al. (2007) identified four distinct clusters of goal combinations. These clusters were associated with different levels of need satisfaction. The most positive outcomes emerged for the cluster representing high endorsement of all four goals. The effects of the individual goals on need satisfaction were, however, not investigated in this study. On the basis of the theoretical tenets of self-determination theory, the endorsement of specific achievement goals could only facilitate the emergence of high levels of self-determined motivation if the three needs are satisfied. Taking all three needs into account is thus likely to maximise explanatory value.

The literature on motivational research as described above has mainly focussed on samples of healthy adolescents and young adults (Bong, 2009; Cury, Da Fonseca, Moller, & Elliot, 2006). Generalisability of findings on motivational constructs and processes identified in this line of research to children below the age of 11 years remains largely untested. The current literature on motivation at best provides preliminary evidence on the motivational orientations of children before they reach adolescence. In the following section, the current state of knowledge on children's motivation will be discussed, focussing largely on the physical education setting.

2.3 Motivation in Children

Firstly, it should be noted that when age is referred to in the literature, and the following review, this is only an indication of average age. There are large inter-individual variations in the rate of development. Self-determination theory assumes that it is human nature to engage in novel and challenging activities (Ryan & Deci, 2007). This curious and active nature of humans is observable from birth onwards, such as in children's early play behaviour, directed towards learning and exploring the environment, in the absence of external incentives (Ryan & Deci, 2000a; White, 1959). Exploratory behaviour is a prerequisite for personal growth, and is often energised by intrinsic motivation (Ryan & Deci, 2000a). However, not all behaviours are inherently interesting, and already at a young age children encounter situations where they have to engage in behaviours that they may not enjoy, such as tidying up after play. Chandler and Connell (1987) provided initial evidence

for the existence of extrinsic and internalised motivational orientations towards unenjoyable behaviours in 5 to 13 year old children. While children included in this study were mostly motivated for intrinsic reasons towards participation in enjoyable behaviours, towards behaviours regarded as unenjoyable, extrinsic and internalised motivational orientations were found to dominate.

Chandler and Connell (1987) identified a decline in extrinsic motivation and an increase in internalised motivation with age. This may represent a developmental process where the regulation of engagement in behaviours that are not inherently enjoyable or interesting gradually shifts from being energised by sources of motivation that are external to the child to an increasing reliance on internal sources as the behaviour becomes personally valued (Chandler & Connell, 1987). Such findings indicate that, even though the motivational continuum forwarded by self-determination theory does not represent a developmental continuum (Mullan & Markland, 1997), the regulation of behaviours is likely to move along the continuum over children's development. Motivational orientations continue to develop across the life span, as children and adolescents learn skills and acquire attitudes that enable them to give direction to their own lives. Children increasingly learn to make, evaluate, and revise plans for action, and independently select appropriate strategies for behaviour, including physical activity behaviour (Wehmeyer & Palmer, 2000).

In line with Chandler and Connell's (1987) study, Ryan and Connell (1989) were able to identify external, introjected, identified and intrinsic motivational regulation as distinct forms of motivation underlying behaviour in grade 3 to 6 primary school students, which typically involves 8 to 12 year old children. The different forms of motivational regulation were related to outcomes such as enjoyment, effort, and parental ratings of the child's motivation in a theoretically consistent manner (Ryan & Connell, 1989). A more recent study performed in the school setting found that grade 1 to 3 primary school students (typically 5 to 9 years of age) could distinguish between intrinsic, identified, and controlled (an aggregation of external and introjected regulation) motivational regulations (Guay et al., 2010). Age was found to affect the strength of the relationship between the different forms of motivation, with the regulations becoming more distinctive with age (Guay et al., 2010). It was demonstrated that the motivational regulations reported by these children differed across school subjects from grade three onwards.

A few studies are known to have investigated the motivational regulations in primary school-aged children in the domain of physical activity, including physical education. Focussing on the sport setting, Gagné, Ryan, and Bargmann (2003) applied the motivational

continuum advanced by self-determination theory to a small sample of 7 to 17 year old gymnasts. No moderating effects of age on the results were identified in this study. The different forms of motivation were related with other constructs in a fashion largely mirroring findings of research involving samples of youth and adults. Self-determined forms of motivation were associated with the most adaptive constructs such as positive affect and self-esteem. Furthermore, satisfaction of the needs for competence, autonomy and relatedness was found to be positively related to self-determined motivation (Gagné et al., 2003). Positive effects of need satisfaction on the more adaptive forms of motivation for physical activity were also identified by Sebire, Jago, Fox, Edwards, and Thompson (2013), in a sample of 7 to 11 year old students. In this study, intrinsic motivation was related to physical activity engagement (Sebire et al., 2013). Even though such findings appear to support convergent validity, the researchers did not investigate whether the questionnaires that were applied were suitable for use in children as young as 7 years of age. It is unclear whether the young samples included in the studies interpreted the items in the manner intended by the researchers, and in line with the underlying theory, limiting the robustness of the findings.

Notwithstanding a lack of empirical evidence, several sources of information suggest that the motivational continuum may largely generalise to the child population in physical education settings. Self-determination theory regards intrinsic motivation as an innate, natural tendency towards the exploration of the environment, mastery, and spontaneous interest (Ryan & Deci, 2000a). As physical activity accommodates these tendencies, young children typically consider physical activities as inherently enjoyable and value participation in them (Cumming et al., 2008). As a result, young children are also likely to express intrinsic motivation towards physical education. Theoretically, external, introjected and identified regulation can also be expected to bear relevance to the motivational orientations of child populations in physical education. It is conceivable, for example, that primary school-aged children participate in physical education because they think that it is important to do well at it (external motivation), want to impress their teacher (introjected motivation), or strive to win an award (identified regulation). Integrated regulation, in contrast, is unlikely to play a role in children's motivation for physical education, as it is a developmentally more advanced form of regulation. Children are too young to have developed a coherent sense of the self, which allows for the assimilation of the identification with the importance of a behaviour, so that engaging in the behavior is fully congruent with this sense of self (see Vallerand, 2001). Regarding need satisfaction, self-determination theory considers the three needs as innate, and universal, implying that satisfaction of the needs is critical throughout all stages of life,

and in all settings (Deci & Ryan, 2000). Taken together, based on theoretical postulations and preliminary findings of motivational research in a sport setting, it appears highly conceivable that the different forms of motivational regulation also play an important role in energising young children's behaviours in physical education.

Also in relation to achievement goal theory, research involving primary school-aged or pre-adolescent samples is scarce, despite a focus on child samples in the pioneering work on achievement goals. Based on developmental research with children (e.g., Nicholls, 1978), Nicholls and Miller (1984) concluded that most children are able to distinguish effort from ability when they reach the age of 12 years. This ability was proposed to be vital to the development of mastery and performance goals. Prior to the development of this ability, children tend to believe that high effort unconditionally leads to gains in learning and improvement (i.e., unconstrained by their ability level) and consequently higher levels of ability (Nicholls, 1978). This idea of a direct link between effort and progress was referred to as an undifferentiated conception of ability. Once children can differentiate effort from ability, they are considered to have developed a mature understanding of ability. With this insight, children become more likely to judge their performance relative to others, that is, they become more likely to adopt performance goals (Nicholls, 1989).

More recently, researchers have argued that the age at which children start to differentiate mastery goals from performance goals varies by setting (Dweck, 2002; Fry & Duda, 1997). Fry and Duda (1997) found that children distinguished between effort and ability at an earlier age in a physical, compared to an educational setting. The emergence of achievement goals may not be contingent solely on children's developing cognitive abilities, but also on children's level of experience with the specific situation (Butler, 2005). In early stages of skill acquisition children focus on learning and determining what is required to successfully complete a task. It is likely that children will only start to compare their performance with that of others after a certain amount of practice and experience (Butler, 2005). Consequently, when children encounter ample exposure to a specific context at a young age, they may start to engage in social comparisons to evaluate their performance from an earlier age onward, increasing the likelihood of performance goal adoption.

Besides experience, cues in the environment are also likely to impact on the development of achievement goals. At a young age, children are generally surrounded by an environment where a focus on learning and mastery predominates. Consequently, children are likely to adopt mastery goals, as these goals are closely tailored to the environment. However, children may be able to adopt performance goals in the circumstance that such

goals are suited to the environment. In line with this, children have been found to adopt normative goals from a young age onwards, as long as tasks are meaningful, and information on performance is easily accessible (Smiley, 1994). The public, physical and competitive nature of physical education facilitates evaluation of ability and effort expenditure relative to others (Cumming et al., 2008; Duda, Fox, Biddle, & Armstrong, 1992; Fry & Duda, 1997). For example, high effort is accompanied with bodily responses such as sweating, increased breathing, muscle tension and/or fatigue. As a result of these readily accessible cues on effort and performance, performance goals can be expected to develop at an earlier age in physical education compared to other school settings where less cues are apparent (see Cumming et al., 2008; Fry & Duda, 1997). In a sports setting, Cumming et al. (2008) found support for this by showing that children could reliably distinguish mastery goals from performance goals by the age of 9 years.

As already discussed, an approach-avoidance dimension was later added to the mastery and performance goal dichotomy, resulting in a 2 x 2 framework. In their study focussing on achievement goals in 9 to 14 year old children, Cumming et al. (2008) were unable to provide evidence for the existence of separate approach and avoidance goals in these young children. Inconsistent with the conjecture that goal orientations develop at an earlier age in the physical activity domain, in an educational setting Bong (2009) found the four goals to be distinguishable constructs in children as young as first grade (which typically involves 6 to 7 year old children). This unexpected finding, contradicting theoretical propositions and results of research grounded in the dichotomous achievement goal framework, may be a result of the different methods, criteria and measures applied in the studies by Cumming et al. (2008) and Bong (2009). For example, Cumming et al. (2008) were unable to generate subscales tapping independent mastery and performance avoidance goals, as a result of strong correlations between the two avoidance goal subscales (around .70). When merging the mastery and performance avoidance goal subscales into a general avoidance goal subscale, thus applying a trichotomous framework, a high correlation (.56) emerged between the performance approach goal and avoidance goal subscales (Cumming et al., 2008). Based on this close relationship between the two subscales, Cumming et al. (2008) concluded that they could not generate a conceptually independent avoidance goal subscale. Applying these same criteria to the results of the confirmatory factor analysis performed by Bong (2009), it appears that the youngest children included in this study (grade 1 and 2, typically 6 to 8 years of age) distinguished between mastery approach and mastery avoidance goals (as in the study by Cumming and colleagues), but did not differentiate performance

approach from performance avoidance goals or mastery approach from performance approach goals.

In the study by Bong (2009), the strength of the relationship between the four goal constructs was lower in third and fourth grade students (typically 8 to 10 years of age) than in first and second grade students. Children appeared to be better able to differentiate the four achievement goals in the higher grades. However, based on Cumming and colleagues' (2008) stringent criterion (.56), the mastery approach - performance approach goal and performance approach - performance avoidance goal distinctions were not consistently made by children in this older age-group. Taking the findings of the two studies together, it appears that children may start to differentiate approach and avoidance goals at an earlier age than mastery and performance goals (see Figure 2.1, and Pannekoek, Piek, & Hagger, 2013). This implies that children may be able to differentiate potential success situations from potential failure situations, and related outcome expectancies which they want to approach from those they want to avoid (valence of achievement goals), before they are capable of reliably distinguishing between situations where success is achieved through task mastery or through outperforming others (definition of achievement goals). This notion is in line with the depiction of approach and avoidance tendencies as congenital, conceivably driven by a neuroanatomical structure of the brain (Elliot & Covington, 2001).

Young children are generally found to be mastery oriented (Anderman, Austin, & Johnson, 2002; Nicholls, 1989; Stipek & McIver, 1989). After initial experiences have accumulated, children are likely to begin to discriminate between situations in which they expect to be successful and situations where failure is anticipated. Experiences of failure are associated with unpleasant feelings, which children will try to avoid. In the physical activity domain, children are likely to encounter failure at an early age, as they learn through trial and error. As a result, general avoidance goals, involving the universal avoidance of negative outcomes, can be expected to emerge early in childhood. As distinguishing between effort and ability is not needed to identify success and failure situations, the differentiation of approach and avoidance goals may occur before a mature conception of ability has emerged. This may have been represented in the general avoidance goal that was identified by Cumming et al. (2008) in 9 and 10 year old children.

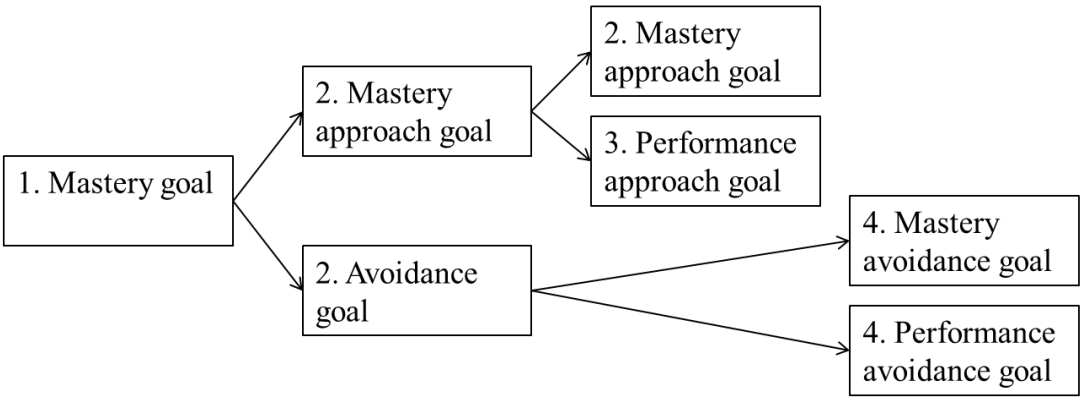


Figure 2.1. Plausible progression of achievement goal development.

2.3.1 Developmental Changes

Besides the development of children's capacity to endorse specific motivational orientations, developmental trends are also apparent in the level of endorsement of motivational constructs. Such trends may be a result of children's exposure to changing environments over development. Research has indicated that in physical education, perceptions of competence tend to decline with age, particularly during the transition from primary to secondary school (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Papaioannou, Bebetsos, Theodorakis, Christodoulidis, & Kouli, 2006; Spray et al., 2013; Warburton & Spray, 2008). During the same period, declines in students' endorsement of mastery approach (Barkoukis, Ntoumanis, et al., 2010; Marsh et al., 2006; Spray et al., 2013; Warburton & Spray, 2008), performance approach (Barkoukis, Ntoumanis, et al., 2010; Warburton & Spray, 2008), and performance avoidance goals (Warburton & Spray, 2008), identified regulation, and intrinsic motivation (Digelidis & Papaioannou, 1999; Ntoumanis et al., 2009), and related hereto enjoyment (Barkoukis, Ntoumanis, et al., 2010; Marsh et al., 2006; Prochaska, Sallis, Slymen, & McKenzie, 2003) in physical education have also been observed. Declines in the endorsement of performance approach goals are not consistently reported, and some studies have found performance approach goals to be more strongly endorsed in older, as compared to younger, students (e.g., Spray et al., 2013). The school environment generally changes over children's development. In particular, after the transfer from primary to secondary school, the school context becomes increasingly focussed on competition, evaluation and performance, which is likely to have an effect on children's achievement goals (Wigfield & Eccles, 2002). Studies have consistently observed children's perceptions of the motivational climate to become more performance-oriented with age (e.g.,

Barkoukis, Ntoumanis, et al., 2010; Ntoumanis et al., 2009; Spray et al., 2013; Wigfield & Eccles, 2002). As a result, it may become more adaptive for children to endorse performance goals, resulting in an increase of the endorsement of such normative goals over development.

Overall, the literature seems to indicate that adaptive motivation declines over development. Findings signifying such declines are not unique to the physical education setting. For example, Fredericks and Eccles (2002) identified comparable declines in children's competence and value beliefs (interest and importance) for math and sports over the period from childhood to adolescence. The negative trends in motivation typically observed over development have been attributed to children's increasing use of social comparison to evaluate competence, and the increasing accuracy of their competence perceptions (Horn & Weiss, 1991; Wigfield & Eccles, 2002). In the study by Fredericks and Eccles (2002), an acceleration in the decline was observed during the transition from primary to secondary school (Fredericks & Eccles, 2002), aligning with findings of other studies (Anderman & Mueller, 2010; Wigfield & Eccles, 1994). This acceleration may be related to developmental changes occurring in early adolescence, which further affect children's competence perceptions. The physical changes that accompany the onset of puberty are likely to negatively (but temporarily) influence children's performance in physical tasks, and as a result, their competence perceptions (Fredericks & Eccles, 2002).

2.4 Gender Differences

Besides differences in motivation based on age, gender is also likely to have an impact on children's motivation and subsequently on their participation in physical activity. In the literature boys are consistently reported to engage in higher levels of physical activity than girls (Biddle, Atkin, Cavill, & Foster, 2011; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Sallis, Prochaska, & Taylor, 2000; Trost et al., 2002). To obtain substantial health benefits, including improvements in cardiorespiratory and muscular fitness, bone health, and cardiovascular and metabolic health biomarkers, WHO guidelines recommend that children and youth should accumulate one hour or more of at least moderate intensity physical activity daily (World Health Organisation, 2010). Results of a large-scale cross-national survey-based study on young people's well-being, health behaviours and their social context, indicate that boys are more likely than girls to meet the WHO guidelines (Currie et al., 2004). Lower levels of physical activity participation in girls than boys have also been identified using objective measurement methods across all ages, including samples as young as first grade primary school-aged children (Nyberg, Nordenfelt, Ekelund, & Marcus, 2009;

Riddoch et al., 2004; Trost et al., 2002). In a study involving 6 to 10 year old Swedish children, boys were found to be approximately 13% more physically active during school time and weekends than girls (Nyberg et al., 2009). In this study, no differences in activity levels between boys and girls were identified for after-school hours during the week, suggesting that disparities may be particularly pronounced in the school setting. Past research performed in the United States and Switzerland, focussing on physical education specifically, has found that primary school-aged boys generally spend more time actively participating in the class compared to their female peers (e.g., Meyer et al., 2012; Nader, 2003; Scruggs, 2007). In contrast to such findings, a study involving 8 to 11 year old Canadian students found levels of engagement in physical education to be equally low for boys and girls, while girls were found to display lower levels of physical activity during schooldays and in the classroom (Nettlefold et al., 2011). Differences in physical education curricula, and cultural differences may have played a role in the discrepant findings.

Physical activity levels have been found to decline with age in both boys and girls, with some studies finding declines to be more marked in girls (Craggs et al., 2011; Riddoch et al., 2004), while other studies have identified similar physical activity trajectories for boys and girls (Duncan, Duncan, Strycker, & Chaumeton, 2007; Nader et al., 2008; Yli-Piipari, Leskinen, Jaakkola, & Liukkonen, 2012). Furthermore, indications of an earlier onset of declining levels of physical activity participation in girls compared to boys have emerged (Dumith et al., 2011; Nader et al., 2008; Wall, Carlson, Stein, Lee, & Fulton, 2011). Identified differences in the physical activity levels and developmental trajectories of boys and girls signal the importance of taking gender into account when investigating physical activity levels and related hereto motivation.. Failure to do so can confound results, while the consideration of potential gender effects may contribute valuable information. For example, it is possible that gender-related differences in motivation play a role in the disparities in activity levels of boys and girls. In the following section, the available literature on gender differences in motivation will be reviewed. For conceptual clarity, the present work largely focuses on ‘gender’ differences, and not ‘sex’ differences. In the literature these constructs have not always been clearly distinguished. According to APA standards (2001), ‘sex’ describes the biological differences between males and females, while ‘gender’ refers to the sociocultural designation of traits and behaviours as feminine or masculine, that is, as characteristic of males or females. Ample evidence is available indicating that biological (sex-related) factors play a role in physical activity levels of boys and girls. For example, biological differences have been found in muscle anatomy, and hormonal differences are

apparent from early childhood onward (Doré et al., 2005; Hines, 2004). Such factors are likely to play a role in the physical activity levels of boys and girls, but are not the focus of the present thesis. Self-determination theory emphasises the essential role of ongoing social support in the operation of natural tendencies. Also achievement goal theory focuses on the influence of socio-contextual factors on motivation. These non-biological factors can be readily targeted in physical activity interventions, and it is the motivational orientations which these factors impact upon that will be focussed on here.

The existing literature suggests that gender differences do not exist in the structure of children's motivational orientations, but rather in the level of motivation, and level of endorsement of important antecedents of motivation. For example, empirical studies have provided evidence for the invariance across gender of the factor structure of both achievement goal theory in a 2 x 2 framework (Alkharusi & Aldhafri, 2010; Nien & Duda, 2008) and self-determination theory (Standage et al., 2005). Despite the absence of structural differences in motivation across gender, boys and girls have been found to score differently on measures tapping constructs of the two theories. Of note are the large inconsistencies in the literature regarding such gender-related differences, suggesting that the effect of gender may be largely person, context and activity specific (Gill, 1999). Some general trends do, however, emerge from the literature.

Both in self-determination theory and achievement goal theory, competence plays a central role (Deci & Ryan, 2000; Elliot & McGregor, 2001). Research has identified gender differences in physical competence perceptions (Hagger, Biddle, & Wang, 2005; Klomsten, 2004), including sports competence (Fredericks & Eccles, 2002; Fredricks & Eccles, 2005). Indications have emerged that gender differences in perceived competence are not related to differences in boys' and girls' actual ability levels (Fredricks & Eccles, 2005), and that girls tend to underestimate their competence (Beyer, 1990; Granleese, Trew, & Turner, 1988).

Gender differences in perceived competence may be a result of the internalisation of stereotypes and gender roles (Chalabaev, Sarrazin, Fontayne, Boiché, & Clément-Guillotin, 2012). Sport and physical activity are often considered as male domains (e.g., Fredricks & Eccles, 2005). Stereotypes surface in the attitudes and behaviours of various socialising agents. For example, parents have been found to provide fewer encouragements and opportunities for engagement in sports to girls than boys (e.g., Fredricks & Eccles, 2005). Gender stereotypes are not only likely to impact upon the competence perceptions of girls, but also upon those of boys. Negative stereotypes concerning girls' engagement in physical activity may affect boys by boosting their motor performance, through increased self-

confidence and motivation (Chalabaev, Sarrazin, Stone, & Cury, 2008). As a result, physical activity participation is encouraged in boys, and undermined in girls.

Signifying the effect of gender stereotyping on participation levels, gender differences in physical education participation have not been consistently identified across all activities. Aelterman et al. (2012) observed that overall children's gender explained 6% of their engagement in moderate to vigorous physical activity in physical education. However, in this study no differences in activity levels across gender were observed for activities that focussed on fitness training and artistic sports (Aelterman et al., 2012), activities that have typically been regarded as gender-neutral or feminine (e.g., Hardin & Greer, 2009). In contrast, gender differences in physical activity levels were found to be more pronounced for skill drills and game play (McKenzie, Marshall, Sallis, & Conway, 2000). Such activities are more male-dominated, as they often involve physical contact, face-to-face opposition, strength, and aggressiveness, features which are regarded as stereotypically masculine. In contrast, activities involving expressivity or aesthetics, such as gymnastics, are typically categorised as feminine (e.g., Hardin & Greer, 2009).

In sport and physical education settings, higher levels of avoidance goal endorsement have been identified for females compared to males, particularly in relation to mastery avoidance goals (Morris & Kavussanu, 2007; Nien & Duda, 2008; Warburton & Spray, 2008). This is likely a results of the generally lower levels of perceived physical competence of females compared to males (see Elliot, 2005). Gender stereotypes may also play a role in the endorsement of avoidance goals, as stereotyped situations in favour of the opposite gender have been hypothesised to generate a focus on performance avoidance goals (Brodish & Devine, 2009; Stone & McWhinnie, 2008). In line with this, Chalabaev et al. (2008) observed that when women were presented with a statement regarding a male-dominated stereotype in relation to an upcoming soccer activity, they were more likely to endorse performance avoidance goals than the corresponding approach goals. This may be a result of a fear of being evaluated based on the stereotype experienced by women (Stone & McWhinnie, 2008). Such findings suggest that gender differences in avoidance goal endorsement may be more pronounced in physical activity contexts and sports that are subject to gender stereotypes. In line with this, in a competitive swimming context, a context that is not gender-stereotyped (see Chalabaev et al., 2012), higher levels of performance avoidance goal endorsement were identified for 7 to 18 year old boys rather than girls (Conroy, Kaye, & Coatsworth, 2006).

Overall, boys tend to be more performance-oriented than girls, both in physical education (Marsh et al., 2006; Warburton & Spray, 2008; Yli-Piipari, Barkoukis, Jaakkola, & Liukkonen, 2013) and sport (Nien & Duda, 2008) settings. With respect to mastery goals the literature on gender differences is more inconsistent. Some studies in primary school physical education settings have found boys to be more likely to endorse mastery goals (Carr & Weigand, 2008; Warburton & Spray, 2008), while other studies in sport and physical education settings have failed to identify gender differences in mastery goal endorsement (Marsh et al., 2006; Nien & Duda, 2008). Using cluster analysis, Wang and colleagues found boys to be more strongly represented than girls in clusters characterised by the most adaptive motivational orientations, including high levels of mastery approach goal endorsement in physical education and sport (Wang & Biddle, 2001; Wang et al., 2007). Girls, in contrast, were found to be more strongly represented in the less adaptive motivational clusters, characterised by low perceived competence and low levels of mastery goal endorsement (Wang & Biddle, 2001; Wang et al., 2007). In a study on 4th grade students in relation to a running program, in contrast, no gender differences in achievement goals were identified (Xiang, Bruene, & McBride, 2004). Again, the absence of gender stereotypes in the particular (running) context may have played a role in the inability of this study to identify gender effects. Gender stereotypes associated with sports are internalised early during childhood (Chalabaev et al., 2012). Already at primary school-age children differentiate sports that they regard as masculine or feminine (Riemer & Visio, 2003).

Gender differences with respect to children's need satisfaction in physical activity settings have not been widely investigated. The only effect of gender on need satisfaction that has received considerable attention involves the need for relatedness. Studies in physical education have identified levels of relatedness need satisfaction to generally be higher for girls than boys (Bagøien et al., 2010; Ntoumanis, 2005; Ntoumanis et al., 2009). In a study focussing on developmental trajectories in children's motivation, Ntoumanis et al. (2009) found that for boys, levels of relatedness need satisfaction decreased subsequent to the transition from primary to secondary school, followed by an increase towards the end of secondary school (Ntoumanis et al., 2009). In the same study, no significant changes in relatedness need satisfaction were observed for girls (Ntoumanis et al., 2009). These findings suggest that boys may be more strongly affected by the disruption of social networks over the school-transition period. In contrast, as a result of higher levels of perceived competence typically observed in boys (e.g., see Bagøien et al., 2010; Fredericks & Eccles, 2002), it is likely that they generally have higher levels of competence need satisfaction than girls.

With respect to the different forms of self-determined motivation, findings on gender differences have been inconsistent. Some studies focussing on secondary school physical education have found the different forms of motivation to be largely invariant across gender (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Standage et al., 2005). In contrast, Ntoumanis (2005) found adolescent boys to be higher in intrinsic motivation for physical education than girls. Similarly, in secondary school physical education Wang, Chatzisarantis, Spray, and Biddle (2002) found boys to be more likely to be motivated for intrinsic and identified reasons, and less likely to be amotivated than girls. The essential role that competence perceptions may play in such gender differences in motivation is illustrated by a recent study of Cairney et al. (2012). Competence perceptions are an important factor in physical education enjoyment, which in self-determination theory is considered a primary indicator of intrinsic motivation (Deci, 1975; Deci & Ryan, 1985b). Girls have been found to be less likely than boys to enjoy primary school physical education (Cairney et al., 2012; Carroll & Loumidis, 2001; Marsh et al., 2006; Prochaska et al., 2003; Yli-Piipari et al., 2013). Furthermore, decreases in girls' enjoyment of physical education over the primary school period have been identified, with the gap between boys and girls increasing (Cairney et al., 2012; Prochaska et al., 2003). However, Cairney et al. (2012) found that when competence perceptions are high, gender may not be significantly related to physical education enjoyment.

In summary, from the literature, which has largely focussed on samples of adolescents and adults, it appears that gender differences exist in motivation for physical activity, and physical education specifically. Gender stereotypes and competence perceptions seem to play important roles in these motivational disparities. Gender differences appear to emerge at an early age, and continue to persist over the school period.

2.5 Level of Motor Proficiency

Thus far, the effects of age and gender on children's motivation have been discussed. Another important factor that is likely to affect children's motivation for physical activity is motor proficiency. As outlined, competence perceptions play a central role in motivation. Children with low levels of motor proficiency are likely to have compromised self-perceptions, including low levels of perceived physical competence (Losse et al., 1991; Piek, Baynam, & Barrett, 2006; Schoemaker & Kalverboer, 1998; Skinner & Piek, 2001), and as a result, they represent a population at risk of compromised levels and quality of motivation. Indeed, an abundance of research has found children with motor difficulties to be at risk of

decreased motivation for physical activity (Rose, Larkin, & Berger, 1998), and physical activity participation (Batey et al., 2014; Cairney, Hay, Veldhuizen, Missiuna, & Faught, 2010). In the general population of 8 to 10 year old children, motor proficiency has been found responsible for 8.7% of the variance in physical activity levels (Wrotniak, 2006). Considering that a substantial percentage of primary school children experience motor difficulties, this poses a serious issue to children's motivation and related hereto their activity levels.

Six percent of primary school children (age range of 5–11 years) experience motor difficulties, not attributable primarily to physical (e.g., Cerebral Palsy) and/or intellectual disorders, to the extent that their performance in daily activities that require motor coordination is substantially below that expected given their chronological age and measured intelligence (American Psychiatric Association, 2013). These children have Developmental Coordination Disorder (DCD, American Psychiatric Association, 2000a). The DSM is the foremost system to classify DCD in both research and clinical practice (Geuze, Schoemaker, & Smits-Engelsman, 2015). The DSM-IV-TR was relied on for the present research, however, a new version has now been published, the DSM-V, which contains more specific criteria (see Table 2.1). For the formal diagnosis of DCD all four criteria need to be met (Geuze, Jongmans, Schoemaker, & Smits-Engelsman, 2001; Geuze et al., 2015).

Central to DCD are delays in achieving motor milestones, clumsiness, poor balance, coordination, and handwriting, resulting in difficulties with performing everyday tasks in home and school environments (Cermak & Larkin, 2002). As a result of their difficulties participating in typical childhood activities, children with DCD are generally more sedentary, and less physically active than their typically developing peers (Cairney, Hay, Faught, Wade, et al., 2005; Fong et al., 2011; Jarus, Lourie-Gelberg, Engel-Yeger, & Bart, 2011; Silman, Cairney, Hay, Klentrou, & Faught, 2011; Wrotniak, 2006). Particularly engagement in vigorous physical activities is compromised in children with DCD, who exhibit a preference for quieter activities (Fong et al., 2011; Jarus et al., 2011). The diversity of activities engaged in by these children is typically limited (Fong et al., 2011).

It has been documented that children with motor difficulties and low preference for active play are generally at a higher risk of physical inactivity in adolescence than children without motor difficulties (Kantomaa et al., 2011). Children with DCD are thought to be at risk of withdrawal from physical activity participation, which has a negative influence on physical fitness, health and motor skill development (Causgrove Dunn & Watkinson, 2002). In line with the suboptimal physical activity patterns that are often observed in children with

DCD, these children typically score negatively on factors such as cardio-respiratory fitness, muscle strength and endurance, and anaerobic capacity and power (for a review see Rivilis et al., 2011). Body mass and percentage of body fat have been found to be significantly higher in children with DCD than their typically developing peers (Faught, Hay, Cairney, & Flouris, 2005; Fong et al., 2011; Silman et al., 2011; Tsiotra, Nevill, Lane, & Koutedakis, 2009). Based on such findings, concerns have been expressed regarding the increased risk of poor cardiovascular health in children with DCD (Rivilis et al., 2011).

Table 2.1. DSM Diagnostic Criteria for DCD

Criterion	DSM-IV	DSM-V
A	Performance in daily activities that require motor coordination is substantially below that expected given the person's chronological age and measured intelligence. This may be manifested by marked delays in achieving motor milestones (e.g., walking, crawling, and sitting), dropping things, "clumsiness", poor performance in sports, or poor handwriting)	The acquisition and execution of coordinated motor skills is substantially below that expected given the individual's chronological age and opportunity for skill learning and use. Difficulties are manifested as clumsiness (e.g., dropping or bumping into objects) as well as slowness and inaccuracy of performance of motor skills (e.g., catching an object, using scissors or cutlery, handwriting, riding a bike, or participating in sports)
B	The disturbance in Criterion A significantly interferes with academic achievement or activities of daily living	The motor skills deficit in Criterion A significantly and persistently interferes with activities of daily living appropriate to chronological age (e.g., self-care and self-maintenance) and impacts academic/school productivity, prevocational and vocational activities, leisure, and play
C	The disturbance is not due to a general medical condition (e.g., cerebral palsy, hemiplegia, or muscular dystrophy) and does not meet criteria for a Pervasive Developmental Disorder	Onset of symptoms is in the early developmental period
D	If Mental Retardation is present, the motor difficulties are in excess of those usually associated with it	The motor skills deficits are not better explained by intellectual disability (intellectual developmental disorder) or visual impairment and are not attributable to a neurological condition affecting movement (e.g., cerebral palsy, muscular dystrophy, degenerative disorder)

Contrasting such negative reports, some children with motor difficulties actively participate in physical activity (Bouffard, Watkinson, Thompson, Causgrove Dunn, & Romanow, 1996; Smyth & Anderson, 2001). The pathways linking DCD to reduced physical activity are not well understood and psychosocial constructs that may play a role in determining the physical activity levels of children with DCD remain largely unexplored. Silman et al. (2011) found that perceived physical adequacy mediated the relationship between DCD and VO2peak. Similarly, perceived sports competence has been found to mediate the relationship between motor skill proficiency and physical activity and fitness (Barnett, Van Beurden, Morgan, & Beard, 2008). Research has indicated that as much as 28% of the variance in children's activity levels can be accounted for by generalised self-efficacy together with DCD status (Cairney, Hay, Faught, Wade, et al., 2005). These reports suggest that competence perceptions play an important role in physical activity engagement in children with DCD. Competence perceptions, including perceived adequacy in basic physical skills and overall physical ability, have consistently been found to be lower in children with DCD compared to their typically developing peers (Cairney, Veldhuizen, et al., 2007; Silman et al., 2011; Skinner & Piek, 2001). The differences in competence perceptions between children with and without DCD have been found to be so pronounced that they can be used as a distinguishing factor between the two groups. The Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA, Hay, 1992), a questionnaire designed to tap children's perceptions of adequacy in performing physically active games or sports, and their likelihood of selecting such activities, has been found to provide a suitable measure for the initial screening for probable DCD (Cairney, Veldhuizen, et al., 2007; Hay, Hawes, & Faught, 2004).

As outlined at the start of this section, the compromised levels of perceived competence in children with DCD are likely to have an impact on their motivational orientations. In the physical activity context, not only satisfaction of the need for competence, but also the need for relatedness is likely to be compromised in children with DCD. As a result of lower levels of actual competence, children with DCD may have low social status, as experienced through situations such as being the last one to be selected by their peers with team-formation in physical education (Katartzi & Vlachopoulos, 2011). As a result of such incidences, children with DCD tend to avoid participating in team games (Katartzi & Vlachopoulos, 2011). Avoidance behaviours decrease opportunities to practice skills, which may in turn result in a developmental skill-learning gap, a deterioration of motor performance and further decreases in perceived competence (Katartzi & Vlachopoulos, 2011; Wall, 2004).

As a result, the problems these children already have with engagement in physical activity may worsen (Causgrove Dunn & Watkinson, 2002). This negative cycle may also lead children with DCD to peer-victimisation and low perceptions of social support (Piek, Barrett, Allen, Jones, & Louise, 2005; Skinner & Piek, 2001), limiting the likelihood of relatedness need satisfaction. Although no empirical studies have investigated autonomy perceptions in children with DCD, the literature indicates that satisfaction of the need for autonomy may also be compromised in these children. Children with higher levels of motor proficiency have been reported to perceive more freedom in their participation in leisure-time physical activities (Poulsen, Ziviani, & Cuskelly, 2007; Poulsen, Ziviani, Johnson, & Cuskelly, 2008). This implies that less autonomy may be experienced by children with lower levels of motor proficiency, which could in turn lead to low levels of autonomy need satisfaction.

Self-determination theory describes how need satisfaction affects the quantity and quality of motivation. Consequently, if differences in need satisfaction exist between children with DCD and typically developing children, this is likely to be reflected in differences in self-determined motivation. No studies are known to have directly investigated the effect of DCD on children's self-determined motivation. However, initial evidence indicates that children with DCD are less likely to enjoy physical education than their typically developing peers (Cairney, Hay, et al., 2007), suggesting they may have lower levels of intrinsic motivation. Furthermore, links have been established between motivation and motor skills performance (Kalaja, Jaakkola, Watt, Liukkonen, & Ommundsen, 2009; Kolovelonis, Goudas, & Dermitzaki, 2011). For example, a positive motivational sequence, whereby a mastery climate positively affects children's perceived competence, which in turn has a positive influence on self-determined motivation for physical education, has been associated with high levels of fundamental movement skills (Kalaja et al., 2009).

Also in achievement goal theory research, limited attention has been devoted to children with motor difficulties, and DCD specifically. In a study involving 10 to 13 year old male Australian children focussing on leisure-time physical activities, no differences in mastery and performance goal endorsement were identified for children with and without DCD (Poulsen, Ziviani, & Cuskelly, 2006). Mastery goals were found to play a mediating role in the relationship between boys' physical coordination skills and general self-concept (Poulsen et al., 2006). For children with compromised levels of motor proficiency, the application of mastery goals to evaluate competence are realistic. Mastery goals focus on improvement and effort, and are consequently achievable by all children, independent of their skill level. In line with this, previous research has indicated that stimulating the endorsement

of mastery goals in children with DCD may counteract their tendency to withdraw from, or avoid participation in, physical activity (Causgrove Dunn & Watkinson, 1994; Causgrove Dunn & Watkinson, 2002). Performance goals, in contrast are less attainable by children with DCD in physical education settings, as a result of these goals' normative focus. The endorsement of performance goals by children with DCD is, thus, likely to result in low competence perceptions (Causgrove Dunn & Watkinson, 1994). No studies as of to date have applied the 2 x 2 achievement goal framework to investigate the achievement goals of children with varying levels of motor proficiency. It seems likely that avoidance goals play an important role in the achievement strivings of children with DCD. When faced with movement challenges, children with DCD have been found to report greater anxiety than typically developing peers (Skinner & Piek, 2001), which may be a result of a fear of failure and low competence perceptions, factors which are positively related to avoidance goals.

2.7 Summary

In summary, self-determination theory and achievement goal theory represent two important frameworks for the investigation of motivation for physical activity, and physical education more specifically. The integration of constructs derived from both theories is likely to increase the variance in physical activity behaviour that can be accounted for.

Based on preliminary indications in the literature, it appears that the same constructs that represent important antecedents of motivation for physical activity and physical activity behaviour in samples of youths and adults are also pertinent in younger samples. Furthermore, the literature suggests that insight in people's motivational orientations could help explain the differences in physical activity levels of various subpopulations, such as children with different levels of motor proficiency. To this end, there is a need for motivational research to go beyond its current main focus, and to apply achievement goal theory and self-determination theory to more divergent samples. This includes a focus on younger samples and populations with compromised levels of motor proficiency.

Chapter 3: Rationale and Aims

3.1 Rationale

In an Australian study involving grade 8 children (Hardy, Okely, Dobbins, & Booth, 2008), around 28% of girls and 16% of boys failed to meet the guidelines of 60 minutes a day of engagement in moderate to vigorous physical activity, averaged over summer and winter (WHO, 2010). The number of grade 10 children not meeting the guidelines was higher, at around 58% for girls and 68% for boys (Hardy et al., 2008). Such statistics indicate that there is a need for intervention to ensure that a larger portion of Australian children reaches the guidelines, and to counter declining levels of physical activity with age, a trend that is consistently reported in the literature (e.g., Nader et al., 2008).

Towards this end, it is important that a deeper insight emerges into the factors underlying the decline in physical activity with age, and how to promote the engagement in sufficient physical activity to obtain health benefits across all ages. Various factors are known to be related to physical activity behaviour, including developmental, environmental, psychological, biological, and socio-cultural factors (Sallis et al., 2000). These factors are likely to undergo changes as children age, particularly during the transition from childhood to adolescence, and from primary school to secondary school.

Motivation plays a critical role in physical activity behaviour (Chen, 2001; Keegan, Harwood, Spray, & Lavallee, 2009), and is energised by various psychological and socio-contextual factors (Standage et al., 2003a; Vallerand & Losier, 1999; see Zhang & Solmon, 2013). For example, a recent study found motivation to mediate the effect of environmental factors, such as perceived neighbourhood safety and parental logistic support, on physical activity (Rutten, Boen, & Seghers, 2013). The parallel decline of motivation and physical activity over the late-primary, and secondary school years (Ntoumanis et al., 2009; Warburton & Spray, 2008; Wigfield & Eccles, 1994; Xiang, McBride, & Guan, 2004) suggests their interrelationship. A deeper insight into children's motivation could, thus, contribute information as to how to effectively promote physical activity and how to prevent a decline of physical activity with age.

Over the years, various motivational theories have been developed. However, motivation is a complex construct, and it is unlikely that a single motivational theory can fully explain the complexities underpinning human motivation. Therefore, rather than considering different motivational theories as competing, there is a need for theoretical integration in motivational research (Bong, 1996; Eccles & Wigfield, 2002; Hagger, 2009).

Different motivational constructs from different theories can be regarded as unique pieces of a puzzle. The uniqueness of different motivational constructs and the specifics of the interrelationship of these constructs, contribute information that is valuable for the generation of a more complete account of motivation.

Self-determination theory (Deci & Ryan, 2000) and achievement goal theory (Elliot, 1997; Nicholls, 1984a) are two prominent theories of motivation that have been applied in the physical activity domain. Efforts have been taken to relate and integrate constructs grounded in these two theories. The interrelationship between motivational constructs from self-determination theory and achievement goal theory has proven to be a useful framework for investigating motivation for physical activity (Moreno, Gonzalez-Cutre, Sicilia, et al., 2010; Ntoumanis, 2001a; Wang, Liu, et al., 2009). However, the majority of this research, and motivational research in general, has focussed on samples of healthy youth aged 11 years and older and adults (Bong, 2009; Erwin & Brown, 2003; Veronneau, Koestner, & Abela, 2005). Knowledge that has emerged from motivational research involving samples of youth and adults can not necessarily be generalised to younger samples. Children have specific characteristics, such as developing cognitive capacities, which are likely to have an impact not only on their motivational orientations, but also on the applicability of research methods to assess these orientations. The limited amount of knowledge that has accumulated on self-determination theory and achievement goal theory in primary school-aged children, as described in Chapter 2, largely stems from early work, and there is a lack of recent studies. The question remains as to whether the same constructs that are found to be important for motivation in youth and adults are also relevant to describe the motivational orientations of younger children, and whether these constructs are interrelated in a similar fashion (see Pannekoek et al., 2013).

One plausible explanation for the lack of research into the motivational orientations of primary school-aged children can be found in an assumption that has long prevailed in motivational research. Young children were assumed to lack the cognitive capacity to engage in social comparison and the necessary self-evaluations, and consequently, the capacity to distinguish between different motivational constructs (Eder, 1990; Nicholls, 1989; also see Butler, 2005 and Harter, 1990). However, contemporary research suggests that children develop the ability to endorse various motivational orientations at an earlier age than previously assumed (see Butler, 2005). In Chapter 2 the preliminary findings regarding children's ability to differentiate between the various motivational constructs forwarded by self-determination theory and achievement goal theory was outlined (see also Pannekoek et

al., 2013). Some evidence has emerged that from the age of 9 years onwards the majority of the constructs can be endorsed, justifying a downward extension of motivational research to include pre-adolescent children.

Despite these emerging insights, the lack of research attention devoted to the motivational orientations of primary school-aged children has persevered. This may be partially a result of the self-report methodology that is commonly applied to assess motivational orientations. Self-report procedures have in the past been regarded as unsuitable for use with children. Children's limited cognitive skills were expected to negatively affect the question-response process (Borgers & Hox, 2000; Scott, 1997). However, over the past decades support has emerged for the applicability of self-report methods to children 8 years of age and over, when age-appropriate questionnaires are used (Borgers, de Leeuw, & Hox, 2000; Rebok et al., 2001; Riley, 2004).

Taken together, a review of the literature substantiates the need for theoretically driven research to investigate motivation for physical activity in primary school-aged children. This research should focus on identifying which factors underlie adaptive motivation, and which factors are most amenable to intervention-induced changes in young populations. Self-determination theory and achievement goal theory provide suitable theoretical frameworks towards this end. The simultaneous consideration of the two theories contributes valuable knowledge on how the different constructs can complement each other to derive a more complete account of motivation. In addition, such research would provide deeper insight into the developmental progression of motivational orientations over childhood and into adolescence. Such insights could inform the development of effective evidence-based interventions aimed at motivating children to be physically active, and facilitating the development of active lifestyles from a young age onwards. Well-designed physical activity interventions could play an important role in the prevention and treatment of overweight and obesity in school-aged children, a health issue of global concern (Janssen et al., 2005).

The childhood period is a particularly important period for the facilitation of adaptive motivational orientations. Children may not yet have clearly formulated their views on physical activity and achievement, and are consequently more susceptible to influences from their environment (Treasure & Roberts, 1995). The importance of promoting constructive motivational orientations at a young age is emphasised by results of a study performed in the academic domain involving 9 to 17 year old students, which found the stability of intrinsic motivation to increase with age (Gottfried, Fleming, & Gottfried, 2001). Motivation is one of the most widely investigated subjects in the field of sport and exercise psychology (Roberts,

2001), and this research tradition should be expanded to include primary school-aged, pre-adolescent samples to enable a life-course approach to the promotion of physical activity. Ultimately, this may facilitate the emergence of positive physical activity habits that persist at older ages and the prevention of the age-related decline in physical activity participation.

3.1.1 Why Physical Education

Schools have been recognised as ideal sites for the implementation of public health initiatives, including interventions targeting children's physical activity behaviours (St Leger, Kolbe, Lee, McCall, & Young, 2007). Children spend about half of their waking hours at school for a significant period of their life, and as a result, the school setting creates an extended time-frame to promote physical activity. Physical education in particular provides a unique setting towards this end. Physical education is a mandated part of the school curriculum in Australia until grade 10, which represents the fourth year of secondary school. As a result virtually all children can be reached through physical education, independent of their life circumstances and level of motor proficiency.

Physical education can make an important contribution to children's overall engagement in physical activity (Morgan, Beighle, & Pangrazi, 2007). A review of studies involving 6 to 18 year old children found physical education to account for approximately 8.7% to 23.7% of daily steps in boys, and 11.4% to 17.2% in girls (Tudor-Locke, McClain, Hart, Sisson, & Washington, 2009). Research has demonstrated that children's motivation for physical education is linked to their effort and level of physical activity in the class (Aelterman et al., 2012; Taylor, Ntoumanis, Standage, & Spray, 2010), suggesting that the contribution of physical education to children's overall physical activity could be enhanced with the optimisation of children's motivational orientations. This is important, as various reports suggest there is ample potential for improvement. For example, a systematic review of studies from five high-income countries established that levels of engagement in physical activity during the physical education class have decreased since the early 1990s (Knuth & Hallal, 2009). Research has also indicated that children do not always engage in sufficient moderate to vigorous physical activity (MVPA) in the class. Some studies (e.g., Nettlefold et al., 2011) report that less than 5% of all primary school students reach the guidelines of 50% of the class time in MVPA forwarded by the American national health promotion project "healthy people" (United States Department of Health and Human Services, 2000).

The enhancement of children's overall engagement in physical activity is a capacious aim for a class that only takes up a very limited proportion of the school curriculum

(McKenzie & Lounsbery, 2009). Children are unlikely to meet the WHO physical activity guidelines (2010) by engaging in physical education only. Consequently, physical education should be regarded as a setting to promote physical activity, complementing, but not substituting other opportunities for physical activity participation within and outside of the school-setting (see Fairclough & Stratton, 2005). Physical education is a critical setting for children to learn and develop both physical and health literacy, and has the potential to influence skills (both physical and cognitive), knowledge and attitudes that are transferrable to other physical activity settings (CDC, 2001; Naylor & McKay, 2009; Pate et al., 2006).

Adaptive motivational orientations in physical education are likely to be transferable, having an impact not only on children's engagement in physical education itself, but also on physical activity outside of the school setting. Research has indicated that children may be more active after school on days on which they had physical education (Dale, Corbin, & Dale, 2000; Morgan et al., 2007). Positive physical education experiences have been linked to higher levels of leisure-time physical activity in young adolescents (Cox et al., 2008; Hagger et al., 2009). In line with this, motivation for physical education has been related to leisure-time physical activity (Chatzisarantis & Hagger, 2009; Cox et al., 2008; Papaioannou et al., 2006). This relationship is likely mediated by motivation for physical activity. Evidence has emerged for the transfer of motivation from physical education to leisure-time physical activity settings (Barkoukis, Hagger, et al., 2010; Hagger, Chatzisarantis, et al., 2005; Hagger et al., 2003). Consequently, if adaptive motivational orientations for physical education can be enhanced, this may have positive effects on children's motivation for leisure-time physical activity, and ultimately their overall activity levels.

A multitude of barriers hinder physical education's efficacy in promoting motivation for and engagement in physical activity. Teachers are not always adequately prepared to instruct physical education classes, and the content of physical education does often not line up with what is relevant to children's lifestyle and health (Hardman, 2008; McKenzie & Lounsbery, 2009). It appears that physical education interventions are not consistently based on theoretical frameworks and empirical evidence on motivation and health behaviour, but instead are often grounded in standard pedagogical practice (e.g., Fairclough & Stratton, 2006). Frequently, the class' main focus is on sport skill training, and not on motivating children to engage in physical activities outside of physical education (Hardman, 2008; McKenzie & Lounsbery, 2009). Consequently, there is a need to restructure physical education so that the classes provide children with enjoyable and diverse experiences, while they are simultaneously taught physical and self-regulation skills that are transferable to

various physical activity settings across the lifespan (McKenzie & Lounsbery, 2009). Towards this end, there is a need for deeper insight into the constructs that are important to motivation, particularly in pre-adolescent children. Further research is needed to inform the design of effective physical education programs and interventions targeting children's motivation to engage in physical activity. Well-designed physical education classes have the potential to impact on the motivational orientations of all children, also those who do not normally engage in organised or more casual leisure-time physical activities.

3.1.2 Research Involving Pre-Adolescent Children

As expressed earlier, there is a need for a deeper insight into the motivational orientations of children. More research is needed to confirm that the constructs forwarded by self-determination theory and achievement goal theory are distinguishable and relevant in child populations, and that they exert a meaningful and consistent influence on children's motivation. It is important that the interrelationship between the constructs is taken into account in such research. In Chapter 2 it was expressed that the evaluation of the interrelationship between constructs can provide valuable insights into the factors and processes underlying motivation. If the interrelationship between constructs as identified in adults (described in Chapter 2) can be confirmed in child samples, this would allow for the application of existing insights to a new population. Furthermore, it would add to the evidence on the constructs' validity in these young populations

A few studies are known to have investigated the interrelationship between the constructs described in achievement goal theory and self-determination theory in young samples. In a study involving 10 to 13 year old physical education students, mastery goals were related to self-determined forms of motivation, and performance goals to controlled forms of motivation (Mouratidis et al., 2010). Furthermore, a study on a sample of competitive swimmers between the ages of 7 and 18 years found the four achievement goals in a 2 x 2 framework to be related to the different forms of self-determined motivation in a manner that was largely consistent with theoretical postulations and previous findings in older samples (Conroy et al., 2006). Mastery approach goals were found to be positively related to self-determined forms of motivation and negatively related to external regulation and amotivation. The opposite pattern was observed for both avoidance goals, which were negatively related to intrinsic motivation, and positively related to external regulation. Performance approach goals were found to be positively associated with external regulation

and amotivation, and unrelated to intrinsic motivation and identified regulation (Conroy et al., 2006).

These studies offer some valuable preliminary insights. As relationships closely mirrored those previously identified in older samples, and theoretical propositions, results seem to suggest that children were able to differentiate the various motivational constructs under investigation. However, caution is required with the interpretation of the results. Motivational constructs were assessed with the use of self-report questionnaires that had been validated in older samples only, and possible effects of the young age of the participants were not accounted for. Children's motivational orientations cannot be considered identical to those of adults, nor is it valid to assume that children's interpretation of questionnaire items is identical to that of adults without testing these assumptions. As age was not taken into account, it remains unclear whether children across the entire age range included in the studies were able to differentiate between the constructs, and whether the constructs were related in a similar fashion at all ages.

A study involving younger children that is known to have taken age into account, both with the assessment of the constructs and the statistical analyses, was performed by Cumming et al. (2008). This study focussed on the development of achievement goals in children (see Chapter 2), and included children as young as 9 years of age. Across all ages involved in the study, mastery goals were found to be positively related to the more self-determined forms of motivation, and negatively related to external regulation and amotivation. Performance goals, however, were not found to be consistently related to any form of motivational regulation in the youngest age group (9-10 y), while they were positively related to the more controlled forms of motivation in the overall sample (9-14 y). These results suggest that performance goals start to have a consistent effect on motivation in children older than 10 years of age. This would imply that children's motivational orientations and their effects continue to develop over pre-adolescence. Findings of the research by Cumming et al. (2008) further emphasise the importance of taking age of participants into account.

Taken together, the available literature suggests that in children 9 years of age and older similar motivational orientations can be found to those of youth and adults, and that these orientations may be interrelated in a similar fashion. However, results of previous research are inconsistent, and it appears that children's motivational orientations continue to develop over pre-adolescence. Research has largely relied on assessment methods that may not have been developmentally appropriate. More research is needed that takes age into account, applying questionnaires that have been specifically developed for use with children.

3.2 Aims of the Study

The primary objective of the present study was to investigate the motivational orientations of 9 to 12 year old children in physical education. Self-determination theory (SDT, Deci & Ryan, 1985b) and achievement goal theory (AGT, Elliot & McGregor, 2001) were used as theoretical frameworks, pursuing efforts of theoretical integration in order to derive a more complete account of motivation. Towards the main aim, it was sought to: (1) Refine and adapt existing questionnaires tapping achievement goal, psychological need satisfaction, and motivational constructs to the context of primary school physical education, (2) Examine the construct validity of scores derived from the newly developed questionnaires, (3) Investigate the associations between the constructs through the testing of a statistical model (4) Investigate this model in different subpopulations. Both achievement goal theory and self-determination theory have a strong emphasis on the construct of competence, and from their inception, links have been drawn between the two theories (e.g., Butler, 1987; Ryan & Deci, 1989, see Chapter 2). Although neither of the theories originated from research in the physical activity domain, an abundance of research has tested and applied the principles of these theories in physical education, exercise, and sport settings (e.g., Moreno, Gonzalez-Cutre, Sicilia, et al., 2010; Ntoumanis, 2001a; Standage et al., 2003a). The focus on achievement goal theory and self-determination theory was not only based on their prominence in motivational research, but also on their main focus on individual factors related to motivation. Both theories acknowledge that socio-contextual factors affect motivation, however, the theories propose that the impact of socio-contextual factors on motivation is channelled through individual factors, such as the individual's goals and psychological needs. As little is known about children's motivational orientations in the physical activity domain, the importance of focussing on the most proximal predictors of motivation was recognised. Once more insight has emerged into factors related to the individual, research could take a further step back, and start looking into how factors in the socio-contextual factors impact upon these individual factors, and motivation.

With respect to achievement goal theory, a 2 x 2 framework was utilised, involving both approach and avoidance goals. Recent suggestions regarding the operational definition of the goal constructs (see Elliot & Murayama, 2008) were taken into account. For self-determination theory, both need satisfaction and the different forms of self-determined motivation were assessed, thus focussing on the cognitive evaluation (Deci, 1975), organismic integration (Deci & Ryan, 1985b), and basic psychological needs (Ryan et al., 1996) subtheories. These subtheories were selected as they are competence-focussed, and

their constructs are context specific and susceptible to intervention induced change (Chatzisarantis & Hagger, 2009; Edmunds, Ntoumanis, & Duda, 2008; Standage et al., 2005). The other subtheories, although adding explanatory value, were not included in the present study as their focus was less relevant to the present study.

The research focussed on physical education specifically, as this context has the potential to reach all school-aged children. Physical education students between the ages of 9 to 12 years old were targeted, to cover the period leading up to adolescence, as well as the transfer from primary to secondary school. In Australia children make the transition from primary to secondary school when they reach year 7 or 8 (state dependent), and typically are between 12 and 14 years of age. During this period significant contextual, individual and social developmental changes occur (Wigfield, Eccles, & Pintrich, 1996), which may result in relative instability of children's motivational orientations. Consequently, it is important to promote the development of strong and adaptive motivational orientations prior to this phase of change. Insight into children's motivational orientations over pre-adolescence may facilitate this.

In order to address the four objectives outlined at the beginning of this section, the study consisted of five phases. The first two phases focussed on the development of adequate assessment methods. The third phase constituted the main aim of the research; an investigation of which constructs derived from self-determination theory (cognitive evaluation theory, organismic integration theory and basic psychological needs theory) and achievement goal theory underlie the motivational orientations of 9 to 12 year old children in physical education, and the constructs' interrelationship through statistical modelling. The last two phases investigated this motivational model more in-depth, considering different subpopulations.

3.2.1 Phase One: Questionnaire Adaptation

The aim of Phase One, described in Chapter 4, was to refine and adapt three existing self-report questionnaires tapping achievement goal, psychological need satisfaction, and motivational constructs to the context of primary school physical education and to subsequently pilot-test these questionnaires. The identification of the most suitable questionnaires for adaptation in the present research was achieved by means of an extensive review of the literature. It was hypothesised that three well-validated physical activity-related questionnaire could be identified that would be suitable for assessment of pre-adolescent populations with only minor adaptations. If adaptations to the items could be kept to a

minimum, this would have the least impact on the psychometric properties and validity of the original questionnaires.

Motivational orientations are generally assessed using self-report methods. It has been suggested that children are capable of self-reporting on their attitudes from 8 years of age onwards (Borgers et al., 2000; Koskey, Karabenick, Woolley, Bonney, & Dever, 2010), with some researchers lowering this age to 7 years (e.g., Bell, 2007; de Leeuw, Borgers, & Smits, 2004). However, the validity of self-report questionnaires when applied to child samples requires careful consideration. With self-report items that have been composed without taking into account children's developing cognitive capabilities into account, children are likely to experience difficulties at some stage of the response process (Borgers et al., 2000; Borgers & Hox, 2000; Borgers, Hox, & Sikkel, 2004; Woolley, Bowen, & Bowen, 2004). Such difficulties may involve the comprehension of questionnaire items, articulation of a response, or response selection (Borgers et al., 2000; de Leeuw et al., 2004).

Questionnaires that were originally developed for the assessment of motivational orientations in samples of youth and adults have often been applied to assess children. The applicability of these measures to younger samples has been largely neglected, and there is a lack of self-report questionnaires that have been validated to tap children's motivational orientations. In response to this, for the purpose of the present study items from three existing questionnaires tapping the relevant constructs were adapted to accommodate the assessment of pre-adolescent children.

Quantitative, questionnaire-based evaluation methods that are generally applied to assess motivational orientations do not provide insight into how the items are interpreted by respondents. Particularly when younger samples are involved, items may not be interpreted as intended by the researcher and in a fashion that is coherent with the underlying theory. This negatively impacts upon the validity of results based on data obtained with the questionnaire. Endeavouring to optimise the questionnaires' validity, qualitative pilot-tests were performed before proceeding to the quantitative evaluation of the questionnaires in Phase Two.

3.2.2 Phase Two: Questionnaire Validation

Phase Two evaluated the reliability and validity of scores obtained with the questionnaires developed in Phase One, based on a larger sample of 9 to 12 year old children, as described in Chapter 5. The factor structure underlying the questionnaires was investigated. It was hypothesised that participants would be able to differentiate between the constructs tapped within each questionnaire. As the questionnaires were specifically

developed for the physical education setting and in consideration of the age of the sample, it was anticipated that the constructs would emerge as clearly distinguishable factors. It was expected that evidence would emerge supporting the questionnaire's psychometric properties. The questionnaires were based on existing, well-validated questionnaires, and the adaptations to the original items underwent qualitative evaluations in Phase One. Data gathered in this phase of the study were utilised for all subsequent phases of the research.

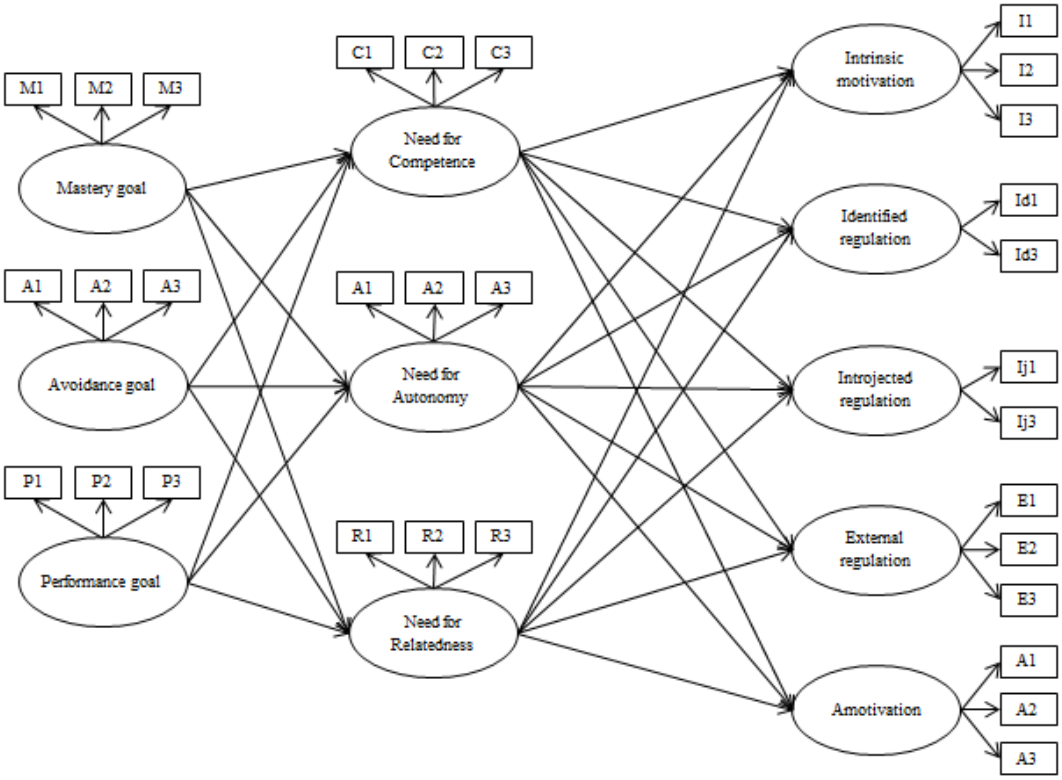
3.2.3 Phase Three: Statistical Model Testing

The main objective of Phase Three (Chapter 6) was investigating the interrelationship between the pertinent achievement goal theory and self-determination theory constructs in pre-adolescent children. The relationship between achievement goals and motivation has been widely investigated, however, motivational research has often failed to take need satisfaction into account. There is some evidence that the three psychological needs may play a mediating role in the relationship between achievement goals and the different forms of self-determined motivation (e.g., Ntoumanis, 2001a; Standage et al., 2003a), however, this requires confirmation, particularly in young samples.

Intrinsically motivated behaviour occurs naturally in very young children, and in order to be sustained, satisfaction of the three needs is required (Ryan & Deci, 2000b). As the three needs are considered innate (Deci & Ryan, 2000), it is likely that the link between need satisfaction and different forms of self-determined motivation already exists at a young age. The plausible mediating role of need satisfaction in the relationship between achievement goals and motivation (see Figure 3.1) is likely to be contingent upon the development of achievement goals. As achievement goals develop, the specific goal that is endorsed is likely to have an impact on motivational and behavioural outcomes, including satisfaction of the innate needs. It seems plausible that the same hypothesises regarding the relationship of achievement goals and the three needs, as forwarded by Ntoumanis (2001a), are pertinent to child samples (see Pannekoek et al., 2013). For example, a child who endorses a performance approach goal, and constantly tries to outperform others, may feel controlled by this goal and experience feelings of rivalry. This is likely to have an impact on satisfaction of, respectively, the innate needs for autonomy and relatedness.

In short, based on the available literature, the pertinent constructs from self-determination theory and achievement goal theory were expected to be interrelated in a fashion largely mirroring findings of previous research in samples of youth and adults (e.g., Standage & Treasure, 2002; Wang et al., 2007; Wang, Liu, et al., 2009; also see Vallerand,

2000). Achievement goals were hypothesised to affect children's need satisfaction, which in turn was expected to have an effect on the different forms of motivational regulation. Such relationships were expected to be conditional on the development of achievement goals and the motivational regulations. As of to date, it remains uncertain whether pre-adolescent children endorse avoidance goals (Conroy et al., 2006 versus Cumming et al., 2008). The hypothesised relationships are visualised in Figure 3.1. More specific hypotheses regarding the direction of the effects are provided in Chapter 6.



Note. For the clarity of presentation, direct paths between all three achievement goals and the different forms of self-determined motivation are not present. Such paths are, however, hypothesised.

Figure 3.1. Hypothesised model based on achievement goal theory and self-determination theory.

3.2.4 Phase Four: Age and Gender Difference in Motivation

The analysis of age and gender differences in motivation was the main aim of Phase Four, described in Chapter 7. The impact of age and gender on the interrelationships between constructs in the model, and children's mean scores on the constructs was examined. From the literature it remains unclear at what age coherent and explicit motivational orientations start to emerge. In pre-adolescent children, the motivational constructs included in the present model may not have yet established as consistently as in older populations. It is important to

investigate whether the different motivational orientations have emerged by the start of pre-adolescence, whether these orientations exert a consistent influence on other constructs, and whether there are age-related trends in children's motivational orientations. Such insights would provide guidance as to from what age onwards to start implementing interventions focussing on motivation, and which factors to focus on. Besides age, also gender has been widely discussed in relation to children's participation in physical education (e.g., Gorely, Holroyd, & Kirk, 2003; Hills & Croston, 2012). Girls have often been found to have less adaptive physical activity patterns than boys (e.g., Aelterman et al., 2012; McKenzie et al., 2000; Ntoumanis, 2005). It is likely that gender differences in motivation play a role in these differences in participation (Carr & Weigand, 2008; Marsh et al., 2006; Ntoumanis, 2005). Consequently, it is important to take children's gender into account when investigating motivation, as girls and boys may require gender specific intervention.

The structure of the model identified in Phase Three was hypothesised to be largely generalisable across the four different age samples (9, 10, 11 and 12 year old children). However, effects of achievement goals and need satisfaction on motivation were expected to be stronger for the older children included in the study, in line with previous research finding relationships between motivational constructs to increase in strength over childhood (Kinlaw & Kurtz-Costes, 2007; Wigfield, 1994). Based on findings of Cumming et al. (2008) involving 9 and 10 year old children, the effects of performance goals on the other constructs in the model were hypothesised to be weaker, and possibly not statistically significant, for the younger children included in the present study. No hypotheses could be made with respect to avoidance goals, as reports in the literature regarding these goals in children are inconsistent.

The younger children included in this study were expected to score higher than older children on the subscales tapping motivational constructs that are adaptive in character. For example, younger children were expected to have higher scores on the mastery goal (see Warburton & Spray, 2008), competence need satisfaction (see Warburton & Spray, 2008), and intrinsic motivation (see Ntoumanis et al., 2009) subscales.

Based on results of previous studies in older samples, indicating the equivalence of models of motivation across gender (e.g., Ntoumanis, 2001b; Standage et al., 2005), no gender effects were expected to emerge with respect to the interrelationship of the motivational constructs in the model. However, differences in boys' and girls' level of endorsement of the motivational constructs were expected. Specifically, boys were hypothesised to score higher on the performance goal, and competence need satisfaction subscales than girls (see Warburton & Spray, 2008). Due to inconsistencies in the literature,

no strong hypotheses could be formulated on gender differences in the approach-avoidance distinction and the different forms of self-determined motivation.

3.2.5 Phase Five: Motor Proficiency and Motivation

Phase Five, described in Chapter 8, explored whether children with varying levels of motor proficiency differ systematically in their motivation for physical education. Children with compromised levels of motor proficiency are known to be at increased risk of low levels of participation in physical activity. Children with DCD represent a population characterised by compromised levels of motor skills. Lower levels of physical activity that are generally observed in children with DCD, and indications are available in the literature that low levels of motivation may play a role in causing the (e.g., Dunn & Watkinson, 2002). However, little is known about the constructs of self-determination theory and achievement goal theory in children experiencing motor difficulties. To gain a deeper understanding why these children are at increased risk of limited engagement in physical activity, it is consequently important that their motivational orientations are considered. If motivational constructs can be identified that are differentially endorsed by children with DCD compared to their typically developing peers, this could be taken into account with the design of physical education programs and interventions, aiming to facilitate adaptive motivation for all children.

Children with DCD have been identified to have lower levels of perceived competence compared to their typically developing peers (Piek et al., 2006; Piek, Dworcan, Barrett, & Coleman, 2000). Research has indicated that compromised perceptions of competence are likely to play an important role in the limited engagement in physical activity of populations with lower levels of motor proficiency (Hagger, Biddle, et al., 2005; Piek et al., 2006). It is widely recognised that competence plays a central role in motivation, and consequently, differences were hypothesised to exist between the motivational orientations of children with DCD and their typically developing peers. These differences were expected to emerge in children's scores on the motivational constructs included in the model, but not in the interrelationship of these constructs (structure of the model). Children with DCD were expected to score lower on satisfaction of the need for competence and relatedness (see Chen & Cohn, 2003; Skinner & Piek, 2001), and intrinsic motivation, as a result of the difficulties experienced by these children. As no research grounded in self-determination theory or achievement goal theory is known to have investigated to motivational orientations of children with DCD, more explicit hypotheses could not be formulated based on the existing literature.

Chapter 4: Phase One: Questionnaire Adaptation

4.1 Introduction

Motivation is an abstract construct that cannot be directly observed. As a result, motivational research relies heavily on questionnaire-based assessment methods (see Fulmer & Frijters, 2009). It is vital that well-designed questionnaires are applied. For example, it is important that questionnaires are age and context specific, to ensure respondents interpret the items in a fashion that is identical to the theory, and researcher-defined meanings of the construct at hand. It cannot be assumed that when the same questionnaire is used across different subgroups, the constructs assessed retain their meaning (Wu, Li, & Zumbo, 2007). To date, no questionnaires have been developed to investigate the constructs grounded in self-determination theory and achievement goal theory that are suitable for the assessment of pre-adolescent children in a physical education setting specifically. The limited amount of research that has applied the two theories to research pre-adolescent children has used questionnaires that were originally developed for use in older samples. Often the applicability of these existing questionnaires to younger populations is not investigated. However, due to their developing cognitive capabilities, children are likely to experience difficulties with the completion of self-report questionnaires (Borgers et al., 2000; Borgers & Hox, 2000; Borgers et al., 2004; Woolley et al., 2004).

