

**Faculty of Health Sciences  
School of Psychology**

**Coaches' Interpersonal Behaviours and Athletes' Basic  
Psychological Need States: Refined Conceptualisation and  
Measurement Based on a Self-Determination Theory  
Perspective**

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**This thesis is presented for the Degree of  
Doctor of Philosophy  
of  
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## **Declaration**

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Numbers HRE2016-0221 and HRE2017-0053-04.

Signature:

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## **Dedication**

In the loving memory of my grandfather, Nimbhalal Bhavsar.

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### **List of Conference Presentations Arising from this Thesis**

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### **Abstract**

In this thesis, I investigated factors influencing the quality of athletes' motivation, and outcomes of well-being and ill-being in sport through the lens of Self-Determination Theory (SDT, Deci & Ryan, 1985; Ryan & Deci, 2017). In Chapter 1, I reviewed SDT research in the sport domain that has demonstrated coach interpersonal behaviours to be comprised of behaviours that support and thwart athletes' basic psychological needs. Numerous self-report measures have been developed to assess athletes' perceptions of their coaches' need supportive and need thwarting behaviours. However, items of such measures do not distinguish between coaching behaviours that thwart and those that are indifferent to athletes' psychological needs. I addressed this limitation of the extant research in Chapter 2 of this thesis. Specifically, I proposed that the current conceptualisation and measurement of coach interpersonal behaviours be extended to include need indifferent behaviours as the third category of interpersonal behaviours, alongside need supportive and need thwarting behaviours. The distinction between need thwarting and need indifference could be important, as need thwarting may be a better predictor of need frustration and more deleterious outcomes of maladaptive functioning (e.g., exhaustion), compared to need indifference. Need indifference, on the other hand, might not relate to need frustration as robustly, and may better predict less deleterious outcomes (e.g., irrelevant thoughts).

Athletes' perceptions of their coaches' interpersonal behaviours influence athletes' experiences of basic psychological need satisfaction and frustration. Research guided by SDT has repeatedly demonstrated the importance of focusing on both the bright (satisfaction) and dark (frustration) sides of the need states. Recently, researchers have also argued for the utility of assessing a third state, that of need unfulfilment. However, the satisfaction, frustration, and unfulfilment of all three needs has not been examined concurrently. In this thesis, I proposed that the current conceptualisation and measurement of basic psychological need states be extended to include need unfulfilment as the third need state, besides those of need satisfaction and need frustration, a possibility that is addressed in Chapter 3. Need unfulfilment warrants distinction from need satisfaction and frustration, as each need state may be associated with distinct contextual factors (need satisfaction with need support, need frustration with need thwarting, and need unfulfilment with need indifference). In

addition, each need state may also result in distinct outcomes (need satisfaction leading to adaptive functioning, need frustration to maladaptive functioning, and need unfulfilment to suboptimal functioning)

Expanding the current conceptualisation of interpersonal behaviours to accommodate need supportive, thwarting, and indifferent behaviours, and that of need states to include need satisfaction, frustration, and unfulfilment, would enable future examinations of three different pathways of motivation. The first pathway extending from perceived need support to need satisfaction and adaptive outcomes, the second from perceived need thwarting to need frustration and maladaptive outcomes, and the third and new trajectory from perceived need indifference to need unfulfilment and outcomes of suboptimal functioning.

In Chapter 2, which includes three studies, I provided a conceptual rationale for the consideration of need indifference as a third overarching category of interpersonal behaviours, in addition to those of need support and need thwarting. In Study 1, I described the development of the 54-item pool for the new measure of athletes' perceptions of their coaches supportive, thwarting, and indifferent behaviours, the Tripartite Measure of Interpersonal Behaviours-Coach (TMIB-C). I also provided evidence for face and content validity by testing the items with athletes and an expert panel, respectively. In Study 2, I tested various theoretically plausible and competing solutions in order to ascertain the best depiction of the factor structure of the new measure, and found the data to be supportive of a 22-item, three-factor solution comprising of the supportive, thwarting, and indifferent behaviours. I subsequently provided evidence for the cross-validation of this model was in Study 3, along with some evidence for nomological networks surrounding the subscales of the TMIB-C with somewhat mixed results. As expected, need indifference was a weaker predictor of autonomy and competence need frustration as compared to need thwarting, and the sole significant predictor of irrelevant thoughts. Unexpectedly, however, need indifference predicted exhaustion as well as need thwarting, and predicted relatedness frustration better than need thwarting. Overall, the TMIB-C was found to be a promising and parsimonious measure of athletes' perceptions of coaches need supportive, thwarting, and indifferent interpersonal behaviours, although further testing is needed to test the evidence for its predictive validity.