Despite the challenges that are inherent in the application of self-report methods to children, researchers have begun to recognise the importance of conducting self-report research in children. Traditionally, parents or teachers have been consulted to gain insight into the health and well-being of children up to 10 years of age (Scott, 1997). However, children themselves possess the most valuable information on their physical and mental states (Bell, 2007; Borgers & Hox, 2000; de Leeuw & Smits, 2004; Scott, 1997; Sturgess, Rodger, & Ozanne, 2002), including their motivation to participate in physical activity. Evidence has emerged that children have a unique and valid perception of themselves, which is relatively stable over time and can only be assessed using self-report (Sturgess et al., 2002).

Researchers have identified that from the age of 8 years onwards self-report methods can be applied successfully (Borgers et al., 2000; Rebok et al., 2001; Riley, 2004). For example, in a qualitative study involving 5 to 11 year old children, Rebok et al. (2001) found that children as young as 8 years of age were capable of self-reporting on virtually all aspects of their health. Common issues with the use of self-report assessment in children, such as problems with the adequate use of the response-scale or item comprehension, were found to

be largely overcome by the age of 8 years (Rebok et al., 2001). The feasibility of self-report assessment in children aged 8 years and over is consistent with Piaget (1929)'s theory of cognitive development, which suggests a cognitive transition point around the age of 7 years. By this age children advance to the concrete-operational period, during which they become better at logical thought, simultaneously considering different perspectives, and integrating different thought processes (Piaget, 1929). Furthermore, language and reading skills further develop during this period (Piaget, 1929). Between the ages of 5 and 7 years, the capacity of sustained attention rapidly increases (McKay, Halperin, Schwartz, & Sharma, 1994). All of these factors are likely to contribute to the reliability of self-report.

Nevertheless, adult levels of cognitive ability and information processing skills are reached only around the age of 16 years (Borgers et al., 2000; de Leeuw et al., 2004). Consequently, it is important that the cognitive validity of items is investigated when questionnaires designed for youth and adults are applied to younger samples. Cognitive validity is the degree to which respondents' reports on their cognitive processes during response selection on questionnaire items mirror the researchers' assumptions regarding the processes that respondents should go through when responding to the items. This includes the degree of correspondence between respondents' item interpretations and researcher's intended meaning of the items given the construct they are designed to operationalise (see Karabenick et al., 2007; Messick, 1995; Woolley et al., 2004). Koskey et al. (2010) used a sample of 8 to 14 year old children to evaluate the cognitive validity of items tapping mastery goals in a classroom setting, originally developed for use in children 10 years of age and older (Koskey et al., 2010). In this study, the cognitive validity of children's responses was found to be moderate to low, with lower levels of cognitive validity for responses from the primary school-aged respondents. The identified issues with the application of these items to primary school children may not have been picked up with quantitative questionnaire evaluation methods. Similarly, Wang, Pyun, Kim, and Chatzisarantis (2009) found that primary school, secondary school, and college students did not consistently interpret all items of a questionnaire tapping different forms of self-determined motivation in an identical fashion. Such reports highlight the need for careful examination of the equivalence in the meaning of questionnaire items, consistent with the underlying theory, before applying questionnaires to new populations. Fulmer and Frijters (2009) outlined the challenges of designing items that are developmentally appropriate for younger populations, emphasising the importance of adequate sentence construction and vocabulary. The use of clear definitions is essential in self-report questionnaires for children (Bell, 2007; Borgers & Hox, 2000; Eddy,

Khastou, Cook, & Amtmann, 2011; Holaday & Turner-Henson, 1989; Rebok et al., 2001). Furthermore, simpler item-wording and the presentation of only one concept at a time have been recommended to yield responses with increased cognitive validity (Woolley et al., 2004). Question length negatively impacts the reliability of self-report in children, as memorising the item places a high demand on verbal memory (Borgers & Hox, 2000; Borgers et al., 2004; Holaday & Turner-Henson, 1989; Knäuper, Belli, Hill, & Herzog, 1997).

In response to these issues, the present phase of the study was devised to identify, qualitatively evaluate and adapt questionnaires to assess the pertinent constructs in 9 to 12 year old children before proceeding to the main aim of the study, the investigation of children's motivation itself. Initially, the most suitable questionnaires were identified, which would allow staying as close as possible to the original items, by means of an extensive review of the literature. One questionnaire per (sub) theory was sought, tapping the constructs grounded in self-determination theory (cognitive evaluation theory and basic psychological needs theory) and achievement goal theory, in a physical activity setting.

This phase consequently aimed to qualitatively evaluate (pilot-test) the items of the selected questionnaires with the use of cognitive pre-testing methods commonly applied during the development of self-report questionnaires (Woolley, Bowen, & Bowen, 2006),. The main focus of the pilot-testing was on the clarity and ease of language used in the items, conciseness of the items, and consistency of children's interpretation of the items with the underlying theory. As such, the aim was to ensure the quality of the items, and make changes where considered necessary, for example due to children's developing cognitive skills and reading proficiency.

4.2 Method

4.2.1 Participants

Fifteen children between the ages of 8 and 12 years with a mean age of 10.24 years (*SD* = 1.42) were recruited from the general population. The sample consisted of 9 boys (*M* age = 10.66, *sd* = 1.40) and 6 girls (*M* age = 9.61, *sd* = 1.45)(see Table 4.1). A purposive sampling strategy (Kerlinger, 1986) was applied to ensure a distribution of participants over gender and age groups. All participants were living in metropolitan Perth, Western Australia.

Table 4.1. Distribution of Participants over Gender and Age

Age	Total *N*	Boys *n*	Girls *n*
8 years	3	2	1
9 years	3	1	2
10 years	2	1	1
11 years	4	2	2
12 years	2	2	/

Children with reading difficulties, as reported by parents, were excluded from participation. However, even within the normal range, children's reading abilities show inter-individual variations (Parrila, Aunola, Leskinen, Nurmi, & Kirby, 2005). To ensure that the final versions of the questionnaires would be suitable for the assessment of all typically developing children in the targeted age range (9-12 years), accounting for children in the lower range of ability, 8 year old children were included in the pilot-testing. Current literature suggests that self-report assessment can be reliably used from this age onwards (Borgers et al., 2000; Koskey et al., 2010). Note that 8 year olds were only included for pilot-test purposes, as the youngest children included in the main part of the study were 9 years of age. The lower age limit of 9 years for the main study was based on previous research in the physical activity domain (e.g., Cumming et al., 2008; Smith, Smoll, Cumming, & Grossbard, 2006).

4.2.2 Procedure

4.2.2.1 Questionnaire selection.

The importance of performing research that is domain-specific has been advocated (Ryan, 1995; Vallerand, 1997). Therefore, the aimed was to identify the most suitable existing questionnaire focussing on physical education or other physical activity setting specifically to assess the constructs from achievement goal theory and the two subtheories of self-determination theory that were the focus of the present study. Various such physical activity specific questionnaires have been developed for use in youth and adult populations. The three questionnaires that were found most suitable for application in pre-adolescent children were selected and, where needed, adaptations were made to the items to accommodate the assessment of younger populations.

4.2.2.1.1 Different forms of self-determined motivation. In the physical activity domain, the majority of these questionnaires developed to tap the different forms of

motivation forwarded by self-determination theory focus on sport and exercise. Examples of such questionnaires are the Sport Motivation Scale (SMS; Pelletier et al., 1995), the Exercise Motivation Scale (EMS; Li, 1999), the Sport Motivation Scale-6 (SMS-6; Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson, 2007), the Behavioral Regulation in Sport Questionnaire (BRSQ; Lonsdale, Hodge, & Rose, 2008), and the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004). Two physical education specific questionnaires are available; the Perceived Locus of Causality Scale (PLOC; Goudas, Biddle, & Fox, 1994), and a revised version hereof, the PLOC-R (Vlachopoulos, Katartzi, Kontou, Moustaka, & Goudas, 2011). The PLOC has been used in the majority of physical education related research on motivation. This 17-item questionnaire was developed based on the Academic Self-Regulation Questionnaire (Ryan & Connell, 1989), applying it to the physical education setting. An amotivation subscale, derived from the Academic Motivation Scale (AMS; Vallerand & Bissonnette, 1992), was added to the original four subscales of the ASRQ. The PLOC taps all forms of motivation described in self-determination theory, with the exception of integrated regulation, which is not normally assessed in research with children (see Chapter 2). Items are responded to on seven-point Likert-type scales.

The more recently developed PLOC-R (Vlachopoulos et al., 2011) has been evaluated in a large sample of 10 to 18 year old physical education students. The paper reporting on the PLOC-R was published subsequent to questionnaire-development phase of the present study, and the questionnaire could therefore not be considered for application. No qualitative component was included in the study by Vlachopoulos et al. (2011), and consequently, it remains uncertain whether children of the entire age range included in the study interpreted the items in a manner consistent with self-determination theory.

As at the time of initiation of the present study, the PLOC was the only questionnaire available to assess self-determined motivation in physical education this questionnaire was selected for the purpose of the present study. The reliability and validity of the PLOC subscale-scores have been supported in previous physical education research involving children 11 years and older (Goudas et al., 1994; Ntoumanis, 2001b, 2005). Cronbach's alpha values above .70 have been identified for all five subscales of the questionnaire (Goudas et al., 1994) and factorial validity has generally been supported for the questionnaire (Goudas, Dermitzaki, & Bagiatis, 2000; Wang, Hagger, & Liu, 2009). The factor structure has been found to be invariant across culture in a study involving British and Singaporean students (Wang, Hagger, et al., 2009). In contrast, Lonsdale, Sabiston, Taylor, and Ntoumanis (2011) identified cultural differences in the PLOC's reliability in their study involving physical

education students from England and Hong Kong. While reliability indices were found to be satisfactory in the British sample, low reliability indices for the external and introjected regulation subscales were observed in the Hong Kong sample. These results suggest that care needs to be taken with the cross-cultural application of the PLOC.

4.2.2.1.2 Psychological need satisfaction. Since initial research into need satisfaction in physical activity settings in the 1980's, the measurement of the need for competence, autonomy, and relatedness constructs has advanced greatly, particularly exercise settings. Originally, need satisfaction in physical activity domain was largely assessed with the use of single item indicators or subscales derived from other domains (see Wilson, Mack, Gunnell, Oster, & Gregson, 2008). For example, Deci (2001) developed the Basic Need Satisfaction Scale (BNSC) to assess need satisfaction at work. This questionnaire was applied to the physical education setting by Ntoumanis (2005). More recently, methodological developments were initiated in exercise-related research, and in 2006, two exercise specific questionnaires to assess need satisfaction were published; the Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson, Rogers, Rodgers, & Wild, 2006) and the Basic Psychological Needs in Exercise Scale (Vlachopoulos & Michailidou, 2006). The BPNES was based on the BNSC (Vlachopoulos & Michailidou, 2006), while the PNSE was developed based on qualitative information provided by individuals describing personal experiences on satisfaction of their needs for competence, autonomy, and relatedness in exercise settings (Wilson, Rogers, et al., 2006). Based on quantitative evaluations, both questionnaires appear equally suitable for the assessment of need satisfaction in exercise (see Wilson et al., 2008).

In response to the need for context specific questionnaires, both the PNSE and the BPNES have recently been adapted for use in respectively physical activity, and physical education settings. The psychometric properties of the physical education specific version of the BPNES, the Basic Psychological Needs in Physical Education scale (BPN-PE; Vlachopoulos et al., 2011), have been supported in 11 to 18 year old Greek physical education students. The adapted version of the PNSE, the PNSE-PA (Gunnell, Mack, Wilson, & Adachi, 2011; Gunnell, Wilson, Zumbo, Mack, & Crocker, 2012), applies to physical activity settings more generally, and has been used in various populations, including the general population of adults and a clinical sample (Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013; Gunnell et al., 2011; Mack et al., 2012). Initial support for the validity and reliability of the PNSE-PA items has emerged (Gunnell et al., 2012; Mack et al., 2012).

Neither the BPN-PE, nor the PNSE-PA, were published at the time that the present study was initiated. Furthermore, no qualitative component was involved in the development of either of these questionnaires, resulting in uncertainty as to whether the items were relevant to individuals' need satisfaction in the targeted settings. Consequently, the PNSE and BPNES appeared to most suitable candidates for the purpose of the present study.

Inspection of the items of both the PNSE and BPNES suggested that primary school-aged children were likely to experience difficulty responding to the items as a result of the difficulty of their wording. The difficulty of the language used in items of the PNSE and BPNES was evaluated using the Flesch-Kincaid readability analysis (Flesch, 1948; Harrison, 1980). With this method, the average US grade level at which students can be expected to be capable of reading a text or sentence is estimated based on the average number of syllables per word and the average number of words per sentence. Results on average indicated a greater ease of language for the PNSE than the BPNES items. A further positive feature of the PNSE was that its development was informed by qualitative research. The PNSE was, therefore, selected for use in the present study. It was expected that based on this selection, the extent that items needed to be modified to be suitable for the assessment of primary school-aged children in a physical education settings would be minimised.

The initial validation study of the PNSE provided evidence for its structural validity, and internal consistency of scores obtained with the questionnaire was supported, with Cronbach's alpha values exceeding .90 (Wilson, Rogers, et al., 2006). A theoretically consistent pattern of relationships with relevant constructs, such as self-determined motivation, has been identified for the three needs as tapped with the PNSE, supporting its external validity (Wilson & Rogers, 2008).

4.2.2.1.3 Achievement goals in a 2 x 2 framework. An abundance of methods has been applied to assess achievement goals, some of which have focused on the mastery-performance distinction alone (dichotomous framework), and others on both the mastery-performance and approach-avoidance distinctions (2 x 2 framework). Elliot and Murayama (2008) identified several problems with existing measures in the achievement goal literature, suggesting that there is a lack of questionnaires assessing achievement goals in a conceptually rigorous manner. They outlined that even when a clear conceptualisation of achievement goals is in place, there is often poor correspondence between how the goals are conceptualised and how they are operationalised. A more constrained definition of the achievement goal constructs is needed to derive greater conceptual clarity, particularly when examining the effects of the goals (see also Hulleman, Schrager, Bodmann, & Harackiewicz,

2010). In response to this, Elliot and Murayama (2008) revised the Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001), a questionnaire designed for use in the academic domain, and validated in undergraduate university students (Elliot & McGregor, 2001; Muís, Winne, & Edwards, 2009). In the revised version, the Achievement Goal Questionnaire-Revised (AGQ-R; Elliot & Murayama, 2008), all goal irrelevant content, such as motives and affect, was removed from the items. The AGQ-R was selected for the purpose of the present study, based on its conceptual clarity, which is likely to further understanding of the characteristics (both antecedents and consequences) of achievement goals.

The reliability and validity of the AGQ-R subscales have been supported. In their initial development and validation study, which focussed on undergraduate students, Elliot and Murayama (2008) found all four subscales to have high levels of internal consistency. Cronbach's α values of .84, .88, .92, and .94 were identified for mastery approach, mastery avoidance, performance approach, and performance avoidance goal subscales, respectively. The alpha found for the performance-avoidance goal subscale was improved from the original AGQ. Six alternative models were tested, and the hypothesised 2 x 2 model provided the best fit to the data (Elliot & Murayama, 2008). A recent study applying a trichotomous goal framework found an acceptable model fit for the AGQ-R based on the two approach goal subscales and the performance avoidance goal subscale when applied to grade 5 and 6 primary school children (Michou, Mouratidis, Lens, & Vansteenkiste, 2013). No study is known to have applied the AGQ-R to the physical activity domain.

The selected questionnaires were initially subjected to a readability evaluation using the Flesch-Kincaid readability analysis (Flesch, 1948; Harrison, 1980). In order for items to be considered applicable to 9 year old children, a reading level of grade 4.0 or less is required. The analysis revealed that the PLOC items largely conformed to this criterion (with the exception of one item). However, the AGQ-R and PNSE had average Flesch-Kincaid readability item-scores of 6.15 and 7.71 respectively, raising the possibility that measurement error may be introduced when applying the questionnaires to younger age groups. In response to the readability results, the AGQ-R and PNSE items underwent adaptations prior to submitting the questionnaires to pilot-tests.

4.2.2.3 Evaluation of the adapted questionnaires.

Following the initial adaptations, a team of four researchers with expertise in self-report assessment reviewed the items. The revised items were directly compared with the original items in order to determine whether the original item content was retained. Items

were also evaluated based on their accuracy in reflecting the underlying theory, particularly where changes to the item content were needed to ensure relevance to the physical education context, or due to theoretical advancements. The items' pertinence to physical education settings was reviewed, as well as the appropriateness of the phrasing of items for child respondents. A primary school teacher was asked to provide feedback on the items, with an emphasis on the language comprehension level required for children to be able to adequately respond to the items. Additional revisions were made based on these evaluations.

Once the research team agreed upon the suitability of all items, the questionnaires were submitted to pilot-tests. Prior to the start of the pilot-tests, parent consent for their child to participate in this study was sought (see Appendix A). The task was explained to the child, and it was emphasised that it was not a test where the child could do badly or respond incorrectly. Child consent was requested (see Appendix B) and approval was sought from both parent and child to audiotape the pilot-test.

Pilot-tests were conducted one-on-one (child and interviewer). Questionnaire administration was computer-based, using a forced-choice response format. The questionnaire display was designed using online survey-based computer software (Qualtrics Inc.). Successful application of computer-based assessment of self-report measures has been documented in children as young as 8 years of age (de Leeuw, Hox, Kef, & Van Hattum, 1997; Rew, Horner, Riesch, & Cauvin, 2004; van Hattum & de Leeuw, 1999). It has been reported that children generally enjoy this method of assessment (de Leeuw, Hox, & Kef, 2003; de Leeuw et al., 1997; Rew et al., 2004).

In line with the common practice of cognitive pre-testing, pilot-tests were conducted in an interview format. A 'think-aloud' method was applied, which involves the encouragement of participants to articulate everything they are thinking during the question-response process (see Bell, 2007; Bowen, Bowen, & Woolley, 2004; Willis, 2005; Woolley et al., 2006). This appears to be an efficient technique in child samples, as children often engage in thinking aloud naturally, for example, by verbalising their thoughts during play (de Leeuw et al., 2004). Questionnaire items were considered to possess cognitive validity when the meaning of the item as expressed by the respondent in the cognitive pre-test interview matched the definition based on the underlying theory (Karabenick et al., 2007; Koskey et al., 2010; Woolley et al., 2004). Assessments were audiotaped, and the interviewer kept notes of the process, focussing on the child's behaviour and motivation (e.g., signs of doubt).

Items were presented to the respondents on the computer screen one at a time. Consequently, the interviewer progressed through a four-step procedure with the child

respondent, following the procedure described by Bowen and colleagues (2004). Firstly, the child was asked to read aloud the item on the screen, as difficulties experienced with reading the item may indicate problems with the item. The child was then invited to select the response option that best reflected his or her answer on the five-point Likert-type scale presented underneath the item. Following response selection, the child was probed to give his or her personal interpretation of the item, and lastly, the child was asked to explain how he or she came to select the specific response. Respondents were requested to select their scaled response before they were asked to report on their thoughts concerning the item to avoid distortion of the normal question-response process. During the questionnaire development, the appropriateness of some of the terms used in the items in relation to children's comprehension skills was queried. An explanation of the meaning of these terms was requested from all child respondents during the interview. Follow-up probing questions were used to gain further information about respondents' interpretation of questionnaire items, and their response selection. Examples of probes that were used are; 'What does the term *X* mean to you?' or 'Can you repeat this sentence, but now in your own words?'. After each interview revisions were made to the items where needed, thereby progressively increasing the developmental suitability of the items (see also Pannekoek, Piek, Kane, & Hagger, 2014).

4.3 Results and Discussion

4.3.1 General Questionnaire Adaptation

Items of the selected existing questionnaires underwent wording and response format changes, taking into account children's developing capabilities. Care was taken to keep deviations from the original item content to a minimum. A key aim was to keep the items as concise as possible, without losing item content.

All items were modified to explicitly refer to the physical education context. In the original questionnaires, the items make no specific reference to the context. Previous research has found that 8 to 12 year old children experience difficulties with the context specificity of their responding (Koskey et al., 2010). In response to this, the wording order of the items was changed, moving the conditional statement (physical education setting) to the start of the item (see Pannekoek et al., 2014). This is considered a more developmentally appropriate order (Woolley et al., 2004), priming the respondents to keep the physical education context in mind, prior to advancing to reading the remainder of the item.

The items of all three questionnaires were phrased positively, as it has been reported that negatively-worded items are problematic in research involving children (Borgers et al.,

2000; Marsh, 1986, 1996). Exceptions were the items tapping the avoidance goal construct, as avoidance goals are inherently negative in character (Elliot & McGregor, 2001). Careful attention was paid to children's interpretation of the avoidance goal items in the pilot-testing, in order to be able to pick up any issues resulting from the negative item-wording.

4.3.1.1 Response scale selection.

The response scale of all three questionnaires was adapted. While for the final questionnaires four-point scales were preferred (see Chapter 5), for the purpose of the pilot-testing a five-point scale was selected. The neutral midpoint was used to evaluate item performance, as midpoint response selection may be indicative of possible issues with the item (see Kulas & Stachowski, 2013). The verbal anchors labelling the response options in the AGQ-R, PLOC and PNSE were followed; "strongly disagree" (1), "disagree" (2), "agree" (4), and "strongly agree" (5). The midpoint of the scale was labelled "don't know" (3), to best represent the purpose of this response option in the pilot-testing. Midpoint selection during the pilot-testing was followed with additional questions, to gain insight into the underlying reason for this response.

All options on the response scale were labelled verbally, as well as visually. A 'pie' chart image was used to illustrate the verbal labels, reflecting the degree of agreement with the item (see Figure 4.1). Previous self-report questionnaires for children have used pictures (e.g., smiley faces) to illustrate Likert-type scale response options. Some studies suggest that the addition of pictures to response scales facilitates the response process in young children (Eder, 1990; Harter & Pike, 1984), whereas other studies have argued that the use of pictures can create confusion (Davis-Kean & Sandler, 2001; Dockerell, Lewis, & Lindsay, 2000; Marsh, Craven, & Debus, 1991; Marsh, Ellis, & Craven, 2002). Images such as smiley faces may convey emotional content (e.g., see Chambers & Craig, 1998). For example, children may select the answer option accompanied by a 'happy face' image, because they interpreted this response option as good or appealing. Similarly, the use of circles of increasing size accompanying response options that represent increasing agreement with the item (e.g., small circle for 'never true', big circle for 'always true'; see Riley et al., 2004) may lead to a response selection bias. The response options with larger circles may be selected more frequently compared to smaller circles, as a result of children interpreting bigger as better. The 'pie' chart image was regarded as a neutral way of representing the answer options, minimising room for misinterpretation.

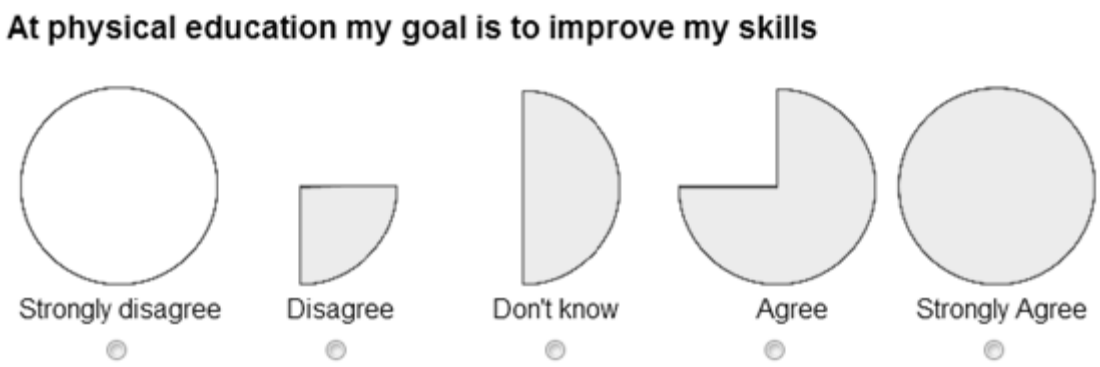


Figure 4.1. Example of the response scale.

In the following sections, questionnaire specific adaptations will be outlined. Both adaptations made prior to pilot testing and adaptations in response to pilot-test results will be discussed, followed by some more general qualitative insights derived from the pilot-tests (see also Pannekoek et al., 2014).

4.3.2 Adaptations to the AGQ-R

4.3.2.1 Initial adaptations to the AGQ-R.

To apply the AGQ-R to the physical education setting, some changes were made to the items (see Table 4.2). The reference to course content and material in AGQ-R items was replaced by a reference to skills, to better suit the physical education context. The questionnaire's mastery approach and avoidance goal items refer to the striving to 'master', 'understand', and 'learn', or to avoid a lack thereof. Even though understanding is likely to play a role in physical education settings, its role was expected to be less pronounced than in academic settings, particularly in younger populations. It was, therefore, decided to focus on the 'learning' aspect of mastery goals. The term 'master' was thought to be a difficult term for children to understand, and was replaced by 'learn' in the items. This was also thought to prevent dichotomous thinking. Children are unlikely to map their mastery of physical skills on a continuum, but instead, are likely to regard themselves as able or unable to perform a skill.

As the focus was on learning and not on understanding, an item was added tapping the avoidance of personal performance that is worse than previously "At physical education I want to avoid performing worse than I previously have". Understanding is often irrevocable, once an understanding has emerged, this is unlikely to be lost. However, particularly in physical activity settings, a learned skill can deteriorate, causing performance to decline.

While all AGQ-R mastery items focus on potential (a more task-based focus), a focus on (a lack of) improvement (intrapersonal standard) was hereby added, in line with Elliot and Thrash' (2001) multidimensional definition of mastery avoidance goals (see Hulleman et al., 2010). In this avoidance goal item a clear emphasis is placed on the personal reference point with regards to performance, to avoid confusion with performance avoidance goal items. Even though a focus on both task-based and intrapersonal standards decreases conceptual unity, both were considered relevant particularly in physical education settings, and both were considered similar enough to belong to the same subscale.

Based on the primary school teacher's recommendation, any reference in the original items to 'my aim is to' was replaced by 'my goal is' or 'I want to' to ensure that all children adequately comprehend the items. Apart from this adaptation, the items of the AGQ-R tapping performance approach and avoidance goals remained largely unchanged at this stage.

Table 4.2. Adaptations to the AGQ-R

AGQ-R	Start pilot tests	final C-AGQPE
Mastery approach goals		
My aim is to completely master the material presented in this class.	At physical education I want to fully learn the skills	At physical education my goal is to do better than I have before
I am striving to understand the content of this course as thoroughly as possible	At physical education my goal is to learn skills as well as possible	At physical education my goal is to improve my skills
My goal is to learn as much as possible	At physical education I want to learn as much as possible	At physical education I want to learn as much as possible
Mastery avoidance goals		
My aim is to avoid learning less than I possibly could	At physical education I want to avoid performing worse than I previously have	At physical education my goal is not to do worse than I have before
I am striving to avoid an incomplete understanding of the course material	At physical education my goal is to avoid only partly learning skills	At physical education I want to make sure I do not lose my skills.
My goal is to avoid learning less than it is possible to learn	At physical education I want to avoid missing out on learning anything	At physical education my goal is not to do worse than last time

Performance approach goals		
My aim is to perform well relative to other students	At physical education I want to do better than other kids	At physical education I want to do better than other kids
I am striving to do well compared to other students.	At physical education I want to do well compared to other kids	At physical education I want to do better than the average kid
My goal is to perform better than the other students.	At physical education my goal is to perform better than others	At physical education my goal is to perform better than others
Performance avoidance goals		
My aim is to avoid doing worse than other students	At physical education I want to avoid doing worse than other kids	At physical education my goal is not to do worse than other kids
I am striving to avoid performing worse than others	At physical education I want to avoid performing worse than others	At physical education I want to make sure I do not perform worse than others
My goal is to avoid performing poorly compared to others	At physical education my goal is to avoid doing poorly compared to others	At physical education my goal is not to do poorly compared to other kids

4.3.2.2 Adaptations to the AGQ-R during pilot tests.

Overall the interviews revealed that the participants adequately understood the concept 'goal'. As one child reported; "A goal is what you stick your mind to, what you're trying to do". No major issues emerged with the mastery and performance approach goal items during the pilot-testing.

Cognitive interviews identified issues with the assessment of avoidance goals. Firstly, several children were found to experience difficulties comprehending the term 'avoid'. In response to this, the wording of the avoidance goal items was revised from "I want to avoid…", to "I want to make sure I do not …" or "my goal is not to…". Some respondents had problems deciding on which end of the Likert-type scale to respond, which may have been a result of the negative wording of the items. Also, respondents often appeared to interpret the avoidance goal items as if they represented approach goals. For the most part, children's rationale for their response selection on performance avoidance goal items, such as "At physical education I want to make sure I do not perform worse than others", represented a focus on positive, rather than negative possibilities, such as; "Yes, I want to do better than other kids". Similar issues were encountered in a qualitative study involving senior high school students (Urdan & Mestas, 2006), indicating that difficulties with the measurement of avoidance goals, without inadvertently tapping approach goals, are not limited to younger children. Such measurement issues may be partially responsible for the high correlation between approach and avoidance goals (e.g., Elliot & Murayama, 2008), and the relatively high levels of avoidance goal endorsement (e.g., Moreno, Gonzalez-Cutre, Sicilia, et al., 2010; Wang, Hagger, et al., 2009) that have previously been identified.

Partly as a result of such concerns, the applicability of the mastery avoidance goal construct to the child population has previously been questioned (Cumming et al., 2008; Sideridis & Mouratidis, 2008). Nevertheless, a recent study involving children aged 12 years and older provided evidence for the empirical distinguishability of performance approach and avoidance goal constructs (Murayama, Elliot, & Yamagata, 2011). The interview reports of the present study indicated that avoidance goals were evident in children between the ages of 8 and 12 years. For example, in response to a performance avoidance goal item, an 11 year old participant stated: "I don't like to be flogged, don't want to be at the back of the pack, so I try to avoid doing worse". The child's focus on the negative possibility of being the worst is indicative of an avoidance goal. In the youngest children included in the current study,

reports of performance avoidance goals were also observed, as illustrated by the statement of an 8 year old respondent: “I’ll try not to look bad on stage”.

The content of the mastery avoidance goal items in the revised measure was congruent with Elliot and Thrash’ (2001) multidimensional definition of these goals, tapping the goal not to fall short of task mastery and the goal to avoid losing competence. Children’s reports during the pilot-testing suggested that in the present sample and setting only the latter type of avoidance goal was relevant to children’s achievement strivings. The mastery avoidance goal item focussing on intrapersonal rather than task-based competence that was added during the initial adaptations appeared to be relevant to children’s aims in physical education, and did not cause major issues during the interviews. On items tapping the goal not to fall short of task-mastery (task-based goal), respondents typically reported that they always wanted to learn more, without showing doubts as to whether they would be able to. In physical education settings, particularly at primary school age, children are unlikely to have learned all there is to learn. Declines in competence, on the other hand, represent a pertinent possibility in physical education, with factors such as fitness playing a role in children’s ability to effectively execute tasks. Based on the interview reports, only those items tapping the striving to avoid declines in competence were retained.

Overall, the pilot-tests seemed to indicate that both avoidance goals can be endorsed by children between the age of 8 and 12 years, but that the assessment of avoidance goals is problematic. The identified measurement issues stressed the need for revisions of the avoidance goal items. The items tapping these inherently negative goals could not be re-worded positively without losing their original meaning. Consequently, the question-response format was adapted to facilitate children’s responding to these negatively worded items. Previous research has experimented with different response formats to be able to tap avoidance goals. For example, Van Yperen (2006) contrasted approach goal items with avoidance goals items to accentuate the goals’ difference in orientation. With this method only an individual’s dominant goal can be revealed. However, individuals can simultaneously endorse multiple goals (Elliot, 1999; Pintrich, 2000b). The concurrent effect of an individual’s dominant and non-dominant goals cannot be accounted for with the application of goal-contrasts. In response to this issue, Law et al. (2012) utilised a grid approach, where an approach goal statement is placed on the vertical of the grid, and an avoidance goal statement on the horizontal, or vice versa. Respondents rate their endorsement of both goals by finding the right coordinates on the grid. With this methodology, approach and avoidance goals are contrasted while a separate score is obtained for the endorsement of both goals. This

methodology was regarded as promising, however, too complex for the age of the population targeted in the present study. Consequently, an adapted version of the grid approach was tested, breaking the response process up in two steps. The child respondents were first asked to choose between a parallel approach and avoidance goal statement, e.g. “At physical education my goal is not to do worse than I have before” versus “At physical education my goal is to do better than I have before” (see Figure 4.2). This contrast aimed to clarify the approach-avoidance distinction, and preceded avoidance goal items only. In a subsequent item respondents were asked to rate their agreement with the avoidance goal statement of the preceding dichotomous item, on a Likert-type scale.

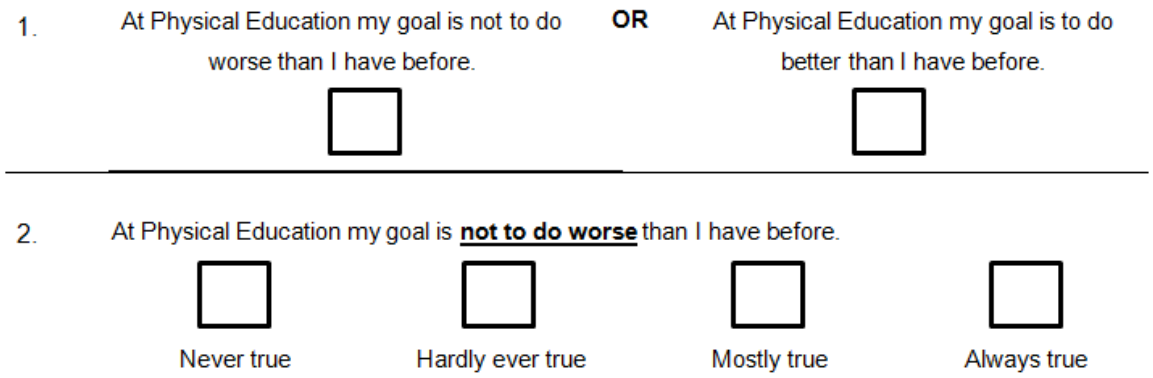


Figure 4.2 Revised avoidance goal item format

The revised format of the avoidance goal items was evaluated in the final five pilot-tests. Respondents experienced no difficulties with the format, however, some approach oriented rationales for response selection on the Likert-type avoidance goal items were still given. Close attention was therefore paid to the avoidance goal items in subsequent quantitative phases of this research, particularly Phase Two, which was expected to provide more clarity on children’s ability to make the approach-avoidance distinction.

The interviews signalled an issue with the item tapping performance approach goals “At physical education I want to do well compared to other kids”. Performance-approach goals represent the aim to outperform others. The pilot-testing revealed that ‘doing well’ was not consistently construed as such, and some participants gave interpretations that reflected equal performance. When both approach and avoidance goals are assessed, such rationales are problematic, as theoretically performing equally implies goal attainment in the case of avoidance and not approach goal endorsement. To accentuate the notion of performance approach goals as outperforming others, the reference to ‘doing well’ was replaced by ‘doing better’ (see Table 4.2).

Performance goal items, as discussed in the previous paragraph, rely on children's use of social comparison. Researchers have suggested that social comparison, which is typically regarded as the main characteristic of performance goals, is only one facet of performance goals. They propose that this facet is to be differentiated from outcome and ability components (Brophy, 2005; Grant & Dweck, 2003). Brophy (2005) has argued that in academic settings social comparison does not generally play a large role in children's achievement goals. The pilot tests, however, highlighted that goals involving social comparison are pertinent to pre-adolescents' experiences in physical education, as exemplified by the following statement by a participant; "I don't want to be left behind. I want to do as well as other kids. The average kid I would like to be as good". Children's use of social comparison may be facilitated by the public and physical nature of the physical education setting, with clearly observable, and thus comparable, performance cues. These findings support the decision to focus on social comparison in all items tapping performance goals, following the AGQ-R.

Children endorsing performance goals rely on a normative standard for competence-based evaluations (Nicholls, 1989), which in physical education largely involves peers. Besides functioning as a standard for competence-based evaluations, pilot-tests showed that peers play an additional role in relation to children's achievement goals. The interviews suggested that the respondents' goal endorsement was influenced by the presence of peers, and related social concerns. Children's reports often indicated that they considered the endorsement of performance approach goals to be inconsiderate towards peers and socially unacceptable, as illustrated by the following account: "It just makes me a show off if I'd do better than others". Outperforming others was also regarded as a risk factor for being picked upon by peers. A 9 year old girl stated: "Sometimes I want to be the best, other times I don't because they'll just be teasing me, I just want to enjoy it". For the same reason, other children conveyed a desire to improve their physical skills: "I want to get better because I don't want to be bullied at school, laughed at, because I'm crap at physical education". Overall, children seemed to prefer performing on an average level: "I want to do as well as other kids. The average kid, I would like to be as good". In their qualitative evaluation of performance goals in high school students, Urdan and Mestas (2006) also identified respondents' concerns about 'standing out in the crowd'. In the present study, children's reported preference to conform to the average seemed to reduce their likelihood to endorse performance approach goals. This might be the result of a contemporary trend at schools, emphasising equality of all students and eliminating competition. Furthermore, it cannot be discounted that socially desirable

responding played a role in these findings. In response to this tendency to conform to the average, for one of the performance approach goal items the point of reference was changed from the more general ‘others’ to ‘the average child’. This was done for an approach goal item only, as only the approach oriented strivings appeared to be affected by children’s tendency to want to conform to the average. With respect to avoidance goal items, children appeared to focus on not being the worst, independent of peers’ average performance.

4.3.3 Adaptations to the PNSE

4.3.3.1 Initial adaptations to the PNSE.

Deci and Ryan (2000) argued that the role of the three psychological needs may vary depending on the context’s functional significance. In response to this, the PNSE items were adapted to best represent the needs in a physical education setting. In contrast to exercise, physical education is generally compulsory at pre-adolescent age. Autonomy items from the PNSE that specifically refer to decisions and choice (reflecting decisional autonomy) were, therefore, removed from the list. PNSE items like “I feel like I am the one who decides what exercises I do” were expected to be less relevant to compulsory physical education classes. A focus on affective autonomy, which concerns the absence of perceptions of pressure, was taken (see Houlfort, Koestner, Joussemet, Nantel-Vivier, & Lekes, 2002b). An example of a revised item that does not imply choice per se is; “At physical education I feel like I can exercise in my own way”. Even when children are not free to decide on the activities they want to partake in, they may experience autonomy in relation to the execution of the activities, in the absence of pressure and anxiety about their performance.

Similarly, the focus of the PNSE relatedness items may not be equally relevant to physical education settings. PNSE items focus on feeling connected and attached to others. In contrast to exercise settings, where individuals often choose their exercise partners, physical education generally involves group activities with changing group members, which children do not always get to choose themselves. In line with this, the items tapping the need for relatedness were adapted to concentrate on feeling accepted and part of the group rather than close relationships (see Table 4.3). The reference to ‘exercise companions’ was changed into ‘other kids’.

The subscale tapping the need for competence remained largely unchanged, with some small changes to the items’ wording. As for the other two subscales, the vocabulary of the items was simplified, to fit children’s developing language skills (see Table 4.3). For example, ‘challenging exercises’ was changed into ‘hard activities’.

4.3.3.2 Adaptations to the PNSE during pilot tests.

During the pilot-testing, some issues with the wording of items tapping the need for autonomy were picked up. Children experienced difficulties understanding the item, “At physical activity I have a say in choosing the activities that I do”, which was directly derived from a PNSE item. One respondent clarified: “I have never heard those four words [I have a say] in the same group ever in my life”. The item was changed into “At physical education I feel I can say what I would like to do”. Furthermore, the items’ phrasing ‘I feel free to’ appeared to be difficult to understand for some children, and was simplified into ‘I feel like I can’ (see Table 4.3).

Despite these minor issues, the pilot-test results supported the effectiveness of the adapted autonomy items, focussing on affective autonomy. Several children reported perceptions of choice or contribution in relation to their physical education class. A certain level of autonomy was experienced by these children in their physical education class, despite its compulsory character. For example, one respondent reported “Sometimes we can persuade the teacher to do a different game the next lesson” and “we can mostly do the activities how we like”.

During the pilot tests some issues were also encountered with the adapted need for relatedness items, which content focussed on feeling part of the group and feeling accepted by others in the physical education class. The pilot-test interviews indicated that items referring to the underlying reasons for perceptions of relatedness such as “I am friends with the kids I do physical education with because we do it for the same reason” appeared to be inappropriate for use in pre-adolescent samples. This is illustrated by the response of an 11 year old child: “I don’t really read their mind at all, but I guess we are friends because of our friendship”. Such items were deleted from the list.

No major adaptations were intially made to the PNSE items tapping the need for competence. In some PNSE items an indication of magnitude is present, such as ‘hardest’. Such references were maintained in the adapted version of the subscale, for example; “At physical education I am able to do the hardest activities”. In their interview reports, children were often found to be hesitant to respond positively to such items, as exemplified by the following statement; “I don’t really think that I can do whatever activity, there might be an activity that I’ve never heard of before that I wouldn’t be able to do”. The same was observed for an item tapping the need for autonomy; “At physical education the activities we do are exactly what I like to do”, as a result of the item’s reference to ‘exactly’. It appeared that children focussed strongly on the indication of quantity or magnitude in these items. This

may reflect children's tendency to think specifically, and to lose sight of their overall orientations in physical education. To resolve this issue, any reference to quantity or magnitude was removed from the items, and efforts were taken to keep the items' wording as universal as possible.

Table 4.3. Adaptations to the PNSE

PNSE	Start pilot tests	final C-PNSPE
Need for competence		
I feel confident I can do even the most challenging exercises	At Physical Education I am able to do the hardest activities	
I feel confident in my ability to perform exercises that personally challenge me	At Physical Education I am good enough to do activities that seem hard	At physical education I feel good enough to do the activities that seem hard
I feel capable of completing exercises that are challenging to me	At Physical Education I can finish activities, even if they are hard	At physical education I can do the activities, even if they are hard
I feel like I am capable of doing even the most challenging exercises	At Physical Education I am good enough to do even the hardest activities.	
I feel good about the way I am able to complete challenging exercises	At Physical Education I feel good about how I can do hard activities	
I feel that I am able to complete exercises that are personally challenging	At Physical Education I can do activities that seem hard to me	At physical education I can do activities that seem hard to me

Need for autonomy

I feel free to exercise in my own way	At Physical Education I feel free to exercise in my own way	At physical education I feel like I can exercise in my own way
I feel free to make my own exercise program decisions	At Physical Education, the activities we do reflect my own choices	
I feel like I am in charge of my exercise program decisions	At Physical Education we exercise the way I want to exercise	
I feel like I have a say in choosing the exercises that I do	At Physical Education I have a say in choosing the activities that I do	At physical education I feel I can say what I would like to do
I feel free to choose which exercises I participate in	At Physical Education I feel free to do the things I like	At physical education I feel like I can do the things I like
I feel like I am the one who decides what exercises I do	At Physical Education the activities we do are exactly what I like to do	

Need for relatedness		
I feel attached to my exercise companions because they accept me for who I am	I like the other kids I do PE with, because they like me the way I am	
I feel like I share a common bond with people who are important to me when we exercise together	I feel close to the other kids in my class when we do Physical Education together	I feel close to the other kids in my class when we do physical education together
I feel a sense of camaraderie with my exercise companions because we exercise for the same reasons	I am friends with the kids I do Physical Education with, because we do it for the same reason	
I feel close to my exercise companions who appreciate how difficult exercise can be	At Physical Education I feel close to the other kids who can do what I can do	
I feel connected to the people who I interact with while we exercise together	I feel close to the other kids who I do Physical Education with	I feel accepted by the other kids I do physical education with
I feel like I get along well with other people who I interact with while we exercise together	I have fun with the other kids I do Physical Education with	I feel part of the group when I do physical education with the other kids in my class

Note. [a] Satisfaction of the need for competence. [b] Satisfaction of the need for autonomy. [c] Satisfaction of the need for relatedness. These constructs will be referred to as such in all following tables.

4.3.4 Adaptations to the PLOC

4.3.4.1 Initial adaptations to the PLOC.

Initially, items of the PLOC remained largely unaltered, as the vocabulary and content was considered suitable for the assessment of pre-adolescent children in physical education. Some minor changes were made to the items' wording (see Table 4.4).

4.3.4.2 Adaptations to the PLOC during pilot tests.

The pilot-test interviews indicated the need for some further revisions to the PLOC items. Children experienced difficulties reading aloud 'exciting'. In response to this, the item tapping intrinsic motivation "I take part in physical education because it is exciting" was revised into "I take part in physical education because I enjoy doing it". No other changes appeared to be required to the intrinsic motivation or identified regulation items based on the interview reports.

More issues emerged for the items tapping introjected regulation. The pilot-tests suggested that the introjected regulation item "I take part in physical education because I want the teacher to think I am good at it" needed revising. Respondents described their disagreement with this item as follows: "I do it [physical education] so I can show my mom how good I am" and "I don't even like my teacher". It appeared that some children were more concerned about the judgement of individuals other than their teacher, such as parents. The reference to the teacher in this item may limit its ability to identify all children who engage in physical education for introjected reasons. The item was changed into; "I take part in physical education because I want others to think I am good at it".

The pilot-tests revealed that children had difficulties understanding the introjected regulation item; "I take part in physical education because I would feel bad about myself if I didn't". Children's interpretation of the items was not consistently in line with the underlying theory. For example, respondents reported that they would feel bad about missing out on something that was fun, which has a more positive orientation than the experience of guilt that the item intended to tap. Also the item; "I take part in physical education because it bothers me when I don't" caused some issues, as children struggled understanding 'bothers me', The two items were consequently replaced by "I take part in Physical Education because I feel guilty when I don't". This item taps the theoretical focus of introjected regulation more explicitly. The avoidance of feelings of guilt can be expected to play a role in children's motivation in physical education, as guilt has been demonstrated to develop as early as the

Table 4.4 Adaptations to the PLOC

PLOC	Start pilot tests	final C-PLOC
Intrinsic Motivation		
I take part in PE because PE is fun	I take part in Physical Education because it is fun	I take part in physical education because it is fun
I take part in PE because I enjoy learning new skills	I take part in Physical Education because I enjoy learning new things	I take part in physical education because I like learning new things
I take part in PE because sport/PE is exciting	I take part in Physical Education because it is exciting	I take part in physical education because I enjoy doing it
Identified Regulation		
I take part in PE because I want to learn PE skills	I take part in Physical Education because I want to learn how to do new things	I take part in physical education because I want to learn how to do new things
I take part in PE because it is important for me to do well in PE	I take part in Physical Education because it is important for me to do well at it	I take part in physical education because it is important for me to do well
I take part in PE because I want to improve in PE	I take part in Physical Education because I want to get better at it	I take part in physical education because I want to get better at it

Introjected Regulation

I take part in PE because I want the teacher to think I'm a good student	I take part in Physical Education because I want the teacher to think I am a good student	I take part in physical education because I want others to think I am good at it
I take part in PE because I would feel bad about myself if I didn't	I take part in Physical Education because I would feel bad about myself if I didn't	I take part in physical education because I feel guilty when I don't
I take part in PE because I want the other students to think I'm good	I take part in Physical Education because I want other kids to think I am good	I take part in physical education because I want other kids to think I am good
I take part in PE because it bothers me when I don't	I take part in Physical Education because I feel bad when I don't	

External Regulation

I take part in PE because I'll get into trouble if I don't	I take part in Physical Education because I'll get into trouble if I don't	I take part in physical education because I'll get into trouble if I don't
I take part in PE because that's what I am supposed to do	I take part in Physical Education because that's what I'm told to do	

I take part in PE so that the teacher won't yell at me	I take part in Physical Education so that the teacher won't yell at me	
I take part in PE because that's the rule	I take part in Physical Education because that's the rule	I take part in physical education because that's the rule
	I take part in Physical Education because I have no choice	I take part in physical education because I have no choice
Amotivation		
I take part in PE but I don't see why we should have sport/PE	I take part in Physical Education but I don't know why we should have it.	I take part in physical education but I don't know why we should have it
I take part in PE but I really don't know why	I take part in Physical Education but I don't know why	I take part in physical education but I don't know the reason why
I take part in PE but I really feel I'm wasting my time in sport/PE	I take part in Physical Education but I feel I am wasting my time at Physical Education	I take part in physical education but I feel I am wasting my time at it

toddler years (Baker, Baibazarova, Ktistaki, Shelton, & van Goozen, 2012; Kochanska, Gross, Lin, & Nichols, 2002).

Concerning the items tapping external regulation, the item “I take part in physical education so the teacher won’t yell at me”, was deleted from the final list. Interviews indicated that it was not relevant to the experiences of all children. For example, a respondent stated; “I have never heard our teacher yell, so that wouldn’t be true for me”. No other issues were encountered with the items of this subscale, nor the amotivation subscale.

4.3.5 General Observations Pilot-Test Interviews

4.3.5.1 Question-response process.

All child respondents were capable of successfully completing the three questionnaires tailored specifically to their developing capabilities. Children did not experience any difficulties reading aloud the questionnaire items, with the exception of the two 8 year old participants. Words such as ‘performance’, ‘exciting’, and ‘practice’ appeared challenging for these young participants. No indication emerged that the 8 year old respondents experienced difficulties during the response-selection process. However, pilot-test assessments were one-on-one, which ensured the quality of the participants’ responses. When questionnaires are completed without support, children who encounter difficulties reading the items may be less motivated to respond to the items. The present sample was too small to draw firm conclusions on the suitability of the questionnaires for use with 8 year old children, an issue that was beyond the scope of the present study. However, inclusion of 8 year olds in the pilot tests served its purpose by confirming that even these younger children were able to respond to the items in line with the underlying theories. The content of the items appeared relevant to children even before they reach the pre-adolescent period. The encountered reading difficulties did, however, reinforce the value of performing all assessments in small groups. If pre-adolescent children (9-12 years) at the lower end of the spectrum of reading ability were to experience difficulties reading or understanding the items, the use of small groups would allow sufficient opportunity to ask questions.

Without exception, the respondents used the computer program without problems, and enjoyed the computer-based assessment. No difficulties were experienced with the use of the five-point Likert-type scale by any of the participants. Examination of the response selection indicated that all participants used the whole range of response options over the course of the questionnaire administration, with the exception of one 9 year old respondent. Furthermore, all children were capable of adequately explaining the meaning of the ‘pie chart’ image accompanying the response scale. An 8 year old boy elucidated: “This one [pie chart] is

empty because it means no I don't like it, and when it's full that means it's full of yes". Children indicated that the images assisted them in their response selection and made the questionnaire look appealing. Nevertheless, respondents conveyed that they did not need the images in order to derive their response. As the addition of images to the response scale was never reported to negatively impact upon response selection, they seem to provide a valuable addition to the response scale.

The interview reports indicated that, for the most part, children's scaled responses accurately reflected their rationale for the response selection. This suggests that children were able to adequately use the response scale to reflect their personal orientations. However, their rationale was not always in line with the item's theoretical meaning. As outlined above, items were revised based on such misunderstandings. Where item-revision seemed impossible without losing the original content, items were deleted. Also, in some instances, item revisions resulted in two items being virtually identical. In such cases, one of the items was deleted.

An issue regarding the pilot-testing process that was picked up, concerned children's ability to describe constructs or items in their own words. When asked to rephrase an item in their own words, children were often found to simply restate the item, only changing the order of the words. A similar tendency was observed by Woolley and colleagues (2004) in their cognitive pre-testing interviews with primary school students. The use of follow-up and probing questions appears essential to gain insight into children's own interpretations and related thoughts.

4.3.5.2 Context specificity.

Issues with context specificity can limit the validity of self-report questionnaires targeting a specific setting. In initial stages of the pilot-testing, some issues with the context specificity of children's responses emerged, with children referring to their participation in sport outside of school, or other school subjects. For example, a 9 year old boy stated: "I take part in activities because I like learning things that I never learned, I like getting more interesting words in my writing". To facilitate children's focus on physical education, this context was explicitly emphasised at the start of the pilot-tests, physical education was referred to at the start of all items, and reminders of the context were presented throughout the assessment. These prompts appeared to support children's sustained focus on physical education, as no difficulties emerged in later pilot-tests.

4.3.5.3 Generality of thinking.

While initially some children experienced difficulties focussing on the appropriate context, other respondents were found to have a tendency to think too specifically within the physical education context. For example, an 11 year old boy disagreed with the mastery approach item “At physical education I want to learn as much as possible” for the following reason: “Sometimes the teacher teaches us differently from what I know, so I don’t really want to learn it”. The boy’s interview reports indicated that he endorsed mastery approach goals, but due to his focus on a specific scenario, mastery goal endorsement was not reflected in his response to this item. As children tend to be very literal in their interpretation of questionnaire items, and focus on specific events, skills, or memories, the need for clear definitions in self-report items for children has been emphasised (Bell, 2007; Borgers & Hox, 2000; Eddy et al., 2011). It is important, then to emphasise to participants that they are expected to respond in accordance with their overall orientations toward physical education.

An overarching finding was that the motivational orientations of a large number of children focussed on the future. This is illustrated by statements such as “I wanna learn how to do things when I’m older” and “I always want to learn as much as possible, as it might become handy in my life”. Similarly in the academic domain, Urdan and colleagues (2001) found that students often reported long-term, utility-value reasons for their motivational orientations.

4.3.5.4 Repetition of items tapping the same construct.

A final issue that arose during the pilot-testing concerned the inclusion of multiple items tapping the same construct. Due to the simplification of the items from the original questionnaires, the degree of similarity between the items within a subscale increased. Respondents showed signs of boredom due to the repetition of what they perceived to be “the same questions”, even though items tapping the same construct were never identical. “Haven’t I just done that one?” was a commonly encountered response during the interviews. However, the use of a set of different items tapping the same construct is recommended with questionnaire-based assessment (e.g., Nunnally, 1978), as it reduces the measurement error, increasing the questionnaire’s reliability. To facilitate children’s motivation to accurately respond to the items it was decided to randomise the presentation order of the items of the three adapted questionnaires, as recommended by Borgers and Hox (2001). This allows for more items tapping other constructs, and thus, more time, between parallel items. Furthermore, for some subscales more than three items were found suitable for use in the

final lists. To minimise the demand on children's concentration span, the three items that performed best during the pilot tests were selected to represent each subscale. This was done by choosing between items with very similar content, and only minor differences in wording.

4.4 Summary

In this first phase of the research qualitative methods were adopted to determine optimal methods to survey children about their motivational orientations in physical education. Three existing self-report questionnaires were selected, and consequently adapted for use in child populations. In motivational research child and adult samples have often been approached in an identical fashion. Generalisability of self-report questionnaires developed for use in youth and adults to younger populations has been largely neglected. The present pilot-tests indicated that child respondents cannot be treated the same way as adults.

Researchers have recognised that individuals may attach different meanings to motivational constructs, or may differ in the underlying reasons for their motivational orientations, such as achievement goals (Urdan & Mestas, 2006), amotivation (Vlachopoulos, Katartzi, & Kontou, 2013), and intrinsic motivation (Vallerand, 2001). These individual differences may in turn result in inter-individual differences in the effects of particular motivational orientations on other motivational constructs and behavioural and affective outcomes. Insight into the underlying thought processes are thus needed to ensure that the constructs assessed are interpreted consistently, and subsequently, to discover clear patterns of interrelationships in motivational orientations. The cognitive interviews provided a deeper insight into children's own reports of the meaning and relevance of the constructs tapped by the questionnaires. By the end of the pilot-testing phase of the research, consistency appeared to have emerged in children's interpretation of the items. This allows the research to move a step closer to its ultimate goal; the investigation of the interrelationship of the motivational constructs.

The questionnaires that resulted from this first phase of the study were labelled the Children's Achievement Goal Questionnaire for Physical Education (C-AGQPE: see Appendix C), the Children's Need Satisfaction in Physical Education Questionnaire (C-PNSPE: see Appendix D), and the Children's Perceived Locus of Causality scale (C-PLOC: see Appendix E). Note that these questionnaires use 4-point Likert type scales, as such scales have been reported to derive the best results when surveying children (Borgers et al., 2004).

Chapter 5: Phase Two: Psychometric Evaluation of the Questionnaires

5.1 Introduction

Phase Two of the study evaluated the psychometric properties of the three questionnaires that were developed in the first phase, in a larger sample of pre-adolescent children. For all three questionnaires, the C-AGQPE, the C-PNSPE and the C-PLOC, the fit of the factor structure on which they were based was tested. With this analysis the aim was to determine whether the factor structure of the original questionnaires could be replicated in a sample of pre-adolescent children, in a physical education setting. Even though an attempt was made to keep modifications to the original questionnaires to a minimum, the factor structure cannot be assumed to be equivalent for the revised questionnaires without testing. Confirmation of the factor structure, and the adequacy of the three questionnaires' psychometric properties is needed before the questionnaires can be applied to investigate children's motivation in physical education, the main aim of the overall research.

5.2 Method

5.2.1 Participant Recruitment

Participants for the second phase of the research were recruited from co-educational public primary schools in the Perth metropolitan area, Western Australia. Participation invitation letters, including information on the research (Appendix G), school consent forms (Appendix J) and a reply paid envelope to return the consent form were sent to the principals of ten schools at a time. These schools were randomly selected from a list of all eligible schools. Ten days after the invitation letters were sent, schools that had not yet responded were followed up with a phone call. If schools showed interest during this phone call, but had not yet responded within the next 10 days, a follow-up call was done. As schools consented, parent and child information packs (see Appendix H and I for the respective invitation letters, and Appendix K and L for the respective consent forms) were delivered to the school, to be distributed to all children in the targeted age-range (9-12 years). Parents were also asked to complete the demographics questionnaire (Appendix F). Parents were invited to return the forms to the class teacher in the enclosed envelope to ensure confidentiality. Returned parenting and demographic questionnaires were assigned an identity number. Schools were provided with reminder notes to be handed out to the children after the invitation letters were distributed. A brief text promoting the research was also provided to the schools, to be placed in their newsletter. Seven recruitment rounds (approaching ten schools at a time) were needed to reach the targeted number of participants.

5.2.2 Measures

5.2.2.1 Parent developmental questionnaire.

The respondents' parents completed a questionnaire on family demographics and identifying any reading difficulties of their child (see Appendix F).

5.2.2.2 Children's questionnaires.

Participants completed the three questionnaires developed in Phase One of the study. All items were responded to on four-point Likert-type response scales, with response options ranging from "*strongly disagree*" (1) to "*strongly agree*" (4). In the pilot-tests described in Chapter 4, five-point scales were applied. Such scales were, however, applied for item-evaluation purposes only. Four-point likert-type scales have been found to elicit optimal results when surveying children (Borgers et al., 2004). On such scales, children have to choose their position with respect to the issue presented in the item, and cannot apply satisficing strategies by simply selecting the midpoint. The subscales of all three questionnaires contained three items, tapping the distinct constructs forwarded by self-determination theory and achievement goal theory. Subscale scores were derived by averaging the corresponding item scores.

5.2.2.2.1 The Children's Achievement Goal Questionnaire for Physical Education (C-AGQPE). This nine-item questionnaire based on the AGQ-Revised (Elliot & Murayama, 2008), was applied to assess children's achievement goals. An alternative response format was applied for the avoidance goal items; six dichotomous items contrasting corresponding approach and avoidance goals complement the six Likert-type items tapping avoidance goals. The direct goal-contrasts within the dichotomous items were hoped to elucidate to the respondents the difference in character of approach and avoidance goals before they proceed to the related Likert-type item. The dichotomous items are applied purely to assist children's responding to the Likert-type items. Data derived from these items were not used in the statistical analyses.

5.2.2.2.2 The Children's Need Satisfaction in Physical Education questionnaire (C-PNSPE). This questionnaire tapping children's need satisfaction in physical education was developed based on the PNSE (Wilson, Rogers, et al., 2006). Minor revisions were made to the PNSE subscale tapping the need for competence, as described in Chapter 4. In contrast, to ensure the questionnaire's applicability to physical education, the subscales tapping the need for autonomy and relatedness underwent more significant revisions. In response to the limited autonomy that is inherent to the compulsory character of physical education, items tapping the need for autonomy were selected to focus on affective rather than decisional

autonomy. Relatedness need satisfaction items focussed on children's feelings of being accepted by peers, and feeling part of the peer-group in the class.

5.2.2.2.3 The Children's Perceived Locus of Causality questionnaire (C-PLOC; Pannekoek et al., 2014). This questionnaire based on the PLOC (Goudas et al., 1994) was administered to assess children's motivational regulations in physical education. The questionnaire's items largely resembled those of the original PLOC, with minor revisions to some items.

5.2.3 Procedure

Prior to participant recruitment, approval from the University's Human Research Ethics Committee and the state's Department of Education was obtained. Groups of five participants at a time completed the three questionnaires, presented to them on digital tablets using the Qualtrics™ online survey software. The administration of the avoidance goal items was paper-based, due to the alternative response format. Previous research has indicated the equivalence of item-response and reliability when comparing web-based and paper-based questionnaire administration in adults (Gwaltney, Shields, & Shiffman, 2008; Ritter, Lorig, Laurent, & Matthews, 2004; Vergnaud et al., 2011). Also in children (8-13 years) research has found that respondents provide the same information on online questionnaires and paper-based versions (Young et al., 2009). Another study involving 8 to 14 year old children found respondents had lower overall scores on a paper based mental health survey compared to the online equivalent, however, differences at the item level were virtually non-existent (Patalay, Deighton, Fonagy, & Wolpert, 2014). Based on such findings, the difference in assessment format of the avoidance goal items was not expected to cause bias in the data.

Questionnaire administration took place during school hours, and in quiet classroom conditions. All participants were allocated their personal identity code, and the questionnaires were completed anonymously. The purpose of the study was explained to participants, and they were instructed to respond honestly. It was emphasised that there were no right or wrong answers, and participants were made aware of their right to withdraw from the study at any time without negative consequences. Completion of the three questionnaires took respondents approximately half an hour.

5.2.4 Data Analysis

The psychometric properties of the C-AGQPE, C-PNSPE, and C-PLOC were evaluated individually using the following procedure. Firstly, the data were inspected for violations of multivariate normality using the Mardia's normalised estimate of multivariate kurtosis provided in the

EQS output. A coefficient exceeding 5.00 was considered to indicate multivariate non-normality of the data (Bentler, 2005). To investigate multicollinearity in the data, inter-item and inter-factor correlations were evaluated. Inter-item correlation coefficients exceeding .90, and inter-factor correlation coefficients exceeding .80 were considered suggestive of multicollinearity (Hair, Anderson, Tatham, & Black, 1998; Hair, Black, Babin, Anderson, & Tatham, 2006). Participants were recruited from different schools, and to detect possible dependencies in the data based on school membership a linear mixed models procedure was applied using SPSS version 19 (IBM). Intra class correlations (ICC) greater than or equal to .10 indicate intra-group dependencies (Lee, 2000).

To test the adequacy of a hypothesised factor structure in explaining the covariances among items of the three questionnaires, for each questionnaire a CFA was conducted using the EQS software (v. 6.2; Bentler, 1995). A maximum likelihood estimation method was applied. This estimation method is robust for departures from normality, especially if the sample is large (West, Finch, & Curran, 1995). Each item was allowed to load only on the latent variable to which it was hypothesised to pertain. To define the metric of the latent variables, one of their factor loadings was randomly fixed to unity. The error terms associated with the indicators, the variances of the latent variables, and the correlations between the latent variables were freely estimated. Residual error terms were not correlated in the factor analyses.

Model fit was evaluated based on a combination of fit indices; the comparative fit index (CFI), the standardised root mean square residual (SRMR), and the root-mean square error of approximation (RMSEA). CFI values exceeding .95, and values below .08 and .06 for the SRMR and RMSEA respectively, indicate an acceptable fit (Hu & Bentler, 1999). Fit indices are indicators of the overall fit of the model to the data, and do not specify the misfit of individual items. Therefore, factor loadings of the individual items were also examined, with loadings of .40 or higher considered acceptable (Ford, MacCallum, & Tait, 1986). Alternative models were tested where the hypothesised model did not result in an adequate fit to the data. The chi-square statistic was used for the comparison of the fit of an alternative model with that of the originally hypothesised model (nested models). Conventionally, the chi-square statistic was also used for the evaluation of model fit, with a statistically nonsignificant chi-square at the $p < .05$ level as the criterion for accepting a model. However, the significance of the chi-square statistic is disproportionately affected by large sample sizes (> 200; Kline, 1998). In response to this, for the evaluation of model fit per se it was relied on the fit indices, as discussed. Discriminant validity was investigated using the Average

Variance Extracted (AVE) values. The AVE value represents the average percentage of variance that the latent variable is able to explain in the theoretically related indicators (Fornell & Larcker, 1981). For every latent variable, the square root of its AVE had to exceed its correlation with other latent variables to support discriminant validity (Chin, 1998a; Fornell & Larcker, 1981). As indication of variance in the items explained by the factors, the coefficient of determination, R-squared (R^2) was inspected. This coefficient is used to estimate practical significance by obtaining a percent of variance of one variable that is predictable from the other variables (see Grissom & Kim, 2005). Cohen (1988) suggested that R^2 values of .01 represent small effects, .09 medium and .25 large effects.

Bootstrap resampling analyses were conducted to confirm whether the model that was found to best describe the data could be replicated in simulated samples based on the original data. Random (bootstrap) subsamples were drawn from the overall dataset, with replacement, using the EQS software. This means that a respondent (i.e., his or her response set) is randomly sampled from the overall population, one at a time, with each respondent being replaced before the next is sampled. The model was re-estimated in each subsample, with a total of 5000 replications.

Following this, the correlation of age with the latent variables was investigated to complement the bootstrap resampling analysis in investigating the robustness of the model and to preclude possible effects of age on the results. The correlations with age establish the potential for age as a moderator. Due to the concern that statistical significance is relatively easy to obtain in bigger samples (e.g. $n > 100$), Cohen's (1988) criteria were applied to estimate the practical significance of the effect of age, where correlations of less than .10 are considered small, less than .30 considered medium and less than .50 considered large.

Lastly, the convergent validity of the latent variables was investigated based on composite reliability and AVE indices. Composite reliability is an alternative to the widely applied Cronbach's coefficient alpha (Cronbach, 1951), and is estimated using structural equation modelling. The two reliability indices can largely be used interchangeably (Peterson & Kim, 2013). Composite reliability was favoured in this case, as it acknowledges the possibility of heterogeneous item-construct relations, consequently producing a more precise estimate of reliability than Cronbach's alpha (Geldhof, Preacher, & Zyphur, 2013). The AVE is a summary measure of convergence among a set of indicators of a latent variable, and as outlined, represents the average percentage of variance that the latent variable is able to explain in the indicators (Fornell & Larcker, 1981). Convergent validity was considered supported when the composite reliability for each latent variable approached or exceeded .70

(Hair et al., 2006; Nunnally & Bernstein, 1994), and the AVE exceeded .50 (Barclay, Thompson, & Higgins, 1995).

In the 2 x 2 achievement goal theory, a definition and a valence component are crossed to define the four achievement goals. As a result, the structure that is hypothesised to underlie achievement goals is two-dimensional. To account for this, a different procedure was followed to evaluate the factor structure of the C-AGQPE. A multiple-indicator correlated trait-correlated method *(*CT-CM) model was applied to the data (Eid, Lischetzke, Nussbeck, & Trierweiler, 2003; Marsh & Hocevar, 1988). Such models are typically used to evaluate multi-trait multi-method matrices (Campbell & Fiske, 1959), in order to examine the convergent and discriminant validity of a set of measures. In a similar fashion, CT-CM models can be applied to evaluate the dimensionality of the achievement goal constructs as tapped by the C-AGQPE (see Figure 5.1). Correlations are estimated between the two valence latent variables (approach and avoidance) and between the two definition latent variables (mastery and performance), but not across the valence and definition latent variables (e.g. correlation between the approach and the performance factor). The fit of the CT-CM model was investigated using the same sets of fit indices and criteria that were applied to evaluate the model fit for the C-PNSPE and the C-PLOC.

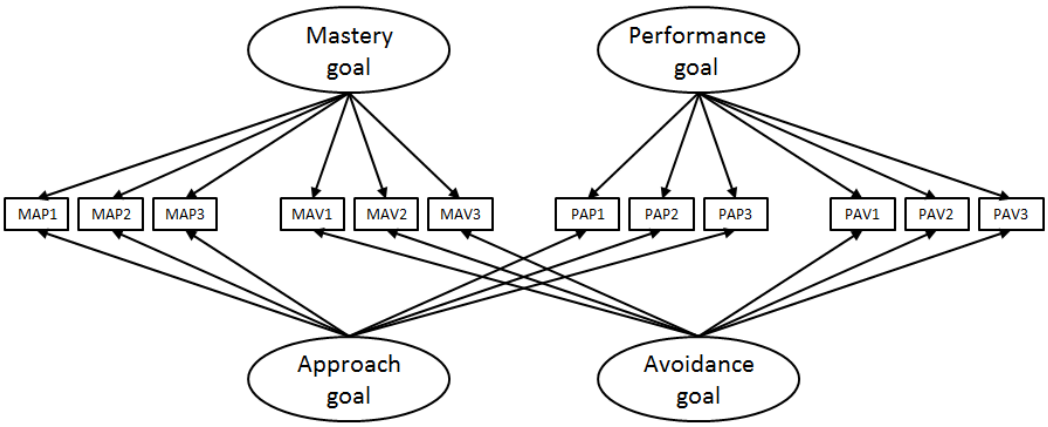


Figure 5.1. *CT-CM achievement goal model*

The pilot-study performed in Phase One of this study highlighted uncertainty regarding pre-adolescent children's ability to differentiate between all four achievement goals, and questionable validity of children's responses to the avoidance goal items. To gain a deeper insight into achievement goals in a 2 x 2 framework in pre-adolescent children in physical education, eight alternative models were examined. The target model was the CT-CM model. The eight alternative models included (1) a single-factor model, in which all

items were influenced by one factor, assuming uni-dimensionality of the items; (2) a two-factor model with mastery and performance factors, in which the valence of the goals was ignored; (3) a two-factor model with approach and avoidance factors, in which the definition of the goals was ignored; (4) a three-factor model with a universal mastery goal factor (ignoring this goal's valence), only taking the valence into account for performance goals, (trichotomous framework as described by Elliot (1999)); (5) a three-factor model with a universal performance goal factor (ignoring this goal's valence), only taking the valence into account for mastery goals; (6) a three-factor model with a universal approach goal factor (ignoring this goal's definition), only taking the definition into account for avoidance goals; (7) a three-factor model with a universal avoidance goal factor (ignoring this goal's definition), only taking the definition into account for approach goals; and lastly (8) a four-factor model in which the full 2 x 2 framework forwarded by achievement goal theory was estimated. To assess the fit of these eight alternative factor models, the procedure described for the C-PNSPE and C-PLOC was followed.