In Chapter 3, which comprises of two studies, I outlined an effort to develop and provide initial validity evidence for the scores of a new multidimensional and

sport-specific measure of athlete need satisfaction, frustration, and unfulfilment, the Psychological Need States in Sport Scale (PNSS-S). In Study 1, I described the development of the initial pool of 46 items, and tested evidence for the factor structure of athletes' responses to these items. Results of the factor analyses for the various theoretically plausible configurations of the three need states were found to be indicative of problems involving a) non-convergence of models, b) poor model fit indices for models that converged, and c) implausible parameter estimates. Upon testing the need unfulfilment items on their own, I found that the issue was not with these items, but that there was no support for modelling need unfulfilment as a third need state alongside satisfaction and frustration. In line with previous findings, however, I found the data to be supportive of a six-factor solution of the satisfaction and frustration of autonomy, competence, and relatedness needs. I subsequently found this six-factor model with a revised 29-item pool was to fit the data well, when tested with an independent sample of athletes in Study 2. In terms of evidence for nomological networks, I found the six need states to be significantly predicted by contextual autonomy, competence, and relatedness support and thwarting as expected. Autonomy and competence need satisfaction were significantly associated with engagement; and competence and relatedness need satisfaction were significantly associated with positive affect. Additionally, autonomy and competence need frustration were significantly associated with exhaustion. All three need frustration states predicted negative affect significantly. In sum, the PNSS-S represents the first sport-specific measure of six distinct, yet, correlated states of the satisfaction and frustration of autonomy, competence, and relatedness needs.

In Chapter 4, I discussed implications of the key findings of Chapter 2 and Chapter 3 in light of a) initial evidence for consideration of a third motivational pathway from need indifference, b) the lack of support for the tripartite model of need states, c) the dimensionality of interpersonal behaviours and need states, and d) coach training programs. Given the focus scale development and advances in measurement, I also proposed some methodological considerations. I drew this final chapter to an end by acknowledging limitations of my studies, and suggested recommendations for future research to enable a more nuanced understanding of the key constructs examined in my thesis.

## Chapter 1: Literature Review

Motivation is a recurring topic in the literature examining athlete performance in sport (Gould, Dieffenbach, & Moffett, 2002; Ntoumanis & Mallett, 2014), and has been considered as a contributing factor for numerous desirable outcomes such as moral behaviours (Hodge & Lonsdale, 2011), well-being (Gagné, Ryan, & Bargmann, 2003) and persistence (Jõesaar, Hein, & Hagger, 2011). One theoretical framework that is widely applied to the study of motivation is that of Self-Determination Theory (SDT; Deci & Ryan 1985; Ryan & Deci, 2017). Within the SDT framework, individuals' motivation is theorised to reflect the influence of the social context and their own experiential need states (e.g., Reeve & Jang, 2006). In the sport literature, the socio-contextual influence has been studied in terms of coaches' need supportive and thwarting interpersonal behaviours and need states in terms of need satisfaction and frustration. In this thesis, I aim to elaborate and refine these conceptualisations further and propose new self-report measures of coach interpersonal behaviours and psychological need states in sport. The development of, and initial validity evidence for the scores derived from, the two new measures is expected to enable a more comprehensive view of athletes' perceptions of the manner in which their coaches interact with them, their experiential need states, and the nature of these motivational constructs for understanding outcomes of adaptive, maladaptive, and diminished functioning.

### The Nature of Motivation in Sport

The word motivation stems from the Latin term *movere*, which denotes “to move” (Kleinginna & Kleinginna, 1981; Ryan & Deci, 2017) and can be interpreted as the forces that bring about the initiation and sustenance of goal-directed behaviour (Lindsley, 1957). The sport domain is characterised by elements of learning, persistence, and performance, which make it an ideal context to examine processes that energise and drive athletic behaviour. It is, thus, no surprise that motivation has been a ubiquitous topic in sport psychology research (Biddle, 1999; Weiss & Gill, 2005).

In terms of its association with adaptive functioning, motivation was advocated to be a unitary construct by several theorists (e.g., Bandura, 1989; Eccles & Wigfield, 2002). In other words, motivation was considered to range from low to high. The assumption here was “the more, the better”; athletes with higher levels of

motivation were expected to be better accomplished. Over time, however, researchers established that optimal outcomes do not consequentially follow higher levels of motivation if the quality, or the kind of motivation underpinning the behaviour, is impoverished (Ryan & Deci, 2000; Vansteenkiste, Lens, & Deci, 2006).

SDT is one theoretical framework in which the quality, or the orientation or type of motivation is specified to have important implications for desirable outcomes (in contrast to the quantity of motivation). SDT has emerged as one of the most popular theories applied to the study of motivation in sport (Lindahl, Stenling, Lindwall, & Colliander, 2015). It is comprised of six mini-theories: cognitive evaluation theory, organismic integration theory, causality orientations theory, basic psychological needs theory, goal contents theory, and relationships motivation theory. Although the six mini-theories are distinct in terms of theoretical aspects, they are consolidated by the basic psychological needs for autonomy, competence and relatedness, and an organismic-dialectic meta-theory (Standage, Curran, & Rouse, 2019). According to the organismic view, curiosity, psychological growth, exploration, and socialness are regarded as innate human characteristics. Although considered innate, these inclinations do not function automatically; they are dependent on the social context which either supports or inhibits these characteristics. The dialectic in SDT is thus denoted by the interaction of proactive individuals with social environments that either facilitate or undermine their inherent inclinations.