5.3 Results

5.3.1 Participants

Eighty co-educational public primary schools were approached, to request participation in the present research. .Of these schools, 23 schools (29%) provided consent for participation. Schools were located in areas representing a wide range of socio-economic status (SES), with an average SES-ranking of 3.07 (*SD* = 2.41, range 1-10). The SES-ranking was based on Australian Bureau of Statistics (ABS) census data from 2006. This classification ranges from 1 to 10, where 1 is indicative of the most advantaged 10%, and 10 of the most disadvantaged 10% governmental schools. The SES of schools who were invited, but declined participation was on average 3.96. Note that schools were randomly selected from the overall list of eligible schools.

A sample of 431 primary school children between the ages of 9 and 12 years was recruited. The original dataset, based on the responses of these participants, was screened for outlier cases prior to the analyses, as outliers may seriously bias results (Hunter & Schmidt, 1990). Mahalanobis distances were calculated to determine whether multivariate outliers were present in the overall database. Towards this end, SPSS version 19 (IBM) was used, and an alpha criterion of <.001 was applied. Three of the twenty participants identified as outliers based on this analysis were also indicated by their parents to have reading difficulties, and were deleted from the database. The reading difficulties of these children may have prevented

them from adequately understanding the questionnaire items. CFA's were conducted with and without inclusion of the remaining seventeen outlier cases, with practically identical results. Retaining outliers in the sample is advised in this case, as outliers can be a genuine representation of the population (Hair et al., 1998).

The final sample consisted of 429 children (*M* age = 10.72 y, *SD* = 1.06), including 215 girls (*M* age = 10.65 y, *SD* = 1.06), and 214 boys (*M* age = 10.79 y, *SD* = 1.06). The children were spread over different school years, as presented in Table 5.1. All participants were enrolled in compulsory physical education classes. In 82.3% of the cases, the mother completed the developmental questionnaire, and in 11.9% by the father. In the remaining 5.8% the child's grandparents or carers completed the questionnaire. For 56.41% of the participants, both parents were Australian, and in 19.11% one of the two parents was Australian. In all other cases, (24.48%) both parents were from a country other than Australia. The most common other countries were England and New Zealand. In 1.86% of all cases, both parents were from England, and 10.49% of participants had one parent from England. In 2.33% of all cases, both parents were from New Zealand, and 6.76% of all participants had one parent from New Zealand. For 88.6% of the participants English was the main language spoken at home, and in 1.2% English together with another language were combined at home. In the other 10.2% a foreign language was the main language spoken at home, with Korean (.9%), Tamil (.5%), Arabic (.5%) and Malayalam (.5%) being the most frequent.

Table 5.1. Participants per School Year (*N*=429)

	Age			
School Year	9 years (*n*=136)	10 years (*n*=120)	11 years (*n*=119)	12 years (*n*=54)
Missing	10 (7.4 %)	3 (2.5 %)	8 (6.7 %)	6 (11.1 %)
3	8 (5.9 %)	0	0	0
4	115 (84.6 %)	12 (10.0 %)	1 (.8 %)	0
5	2 (1.5 %)	102 (85.0 %)	18 (15.1 %)	0
6	1 (.7 %)	3 (2.5 %)	87 (73.1 %)	11 (20.4 %)
7	0	0	5 (4.2 %)	37 (68.5 %)

Preliminary inspection of the data suggested that children's responding was not significantly affected by school membership, as no dependencies associated with school membership were identified (ICC, see Table 5.6, 5.9 and 5.12). There was no evidence of

multicollinearity among the items based on inter-item correlations (see Appendix M) and interfactor correlations (Table 5.6, 5.9, 5.11). These indices will be reported for the models that were found to best fit the data, in the following sections providing the results per questionnaire. The results will be presented starting with the C-AGQPE, followed by the C-PNSPE and the C-PLOC respectively. Per questionnaire, the results course that resulted in the decision on the best fitting model will be outlined, which involved inspection of model fit indices, adequacy of factor loadings, and convergent and divergent validity.

5.3.2 Results C-AGQPE

Means and standard deviations of scores on the items are presented in Table 5.5 (see Appendix N for data). The CT-CM model was the first achievement goal model to be analysed. Based on this model, a Mardia's normalised coefficient of 28.84 was found for the C-AGQPE data, signifying multivariate non-normality of the data. In response to this, the Satorra-Bentler (S-B) robust maximum likelihood estimation method was employed for model estimation. The model fit for all nine models was consequently evaluated based on the S-B scaled chi-squared (λ^2) statistic (Satorra & Bentler, 1988), the robust RMSEA, and the robust CFI.

CFA results for the nine achievement goal models are displayed in Table 5.2. Three models were identified to satisfactorily describe the data; the CT-CM model, the 2 x 2 achievement goal model, and the trichotomous model in which separate mastery and performance approach goals, alongside a universal avoidance goal were distinguished. Because these three models were nested, their fit could be compared using chi-square difference tests. Comparing the CT-CM model and the 2 x 2 model, a significant statistical difference in model fit was found, ($\chi^2(8) = 29.48$; $p < .001$), suggesting that the CT-CM model provided a better fit to the data. Similarly, a significantly better fit to the data was found for the CT-CM model when compared to the three-factor model; ($\chi^2(11) = 39.09$; $p < .001$). Comparing the 2 x 2 model and the three-factor model, a significantly better fit emerged for the 2 x 2 model ($\chi^2(3) = 9.61$; $p < .05$).

Table 5.2. Model Fit of Nine CFA Models for the C-AGQPE (*N*=429)

Model	Df	S-B λ^2	CFI	RMSEA (CI)
MI CT-CM	40	64.89	.98	.04 (.02-.06)
1. One-factor	54	442.83	.69	.13 (.12-.14)
2. Two-factor: M-P	53	428.12	.70	.13 (.12-.14)
3. Two-factor: Ap-Av	53	170.17	.91	.07 (.06-.08)
4. Three-factor: M, Pap, Pav	51	194.78	.88	.08 (.07-.09)
5. Three-factor: P, Map, Mav	51	354.98	.75	.12 (.11-.13)
6. Three-factor: Ap, Mav, Pav	51	161.91	.91	.07 (.06-.08)
7. Three-factor: Av, Map, Pap	51	102.14	.96	.05 (.04-.06)
8. Four-factor: 2 x 2	48	91.00	.97	.05 (.03-.06)

Note. CFA = confirmatory factor analysis; M = mastery goals; P = performance goals; Ap = approach goals; Av = avoidance goals; Map = mastery approach goals; Mav = mastery avoidance goals; Pap = performance approach goals; Pav = performance avoidance goals

5.3.2.1 CT-CM model.

For the CT-CM model, factor loadings were found to be statistically significant ($p < .05$), with the exception of the loadings of the three performance approach goal items on the approach goal latent variable. While factor loadings for these items were found to exceed the recommended minimum value of .40 on the performance goal latent variable, they did not reach this standard on the approach goal latent variable (see Table 5.3). Also, two of the factor loadings on the approach goal latent variable were negative in character where a positive association would be expected. Results thus suggest that items of the performance approach goal subscale did not adequately tap the approach goal component they were intended to tap. R^2 values were in the large range (>.25, see Table 5.3). These values, however, represent aggregate scores for both performance and approach components, and as such, do not provide information on the individual components. That is, no information is available on how much variance is explained by the latent variables in the approach versus the performance indicators.

Despite their statistical significance, the factor loadings of the other items were also inspected, together with R^2 indices. It is important to take such indices of practical significance into account, rather than relying solely on statistical significance, as statistical significance may be biased as a result of the sample size of the population in which the effect was tested (see Hagger & Chatzisarantis, 2009). Less than satisfactory (< .40) factor loadings were also identified for items from the other three subscales, suggesting that the intended

goal components were not adequately reflected in all items (see Table 5.3). Like performance approach goal items, based on factor loadings the mastery approach goals items appeared to adequately tap the definition goal component (mastery), but not the valence goal component (approach). Furthermore, factor loadings indicated that the mastery and performance avoidance goals items effectively tapped the avoidance goal component, but not the mastery and performance goal components respectively. These results may point at the existence of a universal avoidance goal factor, which is indicated by items of both mastery and performance avoidance goal subscales. For all items R^2 values were in the large range (>.25, see Table 5.3), however, again, no information is available for the individual indicators.

The correlation between the approach and avoidance latent variables was ϕ = .039, suggesting that children clearly differentiated between the two constructs. For the mastery and performance latent variables the correlation was higher, with ϕ = .82, exceeding the standard for multicollinearity of ϕ = .80.

Table 5.3. Factor Loadings CT-CM Model (N=429)

Item content	λ^d	λ^v	R^2
Mastery approach goals			
1. At physical education I want to learn as much as possible	.42	.44	.37
2. At physical education my goal is to improve my skills	.45	.35	.33
3. At physical education my goal is to do better than I have before	.53	.25	.35
Performance approach goals			
1. At physical education I want to do better than other kids	.85	-.35	.85
2. At physical education I want to do better than the average kid	.67	.01	.44
3. At physical education my goal is to perform better than others	.72	-.14	.54
Mastery avoidance goals			
1. At physical education my goal is not to do worse than I have before	.26	.59	.42
2. At physical education I want to make sure I do not lose my skills	.27	.57	.40
3. At physical education my goal is not to do worse than last time	.41	.71	.67
Performance avoidance goals			
4. At physical education my goal is not to do worse than other kids	.39	.56	.47
5. At physical education my goal is not to do poorly compared to other kids	.24	.68	.52
6. At physical education I want to make sure I do not perform worse than others	.35	.54	.42

Note. λ^d = factor loading definition component of the goal (mastery/performance), λ^v = factor loading valence component of the goal (approach/ avoidance)

5.3.2.2 2 x 2 model.

In response to the less than optimal results for the CT-CM model, the other two fitting models were further evaluated. Inspection of the 2 x 2 model revealed statistically significant factor loadings for all indicators, exceeding the .40 criterion (see Table 5.4). R^2 values were in the large range (>.25, see Table 5.4), suggesting that the latent variables were able to explain a large amount of the variance in the individual items.

The pattern of interfactor correlations was consistent with a 2 × 2 CT-CM matrix. Correlations were lower for latent variables representing goals without overlapping goal components (mastery approach and performance avoidance goals ϕ = .34; performance approach and mastery avoidance goals ϕ = 0.35) than for latent variables representing goals sharing one of the four goal component (ϕ = .38 -.92). A very strong correlation between the two avoidance goal latent variables emerged, exceeding the .80 standard for multicollinearity (ϕ = .92), and thus suggesting problems with discriminant validity.

Table 5.4. Factor Loadings 2 x 2 Model (*N*=429)

Item content	λ	R^2
Mastery approach goals		
1. At physical education I want to learn as much as possible	.52	.27
2. At physical education my goal is to improve my skills	.58	.33
3. At physical education my goal is to do better than I have before	.64	.41
Performance approach goals		
1. At physical education I want to do better than other kids	.86	.73
2. At physical education I want to do better than the average kid	.67	.44
3. At physical education my goal is to perform better than others	.76	.58
Mastery avoidance goals		
1. At physical education my goal is not to do worse than I have before	.65	.42
2. At physical education I want to make sure I do not lose my skills	.63	.39
3. At physical education my goal is not to do worse than last time	.83	.70
Performance avoidance goals		
4. At physical education my goal is not to do worse than other kids	.69	.48
5. At physical education my goal is not to do poorly compared to other kids	.71	.50
6. At physical education I want to make sure I do not perform worse than others	.66	.44

To further investigate potential issues with discriminant validity, AVE indices were inspected (mastery approach goals .29, performance approach goals .48, mastery avoidance goals .42, performance avoidance goals .39). For all latent variables with the exception of the mastery avoidance and performance avoidance goal factors, the square root of the AVE indices (mastery approach goals .54, performance approach goals .69, mastery avoidance goals .65, performance avoidance goals .62) exceeded the latent variables' correlations with the other latent variables, signifying discriminant validity. The inability to confirm discriminant validity between the two avoidance goals, together with CT-CM model results (e.g. strong correlation between mastery and performance latent variables), suggest that the trichotomous model comprising a universal avoidance goal may be the most fitting for describing pre-adolescent children's achievement goals in physical education.

5.3.2.3 Trichotomous model.

For the three-factor model, standardised factor loadings were statistically significant and exceeded the recommended minimum value of .40 for all items (see Table 5.5). Interfactor correlations were lower than .80, indicating an absence of multicollinearity among the subscales (see Table 5.6). The latent variables accounted for between 26.63% and 72.76% of the variance in the items (based on the R^2 value) (see Table 5.5). R^2 indicate that the size of the explained variance fell in the large range for all items (>.25). The square root of the AVE indices exceeded the inter-construct correlations for all latent variables, providing evidence for the subscales' discriminant validity. Based on these findings, this three-factor model was regarded as most suitable.

Table 5.5. Factor Loadings Trichotomous Model and Descriptive Statistics (*N*=429)

Item content	*M*	*SD*	λ	R^2
Mastery approach goals				
1. At physical education I want to learn as much as possible	3.68	0.52	.52	.27
2. At physical education my goal is to improve my skills	3.66	0.53	.58	.33
3. At physical education my goal is to do better than I have before	3.60	0.61	.64	.41
Performance approach goals				
1. At physical education I want to do better than other kids	2.79	0.90	.85	.73
2. At physical education I want to do better than the average kid	3.14	0.78	.66	.44
3. At physical education my goal is to perform better than others	2.74	0.88	.76	.58
Avoidance goals				
1. At physical education my goal is not to do worse than I have before	3.23	0.86	.63	.39
2. At physical education I want to make sure I do not lose my skills	3.26	0.83	.63	.40
3. At physical education my goal is not to do worse than last time	3.28	0.80	.81	.65
4. At physical education my goal is not to do worse than other kids	3.01	0.82	.68	.46
5. At physical education my goal is not to do poorly compared to other kids	3.18	0.83	.70	.48
6. At physical education I want to make sure I do not perform worse than others	3.20	0.76	.63	.40

Note. Values are based on the trichotomous model that was found to best describe the data

Table 5.6. Descriptive Statistics and Factor Correlations for the C-AGQPE (TS) (*N*=429)

	ICC	*M*	*SD*	ρ	α	AVE	√AVE	1	2
1. Mastery approach goals	.02	3.65	0.41	.55	.60	.29	.54		
2. Performance approach goals	.01	2.89	0.72	.73	.80	.48	.69	.50*	
3. Avoidance goals	.01	3.19	0.61	.79	.83	.39	.62	.37*	.40*

Note. Mean score controlled for number of items in the subscale. *$p < .05$

A bootstrap analysis was performed to confirm the efficacy of the three-factor model in describing children's achievement goals in physical education based on multiple samples drawn from the original sample. Based on this analysis, the following average fit indices were found; S-B $\lambda^2 = 151.04$, $df = 51$, $p < .001$, CFI = .92; RMSEA = .07 (90% CI = .05-.08). The skewness was negative for the CFI (-.31) as well as the RMSEA (-.03). A negative skewness suggests stacking of the results at higher values, indicating a large number of well-fitting models based on indices with a cut-off value close to one such as the CFI. A negative skewness is not desirable for the RMSEA, with a cut-off value close to zero. The negative skewness found for the RMSEA was, however, very small, suggesting that values were

distributed evenly around its mean value of .07. This implies that the RMSEA was not satisfactory for all bootstrap samples. Overall the bootstrap results provided further support for the fit of the three-factor model.

The correlation between age and the latent variables was statistically significant for all three goals (-.06, -.03 and -.09 for mastery, performance and avoidance goals respectively). The correlations fell below the .10 mark for a small effect for mastery, performance and avoidance goals. This suggests that despite the statistical significance of the results, age did not have a practically meaningful impact on the model.

Previous research involving children as young as 9 years of age has often identified high correlations between avoidance goals and (performance) approach goals, inciting concerns regarding the empirical distinctiveness of these goals (e.g., Cumming et al., 2008). To ensure that children across the entire age-range included in the present study distinguished the avoidance goal construct, the correlation between the three subscale scores was investigated per age-group. With correlation coefficients falling well below the .80 criterion that was applied, this analysis indicated that children 9 to 12 years of age all differentiated between the three goals (see Table 5.7).

Table 5.7. C-AGQPE Subscale Score Correlations by Age

	9 years (*n*=136)	10 years (*n*=120)	11 years (*n*=119)	12 years (*n*=54)
Map-Pap	.37**	.26**	.38**	.55**
Map-Av	.33**	.16	.22*	.37**
Pap-Av	.46**	.29**	.22*	.32*

Note. Map = mastery approach goals; Pap = performance approach goals; Av = avoidance goals.

*$p < .05$, ** $p < .01$

Together, the latent variables on average explained between 29.08% and 48.12% of the variance in their respective indicators (AVE, see Table 5.6), not reaching the 50% criterion for convergent validity. Composite reliability coefficients (ρ) exceeding the .70 criterion were found for the performance goal and avoidance goal subscales (ρ = .73 and .79 respectively). With a value of .55, this coefficient fell below the cut-off value for the mastery approach goal subscale (see Table 5.6).

5.3.3 Results C-PNSPE

Means and standard deviations of the C-PNSPE items are presented in Table 5.5 (see Appendix O for data). A Mardia's normalised coefficient of 19.46 was found for the C-AGQPE data, signifying multivariate non-normality of the data, and resulting in the application of the S-B robust maximum likelihood estimation method, as was used for the C-AGQPE.

The results of the CFA indicated a good fit of the model to the data: S-B χ^2 = 25.09, *df* = 24, *p* = .40; CFI = .99; RMSEA = .01 (90% CI = .00-.04). Standardised factor loadings exceeding the recommended minimum value of .40 were found for all items, ranging between .57 and .84 (see Table 5.8). All factor loadings were statistically significant ($p < .05$), and based on R^2 the latent variables accounted for between 31.67% and 71.06% of the variance in the items. R^2 values thus fell in the large range for all items (>.25) (see Table 5.8). The correlations between the three latent variables were all statistically significant, positive and moderate in size ($\phi < .80$), indicating an absence of multicollinearity among the subscales (see Table 5.9). The square root of the AVE indices exceeded the latent variable inter-correlations for all three needs, supporting discriminant validity (see Table 5.9).

A bootstrap analysis was performed to confirm the efficacy of the three-factor model in describing children's need satisfaction in physical education based on multiple samples drawn from the original sample. Based on this analysis, the following average fit indices were found; S-B λ^2 = 49.19, *df* = 51, $p < .001$, CFI = .96; RMSEA = .05 (90% CI = .03-.07). There was a negative skew for the CFI (-.40) and the RMSEA (-.57). The negative skewness for RMSEA indicates that results were stacked towards the upper bound of the confidence interval. This suggests that for some bootstrap samples, the RMSEA was higher than the .05 standard that was applied. Overall, these results supported the validity of the three-factor model.

Table 5.8. Descriptive Statistics and Factor Loadings for the C-PNSPE (*N*=429)

Item content	*M*	*SD*	λ	R^2
Need for competence [a]				
1. At physical education I can do activities that seem hard to me	3.26	0.73	.58	.34
2. At physical education I feel good enough to do the activities that seem hard	3.41	0.66	.84	.71
3. At physical education I can do the activities, even if they are hard	3.39	0.65	.66	.44
Need for autonomy [b]				
1. At physical education I feel I can say what I would like to do	2.86	0.86	.57	.33
2. At physical education I feel like I can exercise in my own way	3.02	0.79	.57	.33
3. At physical education I feel like I can do the things I like	3.02	0.91	.67	.45
Need for relatedness [c]				
1. I feel close to the other kids in my class when we do physical education together	3.24	0.73	.55	.30
2. I feel part of the group when I do physical education with the other kids in my class	3.41	0.69	.69	.47
3. I feel accepted by the other kids I do physical education with	3.32	0.72	.73	.53

Table 5.9. Descriptive Statistics and Factor Correlations for the C-PNSPE (TS) (*N*=429)

	ICC	*M*	*SD*	ρ	α	AVE	√AVE	1	2
1. Need for competence	.01	3.35	.55	.68	.74	.42	.65		
2. Need for autonomy	.06	2.97	.65	.58	.63	.32	.57	.42*	
3. Need for relatedness	.03	3.32	.56	.63	.69	.37	.61	.61*	.44*

Note. Mean score controlled for number of items in the subscale, *$p < .05$

The correlation between age and the latent variables was investigated. This correlation was significant for all three needs (.03, .07 and -.14 for the need for competence, autonomy and relatedness respectively). These coefficients indicate that for the need for competence and autonomy there was virtually no practically significant effect of age, while for the need for relatedness a very small negative effect was present, just exceeding the .10 mark (Cohen, 1988). Despite the significant results, the small size of the correlation coefficients thus suggests that age has little practical significance with respect to need satisfaction.

Together, the latent variables on average explained between 30.14% and 41.63% of the variance in the items (based on AVE, see Table 5.9), thereby not reaching the 50% criterion for convergent validity. Composite reliability coefficients (ρ) fell below the .70 criterion; with values of $\rho = .68$; $\rho = .58$; and $\rho = .63$ for the need for competence, autonomy and relatedness respectively (see Table 5.9).

5.3.4 Results C-PLOC

Means and standard deviations of the C-PLOC items are presented in Table 5.10 (see Appendix P for data). A Mardia's normalised coefficient of 27.25 was found for the C-PLOC data, signifying multivariate non-normality of the data. Consequently, the S-B robust maximum likelihood estimation method was applied.

The hypothesised five factor structure was not found to satisfactorily describe the data, as suggested by the CFA fit indices; S-B scaled $\lambda^2 = 301.19$, $df = 80$, $p < .001$, CFI = .88; RMSEA = .08 (90% CI = .07-.09). In two instances a high interfactor correlation was found, exceeding the criterion for multicollinearity ($\phi = .80$). A high correlation that emerged between amotivation and external regulation ($\phi = .84$), suggesting that the child respondents may not differentiate between these two forms of motivational regulation. Aggregation of items tapping these forms of motivational regulation into one latent variable was, however, not theoretically justifiable. Amotivation represents a lack of intention to act, while all other forms of motivational regulation represent a form of motivation to act. Also between intrinsic motivation and identified regulation ($\phi = .84$), a high interfactor correlation was observed. As the two forms of regulation are adjacent on the motivational continuum, and share characteristics, child respondents may not differentiate between the two. To test this assumption, the fit of a four factor model was tested, with items tapping intrinsic motivation and identified regulation loading on a single latent variable, representing self-determined motivation. This four factor model resulted in a significant increase in the chi-square statistic ($\Delta\lambda^2 = 34.91$, $\Delta df = 4$). Furthermore, the model fit indices indicated that the fit of this model

to the data was slightly worse compared to the five-factor model; S-B scaled λ^2 = 336.10, *df* = 84, $p < .001$, CFI = .86; RMSEA = .08 (90% CI = .08-.09). Together, these results suggest that the five-factor model described the data more accurately than the four-factor model.

As the five-factor model resulted in a better fit of the data, this model was further analysed. Two items presented poor factor loadings and were less well explained by their respective latent variables compared to the other items (based on R^2) (see Table 5.10). These items were subjected to a more thorough inspection. Modification indices for the identified regulation item "I take part in physical education because it is important for me to do well at it" suggested the addition of a path between the item and the latent variable representing introjected regulation. Identified regulation is considered a self-determined form of extrinsic motivation, while introjected regulation represents a controlled form of extrinsic motivation. The more autonomous character of identified regulation that the item was intended to represent may not have been picked up by respondents. For example, respondents may have interpreted 'doing well' as contingent to receiving positive ability evaluations from others, which reflects the controlled character of introjected regulation. As a relationship between the item representing a construct characterised by relative autonomy, and a factor representing controlled motivation was not justifiable based on theory, this item was deleted.

Table 5.10. Descriptive Statistics and Factor Loadings for the C-PLOC (*N*=429)

Item content	*M*	*SD*	λ	R^2
Intrinsic motivation				
1. I take part in physical education because it is fun	3.63	0.59	.73	.53
2. I take part in physical education because I like learning new things	3.55	0.61	.69	.48
3. I take part in physical education because I enjoy doing it	3.65	0.62	.71	.51
Identified regulation				
1. I take part in physical education because I want to learn how to do new things	3.59	0.56	.71[a]/ .79[b]	.51[a]/ .62[b]
2. I take part in physical education because it is important for me to do well	3.20	0.81	.47	.22
3. I take part in physical education because I want to get better at it	3.51	0.61	.61[a]/ .57[b]	.37[a]/ .32[b]
Introjected regulation				
1. I take part in physical education because I want others to think I am good at it	2.43	0.99	.81[a]/ .78[b]	.65[a]/.61[b]
2. I take part in physical education because I feel guilty when I don't	1.92	1.04	.45	.20
3. I take part in physical education because I want other kids to think I am good	2.32	0.98	.85[a]/ .90[b]	.72[a]/ .80[b]
External regulation				
1. I take part in physical education because I'll get into trouble if I don't	1.67	0.93	.83	.68
2. I take part in physical education because I have no choice	1.65	0.91	.81	.66
3. I take part in physical education because that's the rule	2.00	1.10	.72	.49
Amotivation				
1. I take part in physical education but I don't know why we should have it	1.67	0.92	.68	.46
2. I take part in physical education but I feel I am wasting my time at it	1.45	0.73	.69	.48
3. I take part in physical education but I don't know the reason why	1.84	0.96	.64	.41

Note. [a] based on a 3-item subscale, [b] based on a 2-item subscale (after deletion of item 2). All other values are based on the 13 item C-PLOC, as values were almost identical to those derived with the 15 item C-PLOC

Similarly, based on its factor loading it appeared that the item “I take part in physical education because I feel guilty when I don’t” may not have adequately captured introjected regulation. Modification indices suggested the addition of a pathway between the problematic introjected regulation item and the latent variable representing external regulation. With introjected regulation, behaviour is regulated by internal pressures that are directed towards attaining ego-enhancement and pride (internal ‘rewards’) or avoiding feelings of guilt and shame (internal ‘punishment’) (Ryan & Deci, 2000a). In contrast, with external regulation behaviour is regulated by external pressures, and individuals are motivated in order to attain external rewards or avoid external punishment. In other words, the primary feeling related to introjected regulation is that one 'ought' to do an activity (in order to maintain self-esteem) whereas with external regulation an individual feels he or she 'must' do the activity. The introjected regulation item identified as problematic is the only item of the C-PLOC to tap internal pressure to avoid feelings of guilt, the other two items of the subscale tap the motive to approach ego enhancement. The compulsory character of physical education may cause children to experience feelings of guilt if they do not engage in the activities they are obligated to do (external regulation), rather than activities they feel they ought to do (introjected regulation). As children are not free to decide whether to participate or not, internal feelings of guilt may be less relevant, and the introjected regulation item tapping guilt may have primed children to focus on external motives, instead of the internal pressures characteristic of introjected regulation. Also, feelings of guilt as a result of internal pressures may not have yet developed in pre-adolescent children. In response to this issue, it was decided to focus the C-PLOC items exclusively on the approach component of introjected regulation, omitting the avoidance-oriented item.

Removal of the two items resulted in a better fitting model, as suggested by the improved fit indices: S-B scaled $\lambda^2 = 156.14$, $df = 55$, $p < .001$, CFI = .94; RMSEA = .07 (90% CI = .05-.08). Furthermore, the Akaike's Information Criterion (AIC) was inspected, which allows model fit comparisons based on the same dataset. Lower AIC-scores indicate the preferred model (Kline, 2005). The model AIC decreased from 138.53 to 35.88, further indicating improved model fit after deletion of the two items. Standardised factor loadings for the 13-item C-PLOC are provided in Table 5.10. All factor loadings were statistically significant ($p < .05$), and, ranging between .57 and .90, exceeded the recommended minimum value of .40. The latent variables accounted for between 32.15% and 80.10% of the variance in the items (based on R^2). R^2 values indicate that the explained variance was in the large

range (R^2 > .25). Instead, the two items that were removed from the list had medium R^2 values (see Table 5.10).

Self-determination theory proposes that the correlations among the five forms of motivational regulation should conform to a simplex-like pattern. Regulations that are theoretically closer are expected to be more strongly and positively related than more distal regulations. A simplex pattern was largely supported by the data, as indicated by the stronger positive correlations between forms of motivational regulation that are adjacent on the continuum compared to more distant forms of regulation (see Table 5.11). The only exception was introjected regulation, which was found to be more strongly correlated with amotivation (more distant), than with identified and external regulation (more adjacent). Discriminant validity was not consistently supported by the AVE indices. The square root of the AVE indices did not exceed the corresponding inter-construct correlation between intrinsic motivation and identified regulation, and between amotivation and external regulation (see Table 5.11).

The five factor model was re-estimated using bootstrapping, resulting in the following average fit indices; S-B λ^2 = 210.02, *df* = 55, *p* <.001, CFI = .91; RMSEA = .08 (90% CI = .07-.09). The skewness was negative for the CFI, and positive for the RMSEA. This is desirable, as it suggests stacking of the results at respectively the higher and lower bounds of the confidence interval (subject to the cut-off value).

Table 5.11. Factor Correlations for the C-PLOC (*N*=429)

	√AVE	1	2	3	4	5
1. Intrinsic motivation	.65		.84*	.07	-.26*	-.32*
2. Identified regulation	.63	.84*		.20*	-.09	-.09
3. Introjected regulation	.75	.07	.34*		.41*	.43*
4. External regulation	.71	-.26*	-.03	.46*		.84*
5. Amotivation	.62	-.32*	-.05	.47*	.84*	

Note. Correlation coefficients below principal diagonal apply to the 15-item C-PLOC and above the principal diagonal to the 13-item C-PLOC .
*p < .05

The correlation between age and the latent variables was found to be significant for external, introjected and identified regulation (-.15, -.18 and -.18 respectively). Based on the size of the correlation coefficients, the practical significance of the effect appears to be small (*r* >.10). Multi-group analysis was performed, as the effect size of such an analysis would be small.

The latent variables on average explained between 32.15% and 57.02% of the variance in their respective indicators. As such, the AVE > .50 criterion for convergent validity was reached for the external and introjected regulation subscales only (see Table 5.12). Composite reliability coefficients (ρ) fell below the .70 criterion for subscales tapping the two most self-determined forms of motivation and amotivation, with the value approaching the criterion for the intrinsic motivation subscale. Adequate composite reliability was supported for the introjected and external regulation subscales (see Table 5.12).

Table 5.12. Descriptive Statistics and Psychometric properties for the C-PLOC (TS) (*N*=429)

	ICC	*M*	*SD*	ρ	α	AVE
1. Intrinsic motivation	.01	3.61	0.50	.68	.75	.42
2. Identified regulation	.04[a]/ .02[b]	3.43[a]/ 3.55[b]	0.50[a]/ 0.50[b]	.57[a]/ .56[b]	.60[a]/ .62[b]	.32[a]/ .40[b]
3. Introjected regulation	.03[a]/ .02[b]	2.22[a]/ 2.37[b]	0.80[a]/ 0.91[b]	.69[a]/ .73[b]	.71[a]/ .82[b]	.44[a]/ .57[b]
4. External regulation	.04	1.77	0.84	.75	.82	.50
5. Amotivation	.04	1.65	0.70	.64	.71	.38

Note. [a] based on a 3-item subscale, [b] based on a 2-item subscale (after deletion of item 2)

5.4 Discussion

The availability of questionnaires developed specifically for use with pre-adolescent children, such as the C-AGQPE, C-PNSPE, and C-PLOC enables the downward extension of motivational research in physical education. However, to enable further insight into children's motivation, questionnaires need to be psychometrically sound. Based on the quantitative evaluations of the second phase of this study, some adaptations were made to the C-AGQPE, C-PNSPE, and C-PLOC. To best describe the achievement goals of pre-adolescent children in physical education, the C-AGQPE mastery avoidance and performance avoidance subscales were merged into a universal avoidance goal subscale, resulting in a three-factor model. For the C-PLOC, quantitative results indicated the need to remove two of the questionnaire's items. The underlying structure of the C-PLOC and C-PNSE remained unaltered.

5.4.1 C-AGQPE

A three-factor structure was found to provide the most suitable description of pre-adolescent children's achievement goals, based on their responses on the C-AGQPE. This model, consisting of mastery approach goal, performance goal and avoidance goal factors, was confirmed in separate subsamples of the original data. Age was not found to be strongly related to the three goals, suggesting that the model was applicable across the entire pre-adolescent period.

Little is known about primary school-aged children's achievement goals, particularly with respect to the avoidance goal construct. Qualitative data obtained in the pilot-study (described in Chapter 4) indicated that children's accounts for their response on avoidance goal items did not consistently reflect these goals accurately and in line with the underlying theory. However, based on the quantitative results, after combining the mastery and performance avoidance scales, the three subscales tapping achievement goals in a trichotomous framework appeared to produce scores that were reliable and valid. This suggests that, although the child respondents may have experienced difficulties verbally articulating their avoidance goals, avoidance strivings have emerged in pre-adolescent children. Children may not have given much previous thought to their achievement strivings, and as a consequence may not have a representation of their strivings that is readily available for conscious reflection and, subsequently, articulation. Perhaps before children acquire the cognitive capacity to express their achievement goals, they are able to indicate how much a particular goal-description reflects their personal strivings. A vast amount of research has described the differences between multiple-choice and open-ended question, with the latter involving cognitive mechanisms that are more sophisticated (e.g., Hancock, 1994; Kuechler & Simkin, 2010). Whereas open-ended questions require procedural knowledge, for Likert-type items, which resemble multiple-choice questions, recognition can suffice.

Multiple plausible factor models were analysed to ensure that the model was identified that best reflected children's achievement goals. In previous research, the four achievement goals in a 2 × 2 framework have often been regarded as distinct constructs. However, they are combinations of definition (mastery or performance) and valence (approach or avoidance) constructs (Elliot & McGregor, 2001). To determine whether support could be found for the presence of two components underlying each goal construct, a CT-CM model was investigated, which was found to describe the data well. The superior fit found for the CT-CM model, suggests that four discrete factors underlie children's

achievement strivings in physical education; mastery and performance competence strivings and approach and avoidance motivations. Strictly speaking, it could be recommended to abandon the 2 x 2 framework based on these findings, endorsing results of a previous study in a large sample of undergraduate students in a physical education setting (Wu & Chen, 2010). However, as also acknowledged by Wu and Chen (2010), the 2 x 2 achievement goal framework has proven to possess explanatory value in motivational research. For example, mastery avoidance goals have generally been found to result in less maladaptive outcomes than performance avoidance goals (Baranik, Stanley, Bynum, & Lance, 2010), as a result of a combination of factors representing positive (mastery) and aversive (avoidance) motivational strivings for mastery avoidance goals. Such differential outcomes based on goal-construct combinations would not be picked up when investigating the four discrete goal components in isolation. Nevertheless, the CT-CM model provides researchers with valuable insight into which goal-components are reflected in individuals' responses on questionnaire items such as those of the C-AGQPE, aiding construct validation. As the CT-CM model and the conventional factor models provide unique information, it was relied on both methods.

In the present study, CFA results based on the CT-CM model indicated that some issues emerged at the item level, despite an overall fit of the model. Not all items satisfactorily reflected the dual goal components they were intended to tap. Results indicated that items tapping performance approach goals reflected children's performance strivings, but not their approach-oriented strivings. The items referred to the aim to outperform others, and it may be that such strivings were not unique to children with performance approach goals. For example, children may have responded positively to C-AGQPE items such as "At physical education my goal is to perform better than others", with the underlying motive not to do worse than others, that is, to serve their performance avoidance goal. Further studies are needed to investigate the apparent lack of effectiveness of the performance approach goal items in tapping approach strivings. Ultimately, such research may indicate the need to revise the subscale's items to more effectively tap both the performance and the approach components. Until further insight emerges, the CT-CM results suggest that the performance approach goal subscale of the C-AGQPE should be regarded as representative of performance goals, omitting a reference to the valence of these goals.

Results based on the CT-CM model suggest that mastery and performance avoidance goal items did not adequately tap the definition component of children's avoidance goals. In conjunction with the lack of discriminant validity among the two avoidance goal factors that was identified with the inspection of the 2 x 2 model, this suggests that pre-adolescent

children may have a clear notion of avoidance strivings, but fail to distinguish the definition of such strivings. That is, they are yet unable to distinguish whether these goals involve mastery or performance-related motives. It appeared that this inability could not be attributed to item content. The content of the avoidance goal items mirrored that of the approach goal items, and children were able to differentiate between the two goal components based on the approach goal items. Consequently, a three-factor model, comprising a universal avoidance goal factor, was considered to best describe children's achievement goals. Of note is that there did not appear to be developmental trends in children's achievement goals over the pre-adolescent years, as age was not found to be related to the goal constructs in the present study. This suggests that children start to differentiate between the mastery and performance components of avoidance goals only once they reach adolescence.

An important finding was that the relationship between mastery approach and performance goals on the one hand, and the universal avoidance goal on the other hand, was only moderate in size. Also for the 2 x 2 model that was tested, parallel approach and avoidance goals were only moderately related. In previous research, the strong correlation is often identified between performance approach and avoidance goals (Linnenbrink-Garcia et al., 2012; Urdan & Mestas, 2006). The adapted questionnaire format may have played a role in the improved discriminant ability of the C-AGQPE when compared to existing questionnaires, adequately differentiating between approach and avoidance goals. Also, it is possible that in older samples, approach and avoidance goals are more frequently endorsed simultaneously, resulting in a stronger relationship between scores on approach and avoidance goal subscales. Young children typically have overly positive perceptions of their competence (Harter, 1999), and as a result may initially just strive to outperform their peers. As they grow older, children endorsing approach goals may start to doubt their ability to continue to outperform others or to continue to learn and improve. Such doubts may incite concurrent avoidance goal strivings.

The mastery approach goal subscale was the only subscale that adequately represented both the definition and valence components of the goal's definition. However, the reliability of this subscale was less than satisfactory, and the subscale's convergent validity was limited. There is thus scope to further test and validate scores derived from the mastery approach goal subscale of the C-AGQPE, with a focus on increasing the subscale's convergent and discriminant validity.

5.4.2 C-PNSPE

Evaluation of the data obtained with the C-PNSPE provided support for the three factor model that was hypothesised based on self-determination theory and previous research involving the PNSE (Wilson, Rogers, et al., 2006; Wilson, Longley, Muon, Rodgers, & Murray, 2006). Further evidence for the relevance of the three needs to children as young as 9 years of age was gained through the re-evaluation of the model in multiple subsamples of the original. Age was not found to be strongly related to the three needs, suggesting that the needs model was fitting across the entire pre-adolescent period.

The C-PNSPE items tap narrow definitions of the three needs, focussing on those aspects that were considered most relevant to physical education settings specifically. For example, to reflect autonomy in physical education, the focus was exclusively on affective autonomy. Further studies are needed to investigate whether children differentiate between affective and decisional autonomy, and whether these two components of the need for autonomy are differentially related to motivational and behavioural outcomes, or whether their effect is cumulative. For example, it remains to be investigated whether the experience of affective autonomy can substitute for a child's lack of decisional autonomy, or whether decisional autonomy is essential to ensure the most positive outcomes. After the C-PNSPE was formed, a questionnaire was developed tapping need satisfaction in 7 to 11 year old children in the physical activity domain (Sebire et al., 2013). This questionnaire focusses largely on decisional autonomy, which is fitting for the physical activity setting. Future studies could consider using both questionnaires, to investigate this issue.

In the present study, the need for autonomy was moderately related to the other two needs. The statistically significant, positive correlation that was observed between the need for autonomy and the need for relatedness subscales of the C-PNSPE confirms the assertion that the need for autonomy and relatedness are not two opposite ends of a bipolar continuum, but rather, independent but related needs (Deci & Ryan, 2000). In a review on the measurement of need satisfaction in exercise settings, a strong relationship between the need for competence and the need for autonomy subscales of both the PNSE and the BPNES was identified (see Wilson et al., 2008). Scores on the two subscales have been found to overlap, suggesting issues with the discriminant validity of the subscales. For the C-PNSPE, results supported the discriminant validity of the need for competence and autonomy subscales.

A relatively high correlation was found between the subscales tapping the need for competence and the need for relatedness. Discriminant validity was, however, also confirmed for these two need constructs. In pre-adolescent children, competence may be closely related

to peer relations, resulting in the needs' interrelatedness. Previous research has identified a relationship between motor proficiency and relationships with peers. For example, in a sample of children aged 9 to 12 years, children with compromised levels of motor skills were found to be less accepted by their peers in play and classroom settings (Livesey, Lum Mow, Toshack, & Zheng, 2011). High correlations between the need for competence and relatedness were also identified in the study by Sebire et al. (2013) in 7 to 11 year old children. In this study high correlations (≥ .75) were observed between all three needs, but discriminant validity was not addressed.

The reliability of the need for autonomy subscale of the C-PNSPE was found to be somewhat weak. In the study by Sebire et al. (2013) adequate reliability scores were identified for the need satisfaction subscales adapted from various existing questionnaires. In this study, subscales consisted of 6 items. The present subscale contained only three items, which may have contributed to the lower internal consistency. Further efforts are needed to test the autonomy subscale of the C-PNSPE. If the internal consistency of scores obtained with the subscale is constantly found to be on the low side, further adaptations to the items may need to be made.

The reliability of scores derived from the need for relatedness subscale of the C-PNSPE was marginal ($\rho = .63$; $\alpha = .69$). This may be related to the fact that the three items of the subscale tap slightly different aspects of relatedness; feeling close to others, feeling part of the group and feeling accepted. A child may feel accepted by, but not close to his or her peers. In line with this, more children responded negatively on the item referring to 'feeling close to others', compared to the two items tapping more general feelings of relatedness. Further research could consider assessing satisfaction of the need for relatedness with the use of items that refer more consistently to the same aspect of children's experiences of relatedness within physical education. However, for the purpose of the present research all three aspects were included as there is no indication as of yet which aspect of the need for relatedness is most important for motivation, and all three aspects appeared relevant to the physical education setting. It remains to be investigated what the impact of the different aspects of relatedness need satisfaction is on other motivational constructs. It may, for example, be that feeling accepted is not sufficient to impact upon motivation, and that close relationships need to be experienced towards this end.

5.4.3 C-PLOC

The C-PLOC yielded a factor structure that replicated the five factor structure of the PLOC, and fit indices were comparable with those reported for the PLOC in older samples (e.g., Lonsdale et al., 2011), and 7 to 11 year old children in a physical activity setting (Sebire et al., 2013). Age was not found to be strongly related to children's motivational orientations, with some small practically significant effects for external, introjected and identified regulation only. The robustness of the model was supported in the re-evaluation of the model in multiple subsamples of the original, providing further evidence for the relevance of the different forms of motivational regulation in describing the motivational orientations of children as young as 9 years of age.

In addition to its factor structure, the hypothesised simplex structure was largely supported for the C-PLOC. This provides evidence in favour of the validity of the self-determination continuum which the questionnaire was designed to tap (Ryan & Connell, 1989), and replicates previous results regarding the PLOC construct in the physical education context (for a meta-analysis see Chatzisarantis et al., 2003). Focussing on physical activity more generally, Sebire et al. (2013) have recently been able to confirm a simplex structure of the self-determination continuum in 7 to 11 year old children. Both in the present study, and in the study by Sebire et al. (2013), intrinsic motivation and identified regulation were strongly interrelated, and discriminant validity of the two factors could not be confidently confirmed. Also in older samples, studies applying the PLOC have found the intrinsic motivation and identified regulation subscales to be strongly related (e.g., Goudas et al., 1994; Lonsdale et al., 2011; Ntoumanis, 2001b; Wang, Hagger, et al., 2009), suggesting this is not an issue that is unique to younger samples or the C-PLOC.

The relationship between scores on the identified regulation and intrinsic motivation subscales may be a result of, respectively, similarities in what respondents value and what they find enjoyable and feel competent with (Eccles & Harold, 1991). Furthermore, the content of some items of the PLOC and C-PLOC tapping intrinsic motivation and those tapping identified regulation bear similarities. As a result, the different focus of the items may not have been picked up by (the young) respondents. For example, in the PLOC, as well as in the C-PLOC, both an intrinsic motivation and an identified regulation item tap motivation related to learning new things. The intrinsic motivation item refers to children's enjoyment of learning, whereas the identified regulation item refers to children's valuing of learning. Furthermore, in the identified regulation subscale of both the PLOC and the C-PLOC, two items tap children's engagement in physical education because they 'want' to achieve a

certain result. This may not unambiguously convey the theoretical definition of introjected regulation, which involves individuals' valuing of a behaviour or their recognition of a behaviour's importance. For example, respondents may 'want' to engage in a behaviour to obtain the outcome at hand (e.g. to learn how to do new things) for different reasons; they may either enjoy it (intrinsic motivation), or value it (identified regulation). These two identified regulation items could thus be interpreted to represent intrinsic motivation. As outlined, this is an issue that is not unique to the C-PLOC, however, future studies may benefit from changing the wording of the identified regulation items to avoid issues with the subscales' discriminant validity. Based on the results of Vlachopoulos et al. (2011), in their study adapting the PLOC to apply to the physical education setting, it appears that a clearer differentiation between intrinsic motivation and identified regulation can be facilitated by specifically referring to the behaviour's importance within identified regulation items.

In the present study, a strong relationship also emerged between external regulation and amotivation, following results of previous studies applying the PLOC (e.g., Goudas et al., 1994; Ntoumanis, 2001b), or a revised version thereof (Vlachopoulos et al., 2011). The compulsory nature of physical education may play a role in this relationship. Children who are amotivated are obligated to participate in physical education, and may consequently report the same reasons for their engagement as children who are motivated for external reasons (e.g., 'because that's the rule'). Furthermore, participants in the present study reported low levels of external regulation and amotivation, and high levels of the more self-determined forms of motivation. This uneven distribution of scores across the motivation continuum is likely to have affected the strength of the interrelationships between constructs at the extremes (i.e., intrinsic motivation and identified regulation, and amotivation and external regulation). Further research into the motivational constructs' interrelationship in physical education settings is needed, building up an evidence base regarding the questionnaires psychometric properties and validity. Such research would ideally involve more diverse samples. To encourage sample diversity, for example samples of children who have been formally diagnosed with motor difficulties could be included, as these children are likely to score lower on self-determined forms of motivation, and higher on more controlled forms of motivation and amotivation.

Some evidence emerged for the reliability of C-PLOC's subscales, although not consistently for all subscales across all reliability indices that were inspected. Previously, issues have emerged with the internal consistency of the subscales of the PLOC, particularly for the identified, introjected, and external regulation subscales (see Vlachopoulos et al.,

2011). Also, the questionnaire developed by Sebire et al. (2013) based on the BREQ displayed a low internal consistency for the introjected regulation subscale. The low internal consistency that has repeatedly been observed for introjected regulation subscales, including those of the PLOC, may be a result of the different aspects of introjected regulation tapped by the items (Lonsdale et al., 2011). For the PLOC as well as the questionnaire developed by Sebire et al. (2013), some items involve the avoidance of negative competence-related feelings, while other items are approach oriented, and concern the anticipation of the reinforcement of competence perceptions (see Assor, Vansteenkiste, & Kaplan, 2009; Lonsdale et al., 2011). Children have been shown to differentiate between introjected approach regulation and introjected avoidance regulation in academic (*M* age of participants 10.5 y) and sport settings (*M* age = 15.6 y) (Assor et al., 2009), and the two forms of introjected regulation may be relatively independent. In the present study, the item tapping the avoidance component of introjected regulation was deleted, resulting in a subscale focussing uniquely on the approach component of introjected regulation. This seems to have resolved concerns that have previously been raised regarding the reliability of this subscale of the PLOC. The reliability of the C-PLOC's introjected regulation subscale was found to be in the high end of the range of reliability scores previously reported for the corresponding PLOC subscale (see Vlachopoulos et al., 2011). Also the external regulation subscale of the C-PLOC was found to have adequate reliability, contrasting previous findings for the PLOC. The reliability of the identified regulation subscale of the C-PLOC, nevertheless, was comparatively low (see Vlachopoulos et al., 2011). Future studies are needed to reconsider the C-PLOC's identified regulation subscale, with a focus on increasing the subscale's reliability and discriminant validity. When designing a questionnaire, a compromise needs to be made between reliability on the one hand, and complexity and length on the other. After having deleted one item from the identified regulation subscale, it appears that perhaps too much was compromised on reliability. The addition of a new item tapping identified regulation, with a focus on the importance of the anticipated outcome of engagement in physical education (see Vlachopoulos et al., 2011) could improve reliability of the subscale.

5.5 Summary

Overall, the results supported the validity of scores derived with the three questionnaires that were specifically developed for the assessment of pre-adolescent children in physical education. Based on the AVE and composite reliability coefficients that largely fell below the standards for the C-AGQPE, C-PNSPE and C-PLOC, the questionnaires'

reliability and convergent validity appeared to be compromised. Consequently, results obtained with the three questionnaires should be interpreted with caution until further developments provide additional information on the reliability and convergent validity of the questionnaire's subscales. While the questionnaires provide theoretically coherent tools with preliminary evidence of construct validity, questionnaire development is an ongoing process, and there is scope to further test and validate scores derived from the C-AGQPE, C-PNSPE and C-PLOC.

Chapter 6: Phase Three: Testing the Motivational Model

6.1 Introduction

The first two phases of the present research served to facilitate investigating the main aim of the overall research and the focus of Phase Three; examining factors that play a role in pre-adolescent children's motivation for physical education. Specifically, the interrelationship between constructs of self-determination theory and achievement goal theory was investigated, in line with the emphasis on the need for theoretical integration in recent literature on motivation (Hagger, 2009). Researchers have discussed the parallels of self-determination theory and achievement goal theory, together with their additive qualities (Butler, 1989; deCharms, 1968; Ryan & Deci, 1989).

Competence perceptions are of central importance in achievement settings, and play an important role in both self-determination theory and achievement goal theory. Despite being a cognitive theory of motivation, assuming an essential role for thoughts and interpretations, self-determination theory does, however, not clearly explicate how individuals define their competence, (Butler, 1989). The definition of competence is a central focus of achievement goal theory. This theory concentrates on understanding goal-directed behaviour, based on how individuals define success and competence in achievement settings, including physical education. Combining the two theories thus appears to contribute explanatory value. In line with this, Deci and Ryan (2000, p. 260) recognise the relevance of achievement goals, but emphasise that knowing whether an individual endorses mastery or performance goals is not sufficient. Achievement goals can be related to motives for behavioural engagement that are relatively controlled, or relatively self-determined in character, which in turn, has an impact on the subsequent processes and outcomes such as behaviour and affect (Deci & Ryan, 2000). It must be noted that Deci and Ryan (2000) also argue that there are goals other than mastery and performance goals that can have an important impact upon outcomes (as described in the goal content subtheory), such as social goals. Such goals were not the focus of the present study, which concerned competence related achievement motivation specifically.

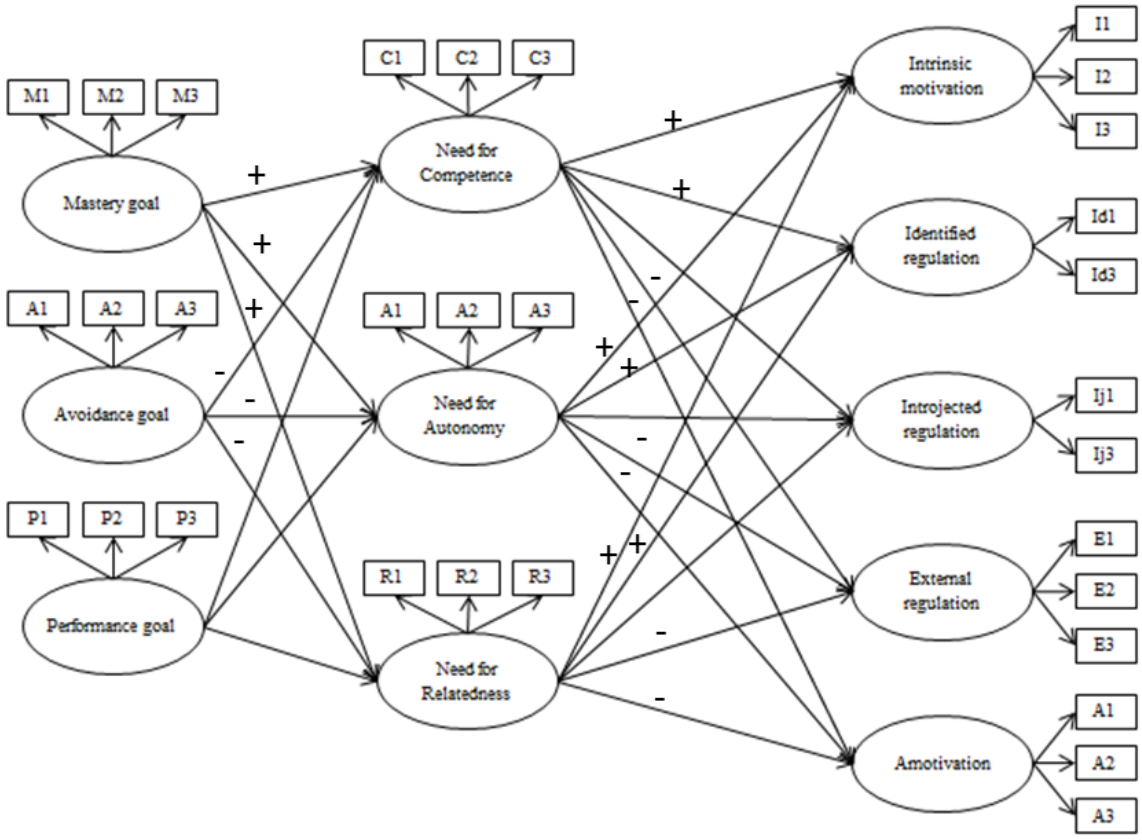
The relationship between individuals' achievement goals and the quality and quantity of their motivation has been investigated in various settings, including physical education (e.g., Hein & Hagger, 2007; Standage et al., 2003a; Standage et al., 2003b). Integrating both theories, researchers have suggested that different definitions of competence described by achievement goal theory have an impact on the likelihood that an individual's needs are

satisfied (for all three needs, Ntoumanis, 2001a), which consequently influences motivation (Deci & Ryan, 2000). However, few studies have taken the full array of constructs representing achievement goals, need satisfaction, and the different forms of motivation into account. A focus on the three psychological needs is largely omitted, and the different forms of motivational regulation are often combined into a relative autonomy index (RAI)[1] (e.g., Moreno, Gonzalez-Cutre, Sicilia, et al., 2010), compromising explanatory power. Discriminating between the qualitatively different forms of motivation is important in order to gain a deeper understanding of the motivational consequences of different goal pursuits. Furthermore, self-determination theory contends that individuals characteristically have multiple concurrent motives for their engagement in a behaviour, which together determine the quality of motivation (Ryan & Deci, 2007). The same RAI can result from qualitatively different combinations of motivational regulations, which has implications for outcomes such as behavioural engagement.

In short, achievement goal theory and self-determination theory help explain different pieces of the overall puzzle, and should be viewed as complementary rather than contradictory theories. To derive a more complete account of the constructs and processes underlying motivation and subsequent physical activity behaviour (Hagger, 2009), the interrelationship of constructs of both theories needs to be considered. Accordingly, this was the focus of this third phase of the study. Specifically, the objective was to test a motivational model based on the literature on motivation in older samples, in order to investigate whether the constructs and processes underlying motivation in pre-adolescent children are comparable to those of youth and adults. Hypotheses regarding the relationships are presented in Table 6.1, and visually displayed in Figure 6.1. There is a lack of empirical evidence regarding the relationship between achievement goals and need satisfaction. Therefore, these hypotheses are largely based on theoretical postulations (e.g., Ntoumanis, 2001a). Mastery approach goals were hypothesised to have a strong positive effect on the satisfaction of all three needs, as a result of the goals' positive definition and valence (approach form of motivation). The effect of performance approach goals on need satisfaction was expected to be less pronounced as a result of the goals' dual character. Both positive and negative effects may emerge, however, the typical direction of the combined effect (positive or negative) remains unclear from the literature. Negative effects on need satisfaction were hypothesised for avoidance goals, due to these goals' focus on negative outcomes. Need satisfaction, in turn, is

[1] RAI = 2 x (intrinsic motivation)+(identified regulation)-(introjected regulation) + 2 x (external regulation)

expected to have an effect on the different forms of motivation, mediating the effect of achievement goals. Based on indications in the literature, achievement goals were also expected to have direct effects on the different forms of motivation, unmediated by need satisfaction (see Cox & Williams, 2008).



Note. + positive effect hypothesised, - negative effect hypothesised. Where no plus or minus is indicated, no significant effect is hypothesised. For the clarity of presentation, direct paths between the three achievement goals and the different forms of self-determined motivation are not present. Such paths are, however, hypothesised. For an overview of all effects, including nonsignificant effects, see Appendix Q.

Figure 6.1. Hypothesised direction of effects achievement goal theory and self-determination theory.

Table 6.1. Hypothesised Interrelationship of Achievement Goal Theory and Self-Determination Theory Constructs

	From	To	Direction	References
H1	Mastery goals	Self-determined forms of motivation	Positive	Moreno, Gonzalez-Cutre, Sicilia, et al. (2010); Standage and Treasure (2002); Barkoukis, Ntoumanis, and Nikitaras (2007)
H2	Mastery goals	Introjected regulation	Absent	Standage and Treasure (2002); Barkoukis et al. (2007)
H3	Mastery goals	External regulation and amotivation	Negative	Standage and Treasure (2002); Barkoukis et al. (2007)
H4	Performance goals	Extrinsic motivation and amotivation	Positive	Standage and Treasure (2002); (Barkoukis et al., 2007)
H5	Performance goals	Self-determined forms of motivation	Absent or negative	Moreno, Gonzalez-Cutre, Sicilia, et al. (2010); Standage and Treasure (2002); Barkoukis et al. (2007)
H6	Avoidance goals	External regulation and amotivation	Positive	Barkoukis et al. (2007)
H7	Avoidance goals	Self-determined forms of motivation and introjected regulation	Negative	Moreno, Gonzalez-Cutre, Sicilia, et al. (2010)
H8	Mastery goals	All three needs	Positive	Ntoumanis (2001a); Shen, McCaughtry,

				Martin, and Fahlman (2009)
H9	Performance goals	All three needs	Effect < that of mastery goals, potentially negative	Ntoumanis (2001a); Shen et al. (2009)
H10	Avoidance goals	All three needs	Negative	Harackiewicz, Barron, Pintrich, Elliot, and Thrash (2002); Shen et al. (2009)
H11	All three needs	Self-determined forms of motivation and introjected regulation	Positive	Ntoumanis (2005); Sebire et al. (2013); Standage et al. (2005); Vlachopoulos (2012); Ntoumanis, 2001b
H12	All three needs	External regulation and amotivation	Negative	Ntoumanis, 2001b; Standage et al. (2005); Sebire et al. (2013); Vlachopoulos (2012)

Note. References based on research in physical education

6.2 Method

6.2.1 Participants

For the purpose of this phase of the study, the data derived from the same sample described in Chapter 5 were used.

6.2.2 Measures and Procedure

The same set of measures as described for Phase Two (Chapter 5) was used, tapping pre-adolescent children's achievement goals, need satisfaction, and quality and quantity of motivation.

6.2.3 Data Analysis

Model testing was performed by applying a partial least squares (PLS) path model approach to Structural Equation Modelling (SEM), using the SmartPLS software (Version 2.0, Ringle, Wende, & Will, 2005). Despite that the same dataset was used as in Chapter 5, different statistical methods were applied to analyse the data, in response to the complexity of the model tested here. The application of a PLS approach was further preferred as some strong inter-construct correlations were observed in the questionnaire validation phase of the study, indicating possible multicollinearity in the data. PLS analyses are not affected by the model's complexity, small sample sizes, or non-normality of the data, and the approach works with ordinal-scaled variables (Haenlein & Kaplan, 2004). In contrast to covariance-based SEM approaches, with this variance based approach to SEM (Reinartz, Haenlein, & Henseler, 2009) no assumptions are made about the data-distribution, thus presenting a non-parametric method (Fornell & Bookstein, 1982, p. 443).

Like covariance-based SEM, PLS models consist of a measurement part reflecting the relationship between the indicators (questionnaire items) and their respective latent variables, and a structural part, reflecting the interrelationship between the latent variables. The method involves an iterative estimation method, which provides successive estimates of factor loadings (measurement model) and path estimates (structural model). As a result, the proportion of variance in the latent variables that remains unexplained (the residual variance) is minimised, and the proportion of explained variance is maximised (Haenlein & Kaplan, 2004).

The fit of the model was evaluated using multiple indices of the measurement model; factor loadings, composite reliability (Rho), and AVE, as described in Chapter 5. Convergent validity was supported when the composite reliability and factor loadings for the latent

variables approached or exceeded .70, and the AVE exceeded .50 (Barclay et al., 1995). Discriminant validity was deemed acceptable when the items' factor loadings on the latent variable they were hypothesised to indicate exceeded the items' cross-loadings on the other latent variables in the model. Also, the square root of the AVE of the latent variables had to exceed the variables' correlation with other latent variables in the model to support discriminant validity (Chin, 1998a).

A bootstrapping resampling technique with 5000 iterations was used to calculate factor loadings and averaged path coefficients (β) of the structural model (see Figure 3.1) across multiple subsamples of the original sample. Bootstrapping increases the power of the statistical results, and allows for the investigation of the significance levels of the averaged path coefficients, by providing a t-statistic. Significance levels were calculate using Excel's function: *p =T.DIST.2T(x,deg_freedom)*, where x is the t-statistic as provided in the PLS output. The strength of relationships among the constructs was reviewed based on the size of the path coefficients, following recommendations by Chin (1998a) that standardized paths should be .20 minimally, and higher than .30 ideally in order to be considered meaningful. These are guidelines to estimate the practical significance of effects, and should not be relied on in isolation, without consideration of other factors. Lastly, the variance explained in the endogenous latent variables (R^2) was evaluated. As SmartPLS does not generate significance tests for the variance explained, effect sizes of the R^2 values were evaluated using Cohen's (1988) criteria, whereby R^2 values of .01 represent small, .09 medium and .25 large effects.

To test whether the relationship between achievement goals and the different forms of motivation was mediated by satisfaction of the need for competence, autonomy and relatedness, a multiple mediation model with the bootstrapping approach described by Preacher and Hayes (2008) was utilised. This method tests the first two steps of mediation; the presence of an effect of the predictors (achievement goals) on the intervening variables (three psychological needs), and of the intervening variables on the outcomes (different forms of self-determined motivation). It further provides the magnitude of the direct effect of the predictor on the outcome variable, the indirect effect of the predictor on the outcome variable through the intervening variable and the total effect (sum of indirect and direct effects). The Preacher and Hayes (2008) approach was preferred as its statistical power is greater than that of the largely applied causal steps approach (Baron & Kenny, 1986), which requires researchers to individually estimate all paths in the model and then evaluate the presence of mediating effects based on statistical criteria. Furthermore, the Preacher and Hayes (2008)

approach does not require multivariate normality of the data, and provides a parsimonious method for analysing multiple mediators (Hayes, 2009; Preacher & Hayes, 2008).

Following recommendations by Preacher and Hayes (2008) for multiple mediation models, 5000 bootstrapping samples with replacement were used to derive a parameter estimate for both total and specific indirect effects. These effects were computed with the bootstrapping algorithm of Preacher and Hayes (2008), which is based on latent variable scores provided in the PLS output. A specific indirect effect represents the ability of a specific intervening variable to mediate the effect of a predictor on an outcome variable, controlling for all other intervening variables (Preacher & Hayes, 2008). For example, it represents the ability of the need for competence to mediate the effect of mastery goals on intrinsic motivation, controlling for the effect of the need for relatedness and autonomy. The total indirect effect represents the sum of the specific indirect effects across the intervening variables (the three needs) for a given relationship in the model (e.g., effect of mastery goals on intrinsic motivation). The significance of the direct effects was evaluated based on the *p*-values provided in the output. Indirect effects were considered statistically significant if the 95% bias-corrected confidence interval for the parameter estimates did not include zero (Mallinckrodt, Abraham, Wei, & Russell, 2006; Preacher & Hayes, 2008), as this implies that there is at least a 95% chance that the indirect effect is present, that is larger or smaller than zero. Preacher and Hayes (2008) propose that it is possible for specific indirect effects to be significant in the absence of significant direct effects or a significant total indirect effect (see also Mallinckrodt et al., 2006). As such, mediation analyses were performed for all possible indirect effects.

6.3 Results

Convergent and discriminant validity of the factors included in the model was supported (see Table 6.2 and 6.3). Composite reliability indices (Rho) ranged from .79 to .92, and the R^2 values ranged from .10 to .44. The PLS bootstrapped parameter estimates partially supported the hypothesised motivational sequence (see Figure 6.1), with the exception of the avoidance goal latent variable, which was not found to have any statistically significant direct effects on other factors in the model (contradicting H6, H7, and H10).

Table 6.2. Descriptive Statics of Latent Variables in the Measurement Model and Validity Indices

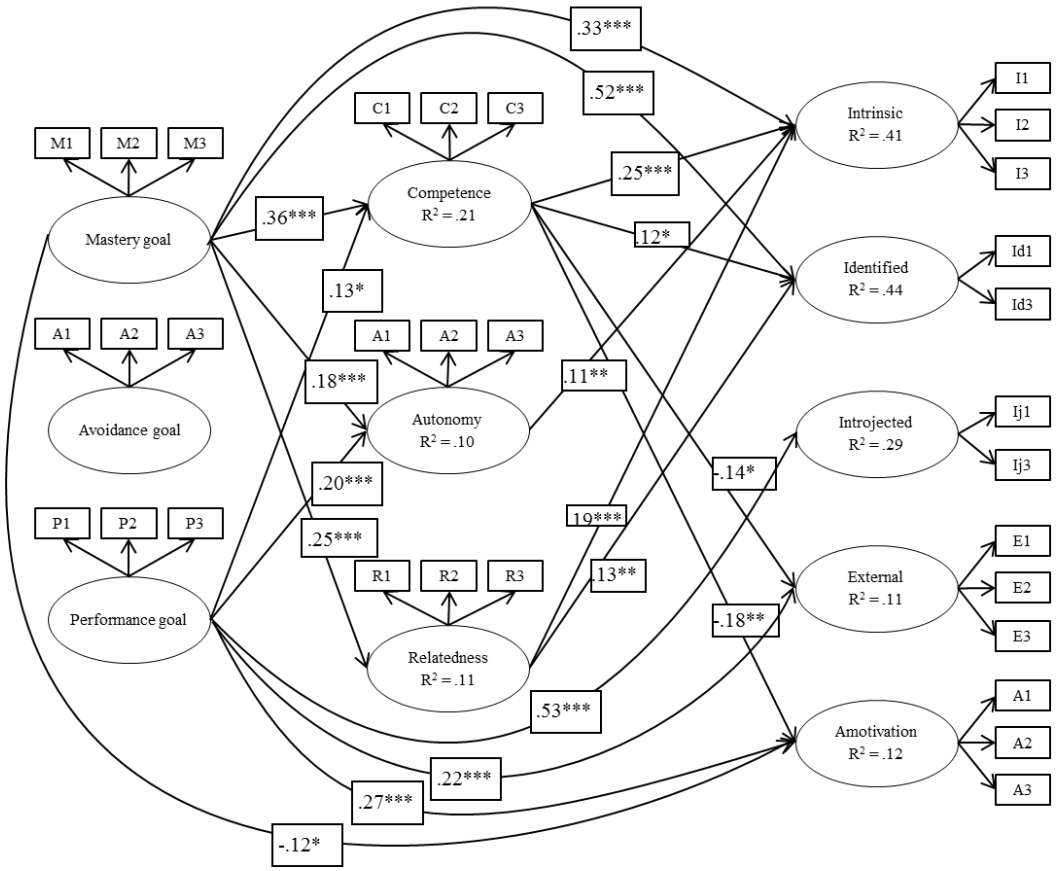
	M[a]	*sd*[a]	Rho[b]	R^2	AVE
1. Mastery goals	3.65	0.41	.79		.56
2. Performance goals	2.90	0.72	.88		.71
3. Avoidance goals	3.19	0.61	.88		.55
4 Need for competence	3.36	0.55	.85	.21	.65
5. Need for autonomy	2.79	0.64	.80	.10	.57
6. Need for relatedness	3.33	0.56	.83	.11	.62
7. Intrinsic motivation	3.61	0.50	.86	.41	.67
8. Identified regulation	3.55	0.50	.84	.44	.72
9. Introjected regulation	2.37	0.91	.92	.29	.85
10. External regulation	1.75	0.84	.89	.11	.74
11. Amotivation	1.62	0.68	.83	.12	.62

Note. [a] Latent variable means; as the SmartPLS output does not provide these values, they were derived using SPSS, based on the unstandardized latent variable scores. Adjusted for number of items per subscale, average item score. [b] reliability score.

Table 6.3. Correlations Between Latent Variables Model (*N*=429)

	1	2	3	4	5	6	7	8	9	10	11
1. Mastery goals	.75										
2. Performance goals	.36	.84									
3. Avoidance goals	.26	.34	.74								
4 Need for competence	.42	.29	.18	.81							
5. Need for autonomy	.25	.26	.11	.30	.75						
6. Need for relatedness	.29	.19	.15	.43	.31	.79					
7. Intrinsic motivation	.51	.25	.17	.49	.32	.43	.82				
8. Identified regulation	.62	.30	.15	.41	.24	.35	.59	.85			
9. Introjected regulation	.16	.51	.21	.07	.07	.11	.07	.19	.92		
10. External regulation	-.08	.13	.06	-.17	-.08	-.15	-.20	-.04	.34	.86	
11. Amotivation	-.13	.14	.01	-.21	-.04	-.15	-.26	-.06	.30	.64	.79

Note. Diagonal elements represent the Square Root of the AVE



Note. For clarity, only those paths that were found to be statistically significant are displayed.

Figure 6.2. Structural model based on achievement goal theory and self-determination theory.

6.3.1 Effects of Approach Goals on Motivation

Mastery goals were statistically significantly and positively related to the two self-determined forms of motivation, confirming H1. H2 could not be confirmed, as no statistically significant effect emerged on introjected regulation. A statistically significantly negative effect of mastery goals on amotivation was observed, in line with H3. Though statistically significant, the path coefficient for this effect fell below the minimum value of .20 recommended by Chin (1998a). Furthermore, no statistically significant relationship between mastery goals and external regulation was identified, partially refuting H3.

Performance goals were statistically significantly and positively related to the two controlled forms of motivation and amotivation, confirming H4. No statistically significant association of performance goals with the self-determined forms of motivation emerged (H5).

6.3.2 Role of Need Satisfaction

Both mastery and performance goals emerged as statistically significant positive predictors of competence and autonomy need satisfaction, in line with H8 and H9. For performance goals, however, the effect on the need for competence was low, while for mastery goals the effect on the need for autonomy was low (path coefficient < .20). Only mastery goals were statistically significantly associated with satisfaction of the need for relatedness, with its effect being positive (see Figure 6.2).

Where statistically significant effects of the needs on the different forms of motivation emerged, the effects of need satisfaction were positive for self-determined forms of motivation, and negative for controlled forms of motivation (see Figure 6.2), in line with H10 and H11. Contradicting expectations, none of the needs was found to be statistically significantly related to introjected regulation (see H11). Also, the need for autonomy and relatedness were not found to have a negative effect on external regulation and amotivation, partially challenging H12. Of note is that the path coefficients for the effect of the three needs on the different forms of motivation largely failed to meet the minimum standard for path strength (see Figure 6.2).