In this literature review, I begin by describing cognitive evaluation theory and organismic integration theory, in which the differentiation of motivation is emphasised. These descriptions are accompanied by empirical evidence from the sport domain. Next, I describe the basic psychological needs theory, which is the basis of this investigation. I introduce the three basic psychological needs and the role that the socio-contextual environment plays in influencing individuals' experiences of need satisfaction and frustration, which are subsequently elaborated in detail. This chapter focuses on the description of only three of the six mini-theories as basic psychological need states (which are influenced by the socio-contextual environment) are theorised to influence key outcomes of cognition, affect, and behaviour directly, as well as indirectly, through the different motivational regulations (Ryan & Deci, 2007). For a comprehensive review of each mini-theory, see Ryan and Deci (2017).



Within SDT, humans are viewed as proactive organisms, with natural inclinations to grow and develop (Deci & Ryan, 2000). Participation in activities out of curiosity, interest, or for the sake of a challenge represent a few manifestations of these active propensities (Vansteenkiste, Niemiec, & Soenens, 2010). Carrying out an activity “for its own sake”, because it is perceived as enjoyable or interesting, instead of doing it for some separable outcomes (such as external rewards or constraints) is the exemplar of such active human tendencies, and is termed as *intrinsic motivation* (Deci & Ryan, 2015). Intrinsic motivation is the focus of the first mini-theory of SDT, cognitive evaluation theory.

It is important to note that sport might not always be perceived as continually enjoyable or even interesting. This might ring particularly true for competitive and high-performance settings (Mallett & Hanrahan, 2004). Consider the case of Australian professional tennis player, Nick Kyrgios, who was rather outspoken about his feelings towards the game. British online newspaper, the Independent, reported Kyrgios stating:

*“I don’t really like the sport of tennis that much. I don’t love it. It was crazy when I was 14. I was all for basketball and I made the decision to play tennis. I got pushed by my parents and to this day I can still say I don’t love the sport.”*

Competitive athletes might spend long hours engaging in repetitive drills and training hard for various reasons. One athlete might do it for the recognition or prize money involved in winning, another out of the pressure to win or the fear of failure, and yet another because he or she considers it to be a way of life. Athletes are also likely to endorse all of these motives to varying degrees. These reasons are instances of sport engagement for instrumental outcomes. Engagement in activities with the intention of achieving an outcome that is separable from the activity itself is encapsulated by the term *extrinsic motivation* (Ryan & Deci, 2000).

Early theorists viewed extrinsic motivation as the opposite of intrinsic motivation (e.g., deCharms, 1968; Harter, 1981). Intrinsic motivation was theorised to be completely self-directed, whereas extrinsic motivation was thought to be externally directed, and no middle ground was considered. However, in SDT, the two are not considered as adversative. It is argued that extrinsic motivation for a behaviour does not involve a complete lack of personal causation, instead, there is a varying degree of relative autonomy underlying the behaviour in question (Ryan & Deci, 2000; Ryan & Connell, 1989). A continuum of autonomy is considered to

underlie different forms of extrinsic motivations (Ryan & Connell, 1989), which range from being highly controlled by external factors to being rather self-determined. This implies that athletes may feel autonomous even if they are participating in sport for some separable outcomes. The multi-faceted structure of extrinsic motivation is captured in organismic integration theory, the second mini-theory of SDT. Ranging from least to most autonomous, the different types of extrinsic motivations are termed external regulation, introjected regulation, identified regulation, and integrated regulation (see Figure 1.1).