The variance in the need satisfaction and motivational regulation (endogenous) variables accounted for by the model (R^2) is presented in Table 6.2. The variance explained was in the high range ($R^2 > .25$) for the two self-determined forms of motivation and introjected regulation (the upper end of the motivational continuum), and in the medium range for the other constructs ($R^2 > .09$).

6.3.3 Mediation Effects

Mediation analyses indicated the presence of multiple statistically significant indirect pathways. Mediation effects for mastery goals are presented in Table 6.4. The need for competence was found to mediate the positive effect of mastery goals on the two self-determined forms of regulation. Furthermore, this need mediated the negative effect of mastery goals on amotivation. The need for autonomy and relatedness played mediating roles in the effect of mastery goals on intrinsic motivation. These mediation effects were partial, with the exception of the effect of mastery goals on amotivation, which was fully mediated.

Table 6.4. Test of Mediation Effects for Mastery Goals (*N*=429)

Mediator	Total effect [a] (*se*)	Direct effect [b] (*se*)	Indirect effect [c] (*se*)	95% BC CI	
				Lower	Upper
		Mastery goals -> Intrinsic motivation			
Total	.61 (.05)***	.39 (.05)***	.22 (.04)	.15	.31*
Need for competence			.12 (.03)	.06	.20*
Need for autonomy			.03 (.01)	.01	.06*
Need for relatedness			.07 (.02)	.03	.12*
		Mastery goals -> Identified regulation			
Total	.76 (.05)***	.64 (.05)***	.12 (.03)	.07	.18*
Need for competence			.06 (.03)	.02	.13*
		Mastery goals -> Amotivation			
Total	-.19 (.08)*	-.08 (.09)	-.11 (.05)	-.21	-.02*
Need for competence			-.09 (.04)	-.18	-.02*

Note. Estimates derived from 5000 bootstrapped samples. Indirect effect represents the product of the path between the independent variable and mediator and the path between the mediator and the dependent variable. The path estimates are different from the SmartPLS output as a result of different estimation methods used in the Preacher and Hayes approach . BC CI = Bias-Corrected Confidence Intervals.

*$p < .05$, ** $p < .01$, *** $p < .001$

[a] c; [b] c'; [c] bootstrapped results

The mediation effects observed for mastery goals were also observed for performance goals (see Table 6.5). Furthermore, the effect of performance goals on external regulation was found to be mediated by the need for competence. The mediation effects for performance goals were partial, with the exception of that of performance goals on intrinsic motivation, which was fully mediated.

Table 6.5. Test of Mediation Effects for Performance Goals (*N*=429)

Mediator	Total effect [a] (*se*)	Direct effect [b] (*se*)	Indirect effect [c] (*se*)	95% BC CI Lower	95% BC CI Upper
		Performance goals -> Intrinsic motivation			
Total	.17 (.03)***	.05 (.03)	.12 (.02)	.07	.17*
Need for competence			.06 (.02)	.03	.10*
Need for autonomy			.02 (.01)	.01	.04*
Need for relatedness			.03 (.01)	.01	.06*
		Performance goals -> Identified regulation			
Total	.21 (.03)***	.13 (.03)***	.08 (.02)	.05	.12*
Need for competence			.05 (.02)	.02	.09*
		Performance goals -> External regulation			
Total	.17 (.06)**	.25 (.06)***	-.09 (.03)	-.15	-.04*
Need for competence			-.05 (.02)	-.09	-.01*
		Performance goals -> Amotivation			
Total	.16 (.05)***	.22 (.05)***	-.07 (.02)	-.11	-.03*
Need for competence			-.05 (.02)	-.09	-.02*

Note. BC CI = Bias-Corrected Confidence Intervals.

*$p < .05$, ** $p < .01$, *** $p < .001$

[a] c; [b] c'; [c] bootstrapped results

In line with recommendations by Preacher and Hayes (2008) mediation analyses were also performed for the relationship between the avoidance goal construct and the different forms of motivation. Despite the absence of significant direct effects, indirect positive effects of avoidance goals on the two self-determined forms of motivational regulation through competence need satisfaction were identified (see Table 6.6). Furthermore, the need for relatedness was found to play a mediating role in the effect of avoidance goals on intrinsic motivation. All effects of avoidance goals were fully mediated. It must be noted, that although significant, all mediated effects were small in size, not meeting the criterion of a minimum of .20, as recommended by Chin (1998a).

Table 6.6. Test of Mediation Effects Avoidance Goals (*N*=429)

Mediator	Total effect [a] (se)	Direct effect [b] (se)	Indirect effect [c] (se)	95% BC CI Lower	95% BC CI Upper
		Avoidance goals -> Intrinsic motivation			
Total	.13 .(04)***	.04 (.03)	.09 (.02)	.04	.14*
Need for competence			.05 (.02)	.02	.09*
Need for relatedness			.03(.01)	.01	.06*
		Avoidance goals -> Identified regulation			
Total	.11 (.04)**	.04 (.04)	.07 (.02)	.04	.11*
Need for competence			.04 (.01)	.02	.08*

Note. BC CI = Bias-Corrected Confidence Intervals.

*$p < .05$, ** $p < .01$, *** $p < .001$

[a] c; [b] c'; [c] bootstrapped results

6.4 Discussion

In this third phase of the study, the interrelationship between constructs from achievement goal theory and self-determination theory was tested, with the aim of gaining a deeper insight into the factors underlying adaptive motivation in physical education. The hypothesised relationships were largely supported, with the exception of those for the avoidance goal construct. No significant direct effects of avoidance goals on any of the psychological needs or motivational regulations were identified. Indices of the measurement model indicated that the avoidance goal construct was adequately tapped by its indicators, suggesting that children were able to effectively respond to the items. Furthermore, children were found to strongly endorse avoidance goals. This suggests that even though avoidance goals appear to have emerged in 9 to 12 year old children, these goals may not yet have a meaningful or consistent effect on their need satisfaction and motivation in physical education. Doubts have previously been expressed about the relevance of avoidance goals to children's motivation (Cumming et al., 2008; Sideridis & Mouratidis, 2008). Unexpectedly, indirect effects of avoidance goals on the different forms of self-determined motivation emerged. Even though these effects were significant, they were very small in size, suggesting that they may have little practical implication. In response to this, the following discussion will focus on approach goals, and their relationship with constructs from self-determination theory.

6.4.1 Effect of Need Satisfaction on Motivation

One of the hallmarks of self-determination theory is its focus on three innate psychological needs that are proposed to be universal to all individuals, across culture, settings, gender and developmental periods (Deci & Ryan, 2000; Ryan & Deci, 2000b; Ryan & Deci, 2002). The theory argues that if the three needs are satisfied, the emergence of self-determined forms of motivation is facilitated (Deci & Ryan, 2000). In line with this theoretical proposition, and previous research in physical education (e.g., Ntoumanis, 2001b; Standage et al., 2005; Vlachopoulos, 2012), the present study found that children who felt proficient, experienced a sense of choice and personal agency, and felt connected to their peers, were more likely to engage in physical education for self-determined reasons.

6.4.1.1 Need for competence

The results underscored the important role of the need for competence in children's motivation, adding to a large body of evidence on the vital role of competence perceptions in motivation for physical education (e.g., Ntoumanis, 2001b; Standage et al., 2006). Satisfaction of the need for competence was not only found to have a positive effect on the self-determined forms of motivation, but results also revealed a negative effect of the need on external regulation and amotivation. This suggests that if children feel proficient, they are less likely to engage in physical education for reasons that are outside their own control, and more likely to value and enjoy participation.

6.4.1.2 Need for autonomy

Deci and Ryan (1985b, 2000) contend that for intrinsic motivation to emerge, satisfaction of the need for autonomy is essential. As decisional autonomy is inherently limited in a physical education setting, it was focussed on affective autonomy in the present study. In line with findings by Vlachopoulos (2012), who also focussed on affective autonomy, the need for autonomy was found to be positively related to intrinsic motivation. An impact of affective autonomy on intrinsic motivation makes conceptual sense, as this form of motivation is free from any internal or external pressures (Houlfort, Koestner, Joussemet, Nantel-Vivier, & Lekes, 2002a).

Against expectations, no significant effect of the need for autonomy on any of the other forms of motivational regulation was observed. A limited influence of autonomy need satisfaction on other motivational variables does not appear to be unique to the present study, and has also been observed in previous physical education research (e.g., Ntoumanis, 2001b; Ommundsen & Kvalo, 2007; Standage et al., 2003a). Theoretically the experience of behavioural autonomy seems to be antithetical to perceived extrinsic pressure to engage in

physical education. Thwarting of the need for autonomy has been proposed to prime the development of controlled motivation (Deci & Ryan, 2008b). In previous work, this has indeed been observed, however, for external regulation only, and with a small effect size (Ntoumanis, 2001b; Vlachopoulos, 2012). A lack of strong effects of the need for autonomy does not appear to be specific to affective autonomy, as the need's role has also been found to be limited in research focussing on decisional autonomy (Ntoumanis, 2001b; vs. Vlachopoulos, 2012). To speculate, indications of a restricted role of both decisional and affective autonomy need satisfaction in physical education may be a result of the compulsory nature of physical education. Even though the items tapping affective autonomy were designed to tap autonomy that can be experienced within a compulsory setting, experience of such affective autonomy may not be sufficient to systematically influence children's motivation. Deci and Ryan (1985b) proposed that the relative impact of each of the three needs may depend on their functional significance in the context.

6.4.1.3 Need for relatedness

In contrast to the need for autonomy, the need for relatedness has often been considered a less prominent predictor of motivation (Deci & Moller, 2005) while in physical education specifically, its role may be more prominent. Previous studies in physical education have identified the effects of the need for relatedness on self-determined forms of motivation to be more pronounced than those of the need for autonomy (e.g., Ntoumanis, 2001b; Standage et al., 2003a). This also appeared to be the case in the present study, as apart from an effect on intrinsic motivation, a positive effect of the need for relatedness emerged on identified regulation, while no such effect emerged for the need for autonomy. In contrast to a lack of autonomy inherent to physical education, the class does provide children with ample opportunities for social interaction. As a result, children may be more likely to regard physical education as enjoyable and understand its value when they feel connected with, and accepted by their peers (see Cox et al., 2009; Niemiec & Ryan, 2009). The same may be true for children's relationship with their teacher. However, the effect of feelings of relatedness with respect to their teacher was not investigated in the present study.

In contrast to findings of Standage et al. (2003a) and Ntoumanis (2001b), no effect of the need for relatedness on introjected regulation was observed in the present study. Ntoumanis (2001b) argued that the needs' relationship with introjected regulation may indicate that children engage in physical education because they do not want to be isolated from the group. In line with this, in an exercise setting, Gillison, Osborn, Skevington, and Standage (2009) found introjected regulation to be related to social motives in adolescent

boys, including the avoidance of social disapproval. The age of the sample may be a contributing factor as to why no such relationship was observed in the present study; it is likely that social concerns did not yet occur in pre-adolescent children. The studies of Standage et al. (2003a) and Ntoumanis (2001b) involved samples of adolescent high school students, and social relationships of increased importance during adolescence (Brown, 2004). Concerns about social relationships over adolescence may induce motives to engage in physical education related to wanting to demonstrate proficiency (introjected regulation), in order to maintain friendships.

Also no significant effect of the need for relatedness on external regulation and amotivation was observed, in contrast to the negative effects that were expected to emerge. The hypothesised effects were based on research combining all three needs into a single need satisfaction variable (Sebire et al., 2013; Standage et al., 2005). However, in 14 to 16 year old British students, Ntoumanis (2001b) also failed to observe a relationship between feelings of relatedness with respect to peers and both external regulation and amotivation. Such findings stress the importance of taking the individual needs into account rather than an aggregate need satisfaction score. The relationship of the need for relatedness with the different forms of self-determined motivation may be unique, dissimilar to that of the need for competence and autonomy. The need for relatedness has been described to play an important role in the process of internalisation (e.g., see Niemiec & Ryan, 2009). People are more likely to internalise the values of others whom they feel connected to and in an environment in which they experience a sense of belonging. External regulation and amotivation represent orientations that are posited on the end of the motivational continuum where no internalisation has yet taken place. As such, the need for relatedness may not be related to these orientations in a meaningful and consistent manner.

6.4.2 Effect of Achievement Goals

6.4.2.1 Effect on need satisfaction.

Self-determination theory largely focusses on explaining the factors that affect need satisfaction. Personal and socio-contextual factors have been identified that have an influence on need satisfaction, including achievement goals (Deci & Ryan, 2000). The criteria children apply to evaluate their competence (self-referenced or objective for mastery goals, or other-referenced for performance goals) are likely to have an impact on how controllable and realizable their achievement strivings are, which in turn, is likely to have an effect on need satisfaction (see Ntoumanis, 2001a). A link between children’s achievement (approach) goals

and the satisfaction of their needs was supported in the present study, with the exception of the relationship between performance goals and the need for relatedness, which was not found significant. Performance goals may not always be conductive to relatedness need satisfaction, and were hypothesised to potentially have a negative effect. A focus on performance goals, which involves children's engagement in normative comparison, is likely to induce feelings of rivalry, which may thwart social relationships and negatively affect relatedness need satisfaction (see Ntoumanis, 2001a). That such negative effect could not be confirmed in the present study is a positive finding, indicating that even when performance goals were endorsed, children did not feel less accepted by, or connected to, their peers. Similarly, the finding that performance goals had a positive effect on the need for competence and autonomy is encouraging. This implies that in the present, young sample, the endorsement of normative goals is not detrimental to need satisfaction even though mastery goal endorsement may be more favorable, with a positive effect on all three needs.

6.4.2.1 Effect on motivation.

In addition to effects on need satisfaction, achievement goals were also hypothesised to directly affect children's motivation in physical education. Both Nicholls (1989) and Deci and Ryan (2000) consider mastery goals to be related to intrinsic motivation. When children focus on personal improvement and skill mastery, outcomes that are intrinsic to the task at hand, they are likely to engage in physical education for relatively autonomous reasons. In line with this, in the present study mastery goals were found to be positively related to intrinsic motivation. Furthermore, a positive effect of mastery goals on identified regulation, and a negative effect on amotivation, was identified. Based on the strength of the structural path, the effect of mastery goals on identified regulation appeared to be more pronounced than on intrinsic motivation. In physical education settings, where not all activities are likely to be regarded as enjoyable by all children, identified regulation plays an important role. For example, children often engage in drills to practice specific motor skills, before applying these skills in physical activities. Children may not enjoy these drills, while recognising the importance of practicing skills, which are needed for activities they do enjoy. In such cases, identified regulation is likely to be instrumental to persistence in effort (Burton, Lydon, D'Alessandro, & Koestner, 2006; Edmunds, Ntoumanis, & Duda, 2006; Gagné & Deci, 2005). Identified regulation keeps individuals oriented toward the long-term importance of a behaviour (Burton et al., 2006; Edmunds et al., 2006). Long-term engagement in physical education requires learning tasks, developing and improving skills, and sustaining effort, processes which often involve the experience of difficulties or failure. Over time, identified

regulation may thus become more important in regulating children's engagement in physical education than intrinsic motivation (Burton et al., 2006). Furthermore it may play an important role in the transfer of motivation from physical education to leisure-time physical activity settings (Taylor et al., 2010). In a sample of 11 to 16 year old physical education students, Taylor et al. (2010) found both intrinsic motivation and identified regulation to positively predict between-student differences in effort in physical education. However, at the within-person level, only increases in identified regulation in physical education were found to be related to greater leisure-time physical activity (Taylor et al., 2010). The association between mastery goal endorsement and identified regulation, as observed in the present study, thus appears to be adaptive, particularly in the light of behavioural persistence and the transferability from physical education to leisure-time settings. The aim of physical education is not only to ensure children's active engagement in physical education itself, ultimately, it is hoped that it can assist in laying the foundations for an active lifestyle.

A negative effect of mastery goals on the more controlled forms of motivation was hypothesised. Such effects could not be confirmed in the present study, implying that while mastery goal endorsement stimulates adaptive forms of motivational regulation, it does not prevent children from becoming motivated for more extrinsic reasons or becoming amotivated. This contrasts findings of previous studies involving older samples (e.g., Barkoukis et al., 2007). It is likely that an impeding influence of mastery goals on less desirable forms of motivation only emerges later in the course of development. As no previous research has investigated the interrelationship between the motivational constructs at hand in pre-adolescent samples, no such claims can be made with confidence.

As described earlier, while mastery goals have typically been related to adaptive motivational outcomes, performance goals have been ascribed a dual nature (Elliot & Moller, 2003). Performance goals typically involve social comparison and strivings to outperform others. These strivings can result in relatively autonomous, or relatively controlled motives (Deci & Ryan, 2000). For example, children may aim to outperform others, and consequently use this to help identify themselves as a sporty person, to show others they are good, or to win an award, reflecting identified, introjected, and external motives for engagement respectively. Congruent with previous findings of research in physical education (Standage & Treasure, 2002) and sport settings (e.g., Cumming et al., 2008; Ntoumanis, 2001a), in the present study performance goals were found to be positively related to introjected and external regulation, and amotivation. The effect appeared to be most pronounced for introjected regulation. This corroborates the theoretical proposition that children endorsing

performance goals are likely to feel internally controlled and pressured to maintain their self-esteem or prove their competence (Deci & Ryan, 2000).

In the short term, the more controlled forms of motivation that are facilitated by performance goal endorsement can result in positive outcomes. However, they are unlikely to result in long-term behavioural persistence. For example, introjected regulation has been proposed as an important mechanism for initial involvement (through internal prods and pressures), which could provide children with the exposure to physical education needed for them to begin to see the personal value of engagement. It thus has the potential to start the process of internalisation (Deci, Eghrari, Patrick, & Leone, 1994; Gillison et al., 2009), leading to more self-determined forms of motivation (Standage et al., 2003b). In contrast to external regulation, which is triggered by the feeling that one 'must', introjected regulation involves the feeling that one 'should' engage. Consequently, introjected regulation is situated at a transition point along the motivational continuum, where the motives underlying behaviour shift from external pressures (e.g., rewards) to self-imposed pressures (e.g., self-guilt). However, internalisation of the regulation of behaviours and related values does not invariably occur, and if no further internalisation takes place, introjected regulation is unlikely to result in long-term behavioural persistence (Pelletier, Fortier, Vallerand, & Briere, 2001).

From the present results, it remains uncertain whether children would be successful in internalising the value of physical education based on performance goals. Performance goals were directly related to introjected regulation, but not to self-determined forms of motivation. The concurrent endorsement of mastery goals, and satisfaction of the three needs, may be vital to the internalisation process. As such, different combinations of achievement goals endorsed by individuals may play a role in explaining the mixed findings that have emerged in the literature on the effects of performance goals on self-determined forms of motivation. In the present study, performance goals were not found to be related to self-determined forms of motivation, in line with previous findings (Barkoukis et al., 2007; Elliot & Moller, 2003; Standage & Treasure, 2002). However, other studies have identified positive effects of performance goals on self-determined forms of motivation (Elliot & Moller, 2003; Standage et al., 2003b), or negative effects (Ferrer-Caja & Weiss, 2000). Standage and Treasure (2002) identified that different combinations of high and low levels of mastery and performance goal endorsement have dissimilar consequences for students' motivation for physical education. In their study, motivational outcomes were less adaptive when performance goals were endorsed unaccompanied by high levels of mastery goals, or in the case of low endorsement of both

goals (Standage & Treasure, 2002). Other physical education studies have also shown that performance goals can result in adaptive consequences when complemented with mastery goals (e.g., Carr, 2006; Wang & Biddle, 2001). In the present study, children reported high levels of both mastery and performance goal endorsement, and the goals were positively correlated, implying that frequently both goals were endorsed simultaneously. Despite this, performance goal endorsement was not directly related to self-determined forms of motivation. However, indirect effects through satisfaction of the need for competence emerged. This is in line with Standage et al. (2003b)'s findings, which indicated that for children strongly endorsing performance goals, their perceptions of competence moderate the goals' effect on intrinsic motivation. Intrinsic motivation was increased when competence perceptions were high, while it was attenuated when competence perceptions were low. Together, these results suggest that children's concurrent mastery goal endorsement and their competence perceptions play a role in determining the effects of performance goals.

6.4.3 Mediation Effects

Self-determination theory proposes that the need for competence, autonomy and relatedness give achievement goals their psychological tenacity, and influence which regulatory processes guide an individual's goal pursuits (Deci & Ryan, 2000). From this it can be derived that the three psychological needs may play a mediating role in the relationship between achievement goals and motivation. Previously, indications have emerged for the presence of such indirect effects through need satisfaction. For example, the achievement climate in physical education, stimulating children to focus on either personal improvement (mastery) or competition (performance), has been found to have an effect on motivation through need satisfaction (Ntoumanis, 2001b; Standage et al., 2006). Achievement goals are likely to also play a role in this sequence, as the achievement climate in physical education is likely to have an impact on children's achievement goals (İlker & Demirhan, 2013; Wang, Liu, Chatzisarantis, & Lim, 2010). In the present study, the focus was not on the influence of socio-contextual factors, but on personal factors. This focus was taken as little is known about the motivational orientations of pre-adolescent children in physical education, and personal factors are more proximal predictors of motivation than socio-contextual factors.

Confirming expectations, mediation analyses indicated that all three needs mediated one or more effects of achievement goals on the different forms of motivation. The need for competence played the largest role in mediating the effects of achievement goals, increasing

children's likelihood to engage in physical education for self-determined reasons, and decreasing their likelihood to engage for external reasons or to become amotivated. In contrast, the need for autonomy and relatedness did not play a significant role in preventing children from being motivated for extrinsic reasons or becoming amotivated. Children's need satisfaction did not convey any effects of achievement goals on introjected regulation, confirming findings of Vlachopoulos (2012). If needs give goals their psychological tenacity, they are likely to orient children towards self-determined motivation, and away from external regulation when satisfied, with the reverse process occurring when needs are thwarted. Introjected regulation is characterised by the feeling that one 'ought' to engage in a behaviour, which may represent the turning point between being motivated for controlled reasons that are external to the self, or controlled reasons that embody internal pressures. Children who are at an advanced stage in the internalisation of the importance of engagement in physical education, but are still motivated for introjected reasons, may have higher levels of need satisfaction than those whose motivation is more explicitly controlled in character (see Standage et al., 2003a). As a result, varying levels and combinations of need satisfaction may be related to this form of regulation. This would also explain the varying outcomes that have been associated with introjected regulation (Boiché et al., 2008; Gillison et al., 2009). Focussing on the facilitation of need satisfaction, and particularly that of the need for competence, in children who engage in physical education for introjected regulation may help them to value the behaviour, and ultimately to enjoy engagement in the class.

Results of the mediation analyses imply that both achievement goals are likely to result in more adaptive motivational orientations when they satisfy children's psychological needs. This finding is of particular significance in relation to performance goals, as despite the absence of a direct effect on self-determined forms of motivation, results indicated that these goals can have an indirect positive effect, if children's needs are satisfied. Furthermore, the positive effect of performance goals on external regulation and amotivation is likely to be attenuated when children experience a sense of competence. In other words, with performance goal endorsement, satisfaction of the need for competence is likely to increase children's likelihood to engage in physical education for self-determined reasons, and also to serve as a buffer against the positive effect of performance goals on external regulation and amotivation. It is important to note that the majority of mediation effects were partial, suggesting that children's achievement goals have effects on motivation over and above their effect on satisfaction of the three needs as operationalised in the present study.

It remains unclear why no meditation effects through the need for autonomy and relatedness emerged on any of the forms of motivation but on intrinsic motivation. Also, even though statistically significant, the identified mediation effects were generally small in size, particularly with respect to performance goals and avoidance goals. Both issues may be partially related to the narrow definitions that were used for the three needs. For example, items tapping the need for autonomy reflected children's perceptions of affective autonomy within the class, and not their experience of decisional autonomy. Similarly, items tapping the need for relatedness focus on children's perceptions of relatedness with respect to their peers, omitting a focussed on significant others such as teachers and parents. It is likely that if other elements of the three needs were to be tapped in addition to the current attributes, results would indicate a larger mediating role of need satisfaction in the relationship between achievement goals and motivation. For example, relatedness with respect to the teacher rather than peers may mediate the relationship between performance goals and extrinsic forms of motivation and amotivation. If children feel related to their teacher they may be less likely to be motivated to engage in physical education just to please the teacher, and because there is no other option. A study focussing on teacher's relatedness need satisfaction found that teachers' satisfaction of this need with respect to students had a more positive impact on outcome measures that their satisfaction of the need with respect to peers (colleagues) (Klassen, Perry, & Frenzel, 2012). Although not yet investigated, for children, a similar difference may exist.

In a similar vein, the amount of variance explained in the need satisfaction and motivational regulation constructs was generally small to medium-sized. Motivation is a product of a wide variety of factors. As outlined earlier, it has been widely accepted that besides personal factors, socio-contextual factors such as the motivational climate, and support from significant others (e.g., the teacher) have an effect on need satisfaction and motivation. Future studies are needed to incorporate socio-contextual factors in this model, and to investigate the impact of potential additional contributing factors to need satisfaction and motivation. Nevertheless, the present model, with its unique focus on personal factors, was able to account for between 10 and 44% of the variance in the different forms of motivation. The model was less efficacious in explaining variance in children's extrinsic motives for engagement in physical education and amotivation compared to more self-determined motives. Future studies are needed to investigate which motivation related constructs could improve explanatory value with respect to external regulation and amotivation. Regarding the self-determined forms of motivation, results suggest that a

practically significant amount of the variation in these constructs can be attributed to children's achievement goals and the extent to which their psychological needs are satisfied. If interventions can increase children's intrinsic motivation by targeting these underlying constructs, this could have a substantive effect on their engagement in physical education.

6.5 Summary

Results suggest that findings of past research into the interrelationship between motivational variables forwarded by achievement goal theory and self-determination theory involving older samples (e.g., Barkoukis et al., 2007; Moreno, Gonzalez-Cutre, Martin-Albo, & Cervello, 2010; Standage & Treasure, 2002) largely generalise to pre-adolescent children in physical education. Avoidance goals formed an exception, and future work is needed to investigate the role of these goals in pre-adolescent children's motivation. Consistent with self-determination and achievement goal theory, results of this study reinforce the importance of facilitating mastery goal endorsement and satisfaction of all three psychological needs (Deci & Ryan, 2000; Elliot & McGregor, 2001).

The present study builds on the current knowledge base by reporting on the interrelationships of the full array of personal factors described by achievement goal theory and self-determination theory in physical education settings, thereby delivering new insights into mechanisms underlying children's motivation. Such insights could inform the design of effective interventions to promote motivation for physical education in late primary school settings.

Chapter 7: Phase Four: Age and Gender Effects

7.1 Introduction

Phase Four explored whether the model tested in Phase Three was effective in describing the motivational orientations of children across the entire pre-adolescent period and across gender. The way constructs are interrelated may not be equivalent for all children, and may vary depending on children's age and gender. For example, Gillison et al. (2009) found that introjected regulation was underpinned by different reasons and goals when comparing adolescent boys and girls. This may be reflected in the relationship between introjected regulation and achievement goals in the model tested in Phase Three. In the previous phases of the present study children's age and gender were used as control variables. However, insight into the specific impact of these variables on children's motivation would deliver valuable insights, with great practical significance. Firstly, age and gender effects could provide clues to origin of less than optimal indices of validity and reliability that were identified for some of the subscales in Chapter 6. Furthermore, knowledge on the characteristics of the motivational orientations of specific subpopulations could help optimise the effectiveness of interventions aiming to increase all children's motivation for physical education. Consequently, this phase of this study investigated the impact of age and gender on pre-adolescent children's motivation for physical education

Deci and Ryan proposed that the psychological processes and constructs forwarded by self-determination theory are universal across gender and culture, and through developmental periods (Deci & Ryan, 2000; Ryan & Deci, 2000b; Ryan & Deci, 2002). Vallerand (1997) acknowledges that differences are likely to exist in the endorsement of the different constructs of motivation as a function of population differences (e.g., gender, age). However, in line with Deci and Ryan, he argues that the motivational processes described in the hierarchical model of motivation, including the relationship between need satisfaction and self-determined motivation, are similar for all individuals. Based on these postulations, no differences in the interrelationship of motivational constructs as established in Phase Three would be expected across age and gender.

Empirical findings of previous research in the physical activity domain involving samples of youth and adults appear to reinforce propositions that age and gender have little impact upon the interrelationship of motivational constructs (Ntoumanis, 2001b; Standage et al., 2005). For example, in a sample of exercisers between the ages of 16 and 78 years, no gender or age differences were identified for the influence mastery, performance and

avoidance goals on an index of self-determined motivation (relative autonomy index; RAI) (Moreno, Gonzalez-Cutre, Sicilia, et al., 2010). Nevertheless, there is a lack of empirical evidence confirming these suppositions in younger samples. Changes in children's competence perceptions over development are widely discussed in the literature. In various settings, children's perceptions of competence have been found to decline with age (e.g., Fredericks & Eccles, 2002; Wigfield & Eccles, 2002). This trend of decline has been attributed to children's increasing use of social comparison to evaluate competence, and the increasing accuracy of their competence perceptions (Horn & Weiss, 1991; Wigfield & Eccles, 2002). As competence perceptions play a central role in motivation, it is likely that the decline in perceived competence has an effect on other motivational constructs and their interrelationship. As a result of ongoing developmental changes, the motivational orientations of children may not be as well established as those of older populations, and their effects may not be as stable (see Wigfield & Cambria, 2010). However, all constructs are thought to have developed by the age of 9 years, and as such, over pre-adolescence age-related differences in constructs' interrelationships may exist mainly in the strength of the relationships, rather than in the structure. Similarly, gender differences, particularly in strength, are also more likely to exist in the interrelationships between motivational constructs in children compared to adult samples, as a result of gender differences both in physical and psychological development (e.g., Hines, 2011; Malina, Bouchard, & Bar-Or, 2004).

Also in children's endorsement of the individual motivational constructs gender and age differences are likely to exist. Previous research in the educational domain has identified gender differences in levels of intrinsic motivation in children as young as 8 years of age (Guay et al., 2010). It appears that the gender differences identified in this study were a result of gender stereotyping, with boys having higher levels of intrinsic motivation than girls on subjects that are typically regarded as masculine, such as maths (Guay et al., 2010). As physical education is characteristically considered to be a masculine subject by both children and significant others in their environment (Gorely et al., 2003; Hills & Croston, 2012), boys may score higher on the self-determined forms of motivation than girls (see Johnson, Prusak, Pennington, & Wilkinson, 2011). Furthermore, based on the existing literature, boys are likely to score higher on both mastery and performance goals (Carr & Weigand, 2008; Warburton & Spray, 2008). With respect to age, motivation for physical education has generally been found to decline with age. With age, children typically score lower particularly on motivational constructs that are adaptive in character (see Digelidis & Papaioannou, 1999; Papaioannou et al., 2006). For example, in various settings, children's

perceptions of competence have been found to decline with age (e.g., Fredericks & Eccles, 2002; Wigfield & Eccles, 2002). There is a lack of research into gender and age differences in children's endorsement of the motivational constructs in the model, and to the best of the author's knowledge, no study has specifically focussed on the effect of age and gender on the interrelationships between motivational constructs over the pre-adolescent years.

Consequently, the aim of the present phase of the study was to investigate age and gender differences in the interrelationship between constructs included in the motivational model tested in Phase Three in pre-adolescent children specifically. It was hypothesised that differences exist in the relationship of the motivational constructs as a function of age as well as gender. Specifically, the strengths of the paths connecting the constructs in the model tested in Phase Three was expected to be significantly stronger in the older children compared to the younger children, as a result of development. With respect to gender, effects of performance goal endorsement were hypothesised to be more positive for boys than girls, resulting in stronger structural paths between the goal and need satisfaction and self-determined forms of motivation for boys. Considering pre-adolescent children's endorsement of the motivational constructs, gender and age differences were also hypothesised to emerge in subscale scores. It was hypothesised that declining levels of adaptive motivation were already present at pre-adolescent age (e.g., see Jacobs et al., 2002; Warburton & Spray, 2008). Consequently, the endorsement of adaptive motivational constructs, such as self-determined forms of motivation was expected to decrease with age, and the endorsement of less adaptive motivational constructs such as external regulation was expected to increase. Boys were hypothesised to having higher levels of competence need satisfaction and mastery and performance goal endorsement in physical education.

7.2 Method

7.2.1 Participants

For the purpose of this phase of the study, data from the same sample as in Phase Two were used. The total sample consisted of 429 pre-adolescent children. Table 7.1 provides the number of participants per age and gender group, together with mean ages. See Table 5.1 for the division over participants over the different school years.

Table 7.1. Participants per Age Sample

Age-group	N	*M* age (*SD*)	n Boys	*M* age (*sd*)	n Girls	*M* age (*sd*)
Total	429	10.72 (1.06)	214	10.80 (1.05)	215	10.64 (1.06)
9 years	136	9.54 (0.30)	64	9.58 (0.29)	72	9.51 (0.31)
10 years	120	10.47 (0.26)	57	10.48 (0.27)	63	10.46 (0.25)
11 years	119	11.50 (0.30)	62	11.51 (0.30)	57	11.48 (0.31)
12 years	54	12.50 (0.34)	31	12.45 (0.33)	23	12.57 (0.36)

7.2.2 Measures and Procedure

The same set of measures as described in Chapter 5 was applied to assess children's achievement goals, need satisfaction, and both level and form of motivation.

7.2.3 Data Analysis

To test whether age had a moderating effect on the relationships between the latent variables the non-parametric bootstrapping approach for multi-group analyses in PLS, described by Henseler and colleagues (Henseler, 2012; Henseler, Ringle, & Sinkovics, 2009), was used. This method was developed in response to the parametric assumptions of existing multi-group analysis approaches which are based on an unpaired samples t-test (e.g., Keil et al., 2000), similar to a Mann-Whitney-Wilcoxon test (Mann & Whitney, 1947; Wilcoxon, 1947). The non-parametric bootstrapping approach follows the distribution-free characteristic of PLS modelling by directly comparing group-specific bootstrap estimates for each bootstrap sample. Doing so, it estimates the probability of differences in structural paths and factor loadings based on group-membership. In other words, the method allows the researcher to evaluate the robustness of the group-specific parameter estimates.

Firstly, distinct PLS models were estimated for 9, 10, 11 and 12 year old children. As the sample of 12 year old children was relatively small, combining the 11 and 12 year old participants in one group was considered. However, the focus was on the effect of chronological age. Previous longitudinal research has identified marked differences in the activity levels of 11 and 12 year old children (Armstrong, Welsman, & Kirby, 2000; Nader et al., 2008). For example, Nader et al. (2008) identified that girls on average stop meeting the guidelines for physical activity when they are 12 years of age, while still meeting these guidelines at 11 years of age. Such changes in physical activity may be able to be explained by changes in motivational orientations, and as such, it is important to investigate motivation for the different age groups individually.

The measurement and structural models were evaluated for the four age samples separately, using the indices of model fit that were also applied in Chapter 6. That is, for the measurement model, model fit was supported if the composite reliability for the subscales (CR) exceeded .70, the average variance extracted (AVE) exceeded .50 (Barclay et al., 1995), factor loadings exceeded .40 (Ford et al., 1986), the items' factor loadings exceeded the items' cross-loadings on the other latent variables in the model, and the square root of the AVE exceeded the variables' correlation with other latent variables in the model (Chin, 1998a). For the structural models, average path coefficients (β) were obtained for the four age groups individually using a bootstrapping resampling technique with 5000 iterations (Chin, 1998b). These were inspected together with the associated significance levels (using the *t*-statistic[2]), and the variance explained in the endogenous variables (R^2). Results were compared across the age samples.

Subsequent to these analyses, group-differences in the factor loadings (measurement model) and path coefficients were tested using the bootstrap-based PLS multi-group analysis method. The PLS-MGA approach allows for the detection of group effects based on a significance level of $p < .01$. As PLS multi-group method allows for the comparison of only two groups at a time, all age samples were contrasted in separate analyses. The method is suitable for the testing of one-sided hypotheses only, and to account for this, a significance level of $p < .025$ was applied for the evaluation of results. Where significant differences were identified in the age sample-specific factor loadings or path coefficients, this was considered indicative of a moderating effect of group-membership (i.e., age sample). The same procedure was repeated to evaluate whether gender had a moderating effect on the relationships between the latent variables in the model.

As described, multivariate methods were adopted for model comparison across groups, as with such methods type I error rate is reduced (Raykov & Marcoulides, 2012). All latent variables are taken into account simultaneously, allowing for the analysis of interrelationships among the dependent variables, as was the purpose of this part of the study. Considering all constructs simultaneously ensures that no information is lost as a result of multiple independent analyses (as with univariate analysis), making it a more powerful analysis method compared to univariate methods. However, multivariate analysis of the data does not provide the same detail of insight into the data as univariate methods, but rather a more general depiction (Raykov & Marcoulides, 2012). Therefore, univariate methods were

[2] using Excel's function: *=T.DIST.2T(x,deg_freedom)*

considered for the subsequent comparison of mean scores on the constructs across the subgroups. With these analyses, the interrelationship between constructs was not of interest, justifying the use of such methods.

As SmartPLS does not provide bootstrapped latent variable scores, age and gender differences in mean scores on the constructs were evaluated using a set of two-way (age x gender) MANOVAs. Three separate MANOVAs, one for each questionnaire, were performed to evaluate age and gender differences in the subscale scores. In each linear model the main effects for age and gender, and the interaction effects between age and gender were estimated. Partial eta squared ($\eta^2 p$) was inspected as an estimate of effect size for group mean differences. Values of $.01 \leq \eta^2 p < .06$ are considered small, $.06 \leq \eta^2 p < .14$ medium, and $\eta^2 p \geq .14$ large effects (Cohen, 1977). Where statistically significant main effects emerged, univariate comparisons were used to identify significant subgroup differences. Bonferroni corrections were applied to correct for the effects of multiple comparisons. Age has four levels generating four 'male versus female' comparisons for the age x gender interaction. Bonferroni corrections were applied when testing each of these comparisons. All statistical analyses were conducted using SPSS version 19 (IBM), and a $p < .05$ criterion was set for statistical significance.

7.3 Results

7.3.1 Effect of Age on the Measurement Model

Firstly, the age samples did not significantly differ in their distribution of gender (F (3,425) = .72; p =.542). Inspection of the indices of convergent and discriminant validity supported the adequacy of the measurement model across age (see Table 7.2). Across the age samples, all factor loadings were statistically significant, and exceeded the minimum criterion of .40, suggesting that the items adequately indicated the constructs across the entire pre-adolescent age-range. Even though the indices met the standards for all ages, there appeared to be a trend of higher factor loadings and indices of convergent and discriminant validity (AVE, composite reliability) for the older respondents (see Table 7.2). Multi-group analysis of the factor loadings indicated that some loadings were statistically significantly higher for the older age samples. Similarly, the proportion of variance in the variables that was explained by the model was larger for the older respondents (see Table 7.2).

7.3.2 Effect of Age on the Structural Model

Comparison of the structural models for the 9, 10, 11 and 12 year old children revealed differences in the structural paths that emerged as significant, and multi-group analyses indicated statistically significant differences in the strength of the relationships across the age samples. These differences will be discussed for achievement goals and need satisfaction separately.

Table 7.2. Descriptive Statistics per Age Sample

	9 y (*n*=136)				10 y (*n*=120)				11 y (*n*=119)				12 y (*n*=54)			
	M (*sd*)[a]	AVE	Rho[b]	R^2	*M* (*sd*)[a]	AVE	Rho[b]	R^2	*M* (*sd*)[a]	AVE	Rho[b]	R^2	*M* (*sd*)[a]	AVE	Rho[b]	R^2
Mastery goals	3.68 (.38)	.49	.74		3.63 (.41)	.54	.78		3.65 (.38)	.56	.80		3.62 (.52)	.74	.89	
Performance goals	2.91 (.77)	.68	.87		2.93 (.64)	.68	.87		2.83 (.76)	.78	.91		2.97 (.68)	.74	.90	
Avoidance goals	3.27 (.57)	.50	.86		3.19 (.57)	.51	.86		3.12 (.65)	.58	.89		3.17 (.67)	.66	.92	
Need for competence	3.36 (.53)	.59	.81	.18	3.35 (.55)	.70	.87	.23	3.37 (.52)	.61	.82	.23	3.40 (.63)	.86	.95	.32
Need for autonomy	2.97 (.70)	.56	.79	.10	2.91 (.61)	.54	.77	.12	2.99 (.60)	.55	.78	.15	3.08 (.67)	.61	.82	.14
Need for relatedness	3.45 (.49)	.55	.78	.17	3.26 (.63)	.70	.88	.10	3.25 (.57)	.59	.81	.06	3.33 (.50)	.55	.78	.38
Intrinsic motivation	3.67 (.46)	.67	.86	.33	3.57 (.51)	.63	.83	.49	3.60 (.48)	.67	.86	.51	3.57 (.55)	.77	.91	.55
Identified regulation	3.60 (.47)	.67	.80	.44	3.55 (.47)	.70	.82	.50	3.53 (.50)	.73	.84	.45	3.47 (.60)	.85	.92	.68
Introjected regulation	2.56 (.93)[b]	.85	.92	.39	2.39 (.89)	.84	.91	.26	2.17 (.90)	.89	.94	.27	2.27 (.83)	.75	.86	.33
External regulation	1.96 (.93)[b]	.72	.88	.14	1.75 (.83)	.72	.88	.16	1.56 (.68)	.73	.89	.22	1.65 (.84)	.81	.93	.19
Amotivation	1.73 (.77)	.66	.85	.16	1.70 (.71)	.60	.82	.19	1.49 (.56)	.60	.81	.18	1.49 (.58)	.51	.75	.24

Note. [a] Latent variable means and standard deviations. [b] Reliability score

[b] significantly higher than 11 year old children

7.3.2.1 The role of mastery goals across age.

The strength of the structural paths from the three achievement goal latent variables to the self-determination theory latent variables per age sample are presented in Table 7.3. For none of the age samples was the mastery goal latent variable found to have a statistically significant effect on introjected regulation, external regulation and amotivation latent variables. However, the mastery goal latent variable was consistently found to be positively and statistically significantly related to the intrinsic motivation and identified regulation latent variables. The only exception was the absence of a statistically significant relationship between the mastery goal latent variable and the intrinsic motivation latent variable for the 9 year old children. The effect in this youngest age sample was, nevertheless, in the hypothesised positive direction, and almost reached the minimum criterion of .20 for standardised path strength to be considered meaningful (Chin, 1998a). Furthermore, multi-group analysis did not indicate a statistically significant difference in strength of this structural path when comparing 9 year old children to any of the other age samples (see Table 7.3). The only effect of the mastery goal latent variable that was found to differ across age samples with the multi-group analysis was the effect on the identified regulation latent variable, which was stronger for the 10 and 11 year old children compared to the 9 year olds.

The structural paths between the mastery goal latent variable and the three need satisfaction latent variables were found to be positive for all, and statistically significant for most age samples (see Table 7.3). For the 12 year old children these paths did not reach statistical significance, however, path strengths exceeded the minimum criterion of .20 and were similar in magnitude to those for the other age samples. Furthermore, multi-group analyses did not indicate any statistically significant inter-age group differences in the effect of mastery goals on need satisfaction. The statistically insignificant results for 12 year olds were likely a result of the small sample size of this age-group. Chin (1998b) suggested that for model testing using PLS methods, a sample size is needed of ten times the largest number of indicators per one latent variable, or the largest number of independent variables impacting one dependent variable, depending on which of the two is the largest. In the present study, the sample size requirements proposed by Chin (1998b) were met. However, Chin and Newsted (1999) acknowledged that small sample sizes decrease the sensitivity of the test.

7.3.2.2 The role of performance goals across age.

The structural path between the performance goal and introjected regulation latent variables was found to be statistically significant and positive for all age samples (see Table 7.3). For the 9 and 10 year old children, also the structural path between the performance goal and external regulation latent variables was statistically significant and positive. Multi-group analyses indicated that the strength of this path was statistically significantly different for 9 year old compared to 11 year old children, with the path being stronger for the 9 year olds. For the 9 year old children only, the performance goal latent variable was found to have a statistically significant positive effect on the amotivation latent variable. Multi-group analysis indicated this effect to be significantly stronger for 9 year old children compared to 10 and 11 year old children. For the 12 year old children, a positive effect of performance goals on amotivation may also be present, as indicated by the strength of this structural path. The insignificance of the result for the 12 year olds was likely due to the small size of this sample, as discussed in §7.3.2.1.

The structural path from the performance goal latent variable to the need for autonomy latent variable was found to be statistically significant and positive for the 9 and 11 year old children. Despite the insignificance of this path for the 10 and 12 year old children, the strength of the path exceeded the minimum criterion of .20 for all age samples (see Table 7.3). The insignificance of the result for the 12 year old sample was likely due to its relatively small number of participants, as discussed in §7.3.2.1 for the effect of mastery goals on this need. The structural path from the performance goal latent variable to the need for relatedness latent variable was statistically significant and positive for 9 year old children only. On the need for competence latent variable, no statistically significant effects of the performance goal latent variable could be identified (see Table 7.3). However, based on the path strength it appears that performance goals may have a positive effect on this need for the sample of 12 year olds. Multi-group analyses indicated an absence of any statistically significant differences in the strength of the structural paths between the performance goal and the need satisfaction latent variables for the four age samples. The effect of the performance goal on the need for relatedness latent variable formed the only exception, with a statistically significant stronger path for the 9 year old children compared to the 11 year old age sample.

Table 7.3. Structural Paths between Latent Variables per Age Sample – Achievement Goals

	β 9y	β 10y	β 11y	β 12y
Mastery goals-> Need for competence	.24*	.43***	.46***	.28
Mastery goals -> Need for autonomy	.20*	.16	.28**	.24
Mastery goals -> Need for relatedness	.25*	.26**	.25*	.33
Mastery goals -> Intrinsic motivation	.17	.30**	.43***	.43**
Mastery goals -> Identified regulation	.28*** [b c]	.54*** [a]	.68*** [a]	.61***
Mastery goals -> Introjected regulation	-.03	-.07	.04	.12
Mastery goals -> External regulation	.03	.01	-.16	-.18
Mastery goals -> Amotivation	-.08	-.03	-.14	-.14
Performance goals -> Need for competence	.15	.03	.09	.27
Performance goals -> Need for autonomy	.22*	.23	.20*	.24
Performance goals -> Need for relatedness	.23* [c]	.07	-.08 [a]	.17
Performance goals -> Intrinsic motivation	-.03	.01	-.04	.13
Performance goals -> Identified regulation	.05	.15* [c]	-.08 [b]	.17
Performance goals -> Introjected regulation	.57***	.50***	.46***	.54***
Performance goals -> External regulation	.37*** [c]	.24**	.11 [a]	.08
Performance goals -> Amotivation	.45*** [b c]	.18 [a]	.14 [a]	.29
Avoidance goals -> Need for competence	.13	.16	-.06	.07
Avoidance goals -> Need for autonomy	-.10	.05	.05	-.02
Avoidance goals -> Need for relatedness	.05	-.04	.08	.29
Avoidance goals -> Intrinsic motivation	-.08 [c]	-.03	.15 [a d]	-.13 [c]
Avoidance goals -> Identified regulation	-.15*	.04	-.04	-.15
Avoidance goals -> Introjected regulation	.08	.08	-.07	.10
Avoidance goals -> External regulation	-.03	.11	.02	.09
Avoidance goals -> Amotivation	-.21 [b]	.18 [a]	-.01	.08

Note. Controlled for gender. See Figure 3.1 for a visualisation of the structural paths.

* indicates significance of structural path $p < .05$, ** $p < .01$, *** $p < .001$

[a] significant difference with 9 year olds $p < .025$

[b] significant difference with 10 year olds $p < .025$

[c] significant difference with 11 year olds $p < .025$

[d] significant difference with 12 year olds $p < .025$

7.3.2.3 The role of avoidance goals across age.

The avoidance goal latent variable was not found to have a significant effect on any of the motivational regulation latent variables for any of the age samples, with the exception of a statistically significant negative effect on the identified regulation latent variable for the 9

year old children only (see Table 7.3). The strength of this structural path was, however, below the criterion of .20. Furthermore, multi-group analyses indicated that this structural path was not significantly different for the 9 year old subsample compared to the other age samples. No statistically significant effects emerged for the avoidance goal latent variable with respect to the need satisfaction latent variables (see Table 7.3).

7.3.2.4 The role of the need for competence across age.

As presented in Table 7.4, the structural paths between the need satisfaction latent variables and the motivational regulation latent variables were found to for the different age samples. The need for competence latent variable was found to have a statistically significant positive effect on the intrinsic motivation latent variable for 9, 10 and 11 year old children. For 9 year old children, this need latent variable had a further statistically significant positive effect on the identified regulation latent variable, and a negative effect on the external regulation latent variable. A statistically significant negative effect on the amotivation latent variable emerged for the 10 year old children. For the 11 year old children a statistically significant negative effect on the introjected regulation latent variable emerged for the need for competence latent variable. Multi-groups analyses indicated the absence of any statistically significant age-differences in the structural paths of need for competence latent variable.

7.3.2.5 The role of the need for autonomy across age.

No statistically significant effects were identified for the need for autonomy latent variable on any of the motivational regulation latent variables (see Table 7.4). Furthermore, no age-group differences emerged for the need for autonomy latent variable in the multi-group analyses.

7.3.2.6 The role of the need for relatedness across age.

The need for relatedness latent variable was found to have a statistically significant positive effect on the intrinsic motivation latent variable for all age-group samples, with the exception of the 11 year olds (see Table 7.4). Multi-group analysis indicated that the structural path between the need for relatedness and intrinsic motivation latent variables differed significantly for 11 year old children compared to the other age-group samples, being lower in strength for the 11 year olds. The need for relatedness latent variable further had a statistically significant positive effect on the identified regulation latent variable for the 9 year old children only. This structural path was found to be statistically significantly stronger for the 9 year olds compared to 10 and 11 year old children in multi-group analyses. For the 12 year old children the need for relatedness latent variable had a statistically significant

negative effect on the amotivation latent variable (see Table 7.4). However, no significant age-group differences in the strength of this structural path were observed with the multi-group analyses.

Table 7.4. Structural Paths between Latent Variables per Age Sample – Need Constructs

	β 9y	β 10y	β 11y	β 12y
Need for competence -> Intrinsic motivation	.26*	.34**	.30***	.03
Need for competence -> Identified regulation	.21*	.16	-.03	.11
Need for competence -> Introjected regulation	-.04	-.01	-.30**	.02
Need for competence -> External regulation	-.20*	-.11	-.08	-.10
Need for competence -> Amotivation	-.08	-.31*	-.16	-.17
Need for autonomy -> Intrinsic motivation	.10	.06	.15	.11
Need for autonomy -> Identified regulation	.05	.07	.03	.00
Need for autonomy -> Introjected regulation	-.03	-.06	.02	-.13
Need for autonomy -> External regulation	.04	-.05	-.22	-.16
Need for autonomy -> Amotivation	.04	.06	-.07	-.04
Need for relatedness -> Intrinsic motivation	.32** [c]	.21* [c]	-.03 [a d b]	.29* [c]
Need for relatedness -> Identified regulation	.36*** [b c]	-.02 [a c]	.10 [c]	.13
Need for relatedness -> Introjected regulation	.07	.06	.02	-.12
Need for relatedness -> External regulation	.01	-.25	-.19	-.25
Need for relatedness -> Amotivation	.02	-.11	-.21	-.38*

Note. Controlled for gender. See Figure 3.1 for a visualisation of the structural paths.

* indicates significance of structural path $p < .05$, ** $p < .01$, *** $p < .001$

[a] significant difference with 9 year olds $p < .025$

[b] significant difference with 10 year olds $p < .025$

[c] significant difference with 11 year olds $p < .025$

[d] significant difference with 12 year olds $p < .025$

7.3.3 Effect of Gender on the Measurement Model

The sample of boys and the sample of girls were not found to differ statistically significantly in age (t = -1.29, df = 425, p =.196). Inspection of the indices of convergent and discriminant validity supported the adequacy of the measurement model across gender (see Table 7.5). No statistically significant differences in factor loadings across gender emerged.

7.3.4 Effect of Gender on the Structural Model

Comparison of the structural models for boys and girls revealed differences in the structural paths that emerged as statistically significant, and multi-group analyses indicated statistically significant differences in the strength of the structural paths across gender.

Table 7.5. Descriptive Statistics per Gender

	Boys (*n*=214)				Girls (*n*=215)			
	M (*sd*) [a]	AVE	Rho [b]	R^2	*M* (*sd*) [a]	AVE	Rho [b]	R^2
Mastery goals	3.68 (.41)	.58	.80		3.63 (.41)	.54	.78	
Performance goals	3.05 (.71) *	.72	.89		2.72 (.70) *	.69	.87	
Avoidance goals	3.22 (.62)	.56	.88		3.16 (.59)	.53	.87	
Need for competence	3.43 (.54) *	.64	.84	.25	3.29 (.55) *	.67	.86	.15
Need for autonomy	3.01 (.66)	.59	.81	.15	2.93 (.62)	.54	.78	.09
Need for relatedness	3.34 (.56)	.62	.83	.11	3.31 (.56)	.62	.83	.13
Intrinsic motivation	3.61 (.49)	.68	.87	.39	3.60 (.50)	.65	.85	.49
Identified regulation	3.56 (.50)	.75	.85	.41	3.54 (.50)	.72	.84	.49
Introjected regulation	2.46 (.92)	.83	.91	.26	2.28 (.89)	.87	.93	.34
External regulation	1.72 (.82)	.76	.90	.11	1.79 (.85)	.72	.89	.13
Amotivation	1.58 (.65)	.57	.80	.14	1.66 (.70)	.66	.85	.13

Note. [a] Latent variable means and standard deviations. [b] reliability score

* $p < .05$ significantly higher score for boys

7.3.4.1 The role of mastery goals across gender.

The mastery goal latent variable was found to have a statistically significant positive effect on the intrinsic motivation and identified regulation latent variables for both boys and girls (see Table 7.6). No statistically significant effect on the other motivational regulation latent variables was observed for either gender. Multi-group analysis indicated that the strength of the structural path between the mastery goal and intrinsic regulation latent variables was statistically significantly stronger for the sample of boys.

For both genders the structural path between the mastery goal latent variable and the need for relatedness and competence latent variables was statistically significant and positive. However, the mastery goal latent variable's effect on the need for autonomy latent variable was statistically significant for boys only (see Table 7.6). However, no gender difference in the strength of this structural path was identified with the multi-groups analysis.

Table 7.6. Structural Paths between Latent Variables per Gender – Achievement Goals

	β Boys	β Girls
Mastery goals-> Need for competence	.41***	.33***
Mastery goals -> Need for autonomy	.22***	.17
Mastery goals -> Need for relatedness	.24***	.29***
Mastery goals -> Intrinsic motivation	.47***[a]	.21** [a]
Mastery goals -> Identified regulation	.56***	.48***
Mastery goals -> Introjected regulation	.06	-.08
Mastery goals -> External regulation	-.04	-.10
Mastery goals -> Amotivation	-.13	-.10
Performance goals -> Need for competence	.10	.15
Performance goals -> Need for autonomy	.19**	.22***
Performance goals -> Need for relatedness	.03	.14
Performance goals -> Intrinsic motivation	.00	-.02
Performance goals -> Identified regulation	-.07 [a]	.19*** [a]
Performance goals -> Introjected regulation	.48*** [a]	.55*** [a]
Performance goals -> External regulation	.16*	.28***
Performance goals -> Amotivation	.19**	.33***
Avoidance goals -> Need for competence	.13	-.05
Avoidance goals -> Need for autonomy	.09	-.11
Avoidance goals -> Need for relatedness	.14	-.04
Avoidance goals -> Intrinsic motivation	.04	.01
Avoidance goals -> Identified regulation	.00	-.08
Avoidance goals -> Introjected regulation	.03	.09
Avoidance goals -> External regulation	.02	.06
Avoidance goals -> Amotivation	.04	-.06

Note. Controlled for age

* indicates significance of structural path $p < .05$, ** $p < .01$

[a] significant gender difference $p < .025$

7.3.4.2 The role of performance goals across gender.

The effects of the performance goal latent variable on the introjected regulation, external regulation and amotivation latent variables were statistically significant and positive across gender (see Table 7.6). The structural path between the performance goal latent variable and the identified regulation latent variable was statistically significant for girls only. Multi-group analysis indicated that this structural path was statistically significantly stronger

for the sample of girls. Also the structural path between the performance goal and introjected regulation latent variables was statistically significantly stronger for girls, even though statistically significant in for both genders.

For both genders the performance goal latent variable exerted a statistically significant effect on the need for autonomy latent variable only. No differences across gender in the effect of the performance goal latent variable on the need satisfaction latent variables emerged with the multi-group analyses.

7.3.4.3 The role of avoidance goals across gender.

For the avoidance goal latent variable, none of the structural paths emerged as statistically significant, for boys nor girls. All path coefficients fell below the minimum criterion of .20. No gender differences were observed in the multi-group analyses.

7.3.4.4 The role of the need for competence across gender.

Table 7.7 presents the strength of the structural paths between the three need satisfaction latent variables and the motivational regulation latent variables per gender. The need for competence latent variable was found to be statistically significantly and positively related to the intrinsic motivation and identified regulation latent variables for girls only. Statistically significantly and negative structural paths between the need for competence and external regulation latent variables emerged, for girls only. The strength of the path between the need for competence and identified regulation latent variables fell below the minimum criterion of .20. In the sample of boys, statistically significant and negative effects were observed on introjected regulation and amotivation for this competence need latent variable. These effects did not reach statistical significance for girls (see Table 7.7). Multi-group analyses, however, indicated that only the strength of the effect of the need for competence on intrinsic motivation and introjected regulation differed statistically significantly when comparing the sample of boys and girls (see Table 7.7).

7.3.4.5 The role of the need for autonomy across gender.

For the need for autonomy latent variable, the only statistically significant structural path that emerged was that with the intrinsic motivation latent variable in girls. The strength of all structural paths fell below the .20 criterion (see Table 7.7). Multi-group analyses indicated an absence of any statistically significant differences in path strength between boys and girls.

7.3.4.6 The role of the need for relatedness across gender.

The structural path between the need for relatedness and intrinsic motivation latent variables was found to be statistically significant for both boys and girls. The effect of the

need for relatedness latent variable on identified regulation was statistically significant for boys only. The strength of all structural paths fell below the .20 criterion, with the exception of the path between the need for relatedness and intrinsic motivation latent variables for the sample of girls (see Table 7.7). Multi-group analyses indicated no statistically significant differences in path strength when comparing the sample of boys and girls.

Table 7.7. Structural Paths between Latent Variables per Gender – Need Constructs

	β Boys	β Girls
Need for competence -> Intrinsic motivation	0.07 [a]	.37*** [a]
Need for competence -> Identified regulation	0.08	.15*
Need for competence -> Introjected regulation	-0.21**[a]	.03 [a]
Need for competence -> External regulation	-0.06	-.21**
Need for competence -> Amotivation	-0.26**	-.12
Need for autonomy -> Intrinsic motivation	.05	.17**
Need for autonomy -> Identified regulation	.03	.04
Need for autonomy -> Introjected regulation	.00	-.10
Need for autonomy -> External regulation	.00	-.10
Need for autonomy -> Amotivation	.05	-.05
Need for relatedness -> Intrinsic motivation	.16**	.22**
Need for relatedness -> Identified regulation	.13*	.11
Need for relatedness -> Introjected regulation	.05	.03
Need for relatedness -> External regulation	-.18	-.05
Need for relatedness -> Amotivation	-.11	-.11

Note. Controlled for age

* indicates significance of structural path $p < .05$, ** $p < .01$

[a] significant gender difference $p < .025$

7.3.5 The Effect of Age and Gender on Subscale Scores

A series of MANOVAs was conducted, comparing mean scores on the achievement goal, need satisfaction and motivational regulation constructs across the age samples and gender (see Table 7.8). There were no statistically significant interactions between age and gender on any of the variables.

Table 7.8. MANOVA Results Examining Age and Gender

	Wilk's λ	F	*Df*	*p*	$\eta^2 p$
Achievement goals					
Age	.98	0.83	9,1007.72	.585	.01
Gender	.96	5.98	3,414	.001	.04
Age x gender	.98	0.89	9,1007.72	.537	.01
Need satisfaction					
Age	.96	1.83	9,1019.89	.059	.01
Gender	.98	2.86	3,419	.037	.02
Age x gender	.97	1.58	9,1019.89	.117	.01
Motivational orientations					
Age	.93	2.03	15,1151.56	.011	.02
Gender	.98	1.57	5,417	.169	.02
Age x gender	.95	1.53	15,1151.56	.086	.02

Results from the MANOVA indicated the absence of a statistically significant effect of age on children's achievement goals (see Table 7.8). A statistaically signficant main effect for gender on the achievement goal constructs was, however, observed (λ = .96, F(3, 419) = 6.30, p = .000, $\eta^2 p$ = .04). Follow up univariate analysis revealed a gender difference for performance goals (F(1,421) = 18.77, p = .000, $\eta^2 p$ = .04), with boys scoring higher than girls.

Age was not found to have a statistically significant effect on children's need satisfaction. A statistically significant main effect for gender on the need satisfaction constructs did, however, emerge (λ = .98, F(3, 419) = 2.86, p = .037, $\eta^2 p$ = .02) (see Table 7.8). This effect emerged for the need for competence (F(1,421) = 8.25, p = .004, $\eta^2 p$ = .02), with boys scoring higher than girls.

For the different forms of motivational regulation, a statistically significant main effect emerged for age only (Wilks' λ = .93, F(15, 1151.56) = 2.03, p = .05, $\eta^2 p$ = .02). The univariate follow-up tests for differences in scores on individual scales revealed that age had a statistically significant effect on introjected regulation (F(3,421) = 4.46, p = .004, $\eta^2 p$ = .03), external regulation (F(3,421) = 4.35, p = .005, $\eta^2 p$ = .03) and amotivation (F(3,421) = 3.36, p = .019, $\eta^2 p$ = .02). These same three subscales had already been identified to be correlated (small sized correlation) with age in Chapter 5. Simple effect constrasts revealed that 9 year old children scored statistically significantly higher on introjected regulation compared to 11 year old children. Nine year old children also scored statistically significantly

higher than 11 year olds on external regulation. The effect on amotivation was no longer found to be statistically significant in the univariate analysis.

Of note is that, even when satistical significant effects of age or gender were found, the role of age and gender in explaining variance in the variables was very limited. Age and gender at most explained 4% of the variance in the constructs, as indicated by the small size of the partial eta squared values (see Table 7.8).

7.4 Discussion

The aim of this fourth phase of the study was to evaluate potential age and gender differences with respect to the motivational model tested in Chapter 6. Age and gender group comparisons took place at multiple levels, with the aim of gaining insight into how motivation for physical education can be facilitated for all children.

Across the age and gender groups, the items of all three questionnaires appeared to adequately indicate the constructs they were intended to tap. Factor loading were found to be significant for all subsamples, and their values exceeded the minimum criteria for validity and reliability. Furthermore, evaluation of the measurement model fit indices indicated that the fit was acceptable across age and gender samples. This suggests that children across pre-adolescence, and of both genders, interpreted the items representing the constructs in a similar fashion. These findings signal that each of the constructs considered was well defined, and that differences in children's level of experience with physical education or developmental differences did not significantly affect the factorial structure of the motivational questionnaires that were applied. Together, the results seem to provide evidence that the three questionnaires, the C-AGQPE, C-PNSPE and C-PLOC, are equally applicable to pre-adolescent children between the ages of 9 to 12 years, and across gender. Consequently, the evaluation of age and gender differences at the structural level was justified.

Before proceeding to the discussion of age-related differences in motivation, two effects that were consistently observed across age and gender require consideration. In line with findings of an abundance of previous research in the physical activity domain involving older samples, including physical education research (e.g., Barkoukis et al., 2007; Ntoumanis, 2001a; Papaioannou, Simou, Kosmidou, Milosis, & Tsigilis, 2009), mastery goals were found to have a positive effect on identified regulation, and performance goals were found to have a positive effect on introjected regulation. These effects emerged independent of respondents' age or gender, and were the most pronounced effects in the model. As identified regulation is

a more self-determined for of motivation than introjected regulation, this reinforces that mastery goals play a more adaptive role in motivation compared to performance goals. The findings contribute to a wide knowledge base associating the constructs, and add that this association has already emerged by the time children reach the pre-adolescent age. The adaptive qualities of mastery goals will be further illustrated with respect to the goals' effect on need satisfaction. In the following sections, findings regarding effect of age on children's motivational orientations will be discussed, followed by a discussion of gender effects.

7.4.1 Age Differences

Previous studies in sport and exercise settings have often reported motivational models to be invariant across age (e.g., Moreno, Gonzalez-Cutre, Sicilia, et al., 2010; Murcia, de San Román, Galindo, Alonso, & González-Cutre, 2008). In the present study, focussing on a younger population in a physical education context, differences were identified in the interrelationship of constructs across age.

7.4.1.1 Age and the effect of mastery goals on motivation.

Throughout the literature, a clear connection between mastery goals and high levels of intrinsic motivation is drawn (Deci & Ryan, 2000; Rawsthorne & Elliot, 1999). In line with this, a positive effect of mastery goals on intrinsic motivation was observed across all age samples in the present study, with the exception of the sample of 9 year old children. For the 9 year olds, the effect was in the expected direction, however, not of sufficient strength to reach statistical significance. The strength of this relationship for the 9 year olds fell below the minimum criterion for path strength that was set, indicating that the relationship between mastery goals and intrinsic motivation had not yet fully developed for these youngest participants included in the study. It must be noted that there was no significant difference in the strength of this relationship when comparing 9 year olds with any of the older age samples, suggesting that the associating between mastery girls and intrinsic motivation was emerging already in these young participants. Also with respect to identified regulation, it appeared that the relationship with mastery goals was emerging, but not yet fully established for the 9 year old children. The relationship, even though significant in this case, was found to be of lesser strength for 9 year old, compared to 10 and 11 year old children. No statistically significant difference in this effect was observed when comparing 9 year olds to the sample of 12 year old children. However, the uneven group size in the present study may have played a role in the insignificance of this result. When considering the path strength, however, a difference between 9 and 12 year old children did seem to exist, with the path

strength for the sample of 12 year olds having a similar magnitude to that for the samples of 10 and 11 year old children.

It thus appears that for the sample of 9 year old children, the positive effects of mastery goals on the most self-determined forms of motivation is less pronounced than for older pre-adolescent children. This may represent a developmental difference. For young pre-adolescents in physical education, personal learning and improvement (mastery goals) may only just begin to constitute an important source of enjoyment (related to intrinsic motivation), which is valued as an end in itself (identified regulation). Whether such developmental pattern of increasing interrelationships between these constructs exist in children before they reach the age of 10 years can only be confirmed in additional (preferably longitudinal) studies, including younger samples. If such developmental difference was indeed at play, this has important implications for the design of primary school physical education classes and interventions. It would imply that to stimulate adaptive forms of motivation across the entire primary school period, different constructs need to be targeted for different age groups. For younger children, constructs other than the typically highlighted mastery goals would need to be identified that facilitate self-determined forms of motivation.

For none of the age samples was mastery goal endorsement found to have an effect on less self-determined forms of motivation. An impeding effect of mastery goal endorsement on extrinsic forms of motivation has been identified in previous work involving older samples (e.g., Barkoukis et al., 2007). In Chapter 6 it was suggested that the absence of such effects in the present study may be a developmental difference, with such negative effects of mastery goals emerging at older ages. The results of this phase of the study seem to indicate an absence of developmental changes in the relationship of mastery goals with non-self-determined forms of motivation and amotivation over the pre-adolescent period. To prevent pre-adolescent children from becoming amotivated or motivated for non-self-determined reasons, factors other than mastery goals must be considered.

7.4.1.2 Age and the effect of performance goals on motivation.

In the present study, performance goals had a positive effect on introjected regulation across the pre-adolescent age samples. In contrast, a study, investigating achievement goals in a pre-adolescent sample in sports, was unable to confirm a statistically significant relationship between performance goals and introjected regulation for 9 and 10 year old athletes. For the overall sample of 9 to 14 year old athletes, however, the particular relationship did emerge as significant (Cumming et al., 2008). More specifically, in this study by Cumming et al. (2008) performance goals were not related to any of the motivational

regulations for 9 and 10 year old athletes. The discrepancy in findings may reflect an earlier development of the effects of performance goals on children's motivation in physical education, as compared to sport settings.

Contrasting the absence of effect of performance goals in early pre-adolescent children in the study by Cumming et al. (2008), in the present study some unique effects for performance goals were identified for young pre-adolescent children that were not observed in the samples of 11 and 12 year old children. For 9 and 10 year old children positive effects of performance goals on external regulation emerged and for the 9 year olds also on amotivation. This suggests that for these younger children, the endorsement of normative goals positively affects less adaptive forms of motivation, in line with what was hypothesised in Chapter 6 for the overall sample. The focus on demonstrating greater competence than others that often accompanies performance goal endorsement means that participation is a means to an end (external regulation), and can ultimately lead to amotivation if ends are not achieved (Nicholls, 1989). In a sample of 12 to 14 year old physical education students Standage and Treasure (2002) a positive relationship between performance goals and external regulation as well as amotivation was also observed. This suggests that the absence of such effects in older pre-adolescent children in the present study, while such effect was present in the younger participants was not a developmental phenomenon.

What these findings also imply is that at least for the present sample, performance goal endorsement may be more detrimental in early rather than late pre-adolescence. For the 11 and 12 year olds, introjected regulation only was facilitated. This form of regulation concerns feelings of 'I should' participate, as opposed to feelings of 'I must' participate that characterise external regulation, hallmarks the start of the internalisation of the regulation of behaviour (Deci et al., 1994). It has been related to constructs that are more adaptive in character than those related to external regulation and amotivation, including achievement in physical education (Boiché et al., 2008), and short term persistence in a sport setting (Pelletier et al., 2001). It thus appears that older pre-adolescent children are better able to cope with interpersonal comparison, and competitive settings, than younger pre-adolescent children. This is in line with the conclusion of a review on the effect of performance goals, which reported that there is some evidence that performance goals are more adaptive for older as compared to younger children (Midgley et al., 2001).

A positive finding was that although, as hypothesised, performance goals did not have a positive effect on intrinsic motivation and identified regulation, the endorsement of normative goals was not found to not have an impeding effect on these adaptive motivational

constructs either. This was a consistent finding across all age-groups, suggesting the absence of any developmental changes. It implies that even if pre-adolescent children endorse performance goals, they do not inevitably have lower levels of self-determined forms of motivation. The results suggest that pre-adolescent children who concurrently endorse mastery goals for example, can have high levels of intrinsic motivation despite their performance goal endorsement.

7.4.1.3 Age and the effect of mastery goals on need satisfaction

Satisfaction of the needs for competence, autonomy and relatedness is an important facilitator of the emergence of self-determined forms of motivation. In Chapter 6 it was already discussed that for the overall sample, the endorsement of mastery goals has a positive effect on need satisfaction, as hypothesised by Ntoumanis (2001a). The results of the present phase of the study add that for all three needs, this adaptive quality of mastery goals consistently emerges across the pre-adolescent years, without an indication of the presence of any developmental trends. This is an important insight with respect to the design of physical education classes, as it reinforces the significance of stimulating mastery goal endorsement from a young age onwards. Previously it was thought that mastery and performance goals do not develop before the age of 12 years (Nicholls, 1984a). Some evidence has emerged that children can make this distinction at an earlier age (Dweck, 2002; Fry & Duda, 1997). The finding of the present study that mastery goals already have an effect on need satisfaction in a manner that is consistent with theoretical postulations and previous findings in older samples reinforces that at least form the age of 9 years onwards children distinguish mastery goals that are meaningful to their motivation.