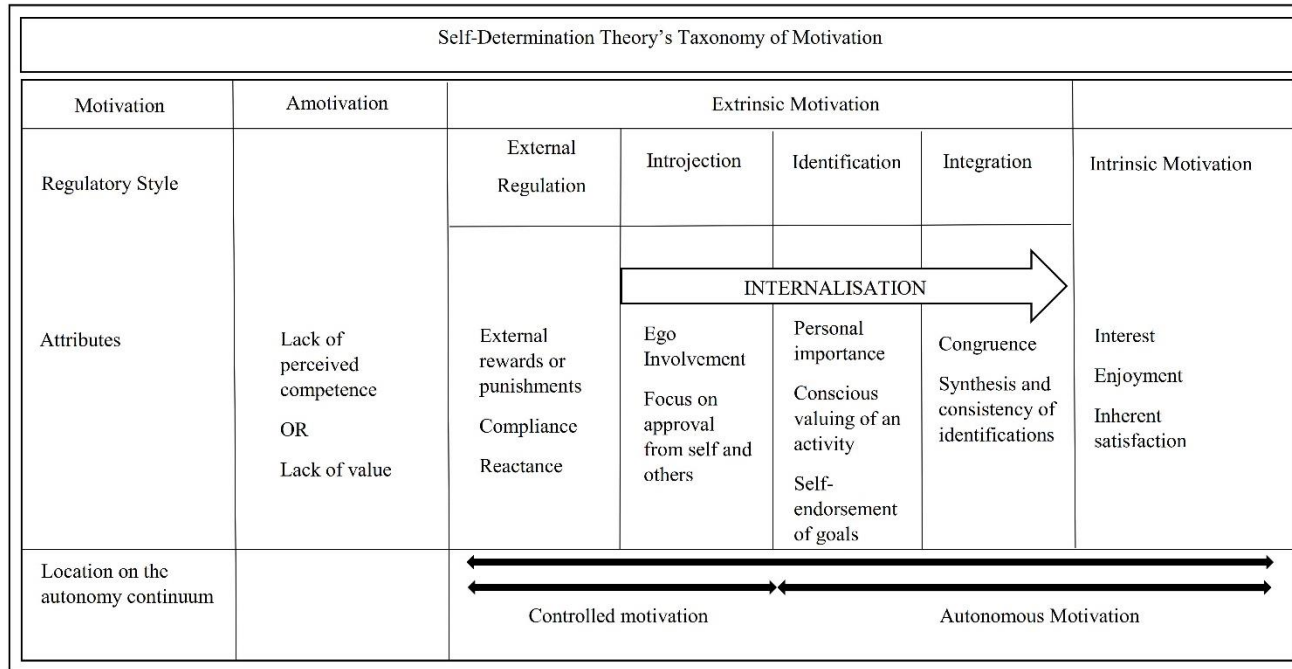


Figure 1.1. The Self-Determination Theory continuum. Adapted with permission from the Center for Self-Determination Theory (2018)

The least autonomous (most controlled) type of extrinsic motivation is termed external regulation. Externally regulated behaviours reflect control by external contingencies, such as obtaining rewards or evading punishment (Deci & Ryan, 2000). Athletes who participate in sport only to win prize money are externally regulated. Introjected regulation lies next to external regulation. Although more self-determined as compared to external regulation, this regulation is still a controlled regulation as it reflects motives brought about by internal contingencies, such as self-esteem, and guilt or shame avoidance (Deci & Ryan, 2000). For example, athletes who experience shame when their performance is not up to par, and pride when it is, are acting out of introjected regulation. Next is identified regulation, a fairly autonomous type of motivation. This describes behaviour regulation that is underpinned by valuing the activity and its benefits (Deci & Ryan, 2000). Individuals demonstrating identified regulation identify with the activity as being instrumental to their goals (Ryan & Deci, 2000). Athletes who choose to train because they value the benefits of training (e.g., improved technique which results in better performance) act out of identified regulation. The most self-determined form of extrinsic motivation is integrated regulation, which is evident when a behaviour is well internalised and has been assimilated into one's core values and structure of the self (Deci & Ryan, 2000). The difference between integrated regulation and intrinsic motivation is that integrated regulation is still extrinsically motivated as the behaviour is performed in order to achieve separable outcomes that are personally important, and not because of enjoyment or interest. For example, athletes who partake in training and live an athletic lifestyle might perceive these behaviours to be a part of their identity, and aligned with their true selves and values, and yet they might not necessarily enjoy training.

All of the types of extrinsic motivation mentioned above involve some amount of intentional or motivated regulation for the behaviour, irrespective of how controlled the regulations (reasons) are. Amotivation, however, represents a state in which an individual is entirely lacking in any intention to engage in an activity, potentially due to feeling incompetent at the activity, not expecting the behaviour to lead to an anticipated outcome, or finding no value in it (Ryan & Deci, 2000). The four types of extrinsic regulations are positioned between amotivation on the one side, and intrinsic motivation on the other. In the SDT taxonomy, the key distinction between types of motivation is between autonomous and controlled motivation (Deci

& Ryan, 2008; Ryan & Deci, 2017). Autonomous motivation is underpinned by engagement in behaviours out of volition, inherent satisfactions and personal value, and comprises of identified and integrated regulations, and intrinsic motivation; controlled motivation, in contrast, is emphasised by contingencies (either external or internal), and consists of introjected and external regulations (Deci & Ryan, 2012).

Researchers have examined the associations between motivational regulations and a variety of outcomes in sport (see Ntoumanis, 2012, for a review). Overall, more autonomous regulation styles (relative to controlled motivation styles) have been found to be associated with more adaptive outcomes such as enhanced learning, self-esteem, and health (Mageau & Vallerand, 2003), sportspersonship (Ntoumanis & Standage, 2009), objective sport performance (Gillet, Berjot, & Gobance, 2009; Gillet, Vallerand, Amoura, & Baldes, 2010), adherence to injury prevention behaviours (Chan & Hagger, 2012), and well-being (Gagné et al., 2003). Contrastingly, controlled regulation styles have been associated with maladaptive outcomes, including burnout (Jowett, Hill, Hall, & Curran, 2013), dropout (García-Calvo, Cervello, Jimenez, Iglesias, & Moreno Murcia, 2010), and anti-social behaviours (Hodge & Lonsdale, 2011).

Individuals are considered to possess an inclination to incorporate extrinsic motives into their self-concept (Reeve, 2012). The process of taking values or beliefs that may be externally imposed and converting them into one's own is termed as internalisation (Ryan, Connell, & Deci, 1985). Motivation for a behaviour might initially be externally regulated (e.g., a basketball player only engages in agility training because the coach won't let him play the next match if he doesn't), but through the process of internalisation the behaviour might be performed later on for identified or integrated regulations reasons (e.g., the player chooses to engage in agility training as he understands that it is beneficial in improving footwork, which makes him faster). Internalisation is not an automatic process; nutrients in the form of need satisfaction are necessary in order for it to function well (Deci & Ryan, 2000).