7.4.1.4 Age and the effect of performance goals on need satisfaction.

In contrast to mastery goals, for performance goals the pattern of effects on satisfaction of the three needs was less distinctive. For none of the pre-adolescent age samples did performance goal endorsement have a significant effect on the satisfaction of the need for competence. It appears that the evaluation of competence based on social comparison and competition did not facilitate per-adolescent children’s sense of competence in physical education. This is in line with hypotheses formulated by Ntoumanis (2001a) that performance goals are less likely than mastery goals to result in competence need satisfaction. With performance goals, feelings of competence are based on normative criteria (e.g. outperforming others), which are not under the person’s own control, and often difficult to meet. Nevertheless, a child endorsing performance goals can experience positive feelings of competence, particularly for children with high levels of motor proficiency. That no effect

of performance goals on competence need satisfaction was identified in the present study may be related to the character of primary school physical education. Over the primary school years physical education is generally less competitive than over the secondary school years (e.g., Barkoukis, Ntoumanis, et al., 2010; Ntoumanis et al., 2009). As a result, children may depend less strongly on their performance goals for the evaluation of their competence. An increased focus on competition as children get older may be reflected in the results for the 12 year old children. The path strength indicated there may be a positive effect of performance goals on competence need satisfaction for this age sample, although not reaching statistical significance potentially due to small sample size. This suggested positive effect emerging for late pre-adolescent children would be in accordance with the significant and positive correlation between performance approach goal endorsement and competence need satisfaction that was identified by Shen et al. (2009), in a study involving 12 to 14 year old physical education students.

Similar to the need for competence, performance goals did not seem to have a substantial effect on children's perceptions of relatedness to peers in physical education. Performance goals were found to have a significant positive effect on relatedness need satisfaction for the 9 year old children only. It appears that the undermining effect of performance goals on relatedness anticipated by Ntoumanis (2001a) is not present in pre-adolescent children in physical education. Such effect may, however, develop over adolescence, with the increasing competitiveness in the environment surrounding children (Barkoukis, Ntoumanis, et al., 2010).

Ntoumanis (2001a) also hypothesised performance goal endorsement to have a debilitating effect on the experience of autonomy. The preoccupation with the adequacy of competence that often results from these normative goals is likely to control behaviour. In the study by Shen et al. (2009), a negative correlation between performance approach goal endorsement and satisfaction of the need for autonomy was indeed observed. In contrast in the present study a positive effect of performance goals on autonomy need satisfaction emerged. This effect was significant for the 9 and 11 year old children only. However, the strength of the effect was not found to differ across the ages, suggesting the effect may have been on the margin of significance across all ages. Satisfaction of the need for autonomy emerges when an individual experiences a sense of control or agency in environmental interactions. The present results suggest that such feelings were enhanced both when mastery and performance goals were endorsed. Both of these goals represent approach oriented goals that were self-imposed by the participants. As such, it appears that independent of the

definition of these goals, participants felt a sense of personal agency pursuing their approach goals. In primary school physical education classes where students set their own achievement goals, it may be the approach component of the goals that enhances a sense of autonomy, while avoidance tendencies are more likely to have a debilitating effect on autonomy need satisfaction. that a negative relationship was found in the study by Shen et al. (2009), even though approach and avoidance goals were taking into account, may be due to the special curriculum that was implemented in the participating schools. This curriculum focussed on conditioning and fitness. It is likely that such focus encouraged a mastery goal climate, where children with performance goals feel out of control due to a lack of opportunity for interpersonal comparison and competition.

Overall, in the present young sample, the effects of performance goals on need satisfaction appeared to be more adaptive than originally hypothesised. This may be a result of the present study's effort to differentiate between approach and avoidance goals, while this distinction has not consistently been considered in the past (Nicholls, 1984a). Furthermore, the high level of (concomitant) mastery goal endorsement in the present sample may have played a role in the adaptive effects on need satisfaction (see Chapter 6), as well as the motivational climate of primary school physical education. No clear pattern of change in the goals' effect across age appeared.

7.4.1.5 Age and the effect of need satisfaction on motivation.

Despite self-determination theory's depiction of the three psychological needs as innate and universal (Deci & Ryan, 2000), various effects of need satisfaction on motivation were found to differ across the age groups. Previous research has suggested that in physical education settings, the need for competence may be of central importance (e.g., Ntoumanis, 2001b). In the present study, this proposition was supported with respect to the 9, 10 and 11 year old children. For 12 year old children, satisfaction of the need for competence was not found to play a significant role in any of the motivational regulations. Previously, Cox et al. (2008) failed to confirm a relationship between perceived competence and an aggregate score of motivation (RAI) in physical education students (*M* age = 12.4 years). Furthermore, in a study involving 12 to 14 year old physical education students, Goudas et al. (1994) did not find competence to have an effect on intrinsic motivation for gymnastics, while such an effect did emerge with respect to football and netball. It appears that perceptions of competence have an effect on motivation that is not consistent across all conditions and at all ages. Differences in children's autonomy need satisfaction may play a role in the inconsistencies in findings. Deci and Ryan (1985b, 2000) hypothesised that competence will be associated with

intrinsic motivation only when autonomy is experienced. According to this assertion, children are unlikely to be intrinsically motivated to engage in physical education under feelings of pressure, independent of their perceptions of competence. However, in the present study, 12 year old children scored relatively high on satisfaction of the need for autonomy, and not significantly different from the other age samples. Furthermore, no indication of any developmental differences in competence need satisfaction, intrinsic motivation or the interrelationship between these constructs was observed. It may be that decisional autonomy, and not affective autonomy, as tapped in the present study, plays a role in the interrelationship between competence need satisfaction and intrinsic motivation. Perceptions of autonomy were not found to have a substantial effect on any of the constructs included in the model. Decisional autonomy may have a more pronounced effect on children's motivation than affective autonomy. As decisional autonomy is very limited in primary school physical education, it is unlikely that the amount of decisional autonomy pre-adolescent children can experience changes from early to late pre-adolescence. However, previous research has reported that adolescents typically yearn to feel more autonomous in their behaviour (see Corpus, McClintic-Gilbert, & Hayenga, 2009). This increased desire for autonomy may already have emerged in the 12 year old children included in the present study, negatively affecting their need satisfaction. If the satisfaction of decisional autonomy was indeed compromised in the 12 year old children, this may in turn have had an effect on the efficacy of competence need satisfaction in facilitating intrinsic motivation.

As expressed, the satisfaction of the need for affective autonomy did not make a significant contribution to any of the forms of motivation, for any of the age samples. It appears that affective autonomy does not play a large role in the motivational orientations of pre-adolescent children. The feeling of being able to contribute to activity choices and the absence of pressure may not be sufficient to influence motivation for physical education, and it may be only actual decisional power that plays this role, something that is lacking in typical primary school physical education curricula.

In contrast to the need for autonomy, the need for relatedness appeared to play a more pronounced role in motivation across the pre-adolescent years. Satisfaction of the need for relatedness had a positive effect on intrinsic motivation across all age samples, with the exception of the 11 year olds. Why no such effect emerged for the sample of 11 year olds remains unclear. Self-determination theory suggests that across all ages intrinsic motivation is more likely to flourish in contexts characterised by a sense of secure relatedness (Deci & Ryan, 2000). Studies have identified such effects in children as young as pre-school age (e.g.,

Anderson, Manoogian, & Reznick, 1976). As a focus on peers and social acceptance generally increases over adolescence (Wigfield, Byrnes, & Eccles, 2006), it is likely that relatedness need satisfaction continues to play a role in motivation for physical education over adolescence. The relatively strong effect of relatedness need satisfaction on intrinsic motivation that was observed for the 12 year old sample is in line with this hypothesis. Furthermore, it appears that over adolescence satisfaction of this need starts to play a role in preventing children from becoming motivated for external reasons or becoming amotivated. If children feel related to others in their class, they are unlikely to take participate only for a reward or because they have to, as the ability to spend time with peers provides an added reason to take part.

No such negative effects appeared to have emerged for 9 year old children. Hoewver, for these young pre-adolescents, relatedness need satisfaction seemed to have an added effect on self-determined forms of motivation. Besides its positive effect on intrinsic motivation, the need for relatedness was also found to have a positive effect on identified regulation for the sample of 9 year olds. No such effect emerged for the other age samples. It thus appears that 9 year old children relied more strongly on perceptions of relatedness with their peers in order to recognise the value of physical education than older pre-adolescent children.

7.4.1.6 Age and differences in mean scores.

While the equivalence of motivational models across age has received limited attention in the literature, more attention has been paid to age effects on isolated motivational constructs. Particularly changes in children's competence perceptions over development have been widely discussed in the literature on motivation. Researchers have argued that young children often have unrealistically high perceptions of their competence, with these perceptions becoming more realistic over the primary school years (Marsh, 1990; Marsh, Craven, & Debus, 1998; Stipek & McIver, 1989; Wigfield et al., 1997). Decreases in competence perceptions have been observed for various school subjects, starting in the early primary school years (Wigfield et al., 1997). As discussed, perceived competence and satisfaction of the need for competence are two different but related constructs. Satisfaction of the need for competence would thus be expected to decline if competence perceptions decline.

In the present study, satisfaction of the need for competence was not found to differ significantly across the pre-adolescent age samples. No indication of a decline of children's competence over the pre-adolescent years emerged. It thus appears that in physical education, children develop realistic perceptions of their competence before they reach the age of 9

years. This concords with the findings by Xiang and Lee (1998). Changes in competence perceptions in older children are more likely to be activity specific (Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991), and are thus, unlikely to be picked up with context specific questionnaires as were used in the present study.

Besides the early declines in children's competence perceptions, a prominent message in the literature on motivation for physical activity, and physical education specifically, is that adaptive motivation tends to decrease with age. For example, in a two year longitudinal study involving 6th and 7th grade middle school students, Cox et al. (2008) found perceived competence, self-determined motivation and enjoyment in physical education to decrease significantly across school years. Similarly, declines in adaptive motivational constructs such as relatedness and self-determined forms of motivation were observed in a three year longitudinal study involving 13 to 15 year old physical education students (Ntoumanis et al., 2009). In the present study, very little evidence was found for the systematic variation of motivational orientations across the pre-adolescent years. Significant differences across age samples emerged for introjected and external regulation only, with 11 year olds scoring significantly lower than 9 year olds on both measures. Ten and 12 year old children also scored lower than 9 year old children on these measures, however, this was not statistically significant.

A previous longitudinal study in the academic domain identified significant declines in extrinsic motivation for primary school students, while declines in intrinsic motivation were more marked for adolescents (Corpus et al., 2009). Corpus et al. (2009) proposed that declines in extrinsic motivation over primary school could be a result of children becoming less inclined to please their teachers, and becoming less dependent on their teacher (Corpus et al., 2009). This may have played a role in the present findings of lower levels of extrinsic motivation for 11 year old children, but no age differences for self-determined forms of motivation. That negative changes in intrinsic motivation were absent in pre-adolescent children in both the present study, and that of Corpus et al. (2009) is a positive finding. Such reports stress the importance of early intervention, to ensure that children maintain their level of self-determined motivation over adolescence.

In line with previous cross-sectional (Xiang & Lee, 1998) and longitudinal research (Xiang, McBride, et al., 2004) involving primary school-aged children, no age differences were observed in children's mastery goal endorsement. This is encouraging, as it implies that children do not appear to lose their interest in learning and personal improvement over pre-adolescence. Less expectedly, also no differences in level of performance goal endorsement

were observed across the age samples. Previous studies have typically found performance goal endorsement to increase with age, with such increases already starting during the primary school years (Xiang & Lee, 1998). Particularly over the transition from primary to secondary school changes in performance goal endorsement can be expected, as a result of changing environments, which often involves an increased competitive character at secondary schools (Ntoumanis et al., 2009; Spray et al., 2013). That no age-related changes in performance goal endorsement were observed in the present study may indicate that in the schools involved the motivational climate, and emphasis on competition, did not significantly differ for the different school years.

Overall, it appears that the age-related decline in adaptive motivational orientations that has been reported (e.g., Barkoukis, Ntoumanis, et al., 2010; Cairney et al., 2012; Van Wersch, Trew, & Turner, 1992) may not yet surface during the pre-adolescent years, but become more pronounced as children move to secondary school (Warburton & Spray, 2008; Wigfield et al., 1991). Rather than systematic age effects, the relatively high standard deviations that emerged for the mean scores on the motivational constructs across the four age samples suggest that large individual differences exist within each age group.

7.4.2 Gender Differences

In line with propositions from Deci and Ryan, previous studies in the physical activity domain have generally found the relationships between various motivational constructs to be largely equivalent across gender (Ntoumanis, 2001b; Standage et al., 2005). In line with this, in the present study the majority of inter-relationships between constructs in the motivational model appeared to be comparable in boys and girls. However, some significant differences based on gender emerged.

7.4.2.1 Gender and the effect of mastery goals on motivation.

Again underscoring the goal's adaptive character, mastery goals were found to be related to intrinsic motivation for physical education in both boys and girls. Focussing on the activities in physical education, and the use of self-referenced sources to evaluate achievement, had a positive effect on engagement for fun and enjoyment. In line with findings of Ferrer-Caja and Weiss (2000) based on a sample of 14 to 19 year old physical education students, this effect was found to be significantly stronger for boys than girls. Findings are, however, not uniform, and the opposite pattern of effects has previously been observed in a sample of older athletes (*M* age = 22.17 y) (Nien & Duda, 2008). The divergent findings may be attributable to the difference in physical activity setting. With sports children do typically have a say in whether they want to be involved, and particularly by the time they

reach adolescent age (as in the study by Nien & Duda) they often select their own sport of interest. With physical education, in contrast, all children are obligated to participate, also those children who would not normally engage in physical activity or the particular activity at hand. Girls' motivation has been found to be more affected by activity type than boys (Johnson et al., 2011). As such, for girls more so than for boys engaging in an activity that they would not have personally selected may decrease the likelihood that their focus on the physical tasks and the learning process results in enjoyment. In contrast, if girls choose to engage in a particular sport, they may derive more enjoyment from engagement in the activity per se, learning, and personal improvement than boys, who may need more than just that to be motivated.

No other gender differences in the effects of mastery goal endorsement on motivation were identified, nor in the strength of the effects. This suggests that mastery strivings are adaptive across gender, and consequently, such strivings should be stimulated for both boys and girls.

7.4.2.2 Gender and the effect of performance goals on motivation.

In the present study, performance goals were found to have comparable positive effects on introjected regulation, external regulation and amotivation across gender. For girls, an additional positive effect of performance goal endorsement on identified regulation emerged. Furthermore, the effect of performance goals on introjected regulation was found to be more pronounced for girls compared to boys. As such, findings suggest that performance goal endorsement may be more adaptive for girls than boys. These findings are in contrast with a review on the consequences of performance goal endorsement across various settings and populations, which flagged that performance goals may be more adaptive in character for boys than girls (Midgley et al., 2001). However, findings of the few studies to have investigated the effect of gender on this relationship in physical activity related research are inconsistent. In a study involving 16 to 78 year old individuals in an exercise setting, no gender differences were observed in the effect of performance approach goals on a composite score of motivation (Moreno, Gonzalez-Cutre, Martin-Albo, et al., 2010). On the other hand, in a sport setting, Nien and Duda (2008) identified a positive effect of performance goals on intrinsic motivation for males only, suggesting that the endorsement of normative goals is likely to results in more adaptive outcomes for boys. No gender difference emerged in this study by Nien and Duda for a composite score of extrinsic regulation. As composite scores were used in the studies by Moreno et al. (2010) and Nien and Duda (2008), it remains ambiguous whether there were gender differences for the distinct extrinsic forms of

regulation such as identified regulation. Furthermore, the consequences of performance goal endorsement are likely to be influenced by many other factors, such as age, context, competence perceptions, and the concurrent endorsement of other achievement goals (see Midgley et al., 2001). As such, until more studies taking a multitude of such factors into account are available, it is not viable to make generalisations concerning the adaptive or detrimental qualities of these normative goals across gender.

Overall, the results suggest that with performance goal endorsement, girls are likely to be motivated for more self-determined reason than boys, while with mastery goal endorsement, boys are likely to have higher levels of self-determined motivation than girls. For both genders, however, the two approach goals were related to multiple forms of motivation. Ultimately it is the combination of motives held by an individual, together with the respective strength of these motives, which determine the extent to which the related outcomes are adaptive.

7.4.2.3 Gender and the effect of achievement goals on need satisfaction.

The effect of mastery and performance goals on need satisfaction was largely comparable across gender. The only gender differences that emerged concerned the effect of mastery goals on autonomy need satisfaction, which was statistically significant for boys only. The size of this effect did, however, not emerge as significantly different across gender. This suggests that, if this effect indeed differs for boys and girls, the difference would only be minor.

The effect of performance goal endorsement on competence need satisfaction, which emerged as statistically significant for the overall sample (see Chapter 5), did no longer reach statistical significance when investigating the separate gender samples. This implies that boys and girls with normative goals in physical education are likely to derive satisfaction of their psychological needs from feelings of affective autonomy only (effect on relatedness need satisfaction was not significant in overall sample, nor gender samples). This makes theoretical sense, as the competition that is inherent to performance strivings may undermine interpersonal relationships, and hamper the experience of feelings of competence as such feelings only emerge only when outdoing others (Ntoumanis, 2001a). However, children endorsing performance goals can still feel like they have a say in the activities they would like to do during the physical education class, and as a result, experience feelings of affective autonomy.

7.4.2.4 Gender and the effect of need satisfaction on motivation.

While the effects of mastery and performance goals were found to be largely comparable across gender, more pronounced gender-based variation emerged for the effects of need satisfaction on the different forms of motivation. Particularly the effect of the need for competence was found to differ for boys and girls. Unexpectedly, the need for competence was found to have a significant effect on intrinsic motivation and identified regulation for girls only. For boys the positive effect of perceptions of competence on these most self-determined forms of motivation was virtually absent. Instead, for boys the role of the need for competence was purely negative in character, preventing boys from becoming motivated for introjected reasons or becoming amotivated. These negative effects of competence need satisfaction on introjected regulation did not emerge for girls. Instead, a negative effect of competence need satisfaction on external regulation was found for girls, which was not observed for boys. Overall, the results seem to indicate that perceptions of competence played a role in motivation across gender, but with different processes underlying the needs' effect for boys and girls. It remains unclear why satisfaction of the need for competence was found to have a positive effect on the two most self-determined forms of motivation for girls only. In a study by Ntoumanis, 2001b, involving older phsycal education students (14-16 years), no difference in these specific effects across gender was observed. One possibility is that there was a near ceiling effect in boys' scores on competence need satisfaction, restricting associations to other constructs. Boys scored significantly higher on this construct than girls, with their average score approximating the upper end of the scale. However, the skewness coefficients were within the range of what is acceptable, and as such indicated that the scores were normally distributed. Until further research on the relationship between competence need satisfaction and the different forms of motivational regulation is available, the only conclusion that can be drawn from the present results is that while competence need satisfaction plays a positive role in motivation for pre-adolescent boys and girls, the way it affects motivation may differ per gender.

The effects of satisfaction of the need for relatedness on motivation were found to be more comparable across gender. Results seemed to indicate that both boys and girls are more likely to be intrinsically motivated for physical education if they experience a sense of connectedness with others in the class. In line with this, no gender differences in the effect of relatedness need satisfaction in physical education on participation in physical activity were identified in a study involving 10 to 13 year old children (McDavid, Cox, & McDonough, 2014). However, in a sample of 14 to 16 year old physical education students, the effect of

satisfaction of the need for relatedness on intrinsic motivation has been found to differ across gender, with the effect being significant for girls only (Ntoumanis, 2001b). It may be that for boys the role of relatedness need satisfaction in physical education decreases when they reach adolescence. Some studies have identified adolescent girls to have stronger social motives in physical activity, while boys have stronger competence-related motives (Leversen, Danielsen, Wold, & Samdal, 2012; Vašíčková, Hřebíčková, & Groffik, 2014).

Regarding the need for autonomy, a significant effect was identified uniquely for girls, on intrinsic motivation. No further effects of this need were observed for girls or boys. Consequently, it appears that the experience of affective autonomy does not play an important role in boys' motivation, who may rely more strongly on the experience of decisional autonomy. No gender differences in the effects of decisional autonomy need satisfaction on motivation (external regulation only) were identified in a study involving adolescent physical education students by Ntoumanis (2001b). However, as discussed, decisional autonomy is inherently limited in primary school physical education. That the facilitation of the experience of affective autonomy appears beneficial to girls' motivation is an important insight, particularly since girls typically have lower levels of motivation for physical education than boys. It may provide teachers with a tangible approach to help enhance motivation in girls specifically.

7.4.2.5 Gender and differences in mean scores.

Gender differences did not only emerge with respect to the constructs' inter-relationship, that is, the processes underlying motivation, but also in the endorsement of the constructs. Gender differences in motivation have been widely reported in the physical activity domain, in studies covering a wide age-range. For example, subject-specific gender differences in intrinsic motivation have been identified in children as young as first to third grade (Guay et al., 2010), but also in adolescents (e.g., Zahariadis, Tsorbatzoudis, & Grouiou, 2005). In physical education settings, boys have generally been found to have higher levels of intrinsic motivation than girls (e.g., Ntoumanis, 2005). In the present study, no gender differences emerged for intrinsic motivation, suggesting that boys and girls equally enjoyed participation in physical education.

Boys have typically been characterised as more performance-oriented in physical education (see Duda & Whitehead, 1998; Marsh et al., 2006). In line with this, in the present study boys were found to report higher levels of performance goal endorsement than girls, while no differences in mastery goal endorsement across gender emerged. These findings were consistent with those of Digelidis and Papaioannou (1999) based on 10 to 17 year old

physical education students. Also in sport settings, boys of various ages, including pre-adolescents, have been found to report higher levels of performance goal endorsement than girls (Cumming et al., 2008) and university students (Nien & Duda, 2008). It appears that boys are more interested in social comparison, and are more competitive than girls (Anderman & Anderman, 1999). As long as mastery goals are endorsed alongside performance goals, as was largely the case in the present study, the stronger endorsement of normative goals in boys does not have to be detrimental to their motivation and participation in physical education (Midgley et al., 2001).

Besides higher levels of performance goal endorsement, boys were found to have higher levels of competence need satisfaction than girls. Lower levels of perceived competence for girls are consistently reported in the literature on physical activity (Bagøien et al., 2010; Digelidis & Papaioannou, 1999; Hagger, Biddle, et al., 2005). The finding that pre-adolescent girls seem to be disadvantaged compared to boys with respect to competence perceptions, requires attention. Competence is a construct that is of central importance to motivation. If physical education teachers could facilitate positive perceptions of physical competence in girls at a young age, for example by providing them with sufficient opportunities for the experience of success, this may result in more adaptive motivational orientations, and ultimately more adaptive participation patterns. This is important, as girls have typically been found to be less motivated for physical education (see Gorely et al., 2003), and to have lower levels of engagement in physical education (McKenzie et al., 2000).

Even though girls scored lower on competence need satisfaction than boys, no indication of a decline in competence need satisfaction emerged, neither for girls, nor boys. No age by gender interaction emerged for the need for competence, that gender difference remained stable over pre-adolescence, with girls consistently having lower levels of competence need satisfaction than boys. In accordance, in a longitudinal study covering the first to the sixth grade of primary school, no gender differences in the rate of decline of competence perceptions in sport were observed (Fredericks & Eccles, 2002). In the present study, no age by gender interactions were observed for the other motivational constructs included in the model either. This suggests that the observed gender differences were relatively constant and that the motivational orientations of boys and girls did not diverge over the preadolescent period. It is possible that gender differences become more pronounced over the adolescent period. According to the gender intensification hypothesis (Hill & Lynch, 1983) girls and boys experience increased pressure to conform to culturally endorsed gender roles at the beginning of adolescence. This may have an impact on motivation for physical

education, with greater differences emerging between boys and girls, as sports and physical activity are typically regarded as masculine domains. However, recent studies have been unable to confirms this hypothesis (Fredericks & Eccles, 2002; Nagy et al., 2010; Ntoumanis et al., 2009; Priess, Lindberg, & Hyde, 2009), and it appears that gender roles seems to be fairly fixed from early childhood (Diamond & Butterworth, 2008).

7.5 Summary

Overall, a pattern of increased explained variance with age emerged with respect to the dependent variables included in the model. Across all ages and gender, the model appeared to be more proficient in explaining which factors stimulate self-determined forms of motivation, rather than which factors thwart such adaptive forms of motivation. Avoidance goals were expected to have a negative effect on need satisfaction and self-determined motivation. However, as was already identified in the previous phase of this study (see Chapter 6), avoidance goals did not play a significant role in the motivational model that was tested. The results of the present phase of the study strengthened these findings by showing that effects of avoidance goals were absent across the pre-adolescent period and gender.

Of note is that some effects in the motivational model that were found to be statistically significant in the overall sample (see Chapter 6), no longer emerged as significant for any of the age or gender groups evaluated in the present phase of the study. This reinforces the need to take age and gender into account when investigating motivation in pre-adolescent samples and also suggests that teachers may need to use different strategies to facilitate adaptive motivation, dependent on the age and gender of the student.

The most consistent and strongest effects in the model, the effect of mastery goals on identified regulation and intrinsic motivation, and the effect of performance goals on introjected regulation, emerged independent of children’s age or gender. As such, when teachers focus on increasing children’s mastery goal endorsement, this is likely to have a positive impact on motivation for all children. The majority of the other effects in the hypothesised model were subject to age and gender-dependent variations. As such, the targeting of the other motivational constructs in an attempt to increase adaptive student motivation may warrant a more individual approach, with strategies tailored to the child’s gender and age.

Chapter 8: Phase Five: Effect of Motor Proficiency

8.1 Introduction

The aim of the overall research was to investigate which factors play a role in children's motivation for physical education. Ultimately, such insights would be able to inform the design of effective physical education curricula and interventions, with the purpose of ensuring adaptive patterns of engagement. While this is important for all children, particularly in the light of decreasing levels of physical activity with age (Nader et al., 2008), some populations are in special need of tailored physical education classes. Children with developmental coordination disorder (DCD) represent one such population.

Children with DCD have compromised levels of motor proficiency. Competence is a construct central to motivation (Deci & Ryan, 2000). From the previous phases of this study it has become evident that competence also plays an important role in children's motivation for physical education; in the motivational model tested in Chapter 6, satisfaction of the need for competence emerged as an important factor influencing children's motivation for physical education. This need was found to have significant effects on motivation for children across the pre-adolescent period, and both boys and girls, even though the specifics of its effects may differ based on individual characteristics (e.g., age and gender, see Chapter 7). Children with low levels of actual motor proficiency (and thus, children with DCD) are at increased risk of having negative perceptions of their physical competence, which is likely to negatively affect their motivation to engage in physical activities and physical education. As such, in the present phase of the study investigated whether the motivational orientations of children with DCD differ from those of their typically developing peers.

Children with DCD have motor difficulties that impede participation in daily activities. The poor motor performance of children with DCD is often misunderstood, being mistaken for poor motivation and effort (Dewey & Wilson, 2001). Although not considered a causal factor in DCD, motivation may play a role in the outcomes of DCD, such as compromised levels of engagement in physical activity. For example, previous research has indicated that variables based on the theory planned behaviour (Ajzen, 1991), a theory linking people's beliefs and behaviour, played a role in explaining the difference in engagement in moderate-to-vigorous physical activity between children with DCD and their typically developing peers (Kwan, Cairney, Hay, & Faught, 2013). Such beliefs are closely related to motivation (Hagger, Chatzisarantis, & Biddle, 2002). Nevertheless, little research attention has been paid to motivation for physical activity, or physical education, in children

with DCD. Insight into the constructs of achievement goal theory and self-determination theory in children with DCD is scant. As children with DCD are typically found to be less physically active participation (Batey et al., 2014; Cairney et al., 2010), physically fit (Cairney, Hay, Veldhuizen, & Faught, 2011; Faught et al., 2005; Rivilis et al., 2011; Silman et al., 2011), and at significantly greater risk for overweight and obesity (Cairney, Hay, Faught, & Hawes, 2005; Faught et al., 2005), and thus at increased risk for poor cardiovascular health, it is important that deeper insights emerge in the motivational orientations of these children (see also Katartzi & Vlachopoulos, 2011). The identification of motivational constructs on which children with DCD systematically score different from their typically developing peers could provide cues to the processes underlying their lower level of engagement, and how to improve outcomes for children with DCD.

Comparing scores on the constructs included in the motivational model, children with DCD were hypothesised to score lower than their typically developing peers on both approach goals, need satisfaction and self-determined forms of motivation, that is, the adaptive constructs. Children with DCD were expected to score higher than their peers on amotivation and avoidance goal endorsement, the less adaptive constructs (see Katartzi & Vlachopoulos, 2011).

8.2 Method

8.2.1 Participants

For the purpose of this phase of the study, the data derived from the same sample as used in Phase Two were used.

8.2.2 Measures

The set of questionnaires that was used to assess children's achievement goals, need satisfaction, and level and form of motivation is described in the previous chapter.

The Movement Assessment Battery for Children-2 (MABC-2; Henderson, Sugden, & Barnett, 2007) was applied to assess potential motor coordination difficulties. Despite their increased time demands, motor tests such as the MABC-2 are preferred above questionnaire-based assessment methods such as the DCDQ-2007 (Wilson, Kaplan, Crawford, & Roberts, 2007), providing a better indication of the motor difficulties experienced by the child (Pannekoek, Rigoli, Piek, Barrett, & Schoemaker, 2012). The MABC-2 is one of the most commonly used motor test, measuring severity of motor impairment (Croce, Horvat, & McCarthy, 2001 ; Geuze et al., 2001), and was as one of the two tests of motor performance

to be recommended for clinicians' use in a review of the currently available tests (Slater, Hillier, & Civetta, 2010). One of the benefits of the MABC-2 is that it is one of the few motor tests suitable for the assessment of children through to adolescence (Henderson et al., 2007), allowing for the ability to track children's motor skills over development. Good reliability and validity has been observed for the test (Brown & Lalor, 2009; Henderson et al., 2007; Wagner, Kastner, Petermann, & Bös, 2011; Wuang, Su, & Su, 2012).

The MABC-2 comprises eight subtests, under three motor skill categories; manual dexterity (3); aiming and catching (2); and balance (3). Specifically, the second (ages 7-10 years) and third age band (ages 11–16 years) were used for the present study. Scores between 57 and 67 (5–15th percentile) indicate "at risk" of motor difficulties and a TTS of 56 or lower (fifth percentile) is considered indicative of significant difficulties (Henderson et al., 2007). In the current study, the 15th percentile was applied as the criterion for motor difficulties (TTS 67); as for research purposes a 15th percentile cut-off is recommended on motor tests to prevent the exclusion of children with mild DCD (Geuze et al., 2001). The term 'probable' (pDCD) was used to refer to participants scoring below this cut-off, as not all criteria of the DSM needed for the formal diagnosis of DCD were evaluated (Geuze et al., 2015). The MABC-2 is designed to test criterion A of the DSM-IV-TR and DSM-V (see Chapter 2.5) specifically (Geuze et al., 2001), and alone cannot be relied on for the purpose of diagnosis (Brown & Lalor, 2009). Also, the MABC-2 does not cover the entire range of motor abilities, and a child's score on the test depends on the nature of the child's difficulties (Geuze et al., 2001). It is important to note that the present study relied on the DSM-IV-TR, while the DSM-V has since been published. The differences in the DSM criteria are not expected to have an impact upon the present results, as it was mainly relied on Criterion A, which does not substantially differ in the two versions of the DSM (see Table 2.1).

8.2.3 Procedure

The procedure for questionnaire administration is described in Chapter 5. On the same day as the questionnaire administration, children underwent the motor test. Two researchers were trained to perform the MABC-2 assessments according to the standard protocol as described in the manual. All children were tested on the motor test individually, one-on-one by one of the two examiners. Assessments took between 20 and 30 minutes per child.

For each of the two MABC age bands that were used, eight tasks are grouped under three categories; Manual Dexterity (3 tasks), Aiming and Catching (2 tasks), and Balance (3 tasks). Children were told that they were going to do some fun activities, and that it was

important that they would try to do as well as they could. The test items were administered in the order they appeared in the Examiner's Manual, starting with Manual Dexterity, followed by Aiming and Catching and then Balance (see Appendix R & S for a description). For every task, children received an explenation and demonstration, in line with the manual (see Appendix R & S). A practice trial followed, wich allowed children to familarise themselves with the task, during which some feedback was given by the examiner. Directly following the practice trial, it was proceeded to the formal trial. If a task required the child to perform the activity twice, testing both left and right hand or foot, the preferred hand or foot was tested first (practice trial and formal trial), followed by the non-preffered hand (practice trial and formal trial). No assistance was provided to the child in any of the formal trials.

8.2.4 Data Analysis

Due to the small size of the sample of children with pDCD (n=25), no statistical modelling could be performed. A specific feature of PLS modelling is its suitability for use with small samples (Henseler et al., 2009). However, the recommendation by Chin (1998b) of a minimum sample size of ten times the largest number of indicators per latent variable, or the largest number of independent variables impacting a single dependent variable, was not met. Consequently, analyses focussed on differences in children's scores on subscales tapping the constructs included in the model based on group membership.

A series of MANOVAs was conducted to test whether differences were apparent in the motivational orientations of children with pDCD and their typically developing peers. Age and gender were also taken into account, resulting in three-way analyses (age x gender x DCD status). Separate MANOVAs were performed for the three different questionnaires (3 or 5 dependent variables per MANOVA). To ensure that the sample provided sufficient power to perform these analyses, G*Power Version 3.1.2, a high-precision statistical power analyses for the most common statistical tests in behavioral research, was used. According to this program, at an alpha-level of .05 the current sample size (N=420) provided an 80% chance of detecting relatively small multivariate 3-way interactions (f^2 = .0125 for 3 dependent variables, f^2 = .0151 for 5 dependent variables), two-way interactions, (f^2 = .0164 for 3 dependent variables, f^2 = .0196 for 5 dependent variables), and main effects (gender, age and DCD: f^2 = .0126 for 3 dependent variables, f^2 = .0310 for 5 dependent variables; age: f^2 = .0263 for 3 dependent variables, f^2 = .0152 for 5 dependent variables). f^2 represents Cohen's f^2, which criteria have been outlined in §6.2.3 (02≤ f^2 <.15 small, 15 ≤ f^2 < .35 medium, ≥.35 large (Cohen, 1988). Values of f^2 < .02 are considered to indicate virtual no effect, between

.02 and .15 a small contribution, between .15 and .35 a medium contribution, and >.35 a large contribution (Cohen, 1988). All values fell in or below the small range, indicating that MANOVA's based on this dataset will be able to pick up small effects. The value for power was set at 80% as this corresponds to the level of power (.80) that is traditionally used in the behavioural sciences (see Cohen, 1988, 1990, 1992, 1994).

In each linear model both main and interaction effects were estimated. Partial eta squared ($\eta^2 p$) was inspected as an estimate of effect size for group mean differences. Values of $.01 \leq \eta^2 p < .06$ are considered small, $.06 \leq \eta^2 p < .14$ medium, and $\eta^2 p \geq .14$ large effects (Cohen, 1977). Where statistically significant main effects emerged, univariate comparisons were used to identify significant subgroup differences. Bonferroni corrections were applied to correct for the effects of multiple comparisons. As outlined in Chapter 7, age has four levels, resulting in four 'male versus female' and 'pDCD versus non DCD' comparisons for the age x gender and age x pDCD interactions. Bonferroni corrections were applied when testing each of these comparisons. DCD and gender are both binary and, therefore, alpha corrections for effects that involved just these variables were not applicable. All statistical analyses were conducted using SPSS version 19 (IBM), and a $p < .05$ was set for statistical significance.

8.3 Results

Data on motor proficiency was missing for 9 participants, and these participants were consequently excluded. The total sample consisted of 420 primary school children (*M* age = 10.73 y, *SD* = 1.06). Twenty-five participants were identified with pDCD, of which 10 girls and 15 boys (*M* age = 10.47 y, *SD* = .99). There were no significant differences between the sample of children with pDCD and the sample of typically developing children (n=395, *M* age = 10.74 y, *SD* = 1.06), with respect to age (t = 1.25, df = 418, p = .21) or gender (t = -1.00, df = 27.14, p = .32). Mean scores on the subscales for children with pDCD and typically developing children are presented in Table 8.1.

Table 8.1. Descriptive Statistics for Children With and Without pDCD Across Gender

	Typically developing children *M* (*sd*) *n*=395	Typically developing girls *M* (*sd*) *n*=199	Typically developing boys *M* (*sd*) *n*=196	Children with pDCD *M* (*sd*) *n*=25	Girls with pDCD *M* (*sd*) *n*=10	Boys with pDCD *M* (*sd*) *n*=15
Mastery goals	3.65 (0.41)	3.64 (.41)	3.66 (.42)	3.60 (0.41)	3.23 (.35)	3.84 (.56)
Performance goals	2.90 (0.73)	2.76 (.71)	3.04 (.73)	2.85 (0.68)	2.43 (.65)	3.13 (.56)
Avoidance goals	3.19 (0.61)	3.16 (.58)	3.22 (.64)	3.20 (0.57)	3.13 (.82)	3.26 (.38)
Need for competence	3.36 (0.54) *	3.29 (.55)	3.44 (.52)	3.16 (0.65) *	3.07 (.58)	3.22 (.71)
Need for autonomy	2.99 (0.63) *	2.96 (.61)	3.02 (.64)	2.59 (0.81) *	2.33 (.59)	2.76 (.90)
Need for relatedness	3.33 (0.55)	3.32 (.57)	3.35 (.53)	3.11 (0.76)	3.10 (.59)	3.11 (.87)
Intrinsic motivation	3.62 (0.49) *	3.63 (.49)	3.62 (.48)	3.36 (0.58) *	3.10 (.50)	3.53 (.59)
Identified regulation	3.54 (0.51)	3.54 (.51)	3.55 (.51)	3.58 (0.40)	3.40 (.39)	3.70 (.37)
Introjected regulation	2.35 (0.90)	2.29 (.90)	2.40 (.91)	2.80 (0.88)	2.15 (.78)	3.23 (.65)
External regulation	1.75 (0.83)	1.80 (.87)	1.70 (.80)	2.13 (0.99)	1.97 (.81)	2.24 (1.11)
Amotivation	1.64 (0.69)	1.69 (.72)	1.59 (.66)	1.96 (0.77)	1.97 (.76)	1.96 (.81)

Note. Adjusted for number of items per subscale, average item score

* significant group-difference based on DCD status $p < .05$

8.3.1 Effect of Motor Proficiency on Construct Relationships

8.3.1.1 Achievement goals.

For achievement goal endorsement, a main effect emerged for gender only (Wilks' $\lambda = .97$, $F(3, 403) = 4.90$, $p = .002$, $\eta^2 p = .04$) (see Table 8.2). The univariate follow-up tests for differences in scores on the individual achievement goal scales revealed that gender had an effect on mastery goals ($F(1,405) = 11.09$, $p = .001$, $\eta^2 p = .03$), and performance goals ($F(1,405) = 6.70$, $p = .010$, $\eta^2 p = .02$). Simple effect constrasts revealed that boys scored higher on both approach goals than girls. All effect sizes for group mean differences fell in the .01-.06 range of $\eta^2 p$, suggesting effect sizes were small.

A gender by DCD status interaction emerged (Wilks' $\lambda = .97$, $F(3, 403) = 3.66$, $p = .013$, $\eta^2 p = .03$). Univariate tests showed that this interaction effect occurred for mastery goals only ($F(1,405) = 9.59$, $p = .002$, $\eta^2 p = .02$). For girls, children with pDCD scored signficantly lower than their typically developing peers, while for boys children with pDCD scored significantly higher than typically developing children (see Table 8.2). Again, the effect size fell in the small range based on Cohen's (1977) guidelines.

Table 8.2. MANOVA Results for Achievement Goal Constructs Examining DCD Status, Age and Gender

	Wilk's λ	F	*df*	*p*	η^2
Age	.98	1.00	9,980.95	.436	.01
Gender	.97	4.90	3,403	.002	.04
DCD status	.99	0.65	3,403	.581	.01
Age x gender	.99	0.61	9,980,85	.790	.01
Age x DCD status	.99	0.60	9,980,95	.797	.00
Gender x DCD status	.97	3.66	3,403	.013	.03
Age x gender x DCD status	.99	0.33	6,806	.921	.00

8.3.1.2 Need satisfaction.

Results revealed a statistically significant difference in need satisfaction for children with pDCD and their typically developing peers (Wilks' λ = .96, $F(3,403) = 5.04$, $p = .002$, $\eta^2 p = .04$) (see Table 8.3). The univariate follow-up tests for differences in scores on the individual scales revealed that DCD status had an effect on the need for competence ($F(1,405) = 4.31$, $p = .039$, $\eta^2 p = .01$), and the need for autonomy ($F(1,405) = 13.72$, $p = .000$, $\eta^2 p = .03$). Children with pDCD scored statistically significantly lower on both competence and autonomy need satisfaction. The effect of DCD status on satisfaction of the need for relatedness approached significance, with children with pDCD scoring lower ($F(1,405) = 3.75$, $p = .054$, $\eta^2 p = .01$). It should be noted, however, that the sizes of these effects were small ($\eta^2 p < .06$).

Also a gender by age interaction emerged with respect to need satisfaction (Wilks' λ = .96, $F(9,980.947) = 1.98$, $p = .039$, $\eta^2 p = .01$). This interaction effect concerned the need for relatedness ($F(3,405) = 2.87$, $p = .036$, $\eta^2 p = .02$). Ten and 12 year old boys scored statistically significantly higher than similar aged girls on the need for relatedness, while 9 and 11 year old boys scored statistically significantly lower on this need than similar aged girls. Effect sizes for group mean differences were small ($\eta^2 p < .06$).

Table 8.3. MANOVA Results for Need Constructs Examining DCD Status, Age and Gender

	Wilk's λ	F	*df*	*p*	η^2
Age	.98	1.12	9,980,95	.344	0.1
Gender	.99	0.74	3,403	.531	.01
DCD status	.96	5.04	3,403	.002	.04
Age x gender	.96	1.98	9,980,95	.039	.01
Age x DCD status	.99	1.18	3,403	.302	.01
Gender x DCD status	.99	0.32	3,403	.809	.00
Age x gender x DCD status	.97	1.77	6,806	.101	.01

8.3.1.3 Motivation.

Results from the multivariate analysis suggested an absence of any effects of DCD status, gender or age on the different forms of motivation (see Table 8.4). Also no interaction effect of DCD status, age and gender was observed for the different forms of motivation, with the exception of a statistically significant interaction effect of age and gender (Wilks' $\lambda = .94$, $F(15,1107.39) = 1.69$, $p = .048$, $\eta^2 p = .02$). Upon further inspection of this interaction effect, considering the five distinct forms of motivation, it was not found to be statistically significant for any of the forms of motivation.

Table 8.4. MANOVA Results for Motivational Constructs Examining DCD Status, Age and Gender

	Wilk's λ	F	*df*	*p*	η^2
Age	.97	0.70	15,1107.39	.791	.01
Gender	.98	2.08	5,401	.068	.03
DCD status	.98	1.77	5,401	.118	.02
Age x gender	.94	1.69	15, 1107.39	.048	.02
Age x DCD status	.98	0.55	15,1107.39	.913	.01
Gender x DCD status	.98	1.79	5,401	.115	.02
Age x gender x DCD status	.97	1.35	10,802	.198	.02

8.4 Discussion

Children with DCD have consistently been reported to engage in lower levels of physical activity compared to their typically developing peers (e.g., Cairney, Hay, Faught, Wade, et al., 2005; Jarus et al., 2011). This has often been attributed to a lack of motivation in children with DCD (e.g., Barnett, Dawes, & Wilmut, 2012; Faught et al., 2005). However,

limited research has investigated the motivational orientations of children with DCD (e.g., Kwan et al., 2013). Self-determination theory advances different forms of motivation, and it remains unclear whether all, none, or some of these forms of motivation are compromised in children with DCD. The present study aimed to shed more light on the motivational orientations of children with compromised levels of motor skills.

All children included in this study were tested with the MABC-2. The prevalence of DCD according to the DSM-IV is 6% of 5 to 11 year old children (American Psychiatric Association, 2000b), and in the literature the most common prevalence statistics reported for DCD are 5-6% (Zwicker, Missiuna, Harris, & Boyd, 2012). In the present study, 6% of the general sample of pre-adolescent primary school children was identified with pDCD. This prevalence was relatively low, as the 15th percentile was used as a cut-off for pDCD (based on a 15% cut-off, 63 children out of the overall sample 420 would have been expected to be identified as pDCD). Following the common trend in the literature, more boys than girls were identified with pDCD (see Cermak & Larkin, 2002).

A number of significant differences in children's scores on the subscales tapping the motivational constructs based on DCD status were identified. Even though the sizes of the identified effects of DCD status on the scores were small, they reached significance despite the limited size of the sample of children with pDCD, and are consequently likely to have practical significance. The magnitudes of the multivariate 3-way interactions were too small to attain statistical significance, but some of the larger (but still relatively small) two-way interactions and main effects did attain significance. These results confirm that the sample size for the omnibus MANOVAs was capable of capturing relatively small effects, and that the non-significant effects were probably too small to be of any practical importance.

When the overall sample size is relatively large, as it was for the present study, the omnibus analyses of the multivariate interactions and main effects are robust to the small cell sizes that are sometimes generated by unbalanced designs. This is not the case for follow-up analyses of simple main effects (Keppel & Wickens, 2004). Simple main effects were tested following significant two-way interactions. In this study, each of the three MANOVAs yielded a significant multivariate 2-way interaction: gender x DCD for achievement goals, age x gender for need satisfaction, and age x gender for the different forms of motivation. The first two interactions yielded significant simple main effects, but the third interaction failed to do so. With larger cell sizes, the simple main effects for the third interaction would most likely have attained statistical significance. However, these effects were very small and therefore of little practical importance.

With respect to need satisfaction, children with pDCD were found to have lower levels of satisfaction of the need for competence compared to their typically developing peers. The lower levels of competence need satisfaction in children with pDCD identified in the present study were in line with findings of previous research, which has consistently reported levels of perceived physical competence to be compromised in children with DCD (e.g., Cairney, Hay, Faught, Wade, et al., 2005; Piek et al., 2000). Compromised competence perceptions are so characteristic of children with DCD, that a measure of children's perceptions of their adequacy in performing physical activities, the Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA; Hay, 1992), has been proposed as an initial screening instrument for DCD (Cairney, Veldhuizen, et al., 2007). Perceptions of competence are likely to play an important role in the outcomes of DCD, such as physical activity participation (see Dunn & Dunn, 2006). Cairney, Hay, Faught, Wade, et al. (2005) found the effect of DCD status on participation in physical activity to be mediated by children's perceptions of adequacy. As much as 28% of the variance in children's physical activity was found to be predicted by their perceptions of physical competence and DCD status. Consequently, it is important that within the physical education class opportunities for success are provided for all children, irrespective of their level of motor skill. Ultimately, this may result in active engagement in the class by all children (Dunn & Dunn, 2006).

Also on satisfaction of the need for autonomy, children with pDCD were found to score lower than their peers. Previously, children with DCD have been found to report lower perceived behavioural control in physical activity behaviours (Kwan et al., 2013). Deci and Ryan (2000) reasoned that rewards and threats are likely to undermine autonomy. On the other hand, the provision of choice and acknowledgement of personal feelings facilitates feelings of autonomy (Deci & Ryan, 2000). Children diagnosed with motor difficulties have been found to engage in more maladaptive behaviours during the physical education class, including the avoidance of performance attempts (Dunn & Dunn, 2006). As a result, it is likely that physical education teachers provide children with motor difficulties with less freedom and independence. Furthermore, DCD often goes undiagnosed (see Cairney, Hay, Faught, & Hawes, 2005), and as a result, teachers may not always understand the behaviours of these children, or be sensitive to the negative feelings experienced by children with motor difficulties. The experience of autonomy was related to intrinsic motivation in the present study, and consequently, it is important that feelings of autonomy are facilitated for all children, across the range of motor ability.

The effect of DCD status on relatedness need satisfaction approached statistical significance. Children with DCD have been found to participate less in social activities than other children, as social activities in childhood often involve physical activity (Chen & Cohn, 2003; Jarus et al., 2011). Previously, in a study investigating the psychosocial implications of DCD in 8 to 10 and 12 to 14 year old children, a link between DCD and social acceptance emerged for the older group only (Skinner & Piek, 2001). It may be that the impact of motor difficulties on social relationships increases over the adolescent period. No indication of such increase emerged from the present results, in the absence of a statistically significant interaction of DCD status with age. On the other hand, age and gender were found to interact with respect to relatedness need satisfaction. At the age of 9 years, boys and girls appeared to have comparable levels of relatedness need satisfaction. Across the 10, 11 and 12 year old age samples, relatedness need satisfaction was found to fluctuate largely, with boys scoring higher than girls at age 10 and 12, and vice versa at 11 years of age. It is unclear what caused these changing levels of relatedness need satisfaction across gender and age groups.

Intrinsic motivation appeared to be slightly compromised in children with pDCD compared to their peers. Nevertheless, children with pDCD did score positively on this adaptive construct. Compared to their typically developing peers, children with DCD (9-14 years of age) have previously been found to have lower levels of enjoyment in physical education, a construct that is closely related to intrinsic motivation (Cairney, Hay, et al., 2007). In a sample of 5 to 7 year old children, however, no differences in enjoyment were observed between children with and without DCD with respect to everyday activities outside of school (Jarus et al., 2011). Over development, differences in intrinsic motivation between children with DCD and their peers may become more pronounced. With increasing age, physical activities demand higher levels of motor skill. It is likely that this causes an increase in the gap between children with and without motor difficulties with respect to performance and skill learning (Wall, 2004). Over time, this is in turn likely to result in lower levels of enjoyment, and thus, intrinsic motivation, as well as lower levels of competence need satisfaction, in children with DCD.

In the present study, no differences in achievement goal endorsement between children with and without pDCD were identified. However, a gender by DCD status interaction indicated that the effect of DCD status on mastery goal endorsement differed across gender. Girls with DCD scored lower, while boys with DCD scored higher, on mastery goals compared to their typically developing peers. In a sample of 10 to 13 year old children, Poulsen et al. (2006) found that mastery goal endorsement positively affected the relationship

between motor proficiency and general perceptions of competence. Similarly, for children with pDCD outcomes in physical education can be expected to be more adaptive when mastery goals are endorsed. Children with pDCD may not be able to outperform their peers on activities in physical education classes, and thus, are less likely to experience success in attaining their goal when endorsing performance goals. However, despite their difficulties with learning new motor skills (Wilson, Ruddock, Smits-Engelsman, Polatajko, & Blank, 2013), children with pDCD can learn, and improve their performance on activities (Smits-Engelsman et al., 2012). As a result, children with pDCD are able to experience success in reaching their mastery goals, particularly when sub-goals are set that are appropriate for the child's skill level, and thus, attainable. Such success experiences are likely to inspire motivation. In the present study, mastery goal endorsement was associated with need satisfaction and self-determined forms of motivation (see Chapter 6). Lower levels of mastery goal endorsement in girls with pDCD compared to their peers, as identified in the present study, may consequently result in fewer opportunities for success for these children. Adaptive motivational orientations are less likely to be facilitated in this case. The higher levels of mastery goal endorsement identified for boys with pDCD compared to their peers are a reassuring finding. It appears that despite their difficulties, these boys have not ceased attempts to improve their motor skills in physical education.

As this was the first study to investigate motivation in pre-adolescent children with pDCD using both achievement goal theory and self-determination theory, results could not be directly compared to previous research. Continued research into this issue is needed to build up a more extensive knowledge base, and increase the robustness of findings.

8.5 Summary

The findings of the present phase of the study are of great practical importance, as the difficulties experienced by children with DCD significantly interfere with activities of daily living and school performance (American Psychiatric Association, 2000b). Children with DCD often engage in fewer activities than their typically developing peers. As a result, they receive less practice of their motor skills, which may cause further delays in these children's motor development. This negative cycle can be broken if children with DCD can be motivated to engage in high levels of physical activity, and to actively engage in physical education. It is important that children with DCD develop motivational orientations that result in persistence, and consequently physical activity engagement over an extended period of time, in order to provoke gains in motor proficiency. The present findings indicate that this

may be facilitated if positive perceptions of competence and feelings of autonomy are facilitated, with, especially for girls, an additional focus on the stimulation of mastery goal endorsement.

Chapter 9: Discussion

The promotion of physical activity across all life stages is a priority for public health (Beaglehole et al., 2011). Towards this end, adaptive motivational orientations need to be established. However, little is known on the motivational orientations of children, and how best to facilitate adaptive motivational orientations in young people. There is a need for more research into this issue, which is highly relevant in the light of the obesity epidemic (Ng et al., 2014) and low levels of physical activity (Hardy et al., 2008). To facilitate research into children's motivation, three physical education-specific questionnaires were developed as a part of the present research. Subsequently, the main part of the study involved a comprehensive investigation of the interrelationship of motivational constructs derived from two of the most prominent contemporary motivational theories, achievement goal theory and self-determination theory, was carried out. Both theories have been considered valuable frameworks to guide the development of behaviour change interventions (e.g., Braithwaite, Spray, & Warburton, 2011; Chatzisarantis & Hagger, 2009). Analyses revealed that achievement goals and need satisfaction are important and significant contributors to children's motivation for physical education. These findings have theoretical and practical implications, adding to the understanding of what determines high quality motivation for physical education in pre-adolescent children. The practical significance of findings of all phases of the present study, with its unique focus on pre-adolescent children, is discussed in the following sections, highlighting implications for the design of physical education classes and interventions.

9.1 Questionnaire-Based Assessment in Pre-Adolescent Populations

The present study provided support for the feasibility of investigating psychological constructs related to motivation in children as young as 9 years of age, with the use of self-report questionnaires. This conforms to the literature indicating that with the use of developmentally appropriate questionnaires, children can be reliably surveyed at that age (Borgers et al., 2000; Rebok et al., 2001; Riley, 2004). More specifically, the questionnaires developed in present research were found to be suitable for the assessment of children across the entire pre-adolescent age range in the physical education setting.

Support for the efficacy of questionnaire-based assessment in pre-adolescent children did not only emerge from the psychometric evaluation of the questionnaires, but also from initial pilot-testing, and the application of the data obtained with the questionnaires to test a motivational model. An important message that can be derived from the pilot-tests is the

significance of explicitly testing questionnaires in the targeted population. The tests provided insight into children's understanding of the items. Children's personal interpretation of avoidance goal items was often found to deviate from the intended item content, in ways that could not have been predicted or identified based on the standard quantitative evaluation practices. This emphasises that questionnaires that have been well-validated and widely applied in certain populations, are not unequivocally applicable to other populations or other contexts. As such, even though in the present study support was found for the applicability of the final version of the questionnaires across the pre-adolescent age-range and gender, as evidenced by the adequate indices of reliability and validity that emerged for the different sub-samples, this does not imply that the questionnaires are unambiguously applicable to populations of any age in any setting or context. The items were developed specifically for use with the population in which they were evaluated, namely pre-adolescent children in an Australian physical education context, and may be interpreted differently by respondents from other populations. Application of the questionnaires to, for example, a collectivistic culture may result in differences in the validity and reliability of scores (see Hagger et al., 2009; Taylor & Lonsdale, 2010; Wang, Hagger, et al., 2009). Without knowledge on the applicability of questionnaires to the specific population at hand, comparison of results across populations may confound conclusions.

9.1.1 Questionnaire-Based Assessment of Avoidance goals

As anticipated based on the literature involving older samples, the majority of issues that emerged during the pilot tests concerned the avoidance goal constructs (e.g., Sideridis & Mouratidis, 2008; Urdan & Mestas, 2006). Child respondents often interpreted the avoidance goal items of the C-AGQPE as if they represented approach goals, in line with findings of previous studies (e.g., Urdan & Mestas, 2006). Such issues, which can be uniquely identified with qualitative research methods, may confound results. For example, strong correlations have often been reported between approach and avoidance goals, inciting concerns regarding the empirical distinctiveness of these constructs, particularly for performance goals (Linnenbrink-Garcia et al., 2012; Urdan & Mestas, 2006). It may, however, be that studies identifying strong correlations failed to adequately tap the avoidance goal construct, with items instead indicating approach orientations for a large part of the sample.

Despite omitting to include a qualitative component, some previous research has found indications that pre-adolescent children endorse avoidance goals in physical education (Warburton & Spray, 2008). In a one-year longitudinal study, all four goals were found to

represent statistically distinguishable constructs in children as young as 10 and 11 years (Warburton & Spray, 2008). Supporting these findings, Wang and colleagues (2007) found the four goals to represent distinguishable constructs in 11 to 18 year old children in physical education. Children's goal endorsement was related to factors such as motivation, perceived competence and enjoyment in a manner consistent with theoretical expectations. However, targeting 9 to 14 year old children in a sport setting, Cumming et al. (2008) were unable to identify independent approach and avoidance goals using their newly developed questionnaire. In their study, the approach and avoidance subscales were found to be closely related, implying that the children may not have discriminated between potential success and failure situations, which they strived to approach or avoid (Cumming et al., 2008). Nevertheless, based on the qualitative interview reports of the present study avoidance goals appeared to be evident in per-adolescent children (see Chapter 4), in line with the studies by Wang and colleagues (2007) and Warburton & Spray (2008). This implies that concerns in the literature about the applicability of the avoidance goal construct to the child population may not be due to the absence of avoidance goals in children, but rather, due to issues with the assessment of the construct in young populations (Cumming, Smith, Smoll, Standage, & Grossbard, 2008; Sideridis & Mouratidis, 2008). Difficulties with the assessment of avoidance goals have emerged in adult populations (Elliot & Murayama, 2008), and due to children's developing cognitive abilities difficulties can, as such, be anticipated when assessing children.

Attempting to minimise assessment issues for the avoidance goal construct, the question-response format was adapted to facilitate children's responding to these negatively worded items (see Chapter 4). The main objective of this alternative format was to elucidate to respondents the distinction between the approach and avoidance goal components. The effectiveness of this novel format was evaluated (Chapter 5) using a systematic approach, considering the two individual goal components for each goal combination. Specifically, this approach allowed insight into whether the new question-response format was effective in revealing the approach-avoidance contrast. These evaluations further supported the presence of avoidance goals in pre-adolescent children. However, it appeared that children did not distinguish the definition component of their avoidance strivings, that is, whether they are mastery or performance-related motives. As outlined in Chapter 5, this resulted in the reliance on a trichotomous model to describe achievement goals in pre-adolescent children. Based on this trichotomous model, the relationship between the two approach goals and the universal avoidance goal was only moderate in size, signifying the constructs distinctiveness.

Despite that support for the relevance of avoidance goals in pre-adolescent children and for the reliability and validity of the newly developed subscale was found, avoidance goals did not appear to play an important role in the motivational model that was subsequently tested. The impact of goals on other factors has been suggested to fluctuate as a function of how meaningful the particular goal is for the individual (Brunstein, Schultheiss, & Maier, 1999). As pre-adolescent children are still in a phase of their life in which they continuously learn and improve, the striving to avoid doing worse may not yet be as relevant as in older populations. It is possible that for pre-adolescent children avoidance strivings are present on the background, but are however, outdone by simultaneously endorsed, more dominant, approach strivings. As such, these goals' effect on other motivational factors may be diminished. Future studies may be able to shed further light on this by including more in-depth qualitative interviews and a focus on dominant goals rather than goal profiles (see Van Yperen, 2006). Due to time constraints, it was not possible to investigate this issue more extensively, and as such, the following discussions mainly concern children's approach-oriented strivings.

9.2 Motivation for Physical Education

The motivational orientations of participants in the present research were generally adaptive. For example, high levels of mastery goal endorsement, competence need satisfaction and self-determined motivation were observed, while levels of amotivation were typically low. Furthermore, no indication of a trend of declining levels of motivation for physical education with age emerged. This suggests that the decline in motivation that is consistently reported across a multitude of countries (e.g., Marsh et al., 2006; Ntoumanis et al., 2009; Sallis, 2000) may emerge only at older ages. The comparison of the motivational orientations of pre-adolescent children, who are typically still adequately motivated for physical education, with those of older samples with declining levels of motivation, may provide insight into which factors and processes play a role in the decline. In Australia, physical education ceases to be compulsory after grade 10 (typically 15 to 16 years of age, 4th year of secondary school) (Barnett et al., 2009). Consequently, it is vital that motivational orientations remain adaptive over the pre-adolescent period and into adolescence, to ensure that students choose to continue their engagement in physical education.

Self-determined forms of motivation, and particularly intrinsic motivation, have been related to behavioural persistence (Deci & Ryan, 2008a). Children with self-determined motives for engagement are more likely to continue participation when physical education is

no longer compulsory, that is, when external forces are removed. Children who are motivated to engage in physical education for extrinsic reasons, for example, to get a good mark, are less likely to continue participation. Consequently, understanding the factors underlying self-determined forms of motivation is important for the design of effective physical education programs and interventions. The present research indicates that already in 9 year old children, motivation for physical education is determined by a variety of different psychological factors, which appear interrelated in a coherent fashion.

In line with previous research, results of the present study suggest that mastery goals are related to the more self-determined forms of motivation. Furthermore, across the pre-adolescent ages, the endorsement of these self-referenced goals was found to be more consistently related to satisfaction of the three psychological needs than the endorsement of performance goals. Need satisfaction, was in turn, positively related to self-determined forms of motivation, partially mediating the effects of achievement goals. These findings suggest that in order to promote self-determined forms of motivation, interventions should focus on the facilitation of mastery goals and need satisfaction.

As a result of the stimulating effect of satisfaction of the need for competence on adaptive forms of motivation, and the need's thwarting effect on less adaptive forms of motivation, this need may be a particularly promising target for intervention. Of the three needs, the need for competence was found to be most consistently related to the different forms of motivation, across age and gender. Researchers have proposed that high levels of competence need satisfaction may serve as a buffer against the developmental declines in children's physical activity levels (Kimm et al., 2005) that have commonly been observed (e.g., Kimm et al., 2005; Ntoumanis et al., 2009). Furthermore, children's perceptions of competence in physical education have been associated with adaptive outcomes, such as increased effort in physical education, as well as intentions to participate, and actual participation in leisure-time physical activity (Taylor et al., 2010). The effects of satisfaction of the need for competence are also more likely to transfer across contexts than the effects of satisfaction of the need for autonomy and relatedness. Children's perceptions of their physical abilities are likely to go beyond the physical education context, as the same skills are often used in leisure-time physical activity. Perceptions of autonomy and relatedness, on the other hand, are typically more strongly related to the specific context (Cox et al., 2008). For example, children may feel closely related to their teacher or peers in physical education, but this does not imply that they have the same feelings with respect to their sport coach or teammates. Nevertheless, results of the present study indicated that satisfaction of the need

for autonomy and relatedness have some positive effects on children's self-determined motivation for physical education. As motivation has repeatedly been found to transfer across physical activity contexts, ultimately this may have an effect on children's motivation for physical activity. A focus on the facilitation of the satisfaction of all three needs is thus likely to be beneficial to pre-adolescent children's motivation for physical education, and conceivably also to their motivation for leisure-time physical activity.

9.3 Practical Implications

Teachers play an important role in shaping the motivational climate in physical education (Braithwaite et al., 2011; Spray et al., 2013). The motivational climate represents the contextual influences (e.g., affective and social conditions), including interpersonal processes, evaluations and achievement cognitions (Ames, 1992b; Nicholls, 1989), which are likely to influence an individual's motivation in a particular context (e.g., physical education). The values conveyed by others in the environment (e.g., peers, teachers, parents) may be perceived by children to emphasise the value of personal improvement and effort expenditure, representing a mastery climate. On the other hand, when the environment largely focusses on competition, the motivational climate is likely to be perceived to endorse the value of outperforming others, representing a performance climate (for a review, see Harwood, Spray, & Keegan, 2008). Motivational climates are of central importance in school settings. Children develop belief systems based on such climates, which have important implications for their interpretation of achievement settings, and related affective and motivational responses (see İlker & Demirhan, 2013; Ommundsen & Kvalo, 2007). Both in younger and older age groups, the motivational climate in physical education has been found to have a significant impact upon a wide variety of cognitive, affective and behavioural factors, including attitude, commitment, enjoyment, competence, and goal endorsement (Braithwaite et al., 2011; Moreno-Murcia, Sicilia, Cervelló, Huéscar, & Dumitru, 2011; Standage et al., 2003a). This is likely to affect both the characteristics and degree of children's motivation (Standage et al., 2003b), as well as their behaviour in physical education (Moreno-Murcia et al., 2011). In line with this, researchers have identified that the nature of feedback given by teachers, and the activities selected for the class, can have a substantial impact on children's motivation (Koka & Hagger, 2010; Tessier, Sarrazin, & Ntoumanis, 2010). Positive feedback is more likely to facilitate intrinsic motivation when it is related to effort and strategy use, rather than ability or the performance of others, and also when the standards against which performance is measured are clear, specific and not too

hard to attain (Henderlong & Lepper, 2002). These reports are in line with the findings of the present research, with mastery goals and competence need satisfaction having a positive effect on intrinsic motivation. Furthermore, informational (e.g., “you did very well on this activity”) rather than controlling feedback (e.g., “you performed as I expected you to”) has been reported to be more likely to result in self-determined forms of motivation (Ryan, 1982). Again, this is line with the present findings, indicating a positive effect of autonomy need satisfaction on intrinsic motivation.

It is important that teachers are aware of the consequences, and particularly benefits, of their teaching behaviours, and of the most effective strategies to facilitate adaptive motivational orientations. With the use of evidence-based, theory driven interventions teachers could be educated regarding the most effective teaching behaviours and strategies to facilitate adaptive motivational orientations in their students.

9.3.1 Facilitation of Mastery Goal Endorsement and its Effects

In the previous section it was argued that, based on the present findings, physical education teachers should aim to facilitate the endorsement of mastery goals. A large body of literature is available outlining strategies that can be applied towards this end. Teachers can actively use different pedagogical and didactical methods to influence the motivational orientations of their students. Previous research has revealed promising results with respect to the effectiveness of manipulating the motivational climate in physical education in order to influence children’s achievement goals (Jaakkola & Liukkonen, 2006; Weigand & Burton, 2002). A valuable framework towards the establishment of a motivational climate that facilitates the adoption of mastery goals and adaptive motivation is provided by the TARGET-model (Ames, 1992a; Epstein, 1989). This model distinguishes six dimensions, which include:

(1) Task – It is important that activities are varied regularly, and that teachers adjust activities to children’s personal ability levels so that students are provided with variety, challenge and control. Furthermore, children should be encouraged to set realistic short-term, self-referenced goals for the activities in the class. In the light of the results of the present study, this is likely to facilitate mastery goal endorsement, and competence and autonomy need satisfaction, all of which were related to self-determined forms of motivation. Additionally, results indicated that competence need satisfaction would thwart motives that are external in character, or amotivation.

(2) Authority - Providing children with choices, giving them leadership roles and allowing them to be involved in the decision making processes is important in order to provide children with a sense of authority. As will be discussed further in the following section, this is likely to also facilitate the satisfaction of children's need for autonomy. The findings of the present study indicated that this is likely to facilitate intrinsic motivation in pre-adolescents.

(3) Recognition - Teacher's recognition of children's personal improvement or effort, independent of their ability level is vital to their motivation. All children should experience opportunities for success. Preferably, such feedback is conveyed to children privately. The present study appears to indicate that this is likely to facilitate self-determined motivation as a result of the facilitation of mastery goal endorsement and satisfaction of the need for competence. Competence need satisfaction would further thwart motives that are external in character, or amotivation.

(4) Grouping - It is recommended that children are grouped in a flexible and heterogeneous fashion (involving children of mixed abilities), with a focus on cooperative group learning. This is likely to facilitate mastery goal endorsement as well as relatedness need satisfaction. As outlined, both factors were found to stimulate intrinsic motivation in the present sample.

(5) Evaluation - Children should be encouraged to use self-referenced criteria for the evaluation of their performance, focussing on individual improvement and effort. Such evaluation would stimulate mastery goal endorsement as well as competence need satisfaction, which were found to have an adaptive effect on motivation.

(6) Time - When children are allowed flexible amounts of time to complete tasks or activities, learning is likely to be maximised, as all students have sufficient time to practice and experience improvement (Morgan, Sproule, Weigand, & Carpenter, 2005). Besides the facilitation of mastery goal endorsement, this is likely to enhance satisfaction of the need for competence, both of which convey the outlined adaptive consequences.

Various studies have provided evidence for the effectiveness of physical education classes that are based on the six TARGET principles, resulting in more adaptive motivational and affective responses of students (e.g., Braithwaite et al., 2011; Jaakkola & Liukkonen, 2006; Morgan & Carpenter, 2002). The present study adds insight into the mechanisms connecting these strategies to more adaptive motivational orientations. All TARGET strategies emphasise personal improvement, which as outlined is likely to facilitate mastery goal endorsement. Mastery goals enable all children to experience success in achieving their

goal, independent of their level of motor proficiency. Such successes, in turn, facilitate positive competence perceptions, and motivate children to persist in their mastery efforts. This was supported by the findings of the present study, with mastery goals being related to need satisfaction and self-determined forms of motivation. Furthermore, mastery goal endorsement was found to increase the likelihood of autonomy and relatedness need satisfaction, both of which were positively related to self-determined forms of motivation. A few of the TARGET dimensions specifically facilitate satisfaction of these two needs, further enhancing adaptive motivational orientations.

9.3.2 Facilitation of Need Satisfaction and its Effects

In the present study need satisfaction was found to play an important mediating role in the effect of achievement goals on the different forms of motivation. However, achievement goals were not found to be able to explain all variance in pre-adolescent children's need satisfaction. In line with this, the literature indicates that the three psychological needs do not only mediate the effects of personal orientations (i.e. achievement goals) on motivation, but also the effects of socio-contextual factors, including teacher practices (Deci & Ryan, 2000). Such external influences are likely to explain a further amount of the variance in need satisfaction. In line with this, previous research has evidenced the importance of taking need satisfaction into account when investigating the interrelationship between aspects of the motivational climate in physical education, students' motivation for physical education and its effect on leisure-time physical activity (e.g., Barkoukis, Hagger, et al., 2010). The motivational climate can directly affect need satisfaction, and it should, therefore, be aimed to create a climate in the physical education class that encourages need satisfaction. Results of the present study reinforced that satisfaction of the three needs in students represents an outcome that physical education teachers should pursue, in order to promote self-determined forms of motivation. The present results indicated that this is already the case in pre-adolescent populations, and that particularly the need for competence has the potential to positively affect motivation.

Even though the TARGET principles were forwarded specifically for the stimulation of children's mastery goal endorsement, the same set of principles is likely to facilitate their need satisfaction. Nevertheless, teacher strategies that promote mastery goal endorsement do not automatically promote the satisfaction of children's psychological needs. Benita et al. (2014) argued that when teachers strongly and rigidly regard mastery goals to be superior to other goals (e.g., performance goals), they may try to promote mastery goals in a controlling

way. This can result in children's endorsement of mastery goals, but is unlikely to result in positive psychological outcomes such as need satisfaction. As reinforced by the present results, such outcomes play a role in conveying the adaptive effects of mastery goal endorsement on motivation, and thus are, important to motivation. A strategy that has consistently been related to need satisfaction in physical education is the provision of autonomy support by physical education teachers. Autonomy supportive environments have been shown to facilitate satisfaction of the need for autonomy, as well as the need for competence and relatedness (Standage et al., 2006). Multiple studies have shown the effectiveness of interventions in enhancing teachers' autonomy supportive behaviours in physical education (e.g., Chatzisarantis & Hagger, 2009; Cheon & Reeve, 2012). Such interventions have been found to be able to provoke positive changes in middle and high school students' motivation for physical education, as a result of these changes in teachers' behaviours (Cheon & Reeve, 2012).

There appears to be a consensus in the literature that physical education teachers should also aim to provide adequate levels of structure in physical education, in order to facilitate satisfaction of the need for competence (see Grolnick & Ryan, 1989; Taylor & Ntoumanis, 2007; Tessier et al., 2010). As in the present study the need for competence emerged as important to self-determined motivation, such strategies appear relevant when pre-adolescent physical education students are involved. Similar to autonomy supportive strategies, recommended strategies for the provision of structure are implicitly tapped within the TARGET framework. Teachers can provide structure by assigning challenging tasks and goals, adjusted to children's personal levels of motor ability (see Taylor & Ntoumanis, 2007), communicating clear and short-term goals that are easily quantifiable, encouraging effort and personal progress, and delivering feedback that is contingent upon children's personal efforts (Reeve, 2009; Skinner & Edge, 2002). However, as expressed earlier, it is important that structure is delivered in an autonomy-supportive fashion (Deci, Vallerand, Pelletier, & Ryan, 1991). In line with this, Taylor and Ntoumanis (2007) found a well-structured autonomy-supportive environment in physical education to promote need satisfaction and self-determined motivation in late pre-adolescent and adolescent students.

Less attention has been paid to children's perceptions of relatedness in physical education, and related hereto, the need for relatedness. However, findings of the present study suggest that the need for relatedness is important to the motivational orientations of pre-adolescent children in physical education, particularly for children in early stages of pre-adolescence. When feeling connected to their teacher, children are more likely to accept the

teacher's values, and thus, internalise the value of engagement in physical education (Deci et al., 1991). This was reflected in the results of the present study, through the positive effects of the need for relatedness on intrinsic motivation and identified regulation that emerged. Tessier et al. (2010) provided support for the malleability of teachers' interpersonal style. When teachers increased their expression of sympathy and understanding towards their students, reflecting improvements in their interpersonal teaching styles, this was found to have a negative effect on adolescent students' controlled motivation, and a positive effect on relatedness need satisfaction. Against expectations, no positive effect on self-determined forms of motivation emerged in this study by Tessier et al. (2010). In contrast, in the present study, a positive effect did emerge, while no negative effect of the need for relatedness on controlled forms of motivation was identified. The focus of the present study was, however, solely on feelings of relatedness with respect to peers, while in the study by Tessier et al. (2010) the focus was on the class teacher. This suggests that the two sources of relatedness may have different effects on children's motivation, a suggestion that requires future testing.

9.3.3 Age and Motivation

In a qualitative study on teaching strategies in physical education by Taylor, Ntoumanis, and Smith (2009), teachers reported applying different strategies dependent on their students' gender and age, to optimise their motivation. The researchers identified that teachers provided a wide variety of reasons and justifications for these population-specific teaching strategies. For example, teachers reported using age-specific strategies, in response to the higher levels of contextual motivation and concentration in younger children, or more advanced levels of maturation in older children (Taylor et al., 2009). The application of these strategies appeared to be largely dependent on teachers' personal beliefs, which may not be in line with the needs of the student and empirical theories (Taylor et al., 2009). Consequently, providing teachers with guidance on the application of age-specific strategies could improve the efficacy of their efforts.

Results of the present study provided some insight into the development of achievement goals. Such insights provide important cues as to how to tailor teaching strategies to students' age. Based on results of previous research (e.g., Bong, 2009; Cumming et al., 2008), it was postulated that children initially endorse goals that are uniquely mastery-oriented, followed by the development of general avoidance goals (see Chapter 2). It was proposed that children may then start to differentiate between mastery and performance goals, with this differentiation emerging for approach goals at an earlier age than for

avoidance goals. In the present study, mastery avoidance and performance avoidance goals were found to be strongly related. In line with findings of Cumming et al. (2008), results suggested that children did not differentiate between the two avoidance goals across the pre-adolescent years. The strength of the relationship between mastery approach goals, performance goals, and a general avoidance goal, however, suggested that children differentiated between these three constructs across the entire pre-adolescent age-range. Consistent with the developmental progression proposed in the present thesis (see also Pannekoek et al., 2013), hypothesising that the distinction between mastery and avoidance goals develops prior to that between mastery and performance goals, the lowest inter-correlation was observed between mastery and avoidance goals. The later development of performance goals may explain why these normative goals were found to have higher correlations with the other goal constructs. Altogether, the results suggested that pre-adolescent children involved in the present study may have been in the final stages of achievement goal development.

Not only knowing which goals children can adopt in physical education, but also knowing what effects these goals have across development, is important for the design of the class, to ensure that the best practices are applied to instil adaptive motivational orientations in all children. Based on the present results, children appear to endorse avoidance goals already at the age of 9 years. If the goals are related to similar maladaptive patterns of outcomes that have previously been identified in older samples (e.g., Chen et al., 2009; Ommundsen, 2004), strategies that discourage the adoption of these goals may be necessary from an early age onwards. In the present study, no significant effects of avoidance goals on the motivational constructs grounded in self-determination theory emerged for any of the age samples. It is plausible that, as a result of the early stage of the goals' development, avoidance goals do not yet have consistent effects on motivation and other outcomes across pre-adolescence. The direction of the effects of avoidance goals on the different forms of motivation was in the hypothesised direction for the 12 year old children only, which may indicate that around this age the goals start to have consistent effects on motivation. However, no such conclusions can be drawn with certainty based on the present results.

Alternatively, the positive character of the motivational orientations of the present sample may have played a role in the absence of effects that were observed for avoidance goals. In a recent longitudinal study by Spray et al. (2013), focussing on students undergoing the transfer from primary to secondary school (*M* age = 11.29), virtually no effects of performance avoidance goals on self-perceptions in physical education emerged. Similar to

the present study, participants in the study by Spray et al. (2013) generally reported positive competence perceptions, and high levels of mastery approach goals. It is plausible that such adaptive orientations outweigh the negative effects of concerns about performing worse than peers (performance avoidance goals) (e.g., see Carr, 2006; Van Yperen, 2006).

As in the present study avoidance goal did not facilitate adaptive motivation, and as based on the existing theory these goals may have negative effects on children's motivation for physical education at older ages (e.g., Cecchini Estrada, González González-Mesa, Méndez-Giménez, & Fernández-Río, 2011), teachers should discourage avoidance strivings in physical education. Towards this end, it is important to prevent children from developing a fear of failure, and to ensure that all children develop positive perceptions of their competence (Nien & Duda, 2008). When children feel confident in physical education, they are more likely to approach activities with an outlook on success, and less likely to focus on possible negative outcomes such as failure.

In contrast to avoidance goals, the other motivational constructs included in the model evaluated in the present study were found to have an impact upon children's motivation. All constructs appeared to have established in children as young as 9 years of age, however, some relationships between motivational constructs were found to differ across the age samples. Such differences reinforce the importance of applying teaching strategies specifically tailored to children's age, and provide important keys to the design of effective classes and interventions for specific age groups. Based on the present findings, teachers are recommended to take utmost care when implementing competitive elements in the physical education class, particularly when teaching children in early stages of pre-adolescence. Competition is likely to stimulate the adoption of performance goals (Ames, 1992c). The endorsement of these normative goals was found to be more likely to lead to amotivation, or external regulation for the nine year old children involved in the present study. For the older pre-adolescent children, no positive effect on these less adaptive motivational outcomes was observed.

Rather than a positive effect on less optimal forms of motivation, for the 12 year old children a trend was observed towards positive effects on adaptive forms of motivation for performance goals. These effects were not of sufficient strength to reach statistical significance, however, in the light of the overall findings, it may indicate that children learn to cope with competition over the pre-adolescent years. Teachers may be able to introduce competitive elements in their physical education classes when teaching late pre-adolescent children, particularly if simultaneously a strong emphasis is placed on learning and mastery.

From studies involving older samples evidence has emerged that performance goals are not always maladaptive, particularly when endorsed alongside mastery goals (Carr, 2006; Elliot & Moller, 2003; Midgley et al., 2001). For example, applying cluster analysis in a physical education context, Carr (2006) identified that clusters high in mastery goal endorsement scored high on adaptive motivational constructs, irrespective of simultaneous performance approach and/or avoidance goal endorsement. Based on these results, Carr (2006) suggested that the endorsement of mastery goals may be sufficient to ensure the facilitation of adaptive motivation. Similarly, in the present study, the simultaneous endorsement of both approach goals may have played a role in the absence of maladaptive effects identified for performance goals for 11 and 12 year old pre-adolescents. It appears that for older pre-adolescent children mastery goals may serve as a "buffer" against the potential negative effects of a focus on normative comparison. When both mastery and performance goals are endorsed, these older children may be able to fall back on their mastery goals when they encounter failure, or when their perceptions of competence are under threat. This may help them maintain their sense of competence and self-determined motivation (Duda, 1997). However, the results indicate that early pre-adolescent children may not yet be able to switch between a focus on mastery and performance goals in order to preserve positive competence perceptions.

For older pre-adolescent children, for whom performance goals appear to have more positive effects on motivation, the introduction of competitive elements in physical education could be advantageous. The motivational orientations of children who simultaneously endorse mastery and performance goals may be more resilient in character (Carr & Weigand, 2008). Over development, children are likely to be exposed to physical education environments with differing emphasis on learning and competition. Motivational climates are likely to become more focussed on competition as children move to secondary school (e.g., Ntoumanis et al., 2009; Spray et al., 2013). Children endorsing both mastery and performance goals may be better able to cope with such contextual changes, consequently presenting a motivational advantage. In line with this, some researchers have argued that the concomitant endorsement of mastery and performance may provide benefits (see Barron & Harackiewicz, 2001). This implies that if physical education teachers would aim to completely eliminate the endorsement of performance goals at all ages, children may encounter difficulties in the more competitive physical education context of middle and high schools. As such, even though the facilitation of mastery goal endorsement remains of vital importance at all ages, for older children also the endorsement of performance goals may be important for continued engagement in physical education and physical activity.

A final age-related issue that emerged from the present study that has implications for teaching practices and the design of physical education classes concerns the need for relatedness. Findings of the present research suggest that satisfaction of the need for relatedness is important for adaptive motivation, particularly among early (9 year old) and late (12 year old) pre-adolescent children. This implies that it is important for teachers to ensure constructive relationships between children. Why this appears to be particularly important for motivation in the early and late pre-adolescent years, cannot be deducted from the present findings.

9.3.4 Gender and Motivation

As described earlier, physical education teachers have been found to report applying different strategies to motivate their students, not only based on the students' age, but also based on their gender (Taylor et al., 2009). Teachers participating in the study by Taylor et al. (2009) articulated that they perceived competition and social comparison to be conducive to motivation in boys, whereas for girls physical activities that do not involve normative comparison were regarded more suitable. In response to this, the teachers reported applying more performance-oriented strategies with boys than girls. There is, however, no empirical evidence to suggest that a performance climate is more adaptive for boys than girls (see Taylor et al., 2009). Teachers thus seem to rely on gender stereotypes for these practices (Taylor et al., 2009). Stereotyped notions held by the teacher, and their subsequent practices, may have played a role in the higher levels of performance goal endorsement for boys than girls that were observed in the present study. That girls have typically been found to be less competitively oriented than boys (Nien & Duda, 2008) is likely to be rooted in gender socialisation (see Booth & Nolen, 2009). Although the level of performance goal endorsement differed across gender, the goals' effects on the different forms of motivation were largely comparable for boys and girls, suggesting that normative goals are not more adaptive for boys than girls, or vice versa.

Overall, few marked gender differences were identified in the present sample, both with respect to the structure and level of children's motivational. This may have been a result of the high levels of perceived competence observed for both boys and girls (as indicated by competence need satisfaction). It has been suggested that the effects of stereotyped teaching practices on children's orientations may be less pronounced if they have positive competence perceptions (see Cairney et al., 2012). Competence need satisfaction, however, was found to be lower in girls than boys. It is, therefore, important that teachers focus on facilitating

positive competence perceptions in girls. If girls can maintain high levels of perceived competence over adolescence, they may be less affected by negative gender-stereotypes prevailing in physical education and physical activity. This may assist girls in maintaining adaptive motivational orientations, as reinforced by the present results, and persisting engagement. The importance of adaptive competence perceptions in girls particularly also became clear from findings of Sallis et al. (2000), who identified perceived competence as one of the most important psychological correlates of physical activity participation in girls. In the present study, the effect of competence need satisfaction was found to be positively related to intrinsic motivation in girls only. Consequently, targeting competence perceptions may be the clue to continued motivation for physical education, particularly in girls. Furthermore, it is important that gender-neutral activities are included in physical education, such as fitness training, tennis, volleyball and swimming (Hardin & Greer, 2009), to minimise the effect of gender stereotyping. Activities involving masculine characteristics, such as physical contact, face-to-face opposition, strength, or aggressiveness (e.g., Chalabaev et al., 2012; Hardin & Greer, 2009), should be minimised. Such activities are not only likely to encourage gender stereotyping, but also, to facilitate performance goal adoption.

Performance goal endorsement was not found to stimulate intrinsic motivation in girls nor boys. However, as discussed earlier, performance goals may under some circumstances be able to positively affect children's motivation when endorsed alongside mastery goals. In the present study, this appeared to be more eminent for girls than boys, as performance goals were positively related to identified regulation in girls only. Consequently, even though physical education classes or interventions should focus on encouraging mastery goal endorsement in both boys and girls, it may beneficial to communicate to girls that competition is not 'for boys only'. Nevertheless, care needs to be taken, as performance goal endorsement was also related to external regulation and amotivation in both boys and girls. It is important that perceptions of competence are simultaneously enhanced, for example by focussing on various aspects of the task. The importance of the effective use of strategies, such as fair play, and the performance of duty roles (e.g. team roles) could be emphasised, rather than children's performance with respect to their peers.

Previous research involving primary, middle and high school students has identified more pronounced declines in motivation for physical education with age in girls than boys (Marsh et al., 2006). A positive finding of the present research was that no indication for the decline in motivation with age emerged, not for boys nor girls. Gender was not found to interact with age, suggesting that over the pre-adolescent years, girls' motivation for physical

education does not decrease relative to that of boys. In contrast to the present study, previous research involving older samples has often observed levels of intrinsic motivation to be lower in girls than boys (e.g., Ntoumanis, 2005; Wang et al., 2002). Early intervention may consequently be vital to maintaining adaptive motivational orientations in girls especially.

Taken together, it is important for physical education teachers to recognise the heterogeneity of children in a class, and to provide for children with differing interests and competencies (Trudeau & Shephard, 2008), including boys and girls. It should be recognised that boys and girls may have dissimilar levels of ability and different orientations towards the various activities performed in physical education. Therefore, it is important that boys and girls are equally included in the class, and that public display and recognition of performance is minimised (see Thorne, 1993). As a result, cooperation between boys and girls could be enhanced, encouraging team-play, and facilitating need satisfaction.

In the previous sections, teaching strategies were discussed to facilitate adaptive motivation for physical education in pre-adolescent children in the light of the present findings. However, as became clear from a study by Taylor, Ntoumanis, and Standage (2008) on teachers' motivational orientations and their perceptions of the school and their students, the focus of interventions should not only be on physical education teachers, but also on the school as an entity. A school that does not allow enough time for physical education, and that largely emphasises performance standards that students need to meet may negatively affect teachers' need satisfaction and self-determined motivation to teach. These motivational constructs are in turn likely to have an effect on their teaching behaviours (e.g., Van den Berghe et al., 2013). Teachers' motivation to teach, has been positively related to students' motivation for learning (Roth, Assor, Kanat-Maymon, & Kaplan, 2007), suggesting that it is important that teachers themselves are motivated to teach for self-determined reasons.

9.3.5 Motor Skills and Motivation

The most important aim of physical education is to provide children with the skills to engage in physical activity, and to adequately regulate their engagement in physical activity, to enable them to become independent participants in leisure-time physical activity. This includes cognitive skills, as discussed in the previous sections of the discussion, and physical skills. The interplay between developing both psychological and psychomotor skills in physical education has been widely recognised (Bailey, 2006; MacNamara et al., 2011). The mastery of fundamental motor skills facilitates participation in a wide range of physical activities, both in physical education, as well as in all other physical activity contexts (e.g. on

the playground, and in leisure-time and sport contexts). Adequate levels of motor proficiency are vital to ongoing and continued engagement in physical activity (Stodden et al., 2008). As fundamental motor skills form the foundation of most sporting and physical activities later in life (Gallahue & Ozmun, 1998), ensuring that children adequately develop these skills should not be overlooked (MacNamara et al., 2011). In line with this, it has been evidenced that children with high levels of proficiency in fundamental motor skills are more likely to be physically active during childhood, and also later in life, compared to children with lower levels of motor proficiency (Barnett et al., 2009; Okely, Booth, & Patterson, 2001; Wrotniak, 2006).

Children's actual levels of motor skill are related to their perceptions of physical competence, and satisfaction of the need for competence (e.g., Katartzi & Vlachopoulos, 2011; Vedul-Kjelsås, Sigmundsson, Stensdotter, & Haga, 2012). This was underscored in the present study by the lower levels of competence need satisfaction identified for children with poorer motor skills (identified as pDCD) compared to their typically developing peers. Competence related constructs, in turn, play an important role in motivation, as was confirmed for the present pre-adolescent sample. In line with this, a trend towards lower levels of intrinsic motivation in children with poorer motor skills, compared to their typically developing peers, was identified in the present study. Nevertheless, children pDCD, on average, were still found to score positively on intrinsic motivation.

Researchers have stressed that the difficulties experienced by children with DCD are partly dependent on their social context, and the social support they receive (for a review, see Cairney, Rigoli, & Piek, 2013). Consequently, it is essential that teachers are aware of the condition, and that motor difficulties experienced by children are identified. This is especially important in the light of lower levels of active engagement in the class of children with poorer motor skills, including those with DCD (Causgrove Dunn & Dunn, 2006). By providing additional support to children with motor difficulties, their competence perceptions can be enhanced, which may facilitate adaptive motivational orientations, continued efforts to practice motor skills, and adaptive participation patterns in physical education (Dunn & Watkinson, 2002; Henderson, May, & Umney, 1989).

In their review on how to motivate children with DCD for physical education, Katartzi and Vlachopoulos (2011) suggested that teachers' efforts to support the need for autonomy, competence, and relatedness in children with DCD may have a positive effect on their motivation for physical activity, and related hereto, their engagement. This recommendation was based on theoretical reasoning, and there was no empirical evidence to

support the supposition. The lower levels of competence and autonomy need satisfaction of children experiencing motor difficulties compared to their typically developing peers, as well as the positive effects of need satisfaction on self-determined forms of motivation, as identified in the present study, seem to support the recommendations by Katartzi and Vlachopoulos (2011).

In the present study the most marked difference between children with motor difficulties and typically developing children emerged for autonomy need satisfaction. Previous studies have identified that teachers provide more structure, autonomy support, and involvement to students whom they perceive to be positively engaged in physical education compared to students whom teachers perceive to be less engaged (Ntoumanis & Standage, 2009; Skinner & Belmont, 1993; Taylor et al., 2008). Based on such reports, it is likely that the lower levels of autonomy need satisfaction identified for children with motor difficulties in the present study were a result of limited provision of autonomy support by their teachers. Furthermore, children with compromised levels of motor skills are likely to engage in disruptive behaviours as a strategy to cope with their difficulties (May-Benson, Ingolia, & Koomar, 2002; Rivard, Missiuna, Hanna, & Wishart, 2007), to which teachers may respond with controlling rather than autonomy supportive teaching strategies. Rivard et al. (2007) found that teachers were more likely to identify motor difficulties in their students when they did not engage in disruptive behaviours. If teachers were better aware of the cause of potential maladaptive behaviours of children experiencing motor difficulties, they may be better able to support these children by providing them with well-structured autonomy support. By setting clear and achievable short-term goals, adjusted to the child's skill level, and providing instructions as to how to evaluate the progress of goal-attainment, teachers may assist children with motor difficulties to develop more positive competence perceptions and adaptive motivational orientations.

Previous research has identified a direct relationship between satisfaction of the need for competence and the development of locomotor and manipulative skills (Kalaja et al., 2009). Additionally, in a recent study competence perceptions were found to partially mediate the relationship between manipulative skills and physical activity, and vice versa (Barnett, Morgan, Van Beurden, Ball, & Lubans, 2010). Consequently, enhancing the competence perceptions of children with compromised levels of motor proficiency may not only result in increased motivation, but also in improved motor skills. This may result in a self-enhancing cycle, as compared to the negative cycle that has often been observed in children with motor difficulties. This again reinforces the importance of ensuring that all

children, also those children with lower levels of motor proficiency, experience a positive sense of competence in physical education (see also Barnett et al., 2008; Barnett et al., 2009).

An encouraging finding of the present study was that children with poorer motor skills scored positively on adaptive motivational constructs. Besides a positive average score on intrinsic motivation, children with motor difficulties were found to strongly endorse mastery goals, similar to children who do not experience motor difficulties. Physical education classes contain children who vary largely with respect to their level of motor proficiency. When mastery goals dominate, all children can experience success in attaining their achievement goals, independent of their level of motor proficiency. An emphasis on performance goals may hinder the participation of children with lower levels of competence. For example, when competition and normative ability is emphasised, highly proficient children may not pass the ball to children with lower levels of motor skill, as this involves the risk of not attaining their endorsed performance goal. This does, however, not imply that teachers cannot introduce game situations in the class, as such situations do not inevitably involve performance goal endorsement. For example, teachers could minimise the emphasis on the outcome of the game situation by forwarding rules that support the involvement of all children, such as a requirement to pass the ball around to all players before an attempt to score can be made. Such strategies minimise the emphasis on outcomes, decreasing the likelihood that performance goals are stimulated. If rules regarding how the game is played are composed with all children's collaboration, and not imposed by the teachers, this could simultaneously facilitate children's experiences of autonomy.

9.4 Study Limitations & Future Directions

The present study provides new insights into pre-adolescent children's motivational orientations in physical education. Strengths of the study include that population and context specific assessment methods were used, and the focus on different subpopulations, to control for the effects of some individual characteristics on motivation. However, a number of limitations require attention, which could inspire future research.

The constructs included in the model were assessed with newly developed questionnaires. Even though these questionnaires were extensively evaluated in the targeted population, and support was generally found for the adequacy of their psychometric properties, indices of validity and reliability were not optimal. The accumulation of evidence relating to questionnaires' validity is a process of continuous evolvement (see Cronbach &

Meehl, 1955), and further application and evaluation of the questionnaires is needed to more firmly establish their reliability and validity.

The suboptimal indices of reliability that were identified for some subscales represent an area where improvements could be achieved. Subscales consisted of three items, which is likely to have negatively affected the scales' reliability (see Maloney, Grawitch, & Barber, 2011). Increased subscale length may have resulted in more positive reliability results. However, the optimal number of items per subscale is contingent on a balance between economy, precision and reliability. Concentration span and motivation are likely to be more limited in pre-adolescent children than in adults. As such, more items per subscale but would have undermined the questionnaires' applicability to young samples, particularly for studies like the present, which include a focus on a wide array of constructs. Two of the subscales comprised only two items due to item deletions. As at least three indicators per construct is preferable, further work may want to develop two additional items (Marsh, 2007).

The restricted range of possible scores for the questionnaire items limited the information the subscales could provide to the model. Responses were given on four-point Likert-type scales, as they have been found to elicit optimal results when surveying children (Borgers et al., 2004). This may, however, have resulted in ceiling effects (e.g., for mastery goals and the need for competence), which may have attenuated the strength of the relationship between the factors included in the model. A further issue with the four–point scales involves the labelling of the choice options. The labels used in the original questionnaires were copied for the C-AGQPE, C-PNSPE and C-PLOC. The same labels accompanying four-point Likert-type scales have been applied in previous research in the physical activity domain (e.g., de Farias Júnior et al., 2011). However, it remains to be determined whether the relative difference in scores on the items is the same between response options. For example, it needs to be investigated whether the relative difference between 'agree' and 'disagree' is the same as the difference between 'disagree' and 'strongly disagree'.

The variance explained in the motivational constructs was limited. Additional variance in the endogenous constructs in the model may be explained with the inclusion of additional constructs. An extensive literature review preceded the selection of the construct of focus. Although a theoretical rationale guided construct selection, the set of constructs selected for inclusion in the present model was not conclusive. Additional constructs, based on other motivational theories, are known to be important to motivation. Furthermore, within the selected theories, a narrow focus was taken on the constructs at hand, omitting some

subcomponents of the constructs. This was regarded a strength of the study, as results provided clarity regarding the role of very specific factors in children's motivation. For example, a focus was taken on children's experience of relatedness with respect to their peers in physical education. Children's need satisfaction is most likely to also be affected by experiences of relatedness with respect to the class teacher. However, if both sources of need satisfaction were tapped within the same subscale, the consequent aggregate score would not provide information regarding the source of need satisfaction. The same need satisfaction score could be obtained for a child feeling close to peers but not to the teachers as for a child feeling close to the teacher but not to peers. Consequently, it would not be possible to derive from the results whether the different sources of need satisfaction are (equally) effective and whether or not they affect the same constructs. Future studies are recommended to include aspects of the motivational constructs that were not targeted in the present study, preferably tapped in separate subscales.

The reliance exclusively on children's self-reports in the present study is likely to have inflated the common method variance. However, self-determination theory contends that individuals' perceptions of socio-contextual and personal factors are more important determinants of their motivation than reports by others (e.g., their teacher). Future studies are needed to include objective outcome measures, such as physical activity levels in physical education, to be able to determine the practical significance of the effects identified with statistical techniques in the present study.

Furthermore, there is a need for longitudinal studies that follow children's motivation for physical education over multiple school years. The cross-sectional design of this study did not allow drawing firm conclusions with respect to the causal direction in the relationships between achievement goals, the three needs and the different forms of motivation. Previous studies have suggested reciprocity in the relationship between motivational constructs (e.g., Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008). Whether or not relationships between the constructs in the present model are dynamic (e.g., reciprocal) requires investigation. Longitudinal research could further provide valuable information on the development of motivational orientations over pre-adolescence, and the factors that stimulate changes in children's motivational orientations over time. Such research could investigate the temporal association between motivation and children's engagement in physical activity, to determine whether the often observed parallel decreases in adaptive motivation and physical activity (Sallis, 2000) are in fact associated.

To engage in the present study, active school, parent and child consent was required. This may have resulted in a sampling bias. It may be that, for example, those schools placing particular focus on physical education, those parents with concerns about their child's physical activity behaviours, or those children who enjoy physical education, were more likely to consent for participation in the study. No data was collected on SES indictors for participants in the pilot study. This may have affected the results, and consequently, this is a limitation of the research. Efforts were, however, undertaken to ensure a diverse sample. For the main study, dependencies in the data based on school membership were calculated to control for differences in children's motivational orientations as a result of the particular school, in a particular SES area, they attended. No dependencies associated with school membership were identified, indicating the independent nature of the observations. A limitation was that no data were available on the number of classes involved in the study. Therefore, it could not be tested whether the data were nested (students nested within classes). Despite the absence of any indication of dependencies in the data, a sampling bias based on schools', parents' and children's willingness to consent may have arisen. For example, only 29% of invited schools participated in the research, increasing the risk of a sampling bias. Participating schools had an average SES score indicating that they belonged to the upper 30% of most advantaged schools. Nevertheless, schools from the entire range of SES (1-10) participated in the research, and participants with an array of backgrounds were included in the study. Previously, a sampling bias was identified as a result of active consent procedures in questionnaire-based research on childhood obesity and associated health behaviours, including physical activity behaviour (Mellor, Rapoport, & Maliniak, 2008). Parents of children who were overweight were less likely to consent for participation (Mellor et al., 2008). Motivation for physical education may have been a less sensitive topic compared to that of the study by Mellor et al. (2008), carrying fewer stigmas, and resulting in a reduced chance of the occurrence of a significant sampling bias.

Given the age of the participants recruited for the present research, ranging from 9 to 12 years, pubertal status may have affected the results. It is plausible that a part of the present sample had reached puberty (e.g., see Lee & Styne, 2013). Puberty is characterised by fundamental, and rapidly occurring changes in physical appearance, biology, and social and psychological capabilities (Patton & Viner, 2007). Furthermore, this major life event has been found to affect self-perceptions (Cumming et al., 2011; Niven, Fawkner, Knowles, & Stephenson, 2007). Physical self-perceptions, in turn, have been identified as a potential mediator of the relationship between children's maturity status and physical activity

behaviour (Cumming et al., 2011; Malina, 2008; Niven et al., 2007). Preliminary findings suggest that motivation for physical activity may play a role in this relationship (Labbrozzi, Robazza, Bertollo, Bucci, & Bortoli, 2013). As girls generally have an earlier onset of body related changes associated with puberty (see Lee & Styne, 2013), girls in the present study may have been more strongly affected by puberty-related changes than boys. This may have confounded the data. However, the limited effect of age on children's scores on the constructs included in the model, together with the absence of age by gender interaction effects, suggest that the results were not systematically influenced by pubertal status. It is acknowledged that chronological age does not represent maturity status, however, more pronounced differences in the motivational orientations and processes of children at the extremes of the age-range (i.e., 9 and 12 years of age) would be expected if maturity status played a role, which was not the case in the present study. Further research involving both pre-adolescents and adolescents is needed to shed more light on the relative impact of pubertal status and chronological age on motivation for physical education, and physical activity more generally.

Lastly, as a result of the small size of the sample of children with motor difficulties (pDCD), the motivational model could not be compared across children with and without motor difficulties. Future studies are needed to investigate the interrelationship between constructs included the model in children experiencing motor difficulties using a larger sample. Such research would preferably distinguish between children scoring between the 15th and 5th percentile on the MABC-2, and those scoring below the 5th percentile. Furthermore, the analysis of the model in children who have been formally diagnosed with DCD could provide additional insights into the impact of motor proficiency on motivation.

The findings of the present study reinforce that combining data from different subpopulations, without controlling for the special characteristics of such populations, does not automatically result in an accurate depiction of the motivational processes and orientations of the particular subpopulations. For example, in the overall sample, performance goal endorsement was found to have a positive effect on children's competence need satisfaction. This effect could not be confirmed in any of the age samples, or for boys and girls independently, despite the relatively large sample size of these subpopulations. Based on their extensive review of the correlates of physical activity in children and adolescents, Sallis et al. (2000) concluded that physical activity is influenced by various environmental, personal, social and cultural factors. The effect of these factors further depends on the developmental, biological and chronological stage of the children (Sallis et al., 2000). In the present study, differences based on age and gender were observed in the constructs that

played pronounced roles in facilitating adaptive motivational orientations (i.e., high levels of self-determined motivation and low levels of controlled motivation). Furthermore, differences in children's endorsement of the motivational constructs were identified based on age, gender and level of motor proficiency. It is, thus, important to take personal characteristics into account when the ultimate aim is to facilitate adaptive motivational orientation in physical education for all children.

Future studies are needed to take a more person-based approach to children's motivation. Such an approach would not only be advantageous to account for individual differences, but also, to gain insight into how different combinations of high and low scores on constructs may affect motivation discordantly. For example, Sheldon and Niemiec (2006) found that the effects of need satisfaction may be more positive if the level of need satisfaction is balanced across the three needs, rather than when the level of satisfaction differs for each individual need. Similarly, results of some studies suggest that the effects of children's achievement goals may vary depending on the specific combinations of goals endorsed (e.g., see Barron & Harackiewicz, 2001; Carr, 2006; Wang et al., 2007). Recently, cluster analysis has been applied to investigate the effects of different combinations of motivational orientations, which could be a valuable approach with respect to the intra-individual analysis of motivation (e.g., Solmon, 2006; Ullrich-French & Cox, 2009; Wang et al., 2007). Importantly, such research should not replace population-based research, applying methods such as structural equation modelling, but rather complement it. Population-based research provides valuable information on the general pattern of effects and processes underlying motivation, while more person-based approaches contributes more specific information on motivation, related processes and behavioural outcomes, based on multiple factors in conjunction.

Lastly, although the school setting provides an important structure for intervention, children are exposed to various other contexts that influence their motivational orientations. For example, parents and the home environment play an important role in shaping children's behaviours (van Sluijs, McMinn, & Griffin, 2007). Including a focus on parents may provide important information, which could help increase the effectiveness of school-based interventions. Ideally interventions to promote physical activity behaviour are multi-dimensional, covering multiple contexts.

9.5 Conclusions

Taken together, results of the present research suggest that the processes underlying motivation for physical education in pre-adolescent children are comparable to those in older samples. Children 9 to 12 years of age were found to discriminate between the constructs forwarded by achievement goal theory, and self-determination theory. However, some differences emerged in the interrelationship of the constructs based on children's age and gender. Furthermore, differences in children's scores on the subscales tapping the motivational constructs emerged based on age, gender and level of motor proficiency (DCD status). These findings highlight the importance of taking individual differences into account when considering motivation. A 'one-fits all' approach is unlikely to be effective in motivating all children to actively engage in physical education.

Psychological factors, as presented in the present research, represent potential malleable targets for intervention. Overall, findings of the present study provide a deeper insight into children's motivation for physical education, providing valuable insights that could facilitate the design of effective interventions aiming to increase children's motivation. It is hoped that the development of such interventions, based on accumulating empirical evidence, helps stimulate children's motivation, and active participation in physical education, optimising its benefits. Ultimately, this is anticipated to contribute to the development of physical activity habits that persist over adolescence and into adulthood. As one of the participants of the pilot-tests stated: "It is important to do well at it (physical education), because I don't want to be one of those couch potatoes, it is important to me to be fit."

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APPENDIX A: PARENT CONSENT FORM

What moves children to move?

Development of an overarching motivational model in the physical domain.

- I have read and understood the information letter about the project, or have had it explained to me in language I understand.
- I have taken up the invitation to ask any questions I may have had, and am satisfied with the answers I received.
- I understand that participation in the project is entirely voluntarily.
- I am willing for my child to become involved in the project, as described.
- I have discussed with my child what it means to participate in this project. He/she has explicitly indicated a willingness to take part, as indicated by his/her completion of the child consent form.
- I understand that both my child and I are free to withdraw from participation at any time within 5 years of project completion, without affecting the family's relationship with my child's teacher or my child's school.
- I understand that data will be stored securely for a minimum period of 5 years, after which it will be destroyed. Also, all contributions made to the project will be destroyed unless explicitly agreed to by myself and my child.
- I give permission for the contribution that my child makes to this research to be published in a journal, provided that my child is not identified in any way.

Name of Child (printed): _____

Date of Birth: _____

Gender: M / F
(please circle)

Name of Parent/Carer (printed):

Signature of Parent: _____ Date: / /

APPENDIX B: CHILD CONSENT FORM

WHAT MOVES CHILDREN TO MOVE?

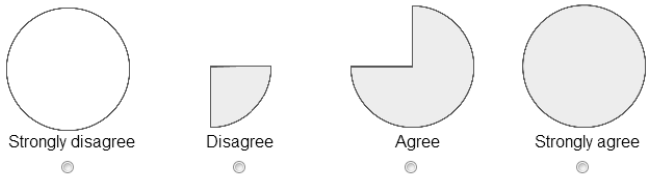
- I know that I don't have to be involved in this project, but I would like to be.
- I know that I will complete 4 questionnaires as part of the project. I understand that I will be asked questions about the items, and this will be recorded on an audiotape.
- I know that I can stop when I want to.
- I understand that data will be stored securely for a minimum period of 5 years, after which it will be destroyed.
- I understand I am free to withdraw from the project at any time within 5 years and my contribution to the project will be destroyed, unless my parents and I agree that you can use it in your report of the project.
- I understand that I need to write my name in the space below, before I can be a part of the project.

Your name: _____ Today's Date: / /

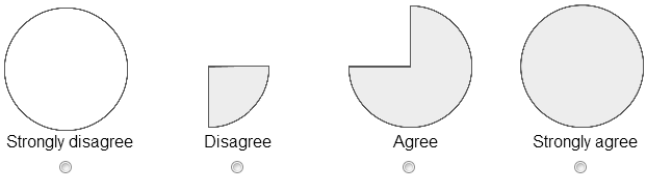
APPENDIX C: C-AGQPE

Mastery approach goals

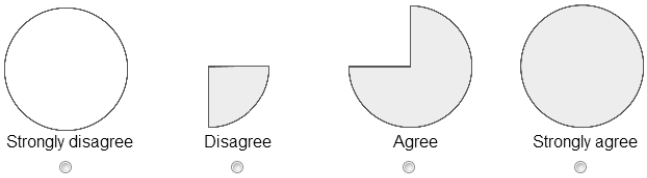
1. At physical education I want to learn as much as possible



2. At physical education my goal is to improve my skills

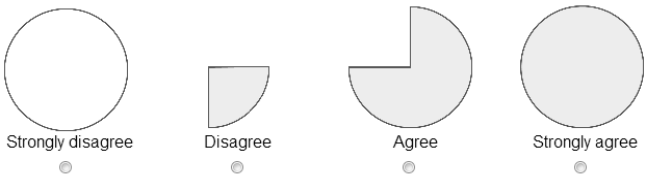


3. At physical education my goal is to do better than I have before

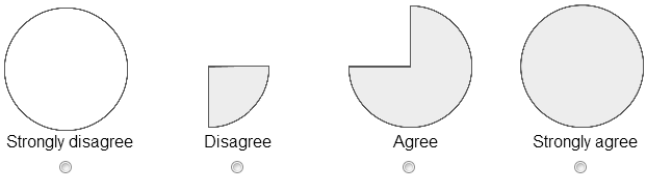


Performance approach goals

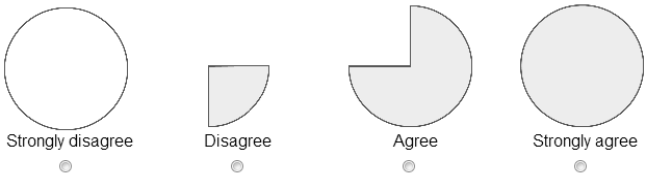
1. At physical education I want to do better than other kids



2. At physical education I want to do better than the average kid



3. At physical education my goal is to perform better than others



Paper-based items (avoidance goal items)

What is my goal at physical education?

For every item, choose the option that is most like your own goal in physical education.

1. At physical education my goal is not to do worse than I have before. **OR** At physical education my goal is to do better than I have before.

☐ ☐

2. At physical education my goal is **not to do worse** than I have before.

☐	☐	☐	☐
Never true	Hardly ever true	Mostly true	Always true

3. At physical education I want to make sure I improve my skills. **OR** At physical education I want to make sure I do not lose my skills.

☐ ☐

4. At physical education I want to make sure I **do not lose** my skills.

☐	☐	☐	☐
Never true	Hardly ever true	Mostly true	Always true

5. At physical education my goal is not to do worse than last time. **OR** At physical education my goal is to learn and improve.

☐ ☐

6. At physical education my goal is **not to do worse** than last time.

☐	☐	☐	☐
Never true	Hardly ever true	Mostly true	Always true

7. At physical education my goal is not to do worse than other kids. **OR** At physical education my goal is to do better than other kids.

☐ ☐

8. At physical education my goal is **<u>not to do worse</u>** than other kids.

☐	☐	☐	☐
Never true	Hardly ever true	Mostly true	Always true

9. At physical education my goal is to do better compared to other kids. **OR** At physical education my goal is not to do poorly compared to other kids.

☐ ☐

10. At physical education my goal is **<u>not to do poorly</u>** compared to other kids.

☐	☐	☐	☐
Never true	Hardly ever true	Mostly true	Always true

11. At physical education I want to make sure I do not perform worse than others. **OR** At physical education I want to make sure I perform better than others.

☐ ☐

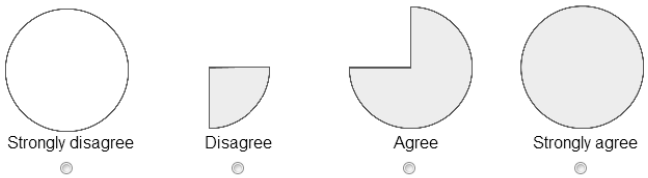
12. At physical education I want to make sure I **<u>do not perform worse</u>** than others.

☐	☐	☐	☐
Never true	Hardly ever true	Mostly true	Always true

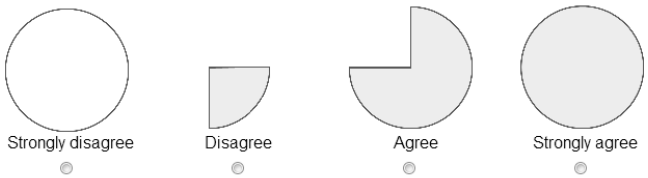
APPENDIX D: C-PNSPE

Need for competence

1. At physical education I can do activities that seem hard to me



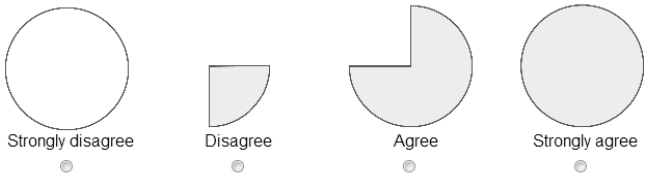
2. At physical education I feel good enough to do the activities that seem hard



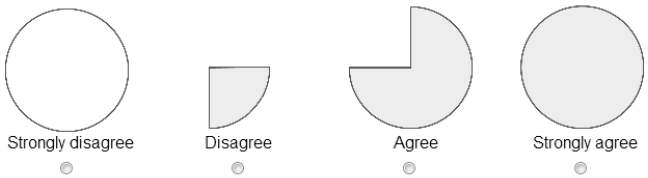
3. At physical education I can do the activities, even if they are hard

Need for autonomy

1. At physical education I feel I can say what I would like to do



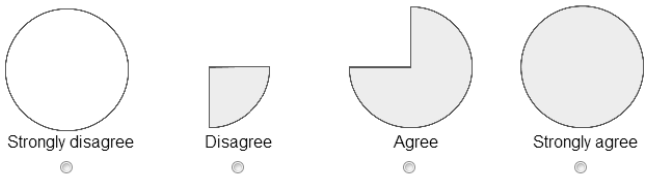
2. At physical education I feel like I can exercise in my own way



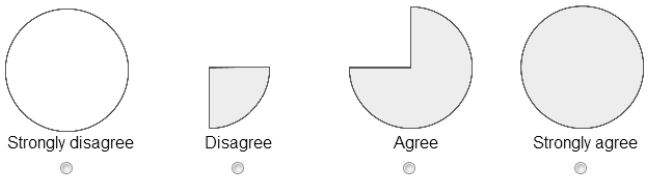
3. At physical education I feel like I can do the things I like

Need for relatedness

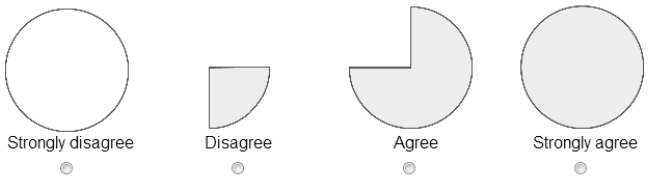
1. I feel close to the other kids in my class when we do physical education together



2. I feel part of the group when I do physical education with the other kids in my class



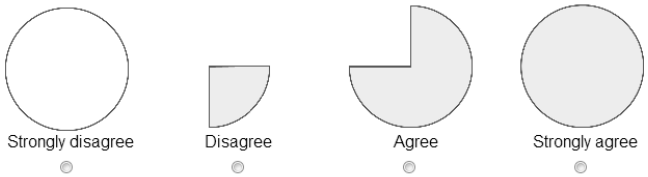
3. . I feel accepted by the other kids I do physical education with



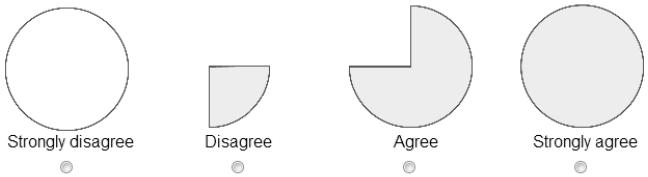
APPENDIX E: C-PLOC

Intrinsic motivation

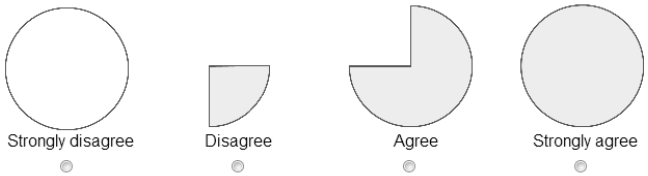
1. I take part in physical education because it is fun



2. I take part in physical education because I like learning new things

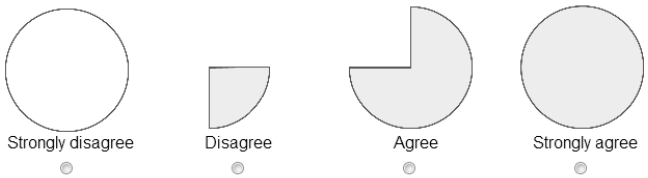


3. I take part in physical education because I enjoy doing it

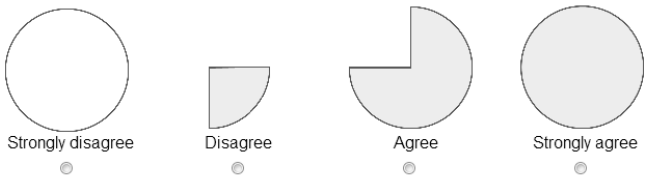


Identified regulation

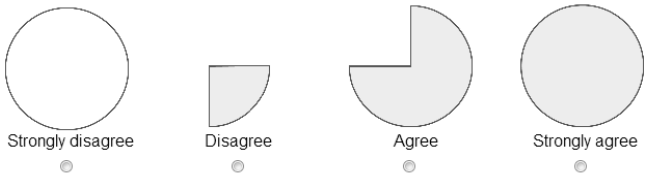
1. I take part in physical education because I want to learn how to do new things



2. I take part in physical education because it is important for me to do well

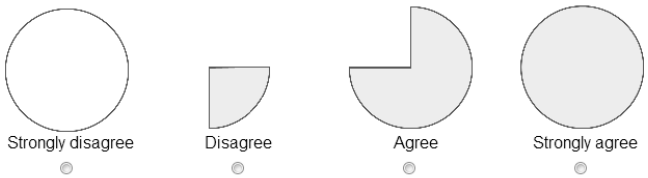


3. I take part in physical education because I want to get better at it

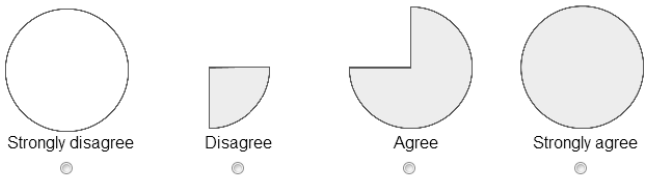


Introjected regulation

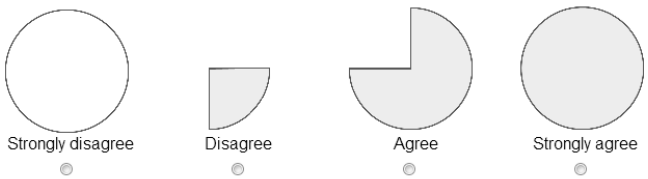
1. I take part in physical education because I want others to think I am good at it



2. I take part in physical education because I feel guilty when I don't

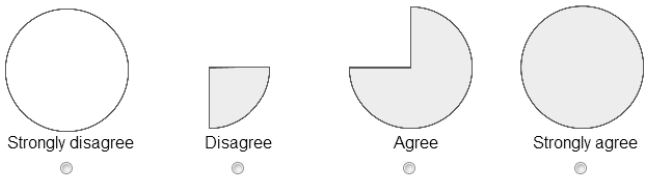


3. I take part in physical education because I want other kids to think I am good

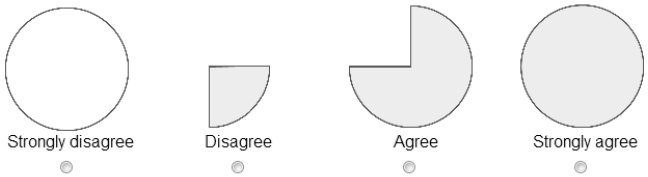


External regulation

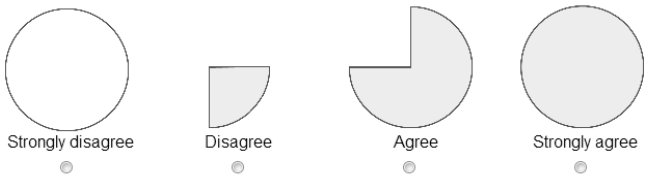
1. I take part in physical education because I'll get into trouble if I don't



2. I take part in physical education because I have no choice

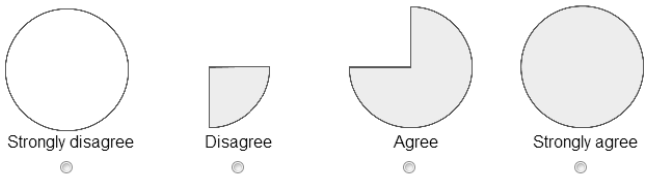


3. I take part in physical education because that's the rule

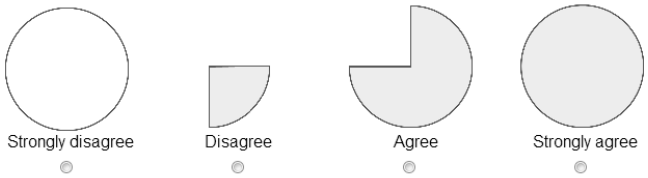


Amotivation

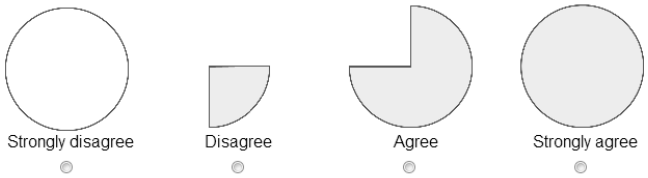
1. I take part in physical education but I don't know why we should have it



2. I take part in physical education but I feel I am wasting my time at it



3. I take part in physical education but I don’t know the reason why



APPENDIX F: PARENT DEVELOPMENTAL QUESTIONNAIRE

What moves children to move? Parent/ Guardian Questionnaire

Child's name: _____Date:_____

1. Nationality (mother): _____
2. Nationality (father): _____
3. Primary language spoken at home:

   _____

4. Highest level of educational attained (mother):

   _____

5. Current main occupation (mother): _____
6. Highest level of education attained (father): _____
7. Current main occupation (father):

   _____

8. Has your child been indicated with any reading difficulties? YES / NO

If yes, please specify _____

9. Has your child been diagnosed with any of the following problems?

Cognitive Disability?	YES / NO
Motor Coordination Problems?	YES / NO
Physical Disability?	YES / NO
Learning Disability?	YES / NO
Medical condition that affects development?	YES / NO
Any other serious psychological or health problem?	YES / NO

If yes, please specify _____

Please ***return this questionnaire with the consent forms*** *to your child's school teacher.*

The success of this study is reliant on the participation of as many children and parents as possible. Your child's participation will be most appreciated and will contribute to important research that will be of benefit to all children. **Thank you for your cooperation!**

APPENDIX G: INFORMATION LETTER SCHOOLS

Linda Pannekoek
PhD student
Curtin University of Technology
GPO Box U1987, Perth, WA, 6845

Dear [name principal],

What moves children to move?
Development of an overarching motivational model in the physical domain.

My name is Linda Pannekoek and I am writing to you on behalf of Curtin University of Technology. I am conducting a research project that aims to gain deeper understanding in motivation to participate in physical activity in children aged 9-12 years. The question that I want to answer is why some children are very motivated to be active, and play active games or sports, while other children are not. More knowledge about this could help in the development of programs to stimulate physically active lifestyles already at a young age. This is important for a child's current and future health. The project is being conducted as a part of a PhD in Psychology at Curtin University.

I would like to invite [name school] to take part in the project. This is because a large sample of primary school children is needed to be able to reliable investigate motivational issues in this age group. [Name school] is one of approximately 20 schools in Western Australia approached for their participation.

What does participation in the research project involve?

I seek access to all students aged 9 to 12 years of age.
The children will be invited to complete five questionnaires asking about their motivation for physical activity, which will encompass one session of approximately 30 minutes. I will come to your school to assess the students (five students at the time). Participating children will also be asked to do a movement test, involving some tasks like catching, throwing and balancing, which takes about 20 minutes per child. The results of this movement test are an indication of the children's general motor competence (fine motor control, gross motor control, balance). In case a child's test results are indicative of *possible* motor difficulties,

their parents will be notified. Assessments will take place during school hours. When you decide to participate in this project, the time of assessment will be carefully selected in cooperation with you and the teachers, to avoid that students miss important regular classes. I will keep the school's involvement in the administration of the research procedures to a minimum. However, it will be necessary for the school to send home with students the information letters and consent forms for both students and their parents.

To what extent is participation voluntary, and what are the implications of withdrawing that participation?

Participation in this research project is entirely voluntary.

If any member of a participant group or their parents decide to participate and then later change their mind, they are able to withdraw their participation at any time. If the project has already been published at the time the participant decides to withdraw, their contribution that was used in that publication cannot be removed from the publication.

There will be no consequences relating to any decision made by a child, parent or the school regarding participation, other than those already described in this letter. Decisions made will not affect the relationship with the research team or Curtin University of Technology.

What will happen to the information collected, and is privacy and confidentiality assured?

All information that is suggestive of the identity of anyone will be removed from the data collected. All documents are then stored securely in a locked cabinet at the School of Psychology at Curtin University (hard copies), or kept on a computer database that is password-protected, and can only be accessed by the research team (Linda Pannekoek, Professor Jan Piek, Professor Martin Hagger and Dr. Robert Kane). The data will be stored for a minimum period of five years, after which it will be destroyed. This will be achieved by deleting the computer files and professionally shredding of the paper documents.

The identity of participants and the school will not be disclosed at any time, except in circumstances that require reporting under the Department of Education Child Protection policy, or where the research team is legally required to disclose the information. Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.

The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from participants.

Consistent with Department of Education policy, a summary of the research findings will be made available to the participating sites and the Department of Education. You can expect this to be available in January 2014.

Is this research approved?

The research has been approved by the Human Research Ethics Committee of Curtin University (approval number HR 121/2011), and has met the policy requirements of the Department of Education as indicated in the attached letter.

Do all members of the research team who will be having contact with children have their Working with Children Check?

Yes. Under the Working with Children (Criminal Record Checking) Act 2004, people undertaking work in Western Australia that involves contact with children must undergo a Working with Children Check. The documents attached to this letter include a list of the research team who will be having contact with children through your school, along with current evidence of their checks.

Who do I contact if I wish to discuss the project further?

If you would like to discuss any aspect of this study with a member of the research team, please contact me on the number provided below. If you wish to speak with an independent person about the conduct of the project, please contact Linda Teasdale, Ethics Committee Secretary, by telephoning +61 89266 2784.

How do I indicate my willingness for [name school] to be involved?

If you have had all questions about the project answered to your satisfaction, and are willing for the school to participate, please complete the **Consent Form** on the following page.

This information letter is for you to keep.

Linda Pannekoek,
PhD student
Curtin University of Technology, School of Psychology
Email: linda.pannekoek@postgrad.curtin.edu.au
Contact telephone: +61420966608

APPENDIX H: INFORMATION LETTER PARENTS/ CARERS

What moves children to move?

Development of an overarching motivational model in the physical domain.

Dear Parent/ Carer,

Thank you for taking the time to read this information sheet. My name is Linda Pannekoek and I am writing to you on behalf of Curtin University. I am conducting a research project that aims to gain a deeper understanding of motivation to participate in physical activity in children. The question that I want to answer is why some children are very motivated to be active, and play active games or sports, while other children are not. More knowledge about this could help in the development of programs to stimulate physical active lifestyles already at a young age. This is important for a child's current and future health. The project is being conducted as part of a PhD in Psychology at Curtin University with my supervisors, Prof. Jan Piek (Primary Supervisor), Prof. Martin Hagger, and Dr. Robert Kane.

I would like to invite your child to take part in the project. The parents of all children in the age range of 9-12 years of selected main stream primary schools in Perth will be contacted to ask for permission for their child to participate in this study. Your child's school is one of about 10 schools in Western Australia approached for their participation. Your child has also been provided with a letter from us that we encourage you to discuss with him/her.

What will you and your child be asked to do?

Participation in the project will involve your child completing **five questionnaires** on a computer**,** asking about their motivation for doing physical activity, which will encompass one session of approximately 30 minutes. I will come to your child's school to assess your child, simultaneously with 4 other children at the time. Your child will also be asked to do a movement test, involving some tasks like catching and throwing and balancing. The results of this movement test are an indication of your child's general motor competence (fine motor control, gross motor control, balance). In case your child's test results are indicative of *possible* motor difficulties, you will be notified. Furthermore, we might ask your child to wear a pedometer during one Physical Education lesson, to measure his/her activity level. Assessments will take place during regular school hours. The time of assessment will be carefully selected in cooperation with the school, to avoid that your child misses important regular classes.

Besides your child's participation, you will also be asked to fill out the **two questionnaires** attached (assessing movement ability and medical history), to be returned with the consent forms.

Do we have to participate?

Participation is voluntary. The decision to participate should always be made completely freely, and all decisions are respected by members of the research team without question. Your decision will not affect your family's relationship with your child's teacher or the school. If a decision is made to participate, it will need to be made by the 9th of May 2012 for your child to be included in the project.

Please note*: Unfortunately due to the purposes of this study, if your child has diagnosed reading difficulties, physical disability or chronic illness, including hearing difficulties or a vision impairment (that doesn't simply require wearing glasses), or a medical condition that affects development (e.g. Down Syndrome), you should decline to participate on that basis and note the reason on the enclosed response form. If you have any questions about eligibility, please contact us at one of the numbers or email addresses listed below. Children with motor difficulties (e.g. Developmental Coordination Disorder) are not excluded from participation.*

What if either of us was to change our mind?

Once a decision is made to participate, either you or your child can change your mind at any time within the minimum 5-year storage period of the research data (see below). All contributions made to the project will then be destroyed unless explicitly agreed to by you. If the project has already been published at the time you and your child decide to withdraw, your child's contribution that was used in reporting the project cannot be removed from the publication.

What will happen to the information collected, and is privacy and confidentiality assured?

The privacy and confidentiality of participants is assured. Information that identifies anyone will be removed from the data collected. The data is will be securely stored in a locked cabinet, and kept on a computer database that is password-protected, and can only be accessed by the research team. The data will be stored for a minimum period of 5 years, after which it will be destroyed. This will be achieved by deleting all electronic data and shredding data which is on hard copy.

The data is maintained in a way that enables us to re-identify an individual's data and destroy it if participation is withdrawn. This is done by using a system of individual codes, known only to the research team, which is used to link each individual's consent form to all data that relate to that individual.

Participant privacy, and the confidentiality of information disclosed by participants is assured except in circumstances that require reporting under the Department of Education Child Protection policy, or where the research team is legally required to disclose that information.

The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from both you and your child.

It is intended that the findings of this study will be published in a professional journal and/or presented at a conference, without disclosing your child's or your child's schools identity. A summary of the research findings may be requested on completion of the project. You can access this by requesting a copy through the school principal. This will be available early in 2014.

Is this research approved?

The research has been approved by Curtin University Human Research Ethics Committee (Approval number 121/2011), and has met the policy requirements of the Department of Education.

How do I know that the people involved in this research have all the appropriate documentation to be working with children?

All persons undertaking research activities on Department sites must complete a Confidential Declaration. Also, under the Working with Children (Criminal Record Checking) Act 2004, people undertaking research that involves contact with children must undergo a Working with Children Check. Evidence that these checks are current for each member of the research team has been provided to the Principal of your child's school. I am also happy to provide you with copies if you have any concerns.

Who do I contact if I wish to discuss the project further?

If you would like to discuss any aspect of this study please contact me on the number provided below. If you wish to speak with an independent person about the project, please contact Linda Teasdale, Ethics Committee Secretary, by telephoning +61 89266 2784.

How does my child become involved?

Before becoming involved, please ensure that you:

- discuss what it means to take part in the project with your child before you both make a decision; and
- take up my invitation to ask any questions you may have about the project.

Once all questions have been answered to your satisfaction, and you and your child are both willing for him/her to become involved, please complete the **Consent Forms** (your child is also asked to complete the Consent Form attached to his/her letter) and **Screening Questionnaires** and return them back to your child's school teacher.

You and your child's participation will be greatly appreciated.

This project information letter is for you to keep.

Linda Pannekoek

PhD student

Curtin University, School of Psychology

Web: http://curtin.edu.au
Email: linda.pannekoek@postgrad.curtin.edu.au
Contact telephone: +61420966608

Alternatively:

Prof. Jan Piek (Primary Supervisor),

Email: J.Piek@curtin.edu.au
Contact telephone: +61 8 9266 7990

APPENDIX I: INFORMATION LETTER CHILDREN

WHAT MOVES CHILDREN TO MOVE?

Dear Student,

My name is Linda Pannekoek and I am from Curtin University. I would like to invite you to take part in a research project that I am doing. It is about what makes kids interested in being active. The question that I want to answer is why some kids like to be active, while other kids do not like it. I am asking for your help with the project because you are in the age group that we want to look at. I will be asking students in about 10 schools in Western Australia to become involved. I will do this project together with my supervisors, Prof. Jan Piek (Primary Supervisor), Prof. Martin Hagger, and Dr. Robert Kane.

What would I be asked to do?

If you agree to take part, you will be asked to complete 5 questionnaires on a computer. These questionnaires ask about your interest and feelings on being active. This will take about 30 minutes. I will come to your school to do this. You will work on the questionnaires at the same time as several other students, during school hours. You will also be asked to do some movement tasks like catching, throwing, and balancing. Lastly, we might ask you to wear a little computer during your Physical Education lesson that measures your activity.

Do I have to take part?

No. You are completely free to say yes or no. I will respect your decision no matter what choice you make. If you don't want to take part, then simply don't write your name on the space provided on the next page. It's that easy.

What if I wanted to change my mind?

If you say no, but then change your mind and want to take part, please let your teacher know.

You can stop at any time, even if you have said yes. Just let your teacher or mum (or dad, or the person who looks after you) know, and they will tell me. If you haven't finished the questionnaires then your answers won't be included in the study. If the project has already been published at the time you decide to withdraw, your contribution that was used in that publication cannot be removed from the publication.

What if I say something during the project that I don't want anyone else to know?

In almost all cases, I will not tell anyone about what you have said while you were participating in the project. I may have to tell someone like your teacher if you tell me that you have been hurt by someone lately. But for all other things you tell me, I won't repeat them to anyone else.

What will you do with the information I give you?

I collect what answers each student has given to the questionnaires, and I will look at how they did on the movement tasks (physical activities). Then I write about the findings in a journal, which is like a magazine, so that other adults can read about it. I will also do a presentation about the findings. When I do this, I won't write or tell anyone your name, the names of any other students or your school.

How do I get involved?

You have already talked with your mum or dad, or the person who looks after you, about what it means to take part in the project. Now you get to say for yourself.

If you **do** want to be a part of the project, please read the next page and write your name in the space on the next page.

This letter is for you to keep.

Linda Pannekoek

PhD student

Curtin University, School of Psychology

Email: linda.pannekoek@postgrad.curtin.edu.au
Contact telephone: +61420966608

Alternatively:

Prof. Jan Piek (Primary Supervisor),

Email: J.Piek@curtin.edu.au
Contact telephone: +61 8 9266 7990

APPENDIX J: CONSENT FORM SCHOOLS

CONSENT FORM

- I have read this document and understand the aims, procedures, and risks of this project, as described within it.

- For any questions I may have had, I have taken up the invitation to ask those questions, and I am satisfied with the answers I received.

- I am willing for this school to become involved in the research project, as described.

- I understand that participation in the project is entirely voluntarily.

- I understand that the school is free to withdraw its participation at any time within five years of project completion, without affecting the relationship with the research team or Curtin University of Technology.

- I understand that data can be withdrawn from this study at any point, unless the project has already been published. The contribution that was used in the publication cannot be removed.

- I understand that this research may be published in a journal or presented on academic conferences, provided that the participants or the school are not identified in any way.

- I understand that the school will be provided with a copy of the findings from this research project upon its completion.

Name of School:

_____

Name of Site Manager (printed):

_____

Signature: Date: / /

APPENDIX K: CONSENT FORM PARENTS

PARENT CONSENT FORM

- I have read and understood the information letter about the project, or have had it explained to me in language I understand.
- I have taken up the invitation to ask any questions I may have had, and am satisfied with the answers I received.
- I understand that participation in the project is entirely voluntarily.
- I am willing for my child to become involved in the project, as described.
- I have discussed with my child what it means to participate in this project. He/she has explicitly indicated a willingness to take part, as indicated by his/her completion of the child consent form.
- I understand that both my child and I are free to withdraw from participation at any time within 5 years of project completion, without affecting the family's relationship with my child's teacher or my child's school.
- I understand that data will be stored securely for a minimum period of 5 years, after which it will be destroyed. Also, all contributions made to the project will be destroyed unless explicitly agreed to by myself and my child.
- I give permission for the contribution that my child makes to this research to be published in a journal and/or presented at a conference, provided that my child or the school are not identified in any way.
- I understand that a summary of findings from the research will be made available to me and my child upon its completion. I also understand that in case my child is identified with *possible* motor difficulties, I will be notified.

Name of School: _____

Name of Child (printed): _____

Date of Birth: _____School grade: _____

Gender: M / F

(please circle)

Name of Parent/Carer (printed):

_____

Signature of Parent: Date: / /

APPENDIX L: CONSENT FORM CHILDREN

CHILD CONSENT FORM

- I know that I don't have to be involved in this project, but I would like to be.
- I know that I will complete 5 questionnaires and I will do some movement tasks like catching, throwing and balancing as part of the project.
- I know that I can stop when I want to.
- I understand that data will be stored securely for a minimum period of 5 years, after which it will be destroyed.
- I understand I am free to withdraw from the project at any time within 5 years and my contribution to the project will be destroyed, unless my parents and I agree that you can use it in your report of the project.
- I understand that participating in this project will not affect my grades, my relationship with my teacher(s) or my school.
- I understand that I need to write my name in the space below, before I can be a part of the project.

Your name: _____ Today's Date: / /

Your school: _____

APPENDIX M: INTERITEM CORRELATIONS

C-AGQPE

	M1	M2	M3	P1	P2	P3	Av1	Av2	Av3	Av4	Av5	Av6
M1	1	.34**	.31**	.14**	.25**	.18**	.13**	.14**	.18**	.12*	.04	.19**
M2	.34**	1	.35**	.20**	.23**	.21**	.12*	.12*	.17**	.17**	.13**	.07
M3	.31**	.35**	1	.29**	.27**	.31**	.17**	.12*	.22**	.17**	.12*	.20**
P1	.14**	.20**	.29**	1	.56**	.66**	.13**	.19**	.29**	.34**	.20**	.27**
P2	.25**	.23**	.27**	.56**	1	.49**	.15*	.21**	.22**	.24**	.17**	.27**
P3	.18**	.21**	.31**	.66**	.49**	1	.09	.17**	.21**	.23**	.12*	.22**
Av1	.13**	.12*	.17**	.13**	.15**	.09	1	.43**	.57**	.40**	.42**	.30**
Av2	.14**	.12*	.12*	.19**	.21**	.17**	.43**	1	.48**	.41**	.48**	.39**
Av3	.18**	.17**	.22**	.29**	.22**	.21**	.57**	.48**	1	.56**	.55**	.47**
Av4	.12*	.17**	.17**	.34**	.24**	.23**	.40**	.41**	.56**	1	.42**	.47**
Av5	.04	.13**	.12*	.20**	.17**	.12*	.42**	.48**	.55**	.42**	1	.53**
Av6	.19**	.07	.20**	.27**	.27**	.22**	.30**	.39**	.47**	.47**	.53**	1

Note. M = mastery approach goal, P = performance goal, Av = avoidance goal
* $p < .05$. ** $p < .01$

C-PNSPE

	Com1	Com2	Com3	Rel1	Rel2	Rel3	Aut1	Aut2	Aut3
Com1	1	.48**	.41**	.18**	.19**	.28**	.16**	.19**	.20**
Com2	.48**	1	.56**	.22**	.36**	.43**	.18**	.25**	.19**
Com3	.41**	.56**	1	.17**	.26**	.27**	.16**	.17**	.18**
Rel1	.18**	.22**	.17**	1	.42**	.39**	.13**	.19**	.12*
Rel2	.19**	.36**	.26**	.42**	1	.48**	.21**	.19**	.16**
Rel3	.28**	.43**	.27**	.39**	.48**	1	.23**	.21**	.18**
Aut1	.16**	.18**	.16**	.13**	.21**	.23**	1	.29**	.41**
Aut2	.19**	.25**	.17**	.19**	.19**	.21**	.29**	1	.39**
Aut3	.20**	.19**	.18**	.12*	.16**	.18**	.41**	.39**	1

Note. Com = need for competence, Rel = need for relatedness, Aut = need for autonomy.
* $p < .05$. ** $p < .01$

C-PLOC

	Am1	Am2	Am3	Extr1	Extr2	Extr3	Intro1	Intro2	Intro3	Id1	Id2	Id3	Intr1	Intr2	Intr3
Am1	1	.45**	.51**	.43**	.46**	.35**	.21**	.35**	.28**	-.05	.04	.05	-.16**	-.05	-.13**
Am2	.45**	1	.39**	.52**	.52**	.33**	.15**	.38**	.22**	-.18**	.01	-.04	-.32**	-.18**	-.32**
Am3	.51**	.39**	1	.44**	.44**	.37**	.24**	.41**	.32**	.02	.08	.08	-.05	.02	-.06
Extr1	.43**	.52**	.44**	1	.66**	.60**	.25**	.46**	.31**	-.08	.08	.02	-.15**	-.07	-.23**
Extr2	.46**	.52**	.44**	.66**	1	.57**	.27**	.43**	.28**	-.10*	.06	-.04	-.18**	-.09	-.25**
Extr3	.35**	.33**	.37**	.60**	.57**	1	.25**	.37**	.28**	-.01	.16**	.04	-.08	-.04	-.17**
Intro1	.21**	.15**	.24**	.25**	.27**	.25**	1	.32**	.70**	.10*	.35**	.23**	.09	.12*	.01
Intro2	.35**	.38**	.41**	.46**	.43**	.37**	.32**	1	.34**	.03	.17**	.10*	-.03	-.00	-.13**
Intro3	.28**	.22**	.32**	.31**	.28**	.28**	.70**	.34**	1	.07	.33**	.21**	.05	.09	-.03
Id1	-.05	-.18**	.02	-.08	-.10*	-.01	.10*	.03	.07	1	.27**	.45**	.43**	.62**	.42**
Id2	.04	.01	.08	.08	.06	.16**	.35**	.17**	.33**	.27**	1	.36**	.20**	.30**	.21**
Id3	.05	-.04	.08	.02	-.04	.04	.23**	.10*	.21**	.45**	.36**	1	.30**	.39**	.28**
Intr1	-.16**	-.32**	-.05	-.15**	-.18**	-.08	.09	-.03	.05	.43**	.20**	.30**	1	.46**	.61**
Intr2	-.05	-.18**	.02	-.07	-.09	-.04	.12*	-.00	.09	.62**	.30**	.39**	.46**	1	.43**
Intr3	-.13**	-.32**	-.06	-.23**	-.25**	-.17**	.01	-.13**	-.03	.42**	.21**	.28**	.61**	.43**	1

Note. Am = Amotivation, Extr = External regulation, Intro = Introjected regulation, Id = Identified regulation, Intr = Intrinsic motivation
* $p < .05$. ** $p < .01$.