Basic psychological needs theory (Ryan & Deci, 2000), the fourth mini-theory in the SDT framework centres on the critical role of a) the fulfilment of three basic psychological needs for optimal functioning, and b) the context in supporting and thwarting these needs. Needs, in SDT, are characterised as “innate psychological nutrients that are essential for ongoing psychological growth, integrity, and well-

being” (Deci & Ryan, 2000, p. 229). According to this mini-theory, psychological needs are identified as the mediating links between supportive or thwarting socio-contextual factors and cognitive, behavioural and affective outcomes (Vansteenkiste et al., 2010). A consideration of the basic psychological needs also aids the understanding of why some individuals experience certain contexts to be sources of positive experiences, whereas for others, such contexts may lead to negative personal experiences (Standage, et al., 2019).

The first of the three basic psychological needs specified in basic psychological needs theory is the need for autonomy, or the need to feel that one self-regulates actions and experiences such that one’s behaviours and authentic interests and values are in congruence (Ryan & Deci, 2017). The second need is that of competence, or the need to feel effective and capable of task mastery (Ryan & Deci, 2017). The third need is that of relatedness, or the need to feel accepted by others, care for them, and to feel appreciated and valued by them (Deci & Ryan, 2014). The three needs are theorised to be indispensable for all individuals regardless of their stage of development or cultural background. Ryan and Deci (2017) state that need satisfaction is crucial for growth and optimal functioning, such that perceiving a lack of need satisfaction is expected to lead to compromised growth and wellness. Furthermore, perceptions of need frustration (having one’s needs actively blocked in a given context, Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011) are expected to result in heightened ill-being as well as maladaptive outcomes. The three basic psychological needs are conceptualised as being independently valuable, yet also highly correlated when the experiences of need satisfaction and frustration are examined in a collective manner in any given context (Ryan & Deci, 2017). The satisfaction or frustration of one need is expected to aid the satisfaction or frustration of the others.

### **The Role of the Social Context**

According to the organismic dialectical view of SDT, the social climate surrounding individuals serves as an antecedent to their experiences of need satisfaction and frustration in that context (Deci & Ryan, 2002, Vallerand, 1997). The coach plays a central part in influencing athlete experiences in, and sometimes outside of sport (Mageau & Vallerand, 2003; Vallerand & Losier, 1999). In 2011, when Neil Craig, senior coach of the Adelaide Crows in the Australian Football

League (AFL) announced his resignation, former professional Australian football player and then captain of the Adelaide Crows, Nathan van Berlo, stressed the influence Craig had had on him:

*“He was like a father figure to me. I came over as a teenager from Perth, Western Australia, never been to South Australia before in my life, which was very daunting in itself and I spent all of a sudden, literally every day, for the next five or six years with this one figure that was my boss, literally, and told me what to do, and I'd look up to him and he'd tell me what I was doing well and what I wasn't, so he became one of the biggest influences of my life over that period of time”* (PickStar, 2017).

Coaches shape their athletes' experiences through the manner in which they communicate with them in training, competitions, and other interactions. The most common ways in which coaches interact with their athletes forms their usual *interpersonal style* (Matosic, Ntoumanis, & Quested, 2016). The terms *styles* and *behaviours* have been used interchangeably in the SDT literature (e.g., Bartholomew, Ntoumanis, Thøgersen-Ntoumani, 2010; Pulido, Sánchez-Oliva, Leo, Sánchez-Cano, & García-Calvo, 2018; Rocchi, Pelletier, Cheung, Baxter, & Beaudry, 2017; Rocchi, Pelletier, & Desmarais, 2017). In this thesis, I use the term interpersonal behaviours. Researchers typically differentiate between adaptive or *need supportive*, and maladaptive, or *need thwarting* interpersonal behaviours (e.g., Hancox, Quested, Thøgersen-Ntoumani, & Ntoumanis, 2015; Ntoumanis, Quested, Reeve, & Cheon, 2017), and often further classify them according to behaviours that are need-specific (e.g., autonomy, competence, and relatedness supportive, and autonomy, competence, and relatedness thwarting). Each of these behaviours is elaborated on in the following paragraphs.

Coach interpersonal behaviours affecting athlete motivation were initially broadly termed as *autonomy supportive* and *controlling* (e.g., Ntoumanis & Mallett, 2014; Occhino, Mallett, Rynne, & Carlise, 2014; Vallerand & Losier, 1999). Autonomy support includes behaviours offered by the social agent in order to recognise and foster others' inner motivational resources, such as their values and goals (Assor, Kaplan, & Roth, 2002; Reeve 2009). Through the use of autonomy supportive behaviours, social agents can ensure that others' inner motivational resources correspond with the ongoing activity (Jang, Reeve, & Deci, 2010). Autonomy supportive behaviours have been extensively examined and thoroughly

elucidated in the sport domain (Wilson, Gregson, & Mack, 2009). A taxonomy of autonomy supportive behaviours was proposed by Mageau and Vallerand (2003), which included seven coach interpersonal behaviours. According to these researchers, autonomy support by a coach is illustrated through behaviours such as encouraging athletes to take initiatives, including them in decision making, providing choice within boundaries, giving athletes rationales for task engagement, acknowledging their perspectives, not providing controlling competence feedback, and preventing ego-involvement. Autonomy supportive behaviours, despite the label, have been posited to predict the satisfaction of the needs for competence and relatedness, alongside the need for autonomy (Ntoumanis, 2012; Ryan & Deci, 2000).

While reviewing coach autonomy supportive behaviours, Mageau and Vallerand (2003) further referred to behaviours of avoiding overt control, criticisms, and tangible rewards for task that the athletes already consider to be interesting as controlling coach behaviours. Controlling behaviours are characterised by coercion and pressure on the part of the coach, to compel athletes to behave in a particular predetermined manner (Bartholomew et al., 2010). On experiencing such behaviours, athletes come to perceive that their behaviours emanate from coach-created external pressure. Controlling coaching behaviours have been contrasted with autonomy supportive coaching behaviours in sport (e.g., Reinboth, Duda, & Ntoumanis, 2004). According to Bartholomew et al. (2010) the more noticeable controlling behaviours include offering rewards and praise that are contingent on athlete compliance with coaches' wants, denial of attention or warmth in instances of non-compliance, intimidation with the use of name-calling and insults, and threats or employing punishments, excessive monitoring and intrusion in athletes' lives outside of sport, and dismissal of athletes' perspectives. Consistent with newer lines of research (e.g., Pulido et al., 2018; Rocchi, Pelletier, & Desmarais, 2017), in this thesis, such behaviours will be referred to as autonomy thwarting behaviours.

Autonomy support and thwarting have been previously viewed as opposites, as lying on two ends of a continuum of motivating behaviours (Deci, Schwartz, Sheinman, & Ryan, 1981). In other words, it was assumed that coaches were likely to interact with their athletes in either an autonomy supportive or a thwarting manner. However, researchers have found low-to-moderate links between these two behaviours (e.g., Pelletier, Fortier, Vallerand, & Brière, 2001), suggesting that the



constructs are independent of each other, can co-occur, and coaches can adopt either behaviour to varying degrees, depending on the circumstance.

SDT-based examinations of the socio-contextual environment in sport have predominantly focused on the aspect of autonomy supportive and thwarting coach interpersonal behaviours (Ntoumanis, 2012). Athletes' perceptions of autonomy supportive coach interpersonal behaviours have been found to be associated with basic psychological need satisfaction (Coatsworth & Conroy, 2009; Rocchi, Pelletier, & Couture, 2013), intrinsic motivation (Amalgro, Saenz-Lopez, & Moreno, 2010), well-being (Amorose & Anderson-Butcher, 2007), and performance (Gillet, Vallerand, Amoura, & Baldes, 2010). In contrast, perceptions of autonomy thwarting coach interpersonal behaviours have been found to be associated with non-self-determined types of regulation (Pelletier et al., 2001), need frustration (Bartholomew et al., 2010), burnout (Balageur et al., 2012), depression, and disordered eating (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011).

The next interpersonal behaviour is that of competence support, which has also been referred to as *structure* (e.g., Curran et al., 2013; Mageau & Vallerand, Skinner, Johnson & Snyder, 2005). Structure, as described in the parenting literature, refers to the manner in which a social agent communicates clear and consistent information and expectations to others, in order to facilitate attainment of the goals and outcomes they desire (Grolnick & Ryan, 1989; Skinner et al., 2005). Outside of the parenting literature, this concept was comprehensively examined in the education domain (e.g., Jang et al., 2010; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009). Sport-specific examinations of structure were initially speculated to be scarce potentially due to an absence of domain specific psychometric instruments (Curran, Hill, & Niemiec, 2013). There has since been a growing body of research examining coach behaviours that support athletes need for competence (e.g., Pulido et al., 2018; Rocchi, Pelletier, & Desmarais, 2017). By employing competence supportive behaviours, coaches assist athletes in experiencing meaningful success and enable them to feel competent in the face of challenges (Matosic, Ntoumanis, & Quested, 2016). Coaches can support their athletes' need for competence by taking athletes' capacity or level of competence into consideration (Pulido et al., 2018), helping them to set realistic goals, providing constructive feedback which is positive and thorough (Ntoumanis & Mallett, 2014; Pulido et al., 2018; Rocchi, Pelletier, & Desmarais,

2017), acknowledging athletes' progress, and demonstrating belief in their ability to achieve their goals, and to succeed (Rocchi, Pelletier, & Desmarais, 2017).

The construct of *chaos* is posited to extend past the mere absence of structure to include behaviours that are inconsistent, disorganised, confusing, and lacking in direction (Skinner et al., 2005), and has previously been used to describe competence thwarting behaviours (e.g., Smith, Quested, Appleton, & Duda, 2016). Competence thwarting behaviours involve laying emphasis on others' failures and relaying information of their incompetence to them (Sheldon & Filak, 2008). Competence thwarting coach interpersonal behaviours include demonstrating scepticism in athletes' abilities to progress and develop in their sport, calling attention to their mistakes, and publicly delivering critical and disparaging feedback (Pulido et al., 2018; Rocchi, Pelletier, & Desmarais, 2017).