APPENDIX N: MAIN DATABASE C-AGQPE

PP	StudyID	Gender	ChronAge	Map1	Map2	Map3	Pap1	Pap2	Pap3	Av1	Av2	Av3	Av4	Av5	Av6
1	NG030799	0	12.85525	3	3	3	2	2	2	3	4	3	3	3	4
2	NG221100	0	11.59977	3	3	3	2	2	1	3	2	3	1	3	2
3	NB120900	1	11.63265	3	3	3	1	3	1	4	3	4	2	2	2
4	NG300900	0	11.58493	4	3	4	3	3	2	2	3	2	3	2	4
5	NB090202	1	10.2242	4	4	4	3	3	3	3	4	4	3	3	3
6	NG150302	0	10.12443	3	3	2	3	3	3	3	3	3	3	3	3
7	NG050402	0	10.06849	4	4	4	3	3	2	2	3	3	4	3	2
8	NB010701	1	10.83219	4	4	4	3	3	2	2	4	2	4	4	4
9	NG051201	0	10.40457	4	3	3	2	2	3	2	2	2	1	2	2
10	NG181101	0	10.61073	1	3	4	3	2	4	4	3	2	4	3	2
11	NG100302	0	10.17215	4	4	4	4	4	2	4	4	4	4	4	4
12	NB190701	1	10.81027	4	4	4	4	4	2	4	4	4	4	4	4
13	NG211201	0	10.37169	4	4	3	4	3	3	3	3	4	4	3	4
14	NG150902	0	9.651826	4	4	4	4	3	4	2	3	2	2	2	3
15	NG030802	0	9.75274	3	4	4	3	3	3	3	3	3	4	4	3
17	NG010100	0	12.34155	4	4	4	1	4	2	4	3	3	3	2	3
18	NG250800	0	11.70776	3	3	4	2	3	3	4	4	4	3	4	3
19	NG110900	0	11.64635	4	4	3	1	2	2	3	2	2	3	2	3
20	NG090800	0	11.75274	3	4	3	2	3	2	2	3	4	3	4	3
21	NB151000	1	11.57123	4	4	4	2	3	2	4	3	3	3	1	1
22	NB261299	1	12.37443	4	4	4	4	4	4	4	4	4	4	4	4
23	CB310500	1	11.95502	4	4	4	3	3	2	3	4	3	4	4	4
24	CG070600	0	11.93584	4	4	4	3	4	3	4	4	4	4	4	4
25	CB260500	1	11.9742	3	3	2	3	3	3	3	4	3	2	4	3
26	CB200100	1	12.31575	4	4	4	3	4	4	4	3	4	4	3	3
27	CG100500	0	12.01096	4	4	4	1	2	3	4	3	4	4	4	2
28	CB240101	1	11.30479	4	4	3	4	4	3	4	3	3	3	3	3

29	CG090601	0	10.93037	4	4	4	3	3	3	4	4	4	3	4	4
30	CB210800	1	11.72968	4	4	3	4	3	4	4	4	4	4	4	4
31	CB140502	1	11.0016	4	4	4	3	4	3	4	3	2	1	3	4
32	CB191101	1	10.48516	4	4	4	3	3	4	3	3	3	3	3	3
33	CG240102	0	10.30479	4	4	3	3	4	3	4	4	4	4	4	4
34	CG190601	0	10.90731	3	3	3	2	2	2	4	4	4	3	3	3
35	CG290502	0	9.960502	4	4	2	4	4	4	4	3	4	4	4	4
36	CG041201	0	10.44406	3	4	4	4	4	3	4	4	4	4	4	4
37	CG070801	0	10.76918	4	4	4	4	4	4	4	3	4	3	3	4
38	CG031201	0	10.4468	4	4	4	4	3	3	4	3	4	4	4	4
39	CG180802	0	9.7379	4	4	4	3	4	4	4	4	4	4	4	4
40	CG140802	0	9.755479	4	4	4	2	1	2	4	4	4	4	4	4
41	CB160203	1	9.243379	3	4	4	4	3	3	2	4	4	2	4	4
42	CG010603	0	9.952283	4	4	4	4	3	4	4	3	4	4	4	4
43	CG270800	0	11.71324	3	3	3	2	1	1	2	3	2	2	3	2
44	CG270802	0	9.713242	3	3	3	3	2	2	3	3	3	3	2	3
45	CB030902	1	9.694064	4	4	4	2	2	2	4	4	4	4	3	3
46	CB090502	1	10.0137	4	1	4	4	4	4	4	2	4	4	3	4
47	CB140102	1	10.33219	4	4	1	1	4	1	4	4	4	4	4	4
48	CB041000	1	11.61073	4	4	4	4	4	4	1	1	1	2	1	2
49	CG120301	0	11.17763	4	4	3	1	1	2	3	4	4	3	3	3
50	CB090600	1	11.93584	4	4	4	4	4	4	4	4	3	3	4	3
51	CB280100	1	12.29932	4	3	4	4	4	3	4	4	4	4	4	4
52	HG260700	0	11.82397	4	3	4	2	3	2	4	3	4	3	3	3
53	HB100203	1	9.302055	3	3	2	2	2	2	2	3	3	3	2	3
54	HG151001	0	10.60251	3	4	4	3	4	2	4	4	4	3	4	3
55	HG121101	0	10.53562	3	4	4	2	2	2	3	3	3	4	4	4
56	HB150501	1	11.01918	4	4	4	3	3	3	4	3	4	3	3	3
57	HB300502	1	9.9879	3	4	4	4	3	4	3	4	4	3	4	3
58	HB090902	1	9.721461	4	4	4	4	3	3	4	4	4	4	4	4

59	HB021202	1	9.493379	4	4	3	2	2	4	4	3	3	3	3	2
60	HG200503	0	9.005479	4	3	3	1	4	1	3	2	3	1	4	4
61	HB130302	1	10.20502	3	3	4	3	3	4	4	3	4	4	4	4
62	HG130603	0	9.941324	4	2	4	4	4	4	3	3	4	1	4	4
63	HB280203	1	9.23242	4	4	3	3	3	4	4	4	4	3	3	4
64	HB040403	1	9.151826	4	4	4	4	3	3	1	1	4	4	4	4
65	HB121200	1	11.44406	4	4	3	4	4	4	4	4	3	3	3	3
66	HB171200	1	11.43037	4	4	4	4	4	4	4	4	4	4	4	4
67	HG230201	0	11.25274	4	3	4	3	3	3	3	3	3	3	3	3
68	HB140203	1	9.269178	3	4	3	3	3	3	4	4	4	3	3	4
69	HB190203	1	9.255479	4	4	4	4	4	2	4	4	4	4	4	1
70	HG260203	0	9.258219	3	4	4	4	3	3	4	3	3	4	3	4
71	CoB0810021	1	9.12	4	4	4	3	3	3	3	3	3	3	3	3
72	C0G020503	0	9.154566	4	4	3	2	3	3	4	4	3	2	2	3
73	CoG080202	0	10.38813	4	3	4	4	3	4	4	4	4	4	4	4
74	CoG230403	0	9.082192	4	4	4	3	4	2	4	4	4	4	4	4
75	CoB161101	1	10.51918	3	2	3	2	3	2	3	3	3	2	3	3
76	CoB201101	1	10.50822	4	4	4	4	3	3	3	4	4	4	4	4
77	CoB081002	1	9.624429	4	4	4	3	4	2	4	4	4	3	4	4
78	CoG150802	0	9.771918	4	3	4	3	3	3	4	1	4	3	1	3
79	CoB091202	1	9.455023	3	3	3	2	3	2	3	4	3	3	3	3
80	CoB050902	1	9.713242	4	2	4	2	4	3	1	4	1	1	1	4
81	CoB250701	1	10.82945	4	4	4	4	4	4	4	4	4	3	4	4
82	CoG060302	0	10.21872	4	4	3	1	2	2	4	3	4	3	3	3
83	CoB161100	1	11.51918	4	4	4	2	3	3	4	4	4	3	3	3
84	CoG230902	0	9.669406	4	4	3	3	3	2	3	2	2	2	3	3
85	CoB120401	1	11.11621	4	4	3	3	3	3	2	2	2	3	3	2
86	CoG060202	0	10.39361	3	3	3	3	3	2	4	3	2	3	3	3
87	GG210401	0	11.10251	3	3	3	2	3	2	3	4	4	3	3	3
88	GB230701	1	10.84977	4	4	3	2	3	2	3	2	2	2	2	2

89	GG160401	0	11.11621	4	4	4	3	4	3	3	4	4	3	4	4
90	GB240801	1	10.7637	4	3	3	2	3	2	3	3	3	3	3	3
91	GG080201	0	11.30479	3	3	4	2	2	1	2	1	2	2	2	2
92	GB180301	1	11.24612	4	3	3	2	2	2	3	3	3	3	3	3
93	GB231100	1	11.51644	4	4	3	4	4	4	4	4	4	4	3	4
94	GB200700	1	11.85799	4	4	4	2	2	2	3	4	3	2	2	2
95	GB011000	1	11.70228	3	3	4	4	4	4	4	4	4	3	4	4
96	HPB090802	1	9.965982	4	4	3	1	2	2	2	3	2	2	3	2
97	HPG200701	0	11.01918	4	3	3	2	3	2	3	3	3	3	3	3
98	HPG101201	0	10.62991	4	4	4	4	2	3	2	3	2	2	2	2
99	HPB070900	1	11.88539	4	4	4	3	4	3	3	3	4	4	3	4
100	HPG210503	0	9.094292	3	4	3	3	3	3	4	3	4	4	4	4
101	HPG280702	0	9.910046	4	4	3	3	3	3	4	4	3	3	3	3
102	HPB270303	1	9.251598	4	3	3	3	3	3	3	3	3	3	3	3
103	HPB091202	1	9.546575	4	4	4	4	4	4	4	4	4	4	4	4
104	HPG130303	0	9.288356	4	4	4	3	2	3	4	4	3	3	3	3
105	HPB250102	1	10.41826	4	4	4	4	4	4	3	4	3	4	3	4
106	HPG260501	0	11.08219	3	3	3	2	3	3	3	3	3	2	3	3
107	HPB250500	1	12.08493	4	3	4	3	4	3	3	3	3	3	3	3
108	HPB110302	1	10.29384	4	4	4	1	2	2	3	3	2	2	3	4
109	HPG270201	0	11.32671	3	4	2	2	2	2	3	3	4	2	3	3
110	HPB280200	1	12.32397	4	4	4	4	4	4	1	4	4	4	3	3
111	HPG100900	0	11.7911	4	3	3	1	2	2	3	3	2	2	2	2
112	HPB111002	1	9.838813	3	3	3	1	3	1	4	2	2	2	2	3
113	HPG050303	0	9.310274	4	3	3	4	4	4	4	4	4	3	4	4
114	LG050702	0	9.996119	4	4	4	1	3	1	4	2	1	1	2	1
115	LG031002	0	9.748858	4	3	4	1	3	1	2	3	3	3	3	4
116	LG281002	0	9.680365	4	4	2	3	4	1	3	3	3	4	3	1
117	LB290802	1	9.844292	4	3	4	4	3	2	4	4	4	4	4	4
118	LG090900	0	11.81575	4	3	4	2	2	2	3	4	4	4	3	3

119	LG211099	0	12.69954	4	4	4	3	4	4	4	4	4	3	3	3
120	LG070700	0	11.99064	3	4	4	3	3	3	4	3	4	3	4	3
121	LB230999	1	12.7774	4	3	4	3	4	3	4	4	4	3	3	4
122	LB250201	1	11.35525	4	4	4	4	4	3	4	3	4	3	3	3
123	LG160400	0	12.21598	4	3	2	2	3	2	2	3	1	2	2	2
124	LG101100	0	11.64635	3	4	4	3	3	3	3	3	3	3	3	3
125	LB190602	1	10.03836	3	3	3	3	3	3	3	3	3	3	1	3
126	LB210402	1	10.20502	4	4	4	3	4	3	3	4	3	3	4	4
127	LG180502	0	10.18858	4	4	4	2	2	2	4	4	4	4	4	4
128	LG230201	0	11.41826	3	3	3	3	4	3	4	4	4	4	4	4
129	RB170501	1	11.12991	4	4	4	4	4	3	4	4	4	3	4	3
130	RG051101	0	10.66279	4	4	4	3	3	3	4	4	4	4	4	4
131	RB010801	1	10.92489	4	4	4	1	2	1	3	3	3	3	3	3
132	RG090302	0	10.32397	4	4	4	3	3	3	4	1	4	4	1	2
133	RB210602	1	10.03562	3	4	4	3	3	3	3	3	4	3	3	2
134	RG300102	0	10.42763	4	3	4	4	4	4	3	4	4	3	4	4
135	CB140701	1	10.9742	4	4	4	4	4	4	3	4	2	3	3	3
136	RG140202	0	10.38813	4	4	4	3	3	3	2	3	2	2	3	2
137	RB291201	1	10.51644	3	4	3	3	3	2	3	3	3	3	3	3
138	RB150701	1	10.97146	3	3	2	3	3	3	3	4	2	2	3	4
139	RG180702	0	9.963242	3	3	4	3	3	3	4	3	4	4	3	3
140	RG290103	0	9.430365	4	4	4	3	3	3	3	3	4	2	4	4
141	RG310303	0	9.263699	3	3	4	3	3	3	3	3	3	3	4	3
142	RB250802	1	9.857991	3	3	3	3	3	2	3	3	3	3	4	3
143	RB170603	1	9.046575	4	4	4	4	4	4	4	4	4	4	4	4
144	RB150303	1	9.307534	4	4	4	2	3	2	3	4	3	3	3	3
145	RB190201	1	11.37443	2	3	3	3	3	2	3	3	2	3	3	3
146	RG160503	0	9.132648	4	4	4	3	4	3	3	4	4	3	4	4
147	RG300702	0	9.930365	3	4	4	3	4	3	4	4	4	3	4	4
148	RG260201	0	11.35525	3	3	4	3	3	2	4	4	4	3	3	4

149	RB240102	1	10.44406	3	4	4	3	4	3	2	1	2	2	2	2
150	RG250102	0	10.44132	4	4	4	4	3	3	3	4	4	4	4	2
151	RG030801	0	10.91941	4	4	4	1	2	1	4	3	3	4	4	3
152	RB021101	1	10.66941	4	4	4	4	4	4	3	4	4	3	3	4
153	RB160201	1	11.38265	4	4	4	3	3	3	4	4	4	1	4	4
154	RB230900	1	11.78014	4	4	3	3	3	3	1	2	1	1	2	2
155	RB280200	1	12.34977	3	3	3	3	3	3	2	3	2	3	3	3
156	RG101000	0	11.73242	4	4	4	1	3	1	4	4	4	3	4	4
157	RG280301	0	11.27192	4	4	4	3	4	3	3	2	3	2	2	2
158	RG160501	0	11.13265	4	4	4	3	3	3	1	3	4	4	3	3
159	RB240401	1	11.20228	4	4	4	4	4	4	4	4	4	4	4	4
160	RB190702	1	9.963242	3	4	3	4	3	2	3	1	3	3	3	2
161	RG140300	0	12.31027	4	4	4	4	4	2	4	2	3	4	1	4
162	RB121202	1	9.565753	4	4	4	3	3	4	3	4	4	4	4	4
163	RG130201	0	11.39361	4	4	4	3	3	3	4	4	4	4	1	4
164	RB290900	1	11.76644	4	3	4	3	1	2	4	1	4	2	4	4
165	RG031000	0	11.75548	3	4	4	3	3	3	3	4	4	1	4	2
166	RB180700	1	11.96598	4	4	4	3	3	3	4	1	4	4	1	2
167	RG071100	0	11.71598	3	3	3	3	3	3	3	3	3	3	3	3
168	RG220503	0	9.183105	4	4	3	2	3	3	3	3	3	2	3	3
169	RB060902	1	9.829452	4	4	4	3	4	4	4	4	4	4	4	4
170	CurG280403	0	9.296575	4	4	4	4	4	4	4	3	3	3	4	4
171	CurG081002	0	9.796575	4	3	4	3	3	3	4	3	4	3	3	3
172	CurB210303	1	9.349772	3	4	3	3	3	4	3	4	3	3	3	3
173	CurG131002	0	9.782877	3	4	4	3	2	3	4	3	4	3	3	3
174	CurG120603	0	9.11621	4	3	1	1	2	1	2	4	4	3	3	3
175	CurG160600	0	12.10525	3	4	3	2	3	2	4	3	2	3	3	3
176	CurB231101	1	10.66941	3	4	4	3	3	3	3	3	3	3	4	4
177	CurB200303	1	9.352511	4	3	4	3	3	3	3	4	3	2	3	3
178	WG180503	0	9.224201	4	4	4	1	2	1	3	4	3	3	3	3

179	WB140103	1	9.563014	4	4	3	3	3	4	4	4	4	3	3	3
180	WG181003	0	9.802055	4	4	4	3	4	3	1	4	4	4	4	4
181	WG301102	0	9.683105	3	4	3	2	3	2	3	3	3	3	2	2
182	WB290402	1	10.27466	4	4	4	4	4	4	2	3	3	3	1	1
183	WB150902	1	9.890868	4	4	4	4	4	4	4	4	4	4	4	4
184	WG040801	0	11.00548	4	4	1	2	4	1	1	1	1	1	1	1
185	WG270603	0	9.107991	4	4	4	1	1	4	2	1	1	1	2	2
186	WB280700	1	12.03562	4	4	4	4	4	4	4	4	4	4	4	4
187	WG230201	0	11.46324	3	3	3	2	3	2	3	3	3	3	3	3
188	WG210301	0	11.39361	4	4	4	4	4	4	3	3	4	3	4	4
189	WG281200	0	11.61895	4	3	3	2	3	2	3	3	3	3	3	3
190	WB110401	1	11.33607	4	4	3	3	3	3	3	4	3	3	2	3
191	WB150800	1	11.9879	3	3	3	1	3	1	3	3	3	2	2	2
192	WG261002	0	9.791096	4	4	4	3	2	3	4	3	4	3	3	3
193	WB291200	1	11.61621	4	4	4	4	4	4	4	4	4	4	4	4
194	WG220401	1	11.31849	4	4	4	3	4	3	4	4	4	3	4	3
195	WG210601	1	11.14909	4	4	4	3	3	4	1	1	2	1	1	2
196	WG231100	1	11.72694	4	4	3	3	3	3	4	3	4	3	4	4
197	WG140202	1	10.50274	3	4	3	3	3	3	4	4	3	3	3	3
198	ChG250202	0	10.46872	4	4	4	3	4	4	4	4	4	4	4	4
199	ChB131100	1	11.75274	4	3	4	3	3	3	2	2	2	2	2	2
200	ChB240402	1	10.31027	3	3	4	2	2	2	3	2	2	1	1	2
201	ChG220701	0	11.06301	4	3	3	2	3	2	4	3	3	2	2	2
202	ChB200501	1	11.24064	4	3	4	1	3	1	4	4	4	3	3	4
203	ChB120401	1	11.34429	4	4	3	3	4	3	4	3	3	3	3	4
204	ChB060902	1	9.938584	4	4	4	3	4	2	4	4	3	3	4	4
205	ChG050503	0	9.280137	4	4	3	4	4	3	4	4	4	4	4	3
206	ChG130203	0	9.50274	4	4	4	2	2	1	4	4	4	3	4	4
207	ChG140303	0	9.422146	3	4	3	1	1	1	2	2	3	2	2	3
208	ChB201202	1	9.672146	4	3	4	4	4	4	4	3	4	3	4	4

209	ChB091202	1	9.702283	4	4	4	3	3	4	2	3	3	3	4	4
210	ChG250402	0	10.32945	3	4	4	2	3	3	3	3	3	3	4	2
211	ChB090902	1	9.952283	4	4	4	3	4	3	4	4	4	2	3	3
212	ChG191202	0	9.674886	3	1	1	1	1	1	2	2	3	1	3	2
213	ChB111202	1	9.696804	3	4	4	3	3	4	2	3	3	2	3	2
214	ChG180700	0	12.09429	3	3	3	2	3	3	3	3	3	3	3	3
215	ChB040800	1	12.05479	4	2	3	2	2	2	4	4	3	3	3	3
216	LaB030902	1	9.952283	4	4	4	1	2	1	2	2	2	2	3	3
217	LaB290503	1	9.221461	4	4	4	4	4	4	1	4	4	4	1	3
218	LaG030902	0	9.952283	4	4	4	2	3	2	3	3	3	3	3	3
219	LaB091102	1	9.769178	4	4	4	4	4	4	4	4	4	4	4	4
220	LaG300703	0	9.046575	4	3	4	4	4	3	3	3	3	3	3	3
221	LaB110400	1	12.34977	3	3	4	3	3	3	4	3	4	3	3	3
222	LaG150801	0	11.00274	4	4	4	3	3	3	4	4	4	4	1	3
223	LaG050900	0	11.9468	3	4	3	3	4	3	4	4	4	4	4	4
224	LaG230801	0	10.98242	4	3	4	3	3	3	3	3	4	3	4	4
225	LaB281201	1	10.63539	4	3	4	2	3	3	3	4	2	3	1	3
226	LaB110302	1	10.43584	4	4	4	3	2	2	4	3	3	3	3	3
227	LaB030602	1	10.20776	4	4	4	3	3	3	1	4	1	1	2	4
228	LaG180502	0	10.2516	4	4	4	3	4	1	4	4	4	4	3	4
229	LaG030602	0	10.20776	4	3	4	3	3	2	4	2	3	3	3	4
230	LaG070302	0	10.4468	3	4	4	2	3	2	3	4	3	3	4	4
231	LaG080602	0	10.19406	4	4	4	4	4	4	3	3	4	3	3	3
232	LaG170901	0	10.91279	4	4	4	4	3	2	3	4	4	3	4	4
233	LaB110900	1	11.93037	4	4	4	2	3	2	2	4	4	4	4	4
234	LaB040402	1	10.37169	3	3	3	3	3	2	3	4	4	4	4	4
235	LaB190301	1	11.41553	4	4	4	2	2	2	4	3	3	3	3	4
236	LaG170101	0	11.58219	4	4	4	3	4	3	4	4	4	4	4	3
237	LaG040900	0	11.94954	4	3	3	1	2	3	3	3	3	3	3	3
238	LaB060700	1	12.11073	3	4	3	1	3	2	3	2	3	2	3	2

239	LaG140203	0	9.508219	3	3	4	1	4	4	2	4	1	2	2	1
240	LaB270502	1	10.25548	4	3	3	3	3	3	3	4	3	3	3	3
241	LaB011100	1	11.82123	4	4	4	4	4	4	4	4	4	4	4	4
242	LaG130703	0	9.140868	3	3	4	2	2	3	3	3	3	3	4	4
243	LaB211299	1	12.68311	3	4	4	3	4	4	1	1	1	1	1	1
244	WooB160403	1	9.360731	4	4	4	4	4	4	4	4	4	4	4	4
245	WooG270702	0	10.07671	3	3	3	3	3	3	3	3	3	3	3	3
246	WooG281102	0	9.7379	4	4	4	3	4	4	4	4	4	4	4	4
247	WooB090402	1	10.36895	4	3	3	3	3	3	4	3	3	3	3	3
248	WooG010501	0	11.30753	4	4	4	4	4	4	4	4	4	4	4	4
249	WooB180102	1	10.58881	4	4	4	3	4	3	4	4	2	3	3	3
250	WooG280502	0	10.23516	3	3	4	2	3	3	3	3	2	2	3	3
251	WooB040102	1	10.62717	4	4	4	3	3	2	3	2	3	3	3	3
252	WooG200900	0	11.91553	3	4	3	3	3	2	3	3	3	3	3	3
253	WooG180700	0	12.08881	4	4	4	4	3	3	3	4	4	4	4	4
254	WooB290101	1	11.56027	4	4	4	1	3	3	4	4	3	3	4	3
255	WooB150301	1	11.43584	4	4	4	4	3	4	3	4	4	4	4	4
256	WooB240799	1	13.07397	4	4	4	4	4	4	4	4	4	4	4	4
257	WooB310899	1	12.97146	4	4	4	4	4	4	4	4	4	4	4	4
258	WooB201199	1	12.74886	4	4	4	3	4	3	2	2	2	1	2	2
259	WooG240999	0	12.90457	4	3	3	2	3	3	3	4	3	3	4	3
260	WooB010300	1	12.47146	4	3	4	2	3	3	4	4	3	4	3	3
261	WooG291099	0	12.81027	3	3	3	2	2	2	3	3	3	3	3	2
262	WooG310100	0	12.55479	3	4	4	3	3	2	2	3	3	2	4	3
263	WooG290800	0	11.97694	4	4	4	1	2	3	3	3	3	3	3	3
264	WooB301199	1	12.7242	4	3	3	3	4	3	3	4	4	4	4	4
265	YB270701	1	11.07397	4	4	4	2	3	1	4	4	4	3	4	4
266	YG020800	1	12.05753	3	4	4	2	2	1	4	3	3	3	4	2
267	YB091200	1	11.70502	3	4	4	2	2	2	3	4	3	3	3	3
268	YG100602	0	10.20776	4	4	4	4	4	4	3	4	4	3	4	3

269	YB061100	1	11.79658	3	3	3	1	3	2	3	3	3	2	3	3
270	YG110403	0	9.371689	4	4	3	4	4	4	3	4	4	4	4	4
271	YG110102	0	10.61621	3	3	3	3	2	3	3	3	3	3	3	3
272	YB240902	1	9.912785	3	4	4	4	4	4	3	4	3	3	3	3
273	FPG170502	0	10.28562	4	4	4	2	3	2	1	3	3	3	3	3
274	FPG020403	0	9.410046	4	4	4	3	4	4	4	4	4	4	4	3
275	FPG221002	0	9.849772	4	3	3	4	4	4	4	3	4	4	4	4
276	FPG180402	0	10.36621	4	4	3	3	3	3	4	4	4	3	3	3
277	FPG280799	0	13.08493	3	3	4	2	2	2	4	4	3	1	3	3
278	FPG200200	0	12.52192	4	4	3	3	3	2	1	2	3	2	3	3
279	FPB170502	1	10.28562	4	3	2	3	3	3	2	4	4	3	3	3
280	FPB290402	1	10.33607	3	4	3	3	4	3	3	3	3	3	3	3
281	FPB080401	1	11.39361	3	3	3	3	3	2	3	4	2	3	4	4
282	FPB040899	1	13.06575	4	4	4	3	3	3	4	4	4	4	3	3
283	FPB020902	1	9.9879	3	4	4	3	3	3	3	3	3	3	4	3
284	FPB170800	1	12.03014	4	4	4	3	4	3	4	4	4	4	4	4
285	FPB050900	1	11.97968	2	3	3	2	2	2	2	3	3	3	3	3
286	FPG301001	0	10.84977	3	3	3	3	3	2	2	3	3	3	2	3
287	FPB050203	1	9.584932	4	4	4	4	4	4	4	4	4	4	4	4
288	FPG071102	0	9.829452	4	3	4	3	3	3	4	3	4	4	4	4
289	FPG220900	0	11.95502	3	3	3	3	3	2	3	3	3	3	2	2
290	FPB030503	1	9.347032	4	3	3	4	1	3	3	4	4	2	3	3
291	RB161202	1	9.702283	2	3	3	3	3	2	3	3	4	3	4	3
292	RG211201	0	10.68858	3	4	4	3	3	3	4	4	4	3	4	3
293	RG240702	0	10.09703	3	4	3	2	2	2	3	2	3	3	3	3
294	RG111001	0	10.88265	4	3	4	3	3	3	4	4	4	4	4	4
295	RB041002	1	9.901826	3	3	3	3	4	3	2	3	3	3	3	3
296	RB260101	1	11.59155	4	4	4	3	4	4	4	3	3	3	3	3
297	RB210100	1	12.60525	4	4	4	4	4	4	4	3	4	4	3	4
298	RB110102	1	10.63265	4	3	4	4	4	3	4	4	4	4	4	4

299	RG050500	0	12.36073	4	4	4	3	3	3	3	3	3	3	3	3
300	RB040901	1	11.02466	4	3	4	3	4	3	3	4	4	3	4	4
301	CotB291002	1	9.855251	3	4	4	4	3	2	4	4	4	4	3	4
302	CotG300103	0	9.602511	4	4	3	3	3	2	2	4	2	2	3	3
303	CotG201102	0	9.796575	4	4	4	4	4	3	3	3	3	3	2	3
304	CotG191002	0	9.882648	4	3	4	2	3	2	3	3	4	3	4	3
305	CotG170603	0	9.226941	4	3	4	1	2	2	3	3	3	2	2	3
307	CotG010702	0	10.18858	4	4	4	3	4	3	1	1	2	3	3	4
308	CotG011102	0	9.847032	4	4	3	3	4	3	3	3	3	3	3	3
309	CotG121102	0	9.818493	4	4	3	2	3	3	4	3	4	3	4	4
310	CotG010503	0	9.355251	4	4	4	3	4	4	4	3	4	4	3	4
311	CotB090103	1	9.660046	4	4	4	3	4	4	4	3	4	3	3	3
312	CotB120503	1	9.323973	4	4	4	4	3	4	4	4	4	4	4	1
313	CotB081102	1	9.829452	4	4	4	3	3	3	2	2	2	2	2	2
314	CotB190102	1	10.63265	4	3	3	3	4	3	4	4	4	4	4	4
315	CotG070601	0	11.25274	4	4	4	1	3	2	4	4	4	3	4	4
316	CotG090701	0	11.16005	4	3	3	2	2	1	2	2	2	2	2	2
317	CotG260602	0	10.20228	4	4	4	2	3	3	3	3	4	3	2	4
318	CotG100602	0	10.24886	3	4	3	3	3	3	3	3	3	3	3	3
319	CotG300602	0	10.19406	4	3	3	2	2	2	3	3	3	3	2	3
320	CotG041202	0	9.760959	4	4	4	2	3	2	4	4	4	4	4	3
321	CotG130603	0	9.25274	3	4	3	2	3	2	3	3	3	3	3	3
322	CotG051102	0	9.852511	3	3	4	2	1	2	3	2	3	4	3	4
323	CotG310303	0	9.496119	4	3	3	3	2	3	3	3	3	3	3	3
324	DHB200401	1	11.39635	4	4	4	4	4	4	1	4	1	4	1	4
325	DHG150999	0	12.9879	4	4	4	3	3	3	4	4	4	3	4	4
326	DHB301000	1	11.86347	4	3	3	2	3	3	3	4	3	3	3	3
327	DHG100201	0	11.58493	4	4	4	2	2	2	3	3	3	3	4	2
328	DHG121000	0	11.91279	4	4	4	4	4	4	1	2	2	2	1	4
329	DHB290103	1	9.61621	3	4	4	2	2	3	2	3	2	2	2	3

330	DHB120902	1	9.996119	4	4	4	4	4	4	4	4	4	4	4	4
331	DHG010403	0	9.446804	4	4	4	3	3	3	1	4	4	3	3	4
332	DHG061202	0	9.763699	4	4	4	3	4	3	4	4	4	3	4	4
333	DHG260503	0	9.296575	4	4	4	4	4	4	4	4	4	4	4	4
334	B170400	1	12.43858	3	3	3	3	3	3	2	3	2	2	2	2
335	B280802	1	10.03836	2	3	2	2	2	2	3	4	3	3	4	3
336	DHG110402	0	10.42489	3	4	4	4	4	4	4	4	4	4	3	3
337	DHB040901	1	11.02192	3	4	3	3	4	3	3	4	3	3	4	3
338	DHB171001	1	10.90457	4	4	3	3	3	3	4	2	3	3	3	3
339	PG070602	0	10.27466	4	4	4	3	3	3	4	3	3	4	4	4
340	PG210102	0	10.64909	3	3	3	3	2	2	3	3	3	3	3	3
341	PG141102	0	9.834932	4	4	3	2	2	2	3	3	3	3	3	3
342	PB110603	1	9.263699	3	4	4	3	4	1	3	4	4	4	3	3
343	PB281202	1	9.713242	4	4	3	1	2	2	3	3	3	4	3	3
344	PG171000	0	11.91005	3	3	3	3	3	3	3	3	3	2	3	2
345	PG010302	0	10.54384	3	4	4	3	3	3	3	3	3	3	3	3
346	PB190902	1	9.9879	4	4	3	3	3	3	3	3	4	4	4	3
347	PB090403	1	9.435845	4	4	4	3	4	4	4	3	4	1	4	3
348	PB030103	1	9.696804	4	3	4	2	3	3	2	1	2	2	3	3
349	PG040203	0	9.610731	3	3	3	2	3	2	1	1	3	2	4	3
350	PB100202	1	10.61073	4	4	4	3	4	3	3	3	3	3	3	3
351	PB190801	1	11.08607	4	4	4	3	4	2	4	4	4	4	4	4
352	PB010200	1	12.63539	3	3	3	3	3	2	3	4	4	3	4	3
353	PG020203	0	9.632648	4	4	4	2	3	2	4	4	3	3	4	3
354	BB171101	1	10.83493	4	4	4	4	4	4	4	4	4	4	4	4
355	BG140701	0	11.18311	4	4	3	2	3	2	3	3	3	2	3	3
356	BB290402	1	10.39087	4	4	4	3	4	3	4	4	4	4	4	4
357	BB110501	1	11.35799	3	4	3	2	3	2	2	2	2	2	2	2
358	BB040100	1	12.70228	4	4	4	2	2	2	4	4	4	3	3	3
359	BG300902	0	9.965982	4	4	3	2	2	2	3	3	3	2	3	3

360	BB111201	1	10.76918	3	3	4	3	4	3	3	3	4	3	2	3
361	MB070803	1	9.121689	4	4	4	1	4	1	4	4	4	3	4	3
362	MG260703	0	9.154566	3	4	4	2	2	3	1	3	3	3	3	3
363	MB190803	1	9.088813	4	4	4	1	4	2	4	3	4	4	3	4
364	MB270903	1	9.98516	4	4	4	4	4	4	4	4	4	4	4	4
365	MG120803	0	9.107991	4	4	4	2	2	2	4	2	4	4	3	4
366	MB090702	1	10.20776	4	4	4	4	4	4	4	4	4	4	4	4
367	MG100602	0	10.28562	4	4	4	3	4	3	4	4	4	3	4	3
368	MB090403	1	9.455023	4	4	4	3	4	3	4	1	4	2	3	3
369	MB280403	1	9.404566	3	4	1	1	1	1	4	4	4	3	4	4
370	MB180902	1	10.00822	4	4	4	4	4	4	1	1	4	4	1	4
371	MB080802	1	10.11895	4	4	4	2	3	2	4	4	4	2	4	4
372	MB051202	1	9.796575	4	4	4	3	4	3	4	4	4	4	4	4
373	MG160603	0	9.269178	3	3	3	2	4	2	2	3	3	3	3	4
374	MG130901	0	11.02192	4	4	4	3	3	2	3	3	3	3	3	3
375	MG280103	0	9.649087	4	4	4	3	4	3	4	4	4	4	4	4
376	MG050602	0	10.29932	4	4	4	3	3	3	4	3	4	3	3	3
377	MG200801	0	11.08607	4	3	4	2	2	2	3	4	3	4	3	3
378	MB080201	1	11.61895	4	4	4	3	4	3	4	4	4	3	4	4
379	MG010700	0	12.22694	4	3	3	3	3	2	3	4	3	3	3	3
380	MG110200	0	12.61073	4	4	4	2	3	3	4	4	4	4	4	4
381	MB030700	1	12.22146	4	4	4	3	4	2	3	3	2	2	3	3
382	MG150301	0	11.52466	4	4	4	1	3	1	4	2	4	1	2	3
383	MG290501	0	11.31849	4	4	3	2	2	2	3	2	3	3	3	3
384	MG190601	0	11.26096	4	4	4	2	2	2	4	4	4	1	3	1
385	MG171100	0	11.84429	3	4	3	3	2	2	4	2	3	3	4	3
386	MB060900	1	12.0411	4	4	4	3	3	2	3	2	2	2	3	2
387	MG050601	0	11.29932	4	4	3	1	3	2	2	4	3	3	4	4
388	MB260999	0	12.9879	4	4	4	3	4	4	3	4	3	3	3	3
389	MB051000	1	11.96324	4	4	4	2	3	2	4	3	3	3	3	3

390	MB070602	1	10.29384	4	4	4	2	1	1	4	4	4	2	2	2
391	MG041001	0	10.97968	4	3	3	3	2	2	3	4	3	4	3	3
392	MB031101	1	10.88265	3	3	4	3	3	2	4	4	3	3	3	3
393	MB300401	1	11.39909	4	4	4	4	4	4	2	3	3	2	3	3
394	MG290701	0	11.14635	4	4	4	4	4	4	1	1	1	1	1	1
395	MB070801	1	11.12169	4	3	3	2	3	2	4	4	3	3	4	3
396	MG080302	0	10.54384	4	4	4	2	3	2	4	3	4	3	4	3
397	MG040202	0	10.62991	4	4	4	3	4	3	1	1	3	3	4	4
398	MB280603	1	9.251598	4	4	3	2	3	2	3	4	2	2	3	3
399	MB021102	1	9.899087	4	4	4	2	3	2	4	3	3	3	4	3
400	MB060502	1	10.39635	4	3	3	1	3	1	2	3	2	2	2	3
401	MG111201	0	10.79384	4	4	4	2	2	1	1	2	2	1	3	3
402	MB240502	1	10.34703	4	4	4	3	3	3	4	4	4	3	3	3
403	MB111200	1	11.79384	3	4	4	4	4	4	4	4	4	3	4	4
404	MB160700	1	12.19954	4	4	4	3	4	3	3	3	2	2	2	3
405	MG190402	0	10.44132	4	4	3	4	4	3	4	4	4	3	3	1
406	MB180602	1	10.2637	3	4	4	2	3	4	3	4	4	3	4	4
407	WLG030701	0	11.23242	4	4	4	4	4	4	4	4	4	1	4	4
408	WLG171099	0	12.93858	3	4	3	3	3	3	3	3	3	3	3	3
409	WLG040899	0	12.99886	1	2	2	2	2	2	3	2	3	3	3	3
410	WLB230401	1	11.42489	4	4	4	3	4	3	4	4	4	3	4	4
411	WLG041099	0	12.9742	4	4	4	3	4	3	4	4	4	3	3	3
412	WLB310101	1	11.64909	4	4	4	3	3	2	3	4	3	3	4	3
413	WLB070601	1	11.30205	3	3	4	4	4	2	4	3	4	3	3	3
414	WLG060402	0	10.47146	4	4	4	3	4	3	2	2	2	2	1	2
415	WLG230402	0	10.42489	3	3	3	2	3	2	2	1	2	3	3	3
416	WLG060602	0	10.30479	4	4	4	3	4	2	3	3	3	4	4	4
417	WLG251201	0	10.74886	3	3	3	3	2	3	3	3	3	3	3	3
418	WLB170502	1	10.36073	3	3	3	1	3	3	2	2	2	3	3	3
419	WLG301201	0	10.73516	4	4	3	2	2	4	3	2	2	2	2	2

420	WLB271101	1	10.82671	4	3	3	3	4	2	4	4	3	4	4	3
421	WLB191102	1	9.847032	4	4	3	4	4	3	4	4	3	3	3	3
422	SB100500	1	12.37991	2	2	2	2	2	1	2	2	1	2	2	2
423	SB090102	1	10.7105	3	3	3	2	3	2	3	2	2	3	3	3
424	SG080301	0	11.55479	3	4	4	4	4	3	3	2	2	3	3	3
425	SB040100	1	12.7242	4	4	4	2	4	2	3	3	3	2	2	2
426	SG020500	0	12.40183	4	4	4	2	3	2	4	4	4	4	4	4
427	SB100700	1	12.21324	4	4	4	4	4	3	4	3	3	3	4	4
428	SB260899	1	12.99886	4	4	4	4	4	4	4	4	4	4	4	4
429	SB030602	1	10.31575	4	4	3	3	3	3	3	3	3	3	3	4
430	SG160403	0	9.446804	4	3	3	2	3	2	4	3	2	3	3	4
431	SG160301	1	11.0274	4	4	4	4	4	4	3	3	3	3	3	3

Note. Gender; 0 = girl 1 = boy. ChronAge = Chronological age. Map1-Map3 = Mastery approach goal items. Pap1-Pap3 = Performance goal items. Av1-Av6 = Avoidance goal items.

APPENDIX O: MAIN DATABASE C-PNSPE

PP	StudyID	Gender	ChronAge	PC1	PC2	PC3	Rel1	Rel2	Rel3	Aut1	Aut2	Aut3
1	NG030799	0	12.85525	2	2	2	2	2	3	2	1	2
2	NG221100	0	11.59977	3	4	3	3	2	4	2	3	3
3	NB120900	1	11.63265	3	3	3	2	2	3	2	3	3
4	NG300900	0	11.58493	4	3	3	1	4	3	3	3	2
5	NB090202	1	10.2242	3	4	4	3	4	3	3	3	4
6	NG150302	0	10.12443	4	3	3	3	3	3	3	3	3
7	NG050402	0	10.06849	4	4	4	3	4	4	3	4	3
8	NB010701	1	10.83219	4	4	4	3	4	4	3	4	3
9	NG051201	0	10.40457	3	2	3	4	3	3	3	3	3
10	NG181101	0	10.61073	4	4	4	4	4	3	4	1	1
11	NG100302	0	10.17215	4	3	4	2	1	1	4	3	3
12	NB190701	1	10.81027	4	3	4	2	1	1	4	3	3
13	NG211201	0	10.37169	2	2	1	4	2	2	1	2	4
14	NG150902	0	9.651826	4	4	4	4	4	4	4	1	3
15	NG030802	0	9.75274	3	3	3	4	3	3	3	3	2
17	NG010100	0	12.34155	4	4	3	3	4	4	4	3	3
18	NG250800	0	11.70776	3	4	3	3	3	3	3	3	4
19	NG110900	0	11.64635	4	4	4	3	4	3	3	2	3
20	NG090800	0	11.75274	4	3	3	3	3	3	2	4	3
21	NB151000	1	11.57123	3	3	4	3	3	3	3	2	4
22	NB261299	1	12.37443	4	4	4	3	4	4	4	4	4
23	CB310500	1	11.95502	4	4	2	2	4	4	2	3	4
24	CG070600	0	11.93584	3	3	3	2	3	4	1	4	2
25	CB260500	1	11.9742	3	3	4	3	4	3	2	2	3
26	CB200100	1	12.31575	4	3	3	4	4	3	2	3	2
27	CG100500	0	12.01096	2	2	2	4	4	4	4	4	3

28	CB240101	1	11.30479	3	4	3	3	3	3	3	2	4
29	CG090601	0	10.93037	3	3	3	4	4	3	4	3	4
30	CB210800	1	11.72968	2	4	3	3	3	3	3	3	3
31	CB140502	1	11.0016	4	3	4	3	4	2	3	3	1
32	CB191101	1	10.48516	4	4	3	4	4	4	2	1	3
33	CG240102	0	10.30479	4	3	4	3	4	4	3	3	3
34	CG190601	0	10.90731	3	3	3	3	3	2	3	2	2
35	CG290502	0	9.960502	4	2	2	4	4	3	4	3	3
36	CG041201	0	10.44406	4	3	3	4	3	4	2	4	3
37	CG070801	0	10.76918	4	4	4	4	4	4	2	3	3
38	CG031201	0	10.4468	3	3	3	4	4	2	1	4	2
39	CG180802	0	9.7379	3	4	4	2	4	4	4	4	3
40	CG140802	0	9.755479	4	4	4	4	4	4	4	3	4
41	CB160203	1	9.243379	1	4	4	3	4	3	1	1	1
42	CG010603	0	9.952283	4	3	3	4	4	3	3	3	3
43	CG270800	0	11.71324	3	3	3	3	3	3	3	3	2
44	CG270802	0	9.713242	3	3	3	3	3	3	3	2	1
45	CB030902	1	9.694064	3	3	3	2	2	4	3	2	2
46	CB090502	1	10.0137	4	3	3	4	4	4	4	4	4
47	CB140102	1	10.33219	4	4	3	3	4	4	1	1	1
48	CB041000	1	11.61073	3	4	4	4	4	3	4	1	1
49	CG120301	0	11.17763	3	3	2	3	4	4	2	2	1
50	CB090600	1	11.93584	4	4	4	1	2	1	4	4	4
51	CB280100	1	12.29932	4	4	4	4	4	4	1	4	4
52	HG260700	0	11.82397	3	4	3	4	3	4	3	3	3
53	HB100203	1	9.302055	2	3	2	3	3	3	3	3	3
54	HG151001	0	10.60251	4	4	4	4	3	4	2	4	2
55	HG121101	0	10.53562	3	3	3	3	3	3	3	4	3
56	HB150501	1	11.01918	2	4	3	3	4	4	3	4	4
57	HB300502	1	9.9879	4	4	3	3	4	4	4	4	4

58	HB090902	1	9.721461	4	4	4	4	3	4	1	4	4
59	HB021202	1	9.493379	3	1	3	4	1	3	3	1	3
60	HG200503	0	9.005479	4	4	4	4	4	4	3	4	3
61	HB130302	1	10.20502	1	2	2	3	3	3	4	3	3
62	HG130603	0	9.941324	4	4	4	4	4	4	1	3	4
63	HB280203	1	9.23242	3	3	4	4	4	3	3	4	4
64	HB040403	1	9.151826	4	3	4	4	3	4	3	3	3
65	HB121200	1	11.44406	4	3	4	3	4	3	2	3	3
66	HB171200	1	11.43037	4	4	4	4	4	4	4	4	4
67	HG230201	0	11.25274	3	3	3	3	3	3	2	3	3
68	HB140203	1	9.269178	3	3	3	4	4	3	3	3	4
69	HB190203	1	9.255479	4	4	4	4	4	3	4	4	4
70	HG260203	0	9.258219	4	3	3	4	4	3	3	4	4
71	CoB0810021	1	9.12	3	3	3	4	3	3	3	3	3
72	C0G020503	0	9.154566	4	3	2	3	3	4	2	2	1
73	CoG080202	0	10.38813	3	4	4	4	4	4	4	3	4
74	CoG230403	0	9.082192	4	4	4	3	3	1	1	1	1
75	CoB161101	1	10.51918	3	4	3	3	3	3	3	3	3
76	CoB201101	1	10.50822	4	4	4	4	4	4	3	3	4
77	CoB081002	1	9.624429	4	3	4	3	4	4	4	3	4
78	CoG150802	0	9.771918	1	3	4	3	3	3	4	4	4
79	CoB091202	1	9.455023	3	3	4	3	4	3	2	3	3
80	CoB050902	1	9.713242	2	3	3	3	3	3	2	3	3
81	CoB250701	1	10.82945	4	4	4	4	4	4	1	3	1
82	CoG060302	0	10.21872	3	4	4	2	3	3	2	3	3
83	CoB161100	1	11.51918	4	4	4	3	4	4	2	4	3
84	CoG230902	0	9.669406	4	3	3	4	4	1	3	4	2
85	CoB120401	1	11.11621	3	4	4	3	3	2	2	3	4
86	CoG060202	0	10.39361	3	4	3	3	3	4	3	3	3
87	GG210401	0	11.10251	3	4	3	3	4	4	3	3	3

88	GB230701	1	10.84977	3	4	3	3	4	4	4	3	4
89	GG160401	0	11.11621	3	3	3	3	2	3	3	3	3
90	GB240801	1	10.7637	3	3	3	2	2	3	2	3	3
91	GG080201	0	11.30479	4	3	4	3	3	3	4	3	2
92	GB180301	1	11.24612	3	3	4	3	3	3	2	2	2
93	GB231100	1	11.51644	2	3	3	3	3	3	3	3	3
94	GB200700	1	11.85799	3	3	3	4	3	4	3	3	2
95	GB011000	1	11.70228	3	4	4	2	3	4	3	3	3
96	HPB090802	1	9.965982	3	3	3	3	4	3	3	1	3
97	HPG200701	0	11.01918	3	3	3	3	3	3	4	3	3
98	HPG101201	0	10.62991	4	3	4	3	3	4	4	4	4
99	HPB070900	1	11.88539	4	4	3	4	2	3	3	2	4
100	HPG210503	0	9.094292	3	3	4	4	4	3	2	3	2
101	HPG280702	0	9.910046	3	4	4	4	4	4	3	3	3
102	HPB270303	1	9.251598	3	4	4	4	4	3	3	4	3
103	HPB091202	1	9.546575	4	4	4	3	3	4	2	2	2
104	HPG130303	0	9.288356	3	3	3	3	3	4	3	3	4
105	HPB250102	1	10.41826	4	4	4	4	4	4	4	4	4
106	HPG260501	0	11.08219	2	3	3	3	3	3	2	3	3
107	HPB250500	1	12.08493	3	3	3	3	4	3	3	3	3
108	HPB110302	1	10.29384	3	4	4	3	4	3	3	2	4
109	HPG270201	0	11.32671	3	3	3	3	4	2	2	3	3
110	HPB280200	1	12.32397	4	4	4	4	4	4	1	4	4
111	HPG100900	0	11.7911	4	3	3	3	3	3	3	3	3
112	HPB111002	1	9.838813	3	3	3	3	3	4	3	3	1
113	HPG050303	0	9.310274	4	3	4	4	3	3	4	3	4
114	LG050702	0	9.996119	4	4	4	3	4	4	4	3	4
115	LG031002	0	9.748858	3	3	3	4	3	4	3	3	1
116	LG281002	0	9.680365	2	1	1	4	4	3	3	4	4
117	LB290802	1	9.844292	4	4	4	3	3	2	2	2	4

118	LG090900	0	11.81575	3	3	4	3	3	2	2	2	3
119	LG211099	0	12.69954	4	4	4	3	4	4	4	4	4
120	LG070700	0	11.99064	4	3	3	4	3	3	3	3	3
121	LB230999	1	12.7774	3	3	4	4	4	4	3	3	3
122	LB250201	1	11.35525	4	4	4	3	4	4	4	2	3
123	LG160400	0	12.21598	3	3	3	3	3	3	1	3	2
124	LG101100	0	11.64635	4	4	4	4	4	3	4	4	3
125	LB190602	1	10.03836	3	3	3	3	3	3	3	3	3
126	LB210402	1	10.20502	4	4	4	4	4	4	3	3	4
127	LG180502	0	10.18858	3	4	4	3	4	2	3	3	4
128	LG230201	0	11.41826	3	3	3	3	3	3	3	3	3
129	RB170501	1	11.12991	3	4	4	4	4	4	3	1	1
130	RG051101	0	10.66279	4	4	4	3	4	4	2	4	3
131	RB010801	1	10.92489	3	4	4	3	4	4	3	2	3
132	RG090302	0	10.32397	3	3	3	3	4	4	2	3	4
133	RB210602	1	10.03562	3	3	2	3	3	3	3	3	3
134	RG300102	0	10.42763	2	3	4	1	1	1	1	1	2
135	CB140701	1	10.9742	4	4	4	4	4	4	3	4	3
136	RG140202	0	10.38813	3	3	3	3	3	4	2	3	4
137	RB291201	1	10.51644	3	3	3	2	3	4	2	2	3
138	RB150701	1	10.97146	3	3	2	2	3	2	3	3	3
139	RG180702	0	9.963242	3	3	3	3	3	3	4	3	3
140	RG290103	0	9.430365	4	4	4	4	4	4	3	4	4
141	RG310303	0	9.263699	4	3	3	3	4	3	3	3	2
142	RB250802	1	9.857991	3	3	3	3	4	3	3	3	3
143	RB170603	1	9.046575	4	4	4	4	4	3	4	4	4
144	RB150303	1	9.307534	3	3	3	3	3	3	2	3	3
145	RB190201	1	11.37443	3	2	3	3	3	3	2	2	4
146	RG160503	0	9.132648	4	4	4	4	4	3	2	2	2
147	RG300702	0	9.930365	3	4	3	3	4	3	2	4	3

148	RG260201	0	11.35525	3	3	3	3	3	3	2	2	3
149	RB240102	1	10.44406	4	4	4	4	4	4	3	3	2
150	RG250102	0	10.44132	3	4	4	4	4	3	2	3	2
151	RG030801	0	10.91941	4	4	4	4	4	4	1	4	2
152	RB021101	1	10.66941	1	2	4	3	3	2	1	3	2
153	RB160201	1	11.38265	4	4	4	2	4	4	1	1	3
154	RB230900	1	11.78014	4	4	3	3	3	3	4	3	4
155	RB280200	1	12.34977	3	3	3	3	4	3	3	3	3
156	RG101000	0	11.73242	4	4	4	4	4	4	4	4	3
157	RG280301	0	11.27192	4	3	4	4	3	3	2	4	3
158	RG160501	0	11.13265	3	3	3	3	4	3	3	4	4
159	RB240401	1	11.20228	4	4	4	1	4	4	4	4	4
160	RB190702	1	9.963242	3	3	2	4	3	3	2	2	4
161	RG140300	0	12.31027	4	4	4	4	4	4	4	4	4
162	RB121202	1	9.565753	4	4	3	4	4	4	4	3	4
163	RG130201	0	11.39361	3	3	3	4	4	4	3	3	4
164	RB290900	1	11.76644	3	4	3	4	4	4	3	3	4
165	RG031000	0	11.75548	3	4	3	3	4	4	3	4	3
166	RB180700	1	11.96598	2	4	2	3	4	4	3	4	1
167	RG071100	0	11.71598	3	2	3	3	2	3	3	3	2
168	RG220503	0	9.183105	2	3	3	4	4	3	3	3	3
169	RB060902	1	9.829452	4	4	4	4	3	3	3	2	1
170	CurG280403	0	9.296575	3	4	4	4	4	4	4	4	4
171	CurG081002	0	9.796575	2	3	4	3	4	4	3	3	3
172	CurB210303	1	9.349772	1	3	4	4	4	3	2	3	3
173	CurG131002	0	9.782877	2	3	3	3	3	3	3	3	2
174	CurG120603	0	9.11621	3	3	3	4	3	3	3	3	4
175	CurG160600	0	12.10525	4	4	4	4	3	4	3	3	3
176	CurB231101	1	10.66941	3	3	3	3	4	3	3	3	3
177	CurB200303	1	9.352511	3	3	4	2	3	3	4	3	3

178	WG180503	0	9.224201	2	4	4	4	4	4	4	1	2
179	WB140103	1	9.563014	4	3	3	3	3	3	2	3	3
180	WG181003	0	9.802055	1	3	3	2	4	4	3	2	1
181	WG301102	0	9.683105	4	4	3	4	4	4	3	3	4
182	WB290402	1	10.27466	4	3	3	3	4	4	3	2	2
183	WB150902	1	9.890868	4	4	4	4	4	4	4	4	4
184	WG040801	0	11.00548	4	4	4	3	4	4	3	2	3
185	WG270603	0	9.107991	2	4	4	3	4	4	4	4	2
186	WB280700	1	12.03562	4	4	4	4	4	4	3	1	1
187	WG230201	0	11.46324	3	2	2	3	3	3	2	3	3
188	WG210301	0	11.39361	3	4	4	4	4	3	4	3	3
189	WG281200	0	11.61895	3	3	3	3	4	2	3	3	3
190	WB110401	1	11.33607	2	3	3	3	3	4	3	3	3
191	WB150800	1	11.9879	3	3	2	3	3	3	2	2	3
192	WG261002	0	9.791096	3	3	4	3	4	4	2	3	4
193	WB291200	1	11.61621	4	4	4	4	4	4	4	4	4
194	WG220401	1	11.31849	3	4	4	4	2	2	2	4	2
195	WG210601	1	11.14909	3	3	3	2	1	2	3	3	3
196	WG231100	1	11.72694	3	3	3	4	4	3	2	3	2
197	WG140202	1	10.50274	3	3	3	3	3	3	2	3	2
198	ChG250202	0	10.46872	4	4	4	4	3	4	3	4	3
199	ChB131100	1	11.75274	4	3	3	3	4	4	3	3	3
200	ChB240402	1	10.31027	3	3	4	3	4	3	3	2	3
201	ChG220701	0	11.06301	4	3	4	4	4	4	4	4	4
202	ChB200501	1	11.24064	3	3	3	3	3	3	3	3	4
203	ChB120401	1	11.34429	2	2	1	1	3	1	1	2	2
204	ChB060902	1	9.938584	4	4	4	4	4	4	3	3	3
205	ChG050503	0	9.280137	4	4	4	4	4	4	4	4	3
206	ChG130203	0	9.50274	3	3	3	3	3	3	2	2	2
207	ChG140303	0	9.422146	2	2	2	2	4	1	3	3	3

208	ChB201202	1	9.672146	1	4	4	4	4	4	3	4	4
209	ChB091202	1	9.702283	4	4	4	4	4	4	4	3	4
210	ChG250402	0	10.32945	3	3	3	4	3	3	3	3	3
211	ChB090902	1	9.952283	4	4	4	2	4	3	3	4	4
212	ChG191202	0	9.674886	3	3	4	3	1	1	1	4	4
213	ChB111202	1	9.696804	3	3	3	2	3	3	2	3	2
214	ChG180700	0	12.09429	2	3	3	2	4	3	3	3	3
215	ChB040800	1	12.05479	3	3	1	3	4	3	3	2	3
216	LaB030902	1	9.952283	3	4	3	4	4	3	3	3	4
217	LaB290503	1	9.221461	4	4	4	4	4	4	3	4	4
218	LaG030902	0	9.952283	3	3	4	3	4	4	4	4	4
219	LaB091102	1	9.769178	3	4	3	4	4	3	3	4	1
220	LaG300703	0	9.046575	4	3	4	3	4	4	3	4	4
221	LaB110400	1	12.34977	3	4	3	3	3	3	4	3	3
222	LaG150801	0	11.00274	3	4	3	4	4	4	4	3	2
223	LaG050900	0	11.9468	3	3	4	4	4	3	2	3	3
224	LaG230801	0	10.98242	3	3	4	3	4	4	2	2	3
225	LaB281201	1	10.63539	3	3	4	3	3	4	3	3	2
226	LaB110302	1	10.43584	3	4	3	3	3	3	3	3	3
227	LaB030602	1	10.20776	3	3	3	4	4	4	3	3	3
228	LaG180502	0	10.2516	4	4	4	4	4	4	1	4	1
229	LaG030602	0	10.20776	3	4	3	4	3	3	2	3	3
230	LaG070302	0	10.4468	3	3	4	2	1	3	3	2	2
231	LaG080602	0	10.19406	4	3	3	3	3	4	3	4	2
232	LaG170901	0	10.91279	4	4	3	4	3	4	3	4	4
233	LaB110900	1	11.93037	4	4	4	4	3	3	3	3	4
234	LaB040402	1	10.37169	3	3	3	3	3	4	2	3	3
235	LaB190301	1	11.41553	1	4	4	4	4	4	3	4	4
236	LaG170101	0	11.58219	4	4	4	3	3	3	4	4	4
237	LaG040900	0	11.94954	4	4	4	3	3	4	3	2	3

238	LaB060700	1	12.11073	3	3	3	3	3	3	3	3	4
239	LaG140203	0	9.508219	4	3	4	4	4	4	3	3	2
240	LaB270502	1	10.25548	4	3	3	3	3	3	3	3	3
241	LaB011100	1	11.82123	4	4	4	4	4	4	3	4	4
242	LaG130703	0	9.140868	3	4	3	3	3	3	1	2	1
243	LaB211299	1	12.68311	3	4	4	3	2	2	2	3	1
244	WooB160403	1	9.360731	4	4	4	2	4	4	3	4	4
245	WooG270702	0	10.07671	3	3	3	2	3	2	3	3	3
246	WooG281102	0	9.7379	3	4	4	4	4	4	3	3	3
247	WooB090402	1	10.36895	3	4	3	4	4	4	3	4	3
248	WooG010501	0	11.30753	3	4	3	4	4	4	3	3	4
249	WooB180102	1	10.58881	4	4	4	2	2	2	3	4	3
250	WooG280502	0	10.23516	3	3	3	3	3	4	3	3	4
251	WooB040102	1	10.62717	3	3	3	3	3	3	3	3	3
252	WooG200900	0	11.91553	2	3	3	3	3	3	3	3	3
253	WooG180700	0	12.08881	4	4	4	3	3	3	3	4	4
254	WooB290101	1	11.56027	4	4	4	4	3	3	2	2	4
255	WooB150301	1	11.43584	3	4	4	2	3	3	4	3	3
256	WooB240799	1	13.07397	4	4	4	3	3	4	3	3	4
257	WooB310899	1	12.97146	4	4	4	3	4	3	4	4	4
258	WooB201199	1	12.74886	3	3	3	4	3	4	2	4	3
259	WooG240999	0	12.90457	3	3	3	3	3	3	3	3	3
260	WooB010300	1	12.47146	4	4	4	3	3	3	3	3	4
261	WooG291099	0	12.81027	2	2	2	3	2	3	3	3	1
262	WooG310100	0	12.55479	4	4	4	2	3	3	3	3	4
263	WooG290800	0	11.97694	3	4	3	3	3	3	3	3	3
264	WooB301199	1	12.7242	3	2	3	3	3	3	3	2	3
265	YB270701	1	11.07397	4	4	3	3	3	3	4	2	2
266	YG020800	1	12.05753	3	3	3	2	3	4	2	3	2
267	YB091200	1	11.70502	3	4	4	4	4	4	3	4	4

268	YG100602	0	10.20776	4	4	4	3	3	3	3	4	3
269	YB061100	1	11.79658	3	3	3	2	3	3	2	2	3
270	YG110403	0	9.371689	2	3	3	4	4	4	1	4	1
271	YG110102	0	10.61621	3	3	2	3	3	3	3	2	2
272	YB240902	1	9.912785	4	4	4	4	4	4	2	4	3
273	FPG170502	0	10.28562	3	3	3	2	3	3	2	2	2
274	FPG020403	0	9.410046	3	4	3	4	4	4	1	2	1
275	FPG221002	0	9.849772	4	4	4	4	4	4	4	1	4
276	FPG180402	0	10.36621	3	3	3	3	4	2	2	3	2
277	FPG280799	0	13.08493	3	3	3	3	3	3	2	3	2
278	FPG200200	0	12.52192	3	3	3	3	3	3	3	3	3
279	FPB170502	1	10.28562	3	3	3	4	3	4	3	3	3
280	FPB290402	1	10.33607	3	3	3	3	3	4	2	3	3
281	FPB080401	1	11.39361	2	2	2	3	3	2	2	1	2
282	FPB040899	1	13.06575	4	4	4	3	4	4	2	3	3
283	FPB020902	1	9.9879	3	4	4	2	3	3	2	2	1
284	FPB170800	1	12.03014	4	4	4	3	4	4	2	3	2
285	FPB050900	1	11.97968	2	2	2	2	3	2	2	3	3
286	FPG301001	0	10.84977	3	3	3	4	3	3	2	4	3
287	FPB050203	1	9.584932	4	4	4	4	4	4	4	4	4
288	FPG071102	0	9.829452	4	3	4	4	4	3	3	2	4
289	FPG220900	0	11.95502	2	3	2	3	3	2	2	2	2
290	FPB030503	1	9.347032	3	4	3	3	2	3	1	3	2
291	RB161202	1	9.702283	2	1	3	2	4	3	4	1	2
292	RG211201	0	10.68858	3	4	4	3	3	3	3	4	4
293	RG240702	0	10.09703	3	3	3	3	3	3	3	3	4
294	RG111001	0	10.88265	4	4	4	3	3	3	3	3	3
295	RB041002	1	9.901826	3	3	3	3	3	3	3	3	3
296	RB260101	1	11.59155	3	4	4	4	4	3	4	4	3
297	RB210100	1	12.60525	3	4	4	3	4	4	4	3	3

298	RB110102	1	10.63265	3	3	4	2	4	3	3	4	4
299	RG050500	0	12.36073	3	3	3	3	3	3	4	3	4
300	RB040901	1	11.02466	4	4	3	4	3	4	4	3	4
301	CotB291002	1	9.855251	4	4	4	3	4	3	3	4	2
302	CotG300103	0	9.602511	3	4	3	4	4	3	3	4	3
303	CotG201102	0	9.796575	4	3	3	3	3	3	3	3	3
304	CotG191002	0	9.882648	3	3	3	3	4	3	3	3	3
305	CotG170603	0	9.226941	2	3	3	4	4	3	3	2	2
307	CotG010702	0	10.18858	4	4	4	3	4	4	4	4	4
308	CotG011102	0	9.847032	3	3	3	4	3	3	3	3	4
309	CotG121102	0	9.818493	3	3	3	3	3	3	3	3	3
310	CotG010503	0	9.355251	4	4	3	4	4	4	4	4	2
311	CotB090103	1	9.660046	4	4	4	4	4	4	4	4	4
312	CotB120503	1	9.323973	4	4	4	4	3	4	4	4	4
313	CotB081102	1	9.829452	3	4	3	3	3	4	4	3	4
314	CotB190102	1	10.63265	4	4	4	3	4	3	3	2	4
315	CotG070601	0	11.25274	3	4	3	3	3	3	3	3	4
316	CotG090701	0	11.16005	4	4	4	3	3	4	2	3	4
317	CotG260602	0	10.20228	3	4	4	3	3	4	2	2	2
318	CotG100602	0	10.24886	2	2	3	3	3	3	3	3	3
319	CotG300602	0	10.19406	2	2	3	3	3	2	2	2	3
320	CotG041202	0	9.760959	3	4	4	4	4	4	4	3	4
321	CotG130603	0	9.25274	3	4	4	2	4	4	3	3	4
322	CotG051102	0	9.852511	3	2	2	2	3	3	2	2	4
323	CotG310303	0	9.496119	3	2	3	3	3	3	2	2	2
324	DHB200401	1	11.39635	4	4	4	4	4	4	4	4	4
325	DHG150999	0	12.9879	3	3	3	4	4	3	3	3	3
326	DHB301000	1	11.86347	4	3	3	3	3	3	4	3	4
327	DHG100201	0	11.58493	3	3	3	1	2	2	3	2	3
328	DHG121000	0	11.91279	4	3	4	3	4	3	4	4	4

329	DHB290103	1	9.61621	3	4	3	3	3	3	3	4	3
330	DHB120902	1	9.996119	3	3	3	4	4	4	4	4	4
331	DHG010403	0	9.446804	3	3	3	4	3	4	3	3	3
332	DHG061202	0	9.763699	3	3	3	3	3	3	3	3	3
333	DHG260503	0	9.296575	2	3	4	4	4	4	4	3	2
334	B170400	1	12.43858	3	3	3	3	3	3	2	2	3
335	B280802	1	10.03836	3	3	2	3	3	3	3	3	2
336	DHG110402	0	10.42489	4	4	4	3	4	3	3	4	4
337	DHB040901	1	11.02192	2	3	3	3	3	3	3	3	4
338	DHB171001	1	10.90457	3	3	3	3	4	3	2	2	2
339	PG070602	0	10.27466	4	4	4	3	4	3	3	3	3
340	PG210102	0	10.64909	3	3	3	3	3	3	2	3	2
341	PG141102	0	9.834932	3	4	3	3	4	3	3	3	2
342	PB110603	1	9.263699	4	4	3	4	4	3	3	3	3
343	PB281202	1	9.713242	2	3	3	3	3	3	3	3	3
344	PG171000	0	11.91005	3	3	3	3	3	3	2	3	2
345	PG010302	0	10.54384	2	2	3	2	2	2	2	2	2
346	PB190902	1	9.9879	4	3	2	2	2	2	2	3	3
347	PB090403	1	9.435845	3	4	4	4	4	4	1	4	4
348	PB030103	1	9.696804	4	4	3	3	4	4	4	4	4
349	PG040203	0	9.610731	3	3	3	3	3	3	2	2	2
350	PB100202	1	10.61073	3	4	3	3	3	4	3	2	3
351	PB190801	1	11.08607	4	4	4	3	3	3	3	4	4
352	PB010200	1	12.63539	4	4	3	3	3	3	2	3	3
353	PG020203	0	9.632648	4	4	4	4	3	4	2	3	1
354	BB171101	1	10.83493	4	4	4	4	4	4	4	4	4
355	BG140701	0	11.18311	4	4	4	3	3	3	4	3	2
356	BB290402	1	10.39087	4	4	4	4	4	4	4	4	4
357	BB110501	1	11.35799	4	4	4	4	4	4	3	3	4
358	BB040100	1	12.70228	4	4	4	2	2	4	3	3	4

359	BG300902	0	9.965982	3	3	4	3	3	3	3	3	4
360	BB111201	1	10.76918	3	3	3	4	3	3	3	4	3
361	MB070803	1	9.121689	4	4	4	4	4	4	4	4	4
362	MG260703	0	9.154566	4	3	3	4	3	4	2	2	1
363	MB190803	1	9.088813	4	4	4	3	4	4	4	4	4
364	MB270903	1	9.98516	4	4	4	4	4	4	4	2	4
365	MG120803	0	9.107991	3	1	3	3	2	2	3	3	2
366	MB090702	1	10.20776	3	4	4	4	4	4	3	3	4
367	MG100602	0	10.28562	4	4	4	4	4	4	1	3	4
368	MB090403	1	9.455023	3	3	3	3	3	3	3	3	3
369	MB280403	1	9.404566	4	4	4	4	4	4	3	2	1
370	MB180902	1	10.00822	4	4	4	4	4	4	3	4	4
371	MB080802	1	10.11895	3	4	3	4	3	4	2	4	1
372	MB051202	1	9.796575	3	4	3	3	4	4	4	4	3
373	MG160603	0	9.269178	3	3	3	3	4	4	4	3	3
374	MG130901	0	11.02192	1	3	3	3	4	3	3	3	3
375	MG280103	0	9.649087	3	4	3	4	4	4	4	4	4
376	MG050602	0	10.29932	3	4	3	3	4	3	3	3	3
377	MG200801	0	11.08607	3	3	3	4	4	4	4	3	4
378	MB080201	1	11.61895	4	4	4	4	4	4	4	4	3
379	MG010700	0	12.22694	4	4	4	4	3	4	4	3	4
380	MG110200	0	12.61073	3	4	3	3	3	4	3	3	4
381	MB030700	1	12.22146	3	3	3	4	3	4	4	4	4
382	MG150301	0	11.52466	3	4	3	3	3	4	2	3	2
383	MG290501	0	11.31849	3	3	3	4	3	4	3	3	3
384	MG190601	0	11.26096	4	4	4	4	4	4	4	3	4
385	MG171100	0	11.84429	3	3	3	2	2	3	1	2	2
386	MB060900	1	12.0411	4	4	4	4	4	4	4	4	4
387	MG050601	0	11.29932	4	4	3	3	4	3	2	3	4
388	MB260999	0	12.9879	4	4	4	4	4	4	3	4	4

389	MB051000	1	11.96324	3	3	3	3	4	4	3	3	3
390	MB070602	1	10.29384	3	4	3	4	4	3	4	3	4
391	MG041001	0	10.97968	3	3	3	3	3	4	4	3	3
392	MB031101	1	10.88265	3	3	4	3	4	3	3	3	4
393	MB300401	1	11.39909	4	4	4	3	4	4	4	4	4
394	MG290701	0	11.14635	4	4	4	2	4	4	3	4	2
395	MB070801	1	11.12169	2	3	3	4	4	4	3	3	3
396	MG080302	0	10.54384	4	4	4	4	4	4	3	2	4
397	MG040202	0	10.62991	4	4	4	4	4	3	1	3	2
398	MB280603	1	9.251598	4	4	4	4	4	4	2	2	1
399	MB021102	1	9.899087	3	3	3	3	3	3	2	3	2
400	MB060502	1	10.39635	4	4	4	3	4	3	1	1	1
401	MG111201	0	10.79384	3	2	3	2	3	2	2	2	2
402	MB240502	1	10.34703	4	4	4	3	4	4	2	3	3
403	MB111200	1	11.79384	4	4	4	4	3	3	3	3	4
404	MB160700	1	12.19954	4	4	3	4	2	3	3	4	3
405	MG190402	0	10.44132	2	3	4	3	3	3	3	3	3
406	MB180602	1	10.2637	4	4	4	3	4	4	3	3	4
407	WLG030701	0	11.23242	4	4	4	3	4	4	4	4	4
408	WLG171099	0	12.93858	3	3	3	3	3	2	3	2	3
409	WLG040899	0	12.99886	2	2	2	4	3	3	4	4	4
410	WLB230401	1	11.42489	2	4	4	3	4	4	4	3	4
411	WLG041099	0	12.9742	3	3	3	4	4	3	3	3	3
412	WLB310101	1	11.64909	3	4	4	3	4	3	2	3	4
413	WLB070601	1	11.30205	4	4	4	3	4	3	4	4	4
414	WLG060402	0	10.47146	3	4	4	4	4	4	3	3	4
415	WLG230402	0	10.42489	3	3	3	3	3	3	2	3	3
416	WLG060602	0	10.30479	3	4	2	1	3	1	3	4	3
417	WLG251201	0	10.74886	2	1	2	1	1	1	1	3	2
418	WLB170502	1	10.36073	2	2	2	4	3	3	2	2	2

419	WLG301201	0	10.73516	4	4	3	4	3	4	4	4	4
420	WLB271101	1	10.82671	3	4	4	3	3	4	3	3	3
421	WLB191102	1	9.847032	4	3	4	2	2	3	3	3	4
422	SB100500	1	12.37991	4	4	4	1	2	3	2	2	2
423	SB090102	1	10.7105	3	3	4	3	3	3	3	3	3
424	SG080301	0	11.55479	3	4	4	3	4	4	3	3	4
425	SB040100	1	12.7242	3	3	4	4	4	2	2	4	3
426	SG020500	0	12.40183	4	4	4	4	4	4	1	3	1
427	SB100700	1	12.21324	4	4	4	1	3	4	4	4	4
428	SB260899	1	12.99886	4	4	4	4	4	4	4	4	4
429	SB030602	1	10.31575	3	3	3	3	3	3	3	3	3
430	SG160403	0	9.446804	3	2	3	4	4	3	1	1	3
431	SG160301	1	11.0274	1	2	4	2	1	1	2	2	1

Note. Gender; 0 = girl 1 = boy. ChronAge = Chronological age. PC1 - PC3 = Need for competence items. Rel1-Rel3 = Need for relatedness items. Aut-Aut3 = Need for autonomy items.