*Interpersonal involvement* (e.g., Grolnick & Ryan, 1989; Skinner & Edge, 2002), *warmth* (Skinner et al., 2005), and *social support* (Sarason, Sarason, Shearin, & Pierce, 1987) have all been used to refer to behaviours that primarily support others' need for relatedness. Relatedness support thus comprises of conveying care and liking towards others, as well as being available for others in times of need. Coaches can support their athletes' need for relatedness by empathising with, taking interest in, caring for, and valuing their athletes (Appleton, Ntoumanis, Quested, Viladrich, & Duda, 2016; Smith et al., 2015).

Being *cold*, by being aloof and inattentive towards others, or being unavailable when needed, has been discussed in relation to relatedness thwarting (e.g., Skinner et al., 2005; Rocchi, Pelletier, Cheung et al., 2017). Relatedness thwarting is characterised by *rejection*, often also referred to as *hostility*, and involves expressing active dislike towards others (Skinner et al., 2005). Coaches thwart their athletes' need for relatedness when they display negative attitudes towards athletes (Pulido et al., 2018), purposefully exclude them from activities (Rocchi, Pelletier, & Desmarais, 2017), and demonstrating aggression towards them (Standage et al., 2019).

Interpersonal behaviours of individuals in position of authority have thus been broadened to refer to need supportive and need thwarting interpersonal behaviours, both of which are made up of behaviours relevant to the needs for autonomy, competence, and relatedness. Athletes' perceptions of coaches' need supportive interpersonal behaviours have been shown to be linked to athletes' basic

psychological need satisfaction (Adie, Duda, & Ntoumanis, 2012; Pulido et al., 2018; Rocchi, Pelletier, & Desmarais, 2017), self-determined types of motivation (Amorose & Anderson-Butcher, 2007), and adaptive outcomes such as persistence (Pelletier et al., 2001), and enhanced performance (Cheon, Reeve, Lee, & Lee, 2015). Contrastingly, athlete need frustration, controlled motivation, and outcomes of maladaptive functioning such as somatic anxiety, worry, and concentration disruption have been shown to be associated with athletes' perceptions of coaches need thwarting interpersonal behaviours (Haerens et al., 2018; Pulido et al., 2018; Ramis, Torregrosa, Viladrich, & Cruz, 2017; Rocchi, Pelletier, & Desmarais, 2017).

**The case for need indifferent interpersonal behaviours.** According to Vansteenkiste and Ryan (2013), “social agents can be actively fostering of, indifferent to, or antagonistic toward the individual’s satisfaction of needs” (p. 265). That is, interpersonal behaviours of social agents are not just limited to need support and need thwarting; social agents can also be indifferent to the needs of others. Need indifference involves a lack of attention towards others’ needs and goals (Cheon et al., 2019); when employing such behaviours, social agents ignore, or ask others to “set aside” their basic psychological needs (p. 687). On perceiving the social agent to be indifferent, individuals deem the activity at hand as irrelevant to, or not associated with their psychological needs. This predisposes them to outcomes such as boredom and disinterest (Cheon et al., 2019).

In this thesis, a case is made for the expansion of current SDT-based conceptualisation and self-report assessment of interpersonal behaviours so as to include not just need supportive and thwarting behaviours, but also behaviours that are indifferent to others’ needs. Need indifferent behaviours should be regarded as separate from need thwarting behaviours as need indifference comprises of a rather neutral or passive form of interaction, whereas need thwarting involves a more robust and direct blocking of others’ basic psychological needs (Vansteenkiste & Ryan, 2013). The distinction between need thwarting and indifference can be better substantiated with an example provided by Vansteenkiste and Ryan (2013) from the parenting domain. Consider, for example, a mother who uses coercive physical force with her children. Such a behaviour is noticeable different from a mother is not being particularly attentive towards her children. The former is an example of need thwarting, and is more likely to result in maladaptive outcomes for the children as compared to the latter, which represents need indifference.

The sport domain is rife with examples of behaviours that are better suited to represent need indifference relative to need thwarting. Coaches who verbally abuse their athletes (need thwarting) would come across quite differently from coaches who do not make much effort to get to know their athletes (need indifference). Assessing need indifference separately from need thwarting would also help delineate their differential associations with key cognitive, affective, and behavioural athlete outcomes. For example, in contrast to need thwarting, which predisposes individuals to *darker* and more maladaptive outcomes such as anger and anxiety, Cheon and colleagues (2019) proposed that need indifference is likely to lead to outcomes of diminished or impoverished functioning, such as disengagement or boredom.

Researchers have previously attempted to include *neutral* behaviours in their investigations. For example, in an investigation to assess the effects of autonomy supportive training on observable teaching behaviours in physical education, Tessier, Sarrazin, and Ntoumanis (2008) observed and rated teachers' behaviours on autonomy supportive, neutral, and controlling categories. The researchers clarified that this third class of behaviours, described as questions or statements that are communicated with a tone that is "neither controlling nor autonomy-supportive" (p. 244) was employed in recognition of the complexity in distinguishing some behaviours as being autonomy supportive or controlling. Another example is the investigation by Kinnafick, Thøgersen-Ntoumain, and Duda (2016), who examined the influence of need supportive text messages on physical activity. Participants in the control group of this intervention were sent neutral messages, which conveyed information or statistics pertaining to physical activity, for example "physical activity is defined as any force exerted by skeletal muscles that results in energy expenditure above resting level".