APPENDIX P: MAIN DATABASE C-PLOC

PP	StudyID	Gender	ChronAge	Am1	Am2	Am3	Extr1	Extr2	Extr3	Intro1	Intro2	Intro3
1	NG030799	0	12.85525	2	2	2	2	2	2	2	1	2
2	NG221100	0	11.59977	1	1	1	2	1	2	2	1	2
3	NB120900	1	11.63265	1	1	1	1	1	1	1	1	1
4	NG300900	0	11.58493	1	1	1	2	2	2	1	1	2
5	NB090202	1	10.2242	2	1	3	1	1	2	3	3	3
6	NG150302	0	10.12443	3	2	3	2	2	2	3	2	3
7	NG050402	0	10.06849	1	1	4	3	3	4	3	3	3
8	NB010701	1	10.83219	1	1	4	3	3	4	3	3	3
9	NG051201	0	10.40457	2	2	2	3	1	3	1	2	1
10	NG181101	0	10.61073	1	2	4	3	2	1	4	4	4
11	NG100302	0	10.17215	1	3	4	4	3	4	2	3	2
12	NB190701	1	10.81027	1	3	4	4	3	4	2	3	2
13	NG211201	0	10.37169	3	3	1	4	4	4	3	2	3
14	NG150902	0	9.651826	4	4	3	4	4	4	4	4	4
15	NG030802	0	9.75274	2	2	2	2	1	2	3	2	3
17	NG010100	0	12.34155	2	1	3	2	1	1	4	2	4
18	NG250800	0	11.70776	2	2	3	3	2	3	2	3	2
19	NG110900	0	11.64635	2	2	2	1	2	1	1	3	1
20	NG090800	0	11.75274	1	1	1	1	1	1	2	1	3
21	NB151000	1	11.57123	1	1	1	1	1	2	3	1	3
22	NB261299	1	12.37443	1	1	1	1	1	1	4	1	1
23	CB310500	1	11.95502	1	1	1	1	1	3	3	1	1
24	CG070600	0	11.93584	1	1	2	1	1	1	3	1	3
25	CB260500	1	11.9742	2	2	1	2	3	2	2	1	2
26	CB200100	1	12.31575	1	1	1	1	1	1	2	1	2
27	CG100500	0	12.01096	1	1	1	1	1	1	1	1	1
28	CB240101	1	11.30479	1	1	1	1	1	2	3	2	2

29	CG090601	0	10.93037	1	1	1	1	1	1	1	1	1
30	CB210800	1	11.72968	2	1	3	1	1	2	4	2	4
31	CB140502	1	11.0016	2	2	4	3	4	3	4	4	4
32	CB191101	1	10.48516	1	1	3	3	3	4	3	2	2
33	CG240102	0	10.30479	3	3	4	3	3	2	3	3	3
34	CG190601	0	10.90731	2	2	3	2	3	2	2	2	2
35	CG290502	0	9.960502	4	3	4	4	3	4	4	1	4
36	CG041201	0	10.44406	4	2	3	2	2	4	4	3	3
37	CG070801	0	10.76918	3	3	4	4	3	4	3	3	3
38	CG031201	0	10.4468	1	3	2	1	1	1	3	2	2
39	CG180802	0	9.7379	4	4	4	4	4	4	2	4	2
40	CG140802	0	9.755479	1	1	1	1	1	1	1	1	1
41	CB160203	1	9.243379	1	1	2	1	1	3	3	1	4
42	CG010603	0	9.952283	3	3	3	3	3	4	3	3	3
43	CG270800	0	11.71324	2	2	2	2	2	2	1	2	1
44	CG270802	0	9.713242	2	2	2	3	3	3	2	2	3
45	CB030902	1	9.694064	1	1	1	3	2	2	1	2	2
46	CB090502	1	10.0137	4	4	4	3	4	4	1	4	4
47	CB140102	1	10.33219	1	1	1	1	1	1	1	1	1
48	CB041000	1	11.61073	1	1	1	1	1	4	4	4	4
49	CG120301	0	11.17763	1	1	1	1	1	1	1	1	2
50	CB090600	1	11.93584	1	1	1	1	1	1	1	1	1
51	CB280100	1	12.29932	1	1	1	1	1	1	4	1	3
52	HG260700	0	11.82397	2	1	3	3	3	4	2	4	3
53	HB100203	1	9.302055	3	1	2	2	2	3	2	2	3
54	HG151001	0	10.60251	1	1	1	1	1	1	3	1	3
55	HG121101	0	10.53562	2	1	3	2	2	3	3	3	3
56	HB150501	1	11.01918	1	1	1	1	1	1	2	1	2
57	HB300502	1	9.9879	4	1	4	1	1	4	4	1	3
58	HB090902	1	9.721461	4	3	3	3	3	4	3	4	4

59	HB021202	1	9.493379	1	2	1	2	3	3	3	4	2
60	HG200503	0	9.005479	1	1	1	1	1	1	1	1	1
61	HB130302	1	10.20502	2	3	2	2	2	2	3	1	4
62	HG130603	0	9.941324	1	1	3	1	1	4	4	1	4
63	HB280203	1	9.23242	4	1	3	3	4	4	3	4	3
64	HB040403	1	9.151826	2	1	4	4	2	4	4	4	4
65	HB121200	1	11.44406	1	2	2	1	1	1	2	3	3
66	HB171200	1	11.43037	1	1	1	1	1	1	4	1	4
67	HG230201	0	11.25274	2	1	2	1	2	1	3	2	3
68	HB140203	1	9.269178	1	1	1	1	1	1	3	2	3
69	HB190203	1	9.255479	1	1	1	1	1	1	1	1	4
70	HG260203	0	9.258219	3	3	3	2	4	3	4	3	3
71	CoB0810021	1	9.12	3	2	3	4	3	3	3	3	3
72	C0G020503	0	9.154566	3	1	1	2	1	1	2	1	2
73	CoG080202	0	10.38813	4	4	3	4	3	3	3	3	4
74	CoG230403	0	9.082192	1	1	1	1	1	1	2	1	1
75	CoB161101	1	10.51918	2	1	2	3	2	2	2	2	2
76	CoB201101	1	10.50822	1	1	1	1	1	1	1	1	2
77	CoB081002	1	9.624429	1	1	1	1	1	1	4	1	2
78	CoG150802	0	9.771918	1	1	1	1	1	1	2	1	1
79	CoB091202	1	9.455023	2	2	2	1	1	1	3	2	3
80	CoB050902	1	9.713242	1	2	2	2	2	2	2	3	3
81	CoB250701	1	10.82945	1	1	2	2	2	2	3	3	3
82	CoG060302	0	10.21872	1	1	1	1	1	2	1	2	1
83	CoB161100	1	11.51918	1	1	1	1	1	1	2	2	1
84	CoG230902	0	9.669406	2	1	2	1	1	1	2	3	2
85	CoB120401	1	11.11621	3	2	3	3	3	3	3	2	3
86	CoG060202	0	10.39361	1	1	2	1	1	1	2	2	2
87	GG210401	0	11.10251	1	2	2	3	1	4	3	1	3
88	GB230701	1	10.84977	1	2	1	1	1	1	1	4	1

89	GG160401	0	11.11621	1	1	1	1	1	2	3	1	2
90	GB240801	1	10.7637	1	2	2	1	2	2	2	2	2
91	GG080201	0	11.30479	1	2	1	2	2	2	2	2	2
92	GB180301	1	11.24612	2	2	2	2	2	2	3	2	3
93	GB231100	1	11.51644	2	1	1	1	1	2	4	1	4
94	GB200700	1	11.85799	2	1	3	1	1	1	2	2	2
95	GB011000	1	11.70228	1	1	2	1	1	1	2	1	2
96	HPB090802	1	9.965982	1	2	1	1	1	1	1	1	1
97	HPG200701	0	11.01918	2	2	2	2	2	3	2	3	2
98	HPG101201	0	10.62991	2	1	1	1	1	2	2	1	2
99	HPB070900	1	11.88539	4	1	1	2	2	3	2	1	1
100	HPG210503	0	9.094292	2	2	3	3	3	4	3	3	3
101	HPG280702	0	9.910046	2	1	2	1	1	2	2	1	2
102	HPB270303	1	9.251598	3	4	3	4	3	4	4	3	3
103	HPB091202	1	9.546575	2	1	2	2	1	4	4	4	4
104	HPG130303	0	9.288356	2	1	2	1	1	1	2	1	2
105	HPB250102	1	10.41826	1	1	1	1	1	1	4	1	4
106	HPG260501	0	11.08219	2	1	2	1	2	2	2	2	2
107	HPB250500	1	12.08493	2	2	2	2	2	3	3	3	3
108	HPB110302	1	10.29384	2	1	1	3	2	4	2	1	2
109	HPG270201	0	11.32671	2	2	3	2	1	2	2	2	2
110	HPB280200	1	12.32397	1	1	1	1	1	1	1	1	1
111	HPG100900	0	11.7911	1	1	2	1	1	2	1	1	1
112	HPB111002	1	9.838813	1	1	1	1	1	4	1	1	1
113	HPG050303	0	9.310274	2	2	2	1	2	2	4	3	4
114	LG050702	0	9.996119	1	1	1	1	1	1	1	1	1
115	LG031002	0	9.748858	4	1	3	2	3	3	3	3	2
116	LG281002	0	9.680365	1	2	1	4	1	3	1	4	1
117	LB290802	1	9.844292	1	1	1	1	1	1	3	1	2
118	LG090900	0	11.81575	1	2	1	2	2	2	2	1	2

119	LG211099	0	12.69954	1	1	1	1	1	1	2	2	2
120	LG070700	0	11.99064	2	2	2	2	3	2	2	2	2
121	LB230999	1	12.7774	1	1	2	1	1	2	4	1	1
122	LB250201	1	11.35525	3	1	3	3	1	2	1	2	1
123	LG160400	0	12.21598	3	1	3	2	2	4	2	3	3
124	LG101100	0	11.64635	3	1	1	1	1	1	1	1	1
125	LB190602	1	10.03836	1	1	1	2	1	2	2	1	2
126	LB210402	1	10.20502	1	1	1	1	1	1	1	1	1
127	LG180502	0	10.18858	4	1	4	1	1	1	1	3	1
128	LG230201	0	11.41826	2	2	2	2	2	3	3	2	3
129	RB170501	1	11.12991	1	1	1	1	1	1	1	1	1
130	RG051101	0	10.66279	1	1	1	1	1	1	3	4	3
131	RB010801	1	10.92489	2	1	1	2	1	1	3	1	4
132	RG090302	0	10.32397	4	2	3	4	3	3	4	3	3
133	RB210602	1	10.03562	3	3	3	3	3	3	3	3	3
134	RG300102	0	10.42763	1	2	3	4	2	4	4	4	4
135	CB140701	1	10.9742	3	1	3	1	1	1	4	1	4
136	RG140202	0	10.38813	1	2	2	2	2	2	3	2	3
137	RB291201	1	10.51644	1	2	4	1	1	1	3	3	3
138	RB150701	1	10.97146	1	1	2	2	2	2	2	1	2
139	RG180702	0	9.963242	1	1	1	1	1	1	2	1	2
140	RG290103	0	9.430365	1	1	1	1	1	2	3	1	1
141	RG310303	0	9.263699	1	1	1	1	1	1	3	3	2
142	RB250802	1	9.857991	1	1	1	1	1	1	3	1	3
143	RB170603	1	9.046575	1	1	3	3	4	4	4	4	4
144	RB150303	1	9.307534	1	1	2	2	2	2	3	1	3
145	RB190201	1	11.37443	2	2	2	2	2	3	2	2	3
146	RG160503	0	9.132648	3	2	1	1	1	1	4	1	3
147	RG300702	0	9.930365	1	1	2	1	1	2	2	2	2
148	RG260201	0	11.35525	1	1	1	1	1	1	1	1	1

149	RB240102	1	10.44406	1	1	2	2	2	1	4	3	3
150	RG250102	0	10.44132	1	2	2	1	1	1	2	1	1
151	RG030801	0	10.91941	1	1	4	1	1	1	1	1	1
152	RB021101	1	10.66941	1	1	2	1	1	1	3	1	3
153	RB160201	1	11.38265	1	1	3	2	2	4	2	2	3
154	RB230900	1	11.78014	1	1	1	1	1	1	2	1	2
155	RB280200	1	12.34977	2	2	2	2	1	2	2	2	2
156	RG101000	0	11.73242	1	1	1	1	1	4	1	1	1
157	RG280301	0	11.27192	1	1	1	2	2	2	1	1	2
158	RG160501	0	11.13265	1	1	1	2	1	2	2	1	1
159	RB240401	1	11.20228	1	1	1	1	1	1	1	1	1
160	RB190702	1	9.963242	3	3	3	3	3	3	3	3	4
161	RG140300	0	12.31027	1	1	1	1	1	1	3	1	2
162	RB121202	1	9.565753	1	1	1	1	1	2	2	1	3
163	RG130201	0	11.39361	1	1	4	1	1	1	1	1	1
164	RB290900	1	11.76644	1	1	4	1	1	1	4	1	2
165	RG031000	0	11.75548	1	1	1	1	1	1	2	1	1
166	RB180700	1	11.96598	3	1	3	1	1	1	3	4	3
167	RG071100	0	11.71598	2	2	2	2	2	3	2	2	2
168	RG220503	0	9.183105	2	1	3	1	3	3	3	3	3
169	RB060902	1	9.829452	1	1	2	3	1	4	4	1	4
170	CurG280403	0	9.296575	4	2	4	3	4	4	3	3	2
171	CurG081002	0	9.796575	2	2	2	2	3	3	3	3	3
172	CurB210303	1	9.349772	1	3	1	1	1	3	2	1	2
173	CurG131002	0	9.782877	1	1	2	1	2	1	3	2	2
174	CurG120603	0	9.11621	1	1	1	1	3	1	1	3	1
175	CurG160600	0	12.10525	1	2	3	2	1	2	2	1	2
176	CurB231101	1	10.66941	1	1	1	1	1	1	1	1	2
177	CurB200303	1	9.352511	1	2	1	1	1	2	1	2	2
178	WG180503	0	9.224201	1	1	2	1	2	1	3	1	4

179	WB140103	1	9.563014	1	1	1	2	2	2	2	2	2
180	WG181003	0	9.802055	1	1	1	1	1	1	3	4	2
181	WG301102	0	9.683105	2	1	1	1	1	2	3	1	3
182	WB290402	1	10.27466	1	1	1	2	1	1	4	1	4
183	WB150902	1	9.890868	4	1	4	1	1	4	4	4	4
184	WG040801	0	11.00548	1	1	1	1	1	1	1	1	1
185	WG270603	0	9.107991	4	1	3	1	1	1	1	1	1
186	WB280700	1	12.03562	1	1	1	1	1	1	4	1	4
187	WG230201	0	11.46324	3	3	2	3	3	3	2	3	2
188	WG210301	0	11.39361	2	2	2	1	1	4	3	3	2
189	WG281200	0	11.61895	2	2	2	3	2	3	2	2	2
190	WB110401	1	11.33607	2	2	2	2	1	2	3	3	3
191	WB150800	1	11.9879	2	2	2	2	2	2	1	2	1
192	WG261002	0	9.791096	3	2	3	4	3	4	3	3	4
193	WB291200	1	11.61621	1	1	1	1	1	1	1	1	1
194	WG220401	1	11.31849	4	2	2	2	2	2	2	2	2
195	WG210601	1	11.14909	1	2	1	1	1	1	2	1	2
196	WG231100	1	11.72694	3	4	2	3	3	3	3	3	3
197	WG140202	1	10.50274	2	2	3	2	2	3	3	2	3
198	ChG250202	0	10.46872	1	1	2	1	1	1	3	1	3
199	ChB131100	1	11.75274	2	1	1	1	2	2	2	2	2
200	ChB240402	1	10.31027	1	2	1	1	1	1	2	1	2
201	ChG220701	0	11.06301	1	1	2	1	1	1	2	1	1
202	ChB200501	1	11.24064	2	1	1	1	1	2	2	1	2
203	ChB120401	1	11.34429	3	3	4	4	4	3	4	3	4
204	ChB060902	1	9.938584	1	1	2	1	1	1	2	1	2
205	ChG050503	0	9.280137	2	3	3	4	1	1	4	4	4
206	ChG130203	0	9.50274	1	1	1	1	1	2	1	1	2
207	ChG140303	0	9.422146	1	1	1	1	1	1	2	2	2
208	ChB201202	1	9.672146	1	1	1	2	1	1	3	1	3

209	ChB091202	1	9.702283	1	1	2	1	1	2	3	2	3
210	ChG250402	0	10.32945	1	2	1	2	1	3	1	3	1
211	ChB090902	1	9.952283	1	1	2	1	1	2	2	4	2
212	ChG191202	0	9.674886	1	1	1	1	1	1	1	1	1
213	ChB111202	1	9.696804	2	1	3	3	2	3	3	3	3
214	ChG180700	0	12.09429	1	1	1	1	1	1	2	1	2
215	ChB040800	1	12.05479	1	1	1	2	1	2	2	2	2
216	LaB030902	1	9.952283	1	1	2	1	2	2	1	1	1
217	LaB290503	1	9.221461	4	1	2	4	3	3	4	4	4
218	LaG030902	0	9.952283	1	1	4	1	1	1	1	1	1
219	LaB091102	1	9.769178	3	3	3	4	4	4	4	4	3
220	LaG300703	0	9.046575	4	3	1	3	4	3	4	3	3
221	LaB110400	1	12.34977	2	1	2	2	1	1	2	2	2
222	LaG150801	0	11.00274	1	2	3	1	1	1	2	1	2
223	LaG050900	0	11.9468	1	3	1	3	3	3	4	4	3
224	LaG230801	0	10.98242	3	1	4	1	4	1	3	1	3
225	LaB281201	1	10.63539	1	1	1	2	1	4	3	2	1
226	LaB110302	1	10.43584	2	2	3	2	1	1	2	1	1
227	LaB030602	1	10.20776	1	1	1	1	1	1	1	1	1
228	LaG180502	0	10.2516	1	1	1	1	1	1	4	4	1
229	LaG030602	0	10.20776	1	1	1	1	2	1	4	4	4
230	LaG070302	0	10.4468	1	1	1	1	1	3	2	3	1
231	LaG080602	0	10.19406	2	1	2	2	1	3	2	2	2
232	LaG170901	0	10.91279	3	1	2	2	1	1	2	2	1
233	LaB110900	1	11.93037	1	1	4	1	1	1	1	1	2
234	LaB040402	1	10.37169	2	2	2	1	1	3	3	2	1
235	LaB190301	1	11.41553	1	1	1	1	1	1	3	1	3
236	LaG170101	0	11.58219	1	1	1	1	1	1	3	1	2
237	LaG040900	0	11.94954	2	1	2	1	1	1	1	1	1
238	LaB060700	1	12.11073	1	1	1	1	1	1	2	3	3

239	LaG140203	0	9.508219	4	4	4	3	2	1	2	3	4
240	LaB270502	1	10.25548	3	4	3	3	3	1	3	3	3
241	LaB011100	1	11.82123	1	1	1	1	1	1	1	1	1
242	LaG130703	0	9.140868	2	2	1	1	1	2	2	2	2
243	LaB211299	1	12.68311	1	2	1	2	2	1	4	1	2
244	WooB160403	1	9.360731	1	1	2	1	4	1	4	1	2
245	WooG270702	0	10.07671	2	2	2	1	2	2	2	1	2
246	WooG281102	0	9.7379	2	1	2	1	2	3	3	2	3
247	WooB090402	1	10.36895	1	1	1	1	1	4	2	1	2
248	WooG010501	0	11.30753	1	1	1	1	1	1	4	1	3
249	WooB180102	1	10.58881	1	1	1	1	1	1	1	1	1
250	WooG280502	0	10.23516	1	1	1	1	1	1	2	1	2
251	WooB040102	1	10.62717	3	2	2	2	3	2	2	1	2
252	WooG200900	0	11.91553	1	1	1	1	1	1	1	1	1
253	WooG180700	0	12.08881	2	2	1	1	2	2	2	2	2
254	WooB290101	1	11.56027	3	1	2	1	1	1	1	1	1
255	WooB150301	1	11.43584	1	1	2	2	1	2	2	2	2
256	WooB240799	1	13.07397	1	1	2	1	1	2	2	1	2
257	WooB310899	1	12.97146	1	1	1	1	1	1	4	1	3
258	WooB201199	1	12.74886	1	1	1	1	1	2	2	1	2
259	WooG240999	0	12.90457	1	1	1	1	1	1	1	3	1
260	WooB010300	1	12.47146	1	1	2	1	1	2	2	2	2
261	WooG291099	0	12.81027	2	3	2	4	4	4	1	4	1
262	WooG310100	0	12.55479	1	1	1	1	1	1	2	1	2
263	WooG290800	0	11.97694	1	1	1	1	2	2	2	1	1
264	WooB301199	1	12.7242	2	4	1	2	2	2	3	2	3
265	YB270701	1	11.07397	1	1	1	4	2	4	1	1	1
266	YG020800	1	12.05753	1	2	2	2	2	3	2	2	1
267	YB091200	1	11.70502	1	1	1	2	1	1	3	2	2
268	YG100602	0	10.20776	3	1	2	1	1	4	3	1	4

269	YB061100	1	11.79658	1	1	1	1	1	1	2	2	2
270	YG110403	0	9.371689	1	1	4	2	4	3	4	4	4
271	YG110102	0	10.61621	1	1	2	2	1	1	3	3	2
272	YB240902	1	9.912785	3	1	3	3	4	4	3	1	2
273	FPG170502	0	10.28562	1	1	2	1	1	1	2	3	2
274	FPG020403	0	9.410046	1	1	1	1	1	1	2	1	1
275	FPG221002	0	9.849772	1	1	1	1	1	1	3	3	4
276	FPG180402	0	10.36621	1	1	2	1	1	1	1	1	2
277	FPG280799	0	13.08493	1	1	2	1	1	2	2	1	2
278	FPG200200	0	12.52192	1	1	1	1	1	2	2	1	2
279	FPB170502	1	10.28562	1	1	1	1	1	1	4	1	2
280	FPB290402	1	10.33607	2	1	2	2	2	2	2	2	2
281	FPB080401	1	11.39361	1	1	1	1	1	1	2	1	2
282	FPB040899	1	13.06575	1	1	1	1	1	1	1	1	2
283	FPB020902	1	9.9879	2	1	2	2	1	1	3	2	3
284	FPB170800	1	12.03014	1	1	1	1	1	1	2	3	2
285	FPB050900	1	11.97968	3	3	3	3	3	2	3	3	3
286	FPG301001	0	10.84977	2	2	2	1	2	2	2	2	2
287	FPB050203	1	9.584932	1	1	1	1	4	4	4	1	4
288	FPG071102	0	9.829452	1	1	1	1	1	1	2	1	1
289	FPG220900	0	11.95502	2	2	2	3	3	2	3	2	3
290	FPB030503	1	9.347032	3	3	3	1	3	2	2	3	1
291	RB161202	1	9.702283	3	3	2	2	1	1	3	3	3
292	RG211201	0	10.68858	1	1	1	1	1	1	2	1	2
293	RG240702	0	10.09703	2	2	3	2	2	1	3	3	2
294	RG111001	0	10.88265	3	1	1	1	1	4	2	1	1
295	RB041002	1	9.901826	3	2	3	2	2	2	3	3	3
296	RB260101	1	11.59155	2	2	2	2	1	4	4	4	3
297	RB210100	1	12.60525	3	3	3	3	3	4	4	4	4
298	RB110102	1	10.63265	2	2	4	3	3	3	3	4	4

299	RG050500	0	12.36073	1	1	3	1	1	1	3	1	1
300	RB040901	1	11.02466	2	1	1	1	1	1	2	1	1
301	CotB291002	1	9.855251	2	2	1	2	2	4	3	4	4
302	CotG300103	0	9.602511	2	1	3	1	1	1	2	2	2
303	CotG201102	0	9.796575	4	2	4	1	1	1	4	3	2
304	CotG191002	0	9.882648	2	1	1	1	1	1	1	1	1
305	CotG170603	0	9.226941	1	1	1	2	1	1	2	3	1
307	CotG010702	0	10.18858	1	1	1	1	1	4	4	1	4
308	CotG011102	0	9.847032	3	2	2	2	3	3	3	3	3
309	CotG121102	0	9.818493	1	1	1	1	1	1	2	1	2
310	CotG010503	0	9.355251	1	1	2	1	4	4	4	4	4
311	CotB090103	1	9.660046	4	1	1	1	1	1	4	4	4
312	CotB120503	1	9.323973	4	1	1	3	3	3	4	1	4
313	CotB081102	1	9.829452	1	1	1	3	2	2	3	1	2
314	CotB190102	1	10.63265	1	1	2	1	1	1	1	1	2
315	CotG070601	0	11.25274	1	1	1	1	1	2	3	2	3
316	CotG090701	0	11.16005	1	1	1	1	1	1	2	1	1
317	CotG260602	0	10.20228	3	1	3	2	3	2	3	3	3
318	CotG100602	0	10.24886	2	1	1	1	1	1	1	2	2
319	CotG300602	0	10.19406	2	1	1	1	1	1	2	1	2
320	CotG041202	0	9.760959	1	1	3	1	2	1	4	4	3
321	CotG130603	0	9.25274	2	1	2	1	2	1	1	2	2
322	CotG051102	0	9.852511	3	3	2	4	3	3	1	2	1
323	CotG310303	0	9.496119	2	2	1	2	2	3	3	2	3
324	DHB200401	1	11.39635	1	2	2	1	1	2	2	1	3
325	DHG150999	0	12.9879	1	1	1	1	1	1	3	1	3
326	DHB301000	1	11.86347	1	1	1	1	1	1	2	2	2
327	DHG100201	0	11.58493	3	3	3	2	2	2	3	2	2
328	DHG121000	0	11.91279	2	3	4	3	2	3	4	4	3
329	DHB290103	1	9.61621	1	1	2	3	3	2	3	4	1

330	DHB120902	1	9.996119	3	1	4	4	1	4	4	4	4
331	DHG010403	0	9.446804	2	1	3	2	2	4	3	2	3
332	DHG061202	0	9.763699	1	1	2	1	3	4	2	1	1
333	DHG260503	0	9.296575	1	1	1	3	1	4	3	4	3
334	B170400	1	12.43858	1	1	1	1	2	2	2	2	2
335	B280802	1	10.03836	1	1	1	1	2	3	2	2	1
336	DHG110402	0	10.42489	1	1	1	1	1	1	4	1	3
337	DHB040901	1	11.02192	2	1	3	2	1	1	4	2	3
338	DHB171001	1	10.90457	1	1	1	1	1	1	2	2	2
339	PG070602	0	10.27466	2	2	2	2	2	2	3	2	3
340	PG210102	0	10.64909	2	2	2	2	2	2	2	2	2
341	PG141102	0	9.834932	1	1	2	3	3	4	3	1	3
342	PB110603	1	9.263699	1	1	1	3	3	3	3	4	2
343	PB281202	1	9.713242	1	1	2	2	2	1	1	1	2
344	PG171000	0	11.91005	2	2	2	2	2	3	3	2	2
345	PG010302	0	10.54384	2	3	3	4	3	4	2	3	3
346	PB190902	1	9.9879	4	2	3	4	3	4	3	1	3
347	PB090403	1	9.435845	1	2	1	1	1	1	1	1	3
348	PB030103	1	9.696804	1	1	2	1	1	1	1	2	1
349	PG040203	0	9.610731	2	2	3	2	2	3	2	2	3
350	PB100202	1	10.61073	3	1	1	1	2	1	3	2	2
351	PB190801	1	11.08607	2	1	1	1	1	2	2	2	2
352	PB010200	1	12.63539	4	1	2	1	2	3	1	1	1
353	PG020203	0	9.632648	1	2	3	1	3	3	3	2	2
354	BB171101	1	10.83493	4	1	4	4	4	4	4	4	4
355	BG140701	0	11.18311	2	1	2	2	1	1	1	3	2
356	BB290402	1	10.39087	1	1	1	1	1	1	4	3	3
357	BB110501	1	11.35799	1	1	1	1	1	2	2	2	2
358	BB040100	1	12.70228	1	1	3	1	1	1	2	1	2
359	BG300902	0	9.965982	1	1	1	3	3	3	3	3	2

360	BB111201	1	10.76918	3	1	3	1	1	1	3	2	3
361	MB070803	1	9.121689	1	1	1	1	1	2	1	1	1
362	MG260703	0	9.154566	1	1	1	1	1	1	2	2	1
363	MB190803	1	9.088813	1	1	1	1	1	1	4	1	3
364	MB270903	1	9.98516	1	1	2	1	1	2	2	4	2
365	MG120803	0	9.107991	2	2	2	1	2	2	3	4	4
366	MB090702	1	10.20776	1	2	2	2	3	2	4	1	4
367	MG100602	0	10.28562	1	1	1	1	1	4	4	1	4
368	MB090403	1	9.455023	1	1	1	1	1	1	3	3	3
369	MB280403	1	9.404566	1	1	1	1	1	1	1	1	1
370	MB180902	1	10.00822	4	1	1	1	2	1	2	3	2
371	MB080802	1	10.11895	1	1	1	1	1	1	1	1	1
372	MB051202	1	9.796575	1	1	1	1	1	1	3	1	2
373	MG160603	0	9.269178	2	1	3	3	2	3	2	2	2
374	MG130901	0	11.02192	1	1	1	2	1	4	1	2	2
375	MG280103	0	9.649087	1	1	1	1	1	1	3	1	3
376	MG050602	0	10.29932	1	1	2	1	1	2	3	1	3
377	MG200801	0	11.08607	1	1	1	1	1	1	2	3	2
378	MB080201	1	11.61895	1	1	1	1	1	1	3	1	3
379	MG010700	0	12.22694	1	1	1	1	1	1	3	2	2
380	MG110200	0	12.61073	1	1	1	4	2	1	3	1	3
381	MB030700	1	12.22146	2	1	2	1	2	2	1	2	2
382	MG150301	0	11.52466	1	1	1	1	2	1	1	1	1
383	MG290501	0	11.31849	1	1	1	1	1	1	2	2	1
384	MG190601	0	11.26096	1	1	1	1	1	1	1	1	1
385	MG171100	0	11.84429	1	1	3	2	2	3	1	1	1
386	MB060900	1	12.0411	1	1	1	1	1	1	1	2	1
387	MG050601	0	11.29932	1	1	1	1	1	1	1	2	1
388	MB260999	0	12.9879	2	1	1	1	1	1	4	1	3
389	MB051000	1	11.96324	1	2	1	1	1	1	2	1	2

390	MB070602	1	10.29384	1	1	2	1	1	1	1	1	1
391	MG041001	0	10.97968	1	1	1	1	1	1	2	1	3
392	MB031101	1	10.88265	3	2	2	1	2	2	3	1	3
393	MB300401	1	11.39909	1	1	2	1	1	2	4	1	4
394	MG290701	0	11.14635	1	1	2	1	1	1	3	4	4
395	MB070801	1	11.12169	1	1	1	2	1	3	2	1	2
396	MG080302	0	10.54384	1	1	1	1	1	1	2	2	1
397	MG040202	0	10.62991	1	1	1	1	1	4	1	1	2
398	MB280603	1	9.251598	1	1	1	1	1	1	1	1	2
399	MB021102	1	9.899087	1	2	2	1	2	2	3	2	3
400	MB060502	1	10.39635	1	1	1	1	1	4	2	2	2
401	MG111201	0	10.79384	3	3	3	1	2	3	1	1	2
402	MB240502	1	10.34703	1	1	1	1	1	1	3	1	1
403	MB111200	1	11.79384	2	1	1	1	1	1	2	1	3
404	MB160700	1	12.19954	3	2	2	2	2	3	3	3	3
405	MG190402	0	10.44132	3	2	3	2	2	3	3	4	3
406	MB180602	1	10.2637	2	1	1	1	1	1	2	1	1
407	WLG030701	0	11.23242	1	1	1	1	1	1	4	1	4
408	WLG171099	0	12.93858	3	3	3	2	3	3	3	1	3
409	WLG040899	0	12.99886	2	1	3	1	4	4	2	1	1
410	WLB230401	1	11.42489	1	1	1	1	1	1	3	1	3
411	WLG041099	0	12.9742	1	2	1	2	2	2	3	2	3
412	WLB310101	1	11.64909	1	1	3	1	1	1	3	2	3
413	WLB070601	1	11.30205	2	1	2	1	1	3	4	1	2
414	WLG060402	0	10.47146	2	1	2	1	1	1	1	2	2
415	WLG230402	0	10.42489	2	1	1	1	1	1	1	1	2
416	WLG060602	0	10.30479	2	3	1	2	4	1	3	2	3
417	WLG251201	0	10.74886	3	3	2	3	4	2	3	4	3
418	WLB170502	1	10.36073	2	3	3	1	2	2	2	3	1
419	WLG301201	0	10.73516	1	1	1	1	1	1	1	1	2

420	WLB271101	1	10.82671	1	1	1	1	1	1	2	1	2
421	WLB191102	1	9.847032	1	1	1	3	1	2	2	1	2
422	SB100500	1	12.37991	1	3	1	2	3	3	1	1	1
423	SB090102	1	10.7105	2	1	2	2	2	2	2	1	3
424	SG080301	0	11.55479	1	2	1	2	2	2	2	1	2
425	SB040100	1	12.7242	2	2	3	1	1	1	2	2	2
426	SG020500	0	12.40183	1	1	1	4	4	4	3	1	1
427	SB100700	1	12.21324	3	1	2	4	4	4	4	4	4
428	SB260899	1	12.99886	4	1	4	1	1	1	1	1	4
429	SB030602	1	10.31575	1	1	1	1	1	2	3	1	3
430	SG160403	0	9.446804	1	1	1	2	1	1	2	1	2
431	SB160301	1	11.0274	1	1	1	1	1	1	4	1	4

PP	StudyID	Gender	ChronAge	Id1	Id2	Id3	Intr1	Intr2	Intr3
1	NG030799	0	12.85525	3	3	3	3	3	3
2	NG221100	0	11.59977	3	3	3	4	3	4
3	NB120900	1	11.63265	3	1	3	4	3	4
4	NG300900	0	11.58493	4	2	3	3	3	3
5	NB090202	1	10.2242	3	3	4	4	4	3
6	NG150302	0	10.12443	4	2	3	2	2	3
7	NG050402	0	10.06849	4	3	4	4	4	3
8	NB010701	1	10.83219	4	3	4	4	4	3
9	NG051201	0	10.40457	4	4	2	2	4	4
10	NG181101	0	10.61073	3	4	3	4	4	1
11	NG100302	0	10.17215	4	4	4	4	4	4
12	NB190701	1	10.81027	4	4	4	4	4	4
13	NG211201	0	10.37169	4	3	3	2	2	2
14	NG150902	0	9.651826	4	4	4	4	4	4
15	NG030802	0	9.75274	4	3	4	4	4	4

17	NG010100	0	12.34155	4	3	4	4	4	4
18	NG250800	0	11.70776	3	3	3	4	3	4
19	NG110900	0	11.64635	4	4	4	4	3	4
20	NG090800	0	11.75274	3	2	2	4	3	4
21	NB151000	1	11.57123	3	3	4	2	2	2
22	NB261299	1	12.37443	4	3	4	4	4	4
23	CB310500	1	11.95502	4	4	4	4	4	4
24	CG070600	0	11.93584	4	4	4	4	4	4
25	CB260500	1	11.9742	2	3	3	3	2	3
26	CB200100	1	12.31575	4	3	4	4	4	4
27	CG100500	0	12.01096	4	2	4	4	4	4
28	CB240101	1	11.30479	4	4	4	4	3	4
29	CG090601	0	10.93037	4	3	4	4	4	4
30	CB210800	1	11.72968	3	3	4	4	3	4
31	CB140502	1	11.0016	3	3	4	4	4	3
32	CB191101	1	10.48516	3	3	3	4	4	4
33	CG240102	0	10.30479	3	3	4	4	3	4
34	CG190601	0	10.90731	3	2	2	3	3	4
35	CG290502	0	9.960502	3	3	4	4	4	4
36	CG041201	0	10.44406	4	3	2	4	3	3
37	CG070801	0	10.76918	4	4	4	4	4	4
38	CG031201	0	10.4468	4	3	4	3	4	3
39	CG180802	0	9.7379	4	4	4	4	4	4
40	CG140802	0	9.755479	4	3	3	4	4	4
41	CB160203	1	9.243379	4	4	4	4	4	4
42	CG010603	0	9.952283	4	4	4	3	4	4
43	CG270800	0	11.71324	4	3	3	3	3	4
44	CG270802	0	9.713242	4	3	3	2	4	3
45	CB030902	1	9.694064	4	3	4	4	4	4
46	CB090502	1	10.0137	4	4	4	4	1	4

47	CB140102	1	10.33219	4	4	4	4	4	4
48	CB041000	1	11.61073	4	4	4	4	4	3
49	CG120301	0	11.17763	4	3	4	3	4	1
50	CB090600	1	11.93584	3	4	4	4	4	4
51	CB280100	1	12.29932	4	4	4	4	3	4
52	HG260700	0	11.82397	3	3	4	4	4	3
53	HB100203	1	9.302055	3	3	3	3	3	4
54	HG151001	0	10.60251	4	3	3	4	3	4
55	HG121101	0	10.53562	3	3	4	3	3	4
56	HB150501	1	11.01918	4	4	4	3	4	4
57	HB300502	1	9.9879	4	4	4	3	4	4
58	HB090902	1	9.721461	3	4	3	4	4	3
59	HB021202	1	9.493379	4	4	3	4	3	4
60	HG200503	0	9.005479	4	4	4	4	4	4
61	HB130302	1	10.20502	2	3	3	3	4	4
62	HG130603	0	9.941324	4	4	4	4	4	4
63	HB280203	1	9.23242	3	4	4	4	4	4
64	HB040403	1	9.151826	4	4	4	4	4	4
65	HB121200	1	11.44406	3	4	4	4	3	4
66	HB171200	1	11.43037	4	4	4	4	4	4
67	HG230201	0	11.25274	3	2	3	3	3	4
68	HB140203	1	9.269178	4	4	4	3	3	4
69	HB190203	1	9.255479	4	4	4	4	4	4
70	HG260203	0	9.258219	4	3	4	3	4	3
71	CoB0810021	1	9.12	3	3	3	3	3	3
72	C0G020503	0	9.154566	3	3	3	3	3	3
73	CoG080202	0	10.38813	4	3	4	4	4	4
74	CoG230403	0	9.082192	4	4	3	4	4	4
75	CoB161101	1	10.51918	3	3	2	3	3	3
76	CoB201101	1	10.50822	4	3	4	4	4	4

77	CoB081002	1	9.624429	4	4	4	4	4	4
78	CoG150802	0	9.771918	3	4	3	4	4	4
79	CoB091202	1	9.455023	3	3	3	3	3	4
80	CoB050902	1	9.713242	3	2	4	4	3	3
81	CoB250701	1	10.82945	4	4	4	4	4	4
82	CoG060302	0	10.21872	3	3	3	4	3	4
83	CoB161100	1	11.51918	4	1	4	4	4	4
84	CoG230902	0	9.669406	4	4	3	4	4	4
85	CoB120401	1	11.11621	4	3	3	3	4	3
86	CoG060202	0	10.39361	3	3	3	4	3	4
87	GG210401	0	11.10251	4	3	3	4	4	3
88	GB230701	1	10.84977	3	4	4	4	4	4
89	GG160401	0	11.11621	4	2	4	3	4	4
90	GB240801	1	10.7637	3	3	3	3	3	3
91	GG080201	0	11.30479	3	2	3	3	3	3
92	GB180301	1	11.24612	3	3	3	3	3	3
93	GB231100	1	11.51644	3	3	4	4	2	4
94	GB200700	1	11.85799	4	2	4	4	4	4
95	GB011000	1	11.70228	2	4	1	4	3	4
96	HPB090802	1	9.965982	4	1	4	4	3	4
97	HPG200701	0	11.01918	4	2	3	4	4	4
98	HPG101201	0	10.62991	4	3	4	3	4	4
99	HPB070900	1	11.88539	4	3	4	4	4	4
100	HPG210503	0	9.094292	4	4	3	3	4	4
101	HPG280702	0	9.910046	4	3	3	4	4	4
102	HPB270303	1	9.251598	3	4	4	4	4	4
103	HPB091202	1	9.546575	4	4	4	4	4	4
104	HPG130303	0	9.288356	3	3	3	3	4	4
105	HPB250102	1	10.41826	4	4	4	4	4	4
106	HPG260501	0	11.08219	3	2	3	3	3	3

107	HPB250500	1	12.08493	4	4	3	4	4	4
108	HPB110302	1	10.29384	4	4	4	4	4	4
109	HPG270201	0	11.32671	3	3	3	3	3	3
110	HPB280200	1	12.32397	4	4	4	4	4	4
111	HPG100900	0	11.7911	3	2	3	4	3	3
112	HPB111002	1	9.838813	4	3	3	4	4	4
113	HPG050303	0	9.310274	4	3	4	3	4	4
114	LG050702	0	9.996119	4	4	4	4	4	4
115	LG031002	0	9.748858	3	3	3	4	4	4
116	LG281002	0	9.680365	4	1	4	4	4	4
117	LB290802	1	9.844292	2	4	3	2	3	2
118	LG090900	0	11.81575	4	2	4	4	4	3
119	LG211099	0	12.69954	4	4	4	4	4	4
120	LG070700	0	11.99064	4	3	3	3	4	4
121	LB230999	1	12.7774	3	3	4	4	3	4
122	LB250201	1	11.35525	4	3	4	3	4	4
123	LG160400	0	12.21598	4	4	3	4	3	4
124	LG101100	0	11.64635	3	1	3	4	3	4
125	LB190602	1	10.03836	3	4	3	3	3	4
126	LB210402	1	10.20502	4	1	4	4	4	4
127	LG180502	0	10.18858	4	3	4	4	4	4
128	LG230201	0	11.41826	3	3	3	3	3	3
129	RB170501	1	11.12991	4	4	4	4	4	4
130	RG051101	0	10.66279	4	4	4	4	4	4
131	RB010801	1	10.92489	4	3	4	4	4	4
132	RG090302	0	10.32397	4	3	4	4	4	4
133	RB210602	1	10.03562	3	3	3	2	3	3
134	RG300102	0	10.42763	3	4	4	4	2	3
135	CB140701	1	10.9742	4	4	4	4	4	4
136	RG140202	0	10.38813	4	4	4	4	4	4

137	RB291201	1	10.51644	4	4	3	4	4	4
138	RB150701	1	10.97146	3	2	2	3	3	2
139	RG180702	0	9.963242	4	2	3	4	3	3
140	RG290103	0	9.430365	4	3	4	4	4	4
141	RG310303	0	9.263699	3	4	4	4	3	3
142	RB250802	1	9.857991	3	3	3	3	3	4
143	RB170603	1	9.046575	4	4	4	4	4	4
144	RB150303	1	9.307534	4	3	3	4	4	4
145	RB190201	1	11.37443	2	3	3	2	2	2
146	RG160503	0	9.132648	4	4	4	4	4	4
147	RG300702	0	9.930365	3	3	4	4	3	4
148	RG260201	0	11.35525	3	2	3	4	3	3
149	RB240102	1	10.44406	3	4	3	3	3	4
150	RG250102	0	10.44132	4	3	3	3	3	3
151	RG030801	0	10.91941	4	3	3	4	3	4
152	RB021101	1	10.66941	4	4	4	4	4	4
153	RB160201	1	11.38265	3	3	3	3	4	4
154	RB230900	1	11.78014	3	3	4	3	3	4
155	RB280200	1	12.34977	3	3	3	4	3	3
156	RG101000	0	11.73242	4	4	4	4	4	4
157	RG280301	0	11.27192	4	3	3	3	4	3
158	RG160501	0	11.13265	4	3	4	4	4	4
159	RB240401	1	11.20228	4	1	4	4	4	4
160	RB190702	1	9.963242	4	4	2	3	3	3
161	RG140300	0	12.31027	4	4	4	4	4	4
162	RB121202	1	9.565753	4	4	4	4	4	4
163	RG130201	0	11.39361	4	4	3	4	4	4
164	RB290900	1	11.76644	4	4	4	4	4	4
165	RG031000	0	11.75548	4	2	4	4	3	4
166	RB180700	1	11.96598	4	2	4	4	4	4

167	RG071100	0	11.71598	3	3	3	3	3	3
168	RG220503	0	9.183105	3	4	4	4	3	3
169	RB060902	1	9.829452	4	4	3	4	4	4
170	CurG280403	0	9.296575	4	4	4	4	4	4
171	CurG081002	0	9.796575	4	3	4	4	4	4
172	CurB210303	1	9.349772	3	3	3	4	3	4
173	CurG131002	0	9.782877	3	3	3	3	3	4
174	CurG120603	0	9.11621	4	3	3	4	4	4
175	CurG160600	0	12.10525	3	4	3	3	3	4
176	CurB231101	1	10.66941	3	4	4	4	3	4
177	CurB200303	1	9.352511	3	3	3	3	3	3
178	WG180503	0	9.224201	4	4	4	4	4	4
179	WB140103	1	9.563014	3	3	3	4	4	4
180	WG181003	0	9.802055	4	3	4	4	3	4
181	WG301102	0	9.683105	4	3	4	4	4	4
182	WB290402	1	10.27466	4	4	4	4	4	4
183	WB150902	1	9.890868	4	4	4	4	4	4
184	WG040801	0	11.00548	4	4	4	4	4	4
185	WG270603	0	9.107991	4	3	4	3	4	4
186	WB280700	1	12.03562	4	4	4	4	4	4
187	WG230201	0	11.46324	3	2	3	3	3	2
188	WG210301	0	11.39361	4	3	4	3	3	4
189	WG281200	0	11.61895	4	3	4	4	4	3
190	WB110401	1	11.33607	4	4	4	3	4	3
191	WB150800	1	11.9879	4	3	3	3	4	3
192	WG261002	0	9.791096	4	4	4	4	4	4
193	WB291200	1	11.61621	4	1	2	4	4	4
194	WG220401	1	11.31849	4	4	4	4	4	3
195	WG210601	1	11.14909	4	3	3	3	4	4
196	WG231100	1	11.72694	3	2	3	3	3	2

197	WG140202	1	10.50274	3	3	3	3	3	3
198	ChG250202	0	10.46872	4	4	4	4	4	4
199	ChB131100	1	11.75274	3	3	3	3	3	3
200	ChB240402	1	10.31027	3	2	3	3	3	3
201	ChG220701	0	11.06301	3	1	1	3	4	3
202	ChB200501	1	11.24064	4	2	4	4	3	4
203	ChB120401	1	11.34429	3	3	4	3	4	3
204	ChB060902	1	9.938584	4	3	4	3	4	4
205	ChG050503	0	9.280137	4	4	4	4	3	4
206	ChG130203	0	9.50274	3	3	3	3	3	4
207	ChG140303	0	9.422146	4	1	3	3	4	2
208	ChB201202	1	9.672146	2	3	3	4	4	4
209	ChB091202	1	9.702283	4	4	4	4	3	4
210	ChG250402	0	10.32945	3	3	3	4	3	3
211	ChB090902	1	9.952283	4	3	4	4	3	4
212	ChG191202	0	9.674886	3	1	1	4	3	4
213	ChB111202	1	9.696804	4	4	3	3	4	3
214	ChG180700	0	12.09429	3	2	3	3	3	3
215	ChB040800	1	12.05479	3	1	2	4	3	4
216	LaB030902	1	9.952283	4	2	4	4	4	4
217	LaB290503	1	9.221461	4	4	4	4	4	4
218	LaG030902	0	9.952283	4	2	4	4	4	3
219	LaB091102	1	9.769178	4	4	4	3	3	3
220	LaG300703	0	9.046575	4	4	4	4	4	4
221	LaB110400	1	12.34977	3	3	4	2	3	3
222	LaG150801	0	11.00274	4	4	4	4	4	4
223	LaG050900	0	11.9468	3	4	3	4	3	4
224	LaG230801	0	10.98242	4	3	3	3	4	4
225	LaB281201	1	10.63539	3	4	4	4	4	4
226	LaB110302	1	10.43584	3	3	4	3	3	4

227	LaB030602	1	10.20776	4	3	4	4	4	4
228	LaG180502	0	10.2516	4	4	3	4	4	4
229	LaG030602	0	10.20776	3	3	3	4	4	4
230	LaG070302	0	10.4468	4	3	3	2	3	4
231	LaG080602	0	10.19406	4	4	4	4	3	4
232	LaG170901	0	10.91279	4	4	4	4	4	4
233	LaB110900	1	11.93037	4	3	3	4	4	4
234	LaB040402	1	10.37169	3	3	3	3	3	1
235	LaB190301	1	11.41553	4	4	4	4	4	3
236	LaG170101	0	11.58219	4	2	4	4	4	4
237	LaG040900	0	11.94954	4	3	3	4	4	4
238	LaB060700	1	12.11073	4	3	4	3	4	4
239	LaG140203	0	9.508219	4	4	4	4	4	4
240	LaB270502	1	10.25548	4	4	4	3	4	4
241	LaB011100	1	11.82123	4	1	4	4	4	4
242	LaG130703	0	9.140868	3	3	4	3	4	3
243	LaB211299	1	12.68311	3	3	4	3	3	3
244	WooB160403	1	9.360731	4	4	4	4	4	4
245	WooG270702	0	10.07671	3	2	3	4	3	4
246	WooG281102	0	9.7379	4	4	3	4	4	4
247	WooB090402	1	10.36895	3	3	3	4	4	4
248	WooG010501	0	11.30753	4	4	4	4	4	4
249	WooB180102	1	10.58881	4	4	4	4	4	4
250	WooG280502	0	10.23516	3	3	3	4	3	4
251	WooB040102	1	10.62717	3	3	4	4	3	4
252	WooG200900	0	11.91553	4	3	3	4	4	4
253	WooG180700	0	12.08881	3	4	4	4	4	4
254	WooB290101	1	11.56027	4	2	4	4	4	4
255	WooB150301	1	11.43584	3	4	4	4	3	4
256	WooB240799	1	13.07397	4	3	4	4	4	4

257	WooB310899	1	12.97146	4	4	4	4	4	4
258	WooB201199	1	12.74886	4	3	4	4	4	4
259	WooG240999	0	12.90457	3	4	3	3	3	4
260	WooB010300	1	12.47146	3	3	3	3	3	3
261	WooG291099	0	12.81027	2	2	2	2	2	2
262	WooG310100	0	12.55479	3	3	3	4	3	4
263	WooG290800	0	11.97694	3	2	4	4	4	4
264	WooB301199	1	12.7242	3	4	3	3	4	3
265	YB270701	1	11.07397	4	4	4	4	4	4
266	YG020800	1	12.05753	3	3	4	2	3	2
267	YB091200	1	11.70502	4	3	4	4	4	4
268	YG100602	0	10.20776	4	4	4	4	4	4
269	YB061100	1	11.79658	3	3	3	3	2	2
270	YG110403	0	9.371689	4	4	4	4	4	4
271	YG110102	0	10.61621	3	3	3	3	3	3
272	YB240902	1	9.912785	3	3	4	3	3	3
273	FPG170502	0	10.28562	4	3	4	4	4	4
274	FPG020403	0	9.410046	4	3	3	4	4	4
275	FPG221002	0	9.849772	4	4	4	3	4	4
276	FPG180402	0	10.36621	4	2	4	3	3	4
277	FPG280799	0	13.08493	3	3	3	4	3	4
278	FPG200200	0	12.52192	3	3	3	3	3	3
279	FPB170502	1	10.28562	4	3	4	4	3	4
280	FPB290402	1	10.33607	3	2	3	4	3	3
281	FPB080401	1	11.39361	3	4	3	2	3	2
282	FPB040899	1	13.06575	3	3	3	3	3	3
283	FPB020902	1	9.9879	4	1	3	3	3	3
284	FPB170800	1	12.03014	4	4	4	4	4	4
285	FPB050900	1	11.97968	2	2	3	2	2	2
286	FPG301001	0	10.84977	4	2	3	4	4	3

287	FPB050203	1	9.584932	4	4	4	4	4	4
288	FPG071102	0	9.829452	4	2	3	4	3	4
289	FPG220900	0	11.95502	3	3	3	3	3	3
290	FPB030503	1	9.347032	3	1	4	2	4	4
291	RB161202	1	9.702283	2	3	3	2	3	3
292	RG211201	0	10.68858	4	4	4	4	4	4
293	RG240702	0	10.09703	4	3	3	3	3	3
294	RG111001	0	10.88265	4	4	4	3	3	4
295	RB041002	1	9.901826	3	3	3	3	3	3
296	RB260101	1	11.59155	4	4	4	4	4	4
297	RB210100	1	12.60525	4	3	4	4	4	4
298	RB110102	1	10.63265	4	4	4	4	4	4
299	RG050500	0	12.36073	4	3	4	4	4	4
300	RB040901	1	11.02466	4	3	3	4	4	4
301	CotB291002	1	9.855251	4	4	4	4	4	2
302	CotG300103	0	9.602511	4	3	4	4	3	4
303	CotG201102	0	9.796575	4	4	4	4	4	4
304	CotG191002	0	9.882648	3	4	4	3	4	4
305	CotG170603	0	9.226941	3	1	3	4	2	4
307	CotG010702	0	10.18858	4	4	4	4	4	4
308	CotG011102	0	9.847032	4	4	3	4	4	4
309	CotG121102	0	9.818493	3	3	3	4	3	4
310	CotG010503	0	9.355251	4	4	4	4	4	4
311	CotB090103	1	9.660046	4	4	4	4	4	4
312	CotB120503	1	9.323973	4	4	4	4	4	4
313	CotB081102	1	9.829452	4	3	4	4	3	4
314	CotB190102	1	10.63265	3	4	4	4	3	4
315	CotG070601	0	11.25274	4	4	4	4	4	4
316	CotG090701	0	11.16005	3	3	3	4	3	4
317	CotG260602	0	10.20228	4	4	4	4	4	4

318	CotG100602	0	10.24886	3	4	3	3	2	3
319	CotG300602	0	10.19406	3	3	2	3	4	3
320	CotG041202	0	9.760959	4	4	4	4	4	4
321	CotG130603	0	9.25274	4	2	3	4	4	4
322	CotG051102	0	9.852511	1	2	3	1	1	1
323	CotG310303	0	9.496119	3	3	2	3	3	3
324	DHB200401	1	11.39635	4	4	4	3	4	4
325	DHG150999	0	12.9879	4	3	3	3	4	4
326	DHB301000	1	11.86347	3	4	3	4	4	4
327	DHG100201	0	11.58493	3	2	3	4	3	4
328	DHG121000	0	11.91279	4	4	4	4	4	4
329	DHB290103	1	9.61621	4	3	3	3	4	4
330	DHB120902	1	9.996119	4	4	4	4	4	4
331	DHG010403	0	9.446804	4	4	4	4	4	4
332	DHG061202	0	9.763699	4	4	3	4	4	4
333	DHG260503	0	9.296575	4	4	4	4	4	3
334	B170400	1	12.43858	4	3	3	4	4	4
335	B280802	1	10.03836	3	3	3	3	3	3
336	DHG110402	0	10.42489	4	4	4	4	4	4
337	DHB040901	1	11.02192	4	3	4	4	4	4
338	DHB171001	1	10.90457	3	4	4	3	4	3
339	PG070602	0	10.27466	4	3	4	4	4	4
340	PG210102	0	10.64909	3	3	3	3	3	3
341	PG141102	0	9.834932	4	4	4	4	4	4
342	PB110603	1	9.263699	4	4	4	4	4	3
343	PB281202	1	9.713242	3	3	3	4	4	4
344	PG171000	0	11.91005	3	3	3	3	3	3
345	PG010302	0	10.54384	3	3	4	2	2	2
346	PB190902	1	9.9879	3	3	4	3	3	2
347	PB090403	1	9.435845	4	4	4	4	4	4

348	PB030103	1	9.696804	4	2	4	4	4	4
349	PG040203	0	9.610731	3	3	3	3	3	3
350	PB100202	1	10.61073	3	4	3	4	3	4
351	PB190801	1	11.08607	4	4	4	4	4	4
352	PB010200	1	12.63539	3	2	3	3	3	3
353	PG020203	0	9.632648	4	4	4	4	4	4
354	BB171101	1	10.83493	4	4	4	4	4	4
355	BG140701	0	11.18311	3	2	4	4	4	4
356	BB290402	1	10.39087	4	4	4	4	3	4
357	BB110501	1	11.35799	4	3	3	3	3	3
358	BB040100	1	12.70228	4	2	4	4	4	4
359	BG300902	0	9.965982	4	3	3	4	4	4
360	BB111201	1	10.76918	3	3	3	4	3	4
361	MB070803	1	9.121689	4	4	4	4	4	4
362	MG260703	0	9.154566	4	3	4	4	4	4
363	MB190803	1	9.088813	4	4	4	4	4	4
364	MB270903	1	9.98516	4	3	3	4	4	4
365	MG120803	0	9.107991	2	3	4	2	2	3
366	MB090702	1	10.20776	4	3	4	4	4	4
367	MG100602	0	10.28562	4	4	4	4	4	4
368	MB090403	1	9.455023	3	3	4	4	3	4
369	MB280403	1	9.404566	4	3	4	4	4	4
370	MB180902	1	10.00822	4	4	4	4	4	4
371	MB080802	1	10.11895	4	4	4	4	4	4
372	MB051202	1	9.796575	3	4	3	3	3	3
373	MG160603	0	9.269178	4	3	3	4	3	4
374	MG130901	0	11.02192	4	4	4	4	3	4
375	MG280103	0	9.649087	4	4	3	4	4	4
376	MG050602	0	10.29932	4	3	4	4	4	4
377	MG200801	0	11.08607	4	3	3	4	4	4

378	MB080201	1	11.61895	4	4	4	4	4	4
379	MG010700	0	12.22694	4	4	3	4	4	4
380	MG110200	0	12.61073	3	3	3	4	3	4
381	MB030700	1	12.22146	4	3	3	4	4	4
382	MG150301	0	11.52466	4	3	3	4	4	4
383	MG290501	0	11.31849	4	3	3	4	3	4
384	MG190601	0	11.26096	4	3	4	4	3	4
385	MG171100	0	11.84429	3	3	4	3	3	4
386	MB060900	1	12.0411	4	4	3	4	4	4
387	MG050601	0	11.29932	4	3	3	4	4	4
388	MB260999	0	12.9879	4	4	4	4	4	4
389	MB051000	1	11.96324	3	2	3	4	4	4
390	MB070602	1	10.29384	4	2	3	3	3	4
391	MG041001	0	10.97968	3	2	3	4	3	4
392	MB031101	1	10.88265	3	3	3	4	3	3
393	MB300401	1	11.39909	4	4	4	4	4	4
394	MG290701	0	11.14635	4	4	4	4	4	4
395	MB070801	1	11.12169	3	2	3	3	3	3
396	MG080302	0	10.54384	4	4	2	4	4	4
397	MG040202	0	10.62991	4	4	4	4	4	4
398	MB280603	1	9.251598	4	4	4	4	4	4
399	MB021102	1	9.899087	3	3	3	3	3	3
400	MB060502	1	10.39635	4	3	3	4	4	4
401	MG111201	0	10.79384	4	2	3	2	3	2
402	MB240502	1	10.34703	4	4	4	4	4	4
403	MB111200	1	11.79384	3	3	3	4	4	4
404	MB160700	1	12.19954	4	3	4	4	4	4
405	MG190402	0	10.44132	4	3	4	3	4	3
406	MB180602	1	10.2637	3	4	4	3	3	3
407	WLG030701	0	11.23242	4	4	4	4	4	4

408	WLG171099	0	12.93858	3	3	3	3	3	3
409	WLG040899	0	12.99886	2	2	1	4	1	3
410	WLB230401	1	11.42489	4	3	4	4	4	4
411	WLG041099	0	12.9742	3	3	3	3	3	3
412	WLB310101	1	11.64909	4	3	4	4	4	4
413	WLB070601	1	11.30205	3	3	4	4	3	4
414	WLG060402	0	10.47146	4	2	4	4	4	4
415	WLG230402	0	10.42489	3	2	3	4	3	4
416	WLG060602	0	10.30479	4	4	4	3	4	2
417	WLG251201	0	10.74886	3	3	3	2	2	1
418	WLB170502	1	10.36073	3	4	4	3	3	3
419	WLG301201	0	10.73516	4	2	4	4	4	4
420	WLB271101	1	10.82671	2	2	3	4	2	4
421	WLB191102	1	9.847032	3	4	3	3	4	4
422	SB100500	1	12.37991	2	1	2	2	2	2
423	SB090102	1	10.7105	3	3	3	4	3	4
424	SG080301	0	11.55479	4	4	4	4	4	4
425	SB040100	1	12.7242	4	4	4	4	4	4
426	SG020500	0	12.40183	4	4	4	4	4	4
427	SB100700	1	12.21324	4	3	4	4	4	3
428	SB260899	1	12.99886	4	4	4	4	4	4
429	SB030602	1	10.31575	4	3	3	4	3	4
430	SG160403	0	9.446804	3	2	3	3	3	3
431	SB160301	1	11.0274	4	4	4	4	4	4

APPENDIX Q: STRUCTURAL PATHS MODEL

	Path strength
Mastery goals-> Need for competence	.36***
Mastery goals -> Need for autonomy	.18***
Mastery goals -> Need for relatedness	.25***
Mastery goals -> Intrinsic motivation	.33***
Mastery goals -> Identified regulation	.52***
Mastery goals -> Introjected regulation	-.01
Mastery goals -> External regulation	-.07
Mastery goals -> Amotivation	-.12*
Performance goals -> Need for competence	.13*
Performance goals -> Need for autonomy	.20***
Performance goals -> Need for relatedness	.09
Performance goals -> Intrinsic motivation	.01
Performance goals -> Identified regulation	.07
Performance goals -> Introjected regulation	.53***
Performance goals -> External regulation	.22***
Performance goals -> Amotivation	.27***
Avoidance goals -> Need for competence	.04
Avoidance goals -> Need for autonomy	-.00
Avoidance goals -> Need for relatedness	.05
Avoidance goals -> Intrinsic motivation	-.00
Avoidance goals -> Identified regulation	-.05
Avoidance goals -> Introjected regulation	.04
Avoidance goals -> External regulation	.05
Avoidance goals -> Amotivation	-.01
Need for competence -> Intrinsic motivation	.25***
Need for competence -> Identified regulation	.12*
Need for competence -> Introjected regulation	-.09
Need for competence -> External regulation	-.14*
Need for competence -> Amotivation	-.18**
Need for autonomy -> Intrinsic motivation	.11**
Need for autonomy -> Identified regulation	.02
Need for autonomy -> Introjected regulation	-.05
Need for autonomy -> External regulation	-.03
Need for autonomy -> Amotivation	.01

Need for relatedness -> Intrinsic motivation	.19***
Need for relatedness -> Identified regulation	.13**
Need for relatedness -> Introjected regulation	.04
Need for relatedness -> External regulation	-.12
Need for relatedness -> Amotivation	-.11

* $p < .05$; ** $p < .01$; *** $p < .001$

APPENDIX R: MABC-2 AGE BAND TWO

Item	Age band 2 (7-10 years)	Task	Practice	Formal Trial
MD1	Placing pegs preferred hand & non-preferred hand	Picking up the pegs one at the time, and placing them on the pegboard	One practice attempt with each hand, placing 6 pegs	Two attempts with each hand
MD2	Threading lace	Threading a lace in a straight line through the holes	One practice attempt, completing four holes	Two attempts
MD3	Drawing trail	Drawing a continuous line following the trail, not crossing the lines	One practice attempt	Two attempts
A&C1	Catching with two hands	Throwing ball at wall from behind marked line at 2 meter distance, and catching it with two hands without trapping it against the body, and without a bounce	Five throws	Ten attempts
A&C2	Throwing beanbag onto mat	Throwing a beanbag in a target on the ground at 1.8 meter distance, attempting to land it in the circle on the target	Five throws	Ten attempts
Bal1	One-board balance best leg & other leg	Balancing on one foot on balance board (timed)	One practice attempt up to 15 seconds	A maximum of two attempts, up to 30 seconds

Bal2	Walking Heel-to-Toe Forwards	Starting with leading foot on a line, walking forwards on the line, placing the heel of one foot against the toe of the other foot	One practice attempt of 5 steps maximum	A maximum of two attempts, up to 15 steps or to the end of the 4.5 long meter line
Bal3	Hopping on mats best leg & other leg	Starting with on one foot in first yellow mat. Hopping in five continuous hops on one foot, landing on each mat, ending in a balanced position on the final mat	One practice attempt	A maximum of two attempts for each leg

Note. MD = Manual Dexterity, A&C = Aiming and Catching, Bal = Balance

APPENDIX S: MABC-2 AGE BAND THREE

Item	Age band 3 (11-16 years)	Task	Practice	Formal Trial
MD1	Turning pegs preferred hand & non-preferred hand	Inverting all pegs in the pegboard, one at a time, as quickly as possible (timed)	One practice attempt with each hand, turning 6 pegs	Two attempts with each hand
MD2	Triangle with nuts and bolts	Constructing a triangle with the provided items, without resting them on the table (timed)	One practice attempt	Two attempts
MD3	Drawing trail	Drawing a continuous line following the trail, not crossing the lines	One practice attempt	Two attempts
A&C1	Catching with one hand best hand & other hand	Throwing ball at wall from behind marked line at 2 meter distance, and catching it with one hand	Five throws with each hand	Ten attempts with each hand
A&C2	Throwing at a wall target	Throwing a tennis ball at a wall from 2.5 meter distance, attempting to hit the target. Does not have to be caught afterwards	Five throws	Ten attempts
Bal1	Two-board balance	Balancing toe-to-heel on keels of a balance board (timed)	One practice attempt up to 15 seconds	A maximum of two attempts, up to 30 seconds
Bal2	Walking Toe-to-Heel Backwards	Starting with leading foot on a line, walking backwards on the line, placing the toe of one foot against the heel of the other foot	One practice attempt of 5 steps maximum	A maximum of two attempts, up to 15 steps or to the end of the 4.5 long meter line

Bal3	Zig-Zag hopping best leg & other leg	Starting with on one foot in first yellow mat. Zig-Zag-ing in five continuous hops on one foot, landing on each mat, ending in a balanced position on the final mat	One practice attempt	A maximum of two attempts for each leg

Note. MD = Manual Dexterity, A&C = Aiming and Catching, Bal = Balance

APPENDIX T: PUBLISHED PAPERS

Pannekoek, L., Piek, J. P., Kane, R., & Hagger, M. S. (In press). The children's perceived locus of causality scale for physical education. *Journal of Teaching in Physical Education*

Pannekoek, L., Piek, J. P., & Hagger, M. S. (2013). Motivation for physical activity in children: A moving matter in need of study. *Human Movement Science, 32,* 1097-1115. doi:10.1016/j.humov.2013.08.004

Pannekoek, L., Rigoli, D., Piek, J. P., Barrett, N. C., & Schoemaker, M. M. (2012). The revised DCDQ: Is it a suitable screening measure for motor difficulties in adolescents? *Adapted Physical Activity Quarterly, 29,* 81-97