Behaviours that entail indifference towards others have also been examined in the organisational psychology domain under the term *laissez-faire leadership*. Laissez-faire leadership is characterised as a passive form of leadership (Bass & Riggio, 2006; Skogstad, Einarsen, Torhsein, Aasland, & Hetland, 2007). Leaders exhibiting such behaviours tend to evade decision-making, offer no feedback or reinforcement, and are uninvolved with their followers (Bass & Avalio, 1990). By operating in this manner, leaders make no effort to identify and fulfil their followers' needs (Bass & Avalio, 1990). Positive correlations have been demonstrated between laissez-faire behaviours and variables such as role conflict, and conflicts with team

members, leading researchers to term these behaviours as counterproductive, and even destructive (Skogstad et al., 2007).

Over the recent years, few researchers have examined laissez-faire leadership in the sport domain. Stebbings, Taylor, and Spray (2016) examined if coaches' interpersonal behaviours acted as mediators in the transfer of well-being and ill-being in coach-athlete dyads. Laissez-faire behaviours were examined alongside the SDT-based interpersonal behaviours of autonomy support and control. Given the absence of a sport-specific measure of laissez-faire coach behaviours, the authors developed seven items based on the conceptual definition of the construct. Illustrative examples are items such as "My coach avoided making decisions in training", and "My coach did not use his/her authority when he/she needed to". Athletes respond to these items on a 7-point rating scale (1= *strongly disagree*, 7 = *strongly agree*). Stebbings et al. (2016) reported that tests of internal consistency and factor structure with an independent sample were indicative of acceptable estimates and model-data fit, and that athletes' perceptions of coaches' laissez-faire behaviours negatively predicted their perceptions of the quality of the coach-athlete relationship.

The Coach Leadership Assessment System (CLAS, Turnnidge & Côté, 2019) is an observational instrument that can be used to assess coaches' real-time leadership behaviours in the sport domain. The system is based on the full-range leadership model (Bass & Riggio, 2006), comprising laissez-faire, transactional, and transformational leadership, and can be used to assess five higher-order dimensions of transformational, transactional, neutral, laissez-faire, and toxic coaching. In the CLAS, the dimension of the coach demonstrating laissez-faire behaviours is described as consisting of "disinterest in or ambivalence towards the athletes or practice activities" (Turnnidge & Côté, 2019, p. 221). An example of such a behaviour is the coach paying no heed to athletes' requests for assistance (Turnnidge & Côté, 2019). Upon closer inspection of the above mentioned efforts to assess neutral (e.g., Kinnafick et al., 2016; Tessier et al., 2008) and laissez-faire (Stebbing et al., 2016) behaviours in sport and related domains, it becomes evident that no theoretical rationales were provided in these studies regarding what such behaviours constituted in relation to the psychological needs, nor their antecedents and consequences in relation to other SDT constructs.

In terms of assessing need indifferent behaviours from the SDT-perspective, Quedsted, Ntoumanis, Stenling, Thøgersen-Ntoumani, and Hancox (2018) recently

attempted to assess need indifference alongside need support and need thwarting. The researchers developed and provided initial validity evidence for the Need-Relevant Instructor Behaviours Scale (NIBS), an observational measure that assesses exercise instructors' interpersonal behaviours. Need indifference was conceptualised by the researchers as a socialising behaviour deficient of any need supportive or thwarting features. Examples of such behaviours include communicating in a manner that is lacking in motivational ingredients– e.g., instructing participants to “keep going” without any clarification of what that might imply. It is important to note that the NIBS is specific to the context of group exercise; such behaviours might not be sufficiently relevant to the sport context. More importantly, it is an observational measure, providing an objective assessment of the socio-contextual environment. From an SDT standpoint, it is the subjective interpretation of such environments that influences individuals' behaviours, hence, self-reports capturing perceptions of such environments are also valuable and needed in the literature. In the next section, I review existing self-report measures of interpersonal behaviours in sport, and other life domains.

**Self-report measures of interpersonal behaviours in sport and other life domains.** The measurement of interpersonal behaviours based on the SDT perspective has been approached two ways. Some researchers have taken a multidimensional route and modelled distinct dimensions for the support and thwarting of each basic psychological need (e.g., Pulido et al., 2018; Rocchi, Pelletier, & Desmarais, 2017). However, in line with the theoretical consideration that the three needs can be expected to be highly interrelated, unidimensional approaches to represent an overarching behaviour consisting of items pertaining to all three needs are also common (e.g., Need Support for Exercise Scale; Markland & Tobin, 2010; Need Support at Work Scale, Tavfelin & Stenling, 2018). In this section, I will review and discuss the potentials and the shortcomings of commonly employed measures of coach interpersonal behaviours, as well measures of interpersonal behaviours developed in other domains, but frequently adapted to sport. An overview of the commonly employed measures is presented in Table 1.1.

Table 1.1. *Commonly Utilised Self-report Measures of Interpersonal Behaviours in Sport*

Name	Authors	Items	Response categories	Context	Dimensions	Analyses
The Health Care Climate Questionnaire	Williams et al. (1996)	15	1 = <i>not true at all</i> , 5 = <i>very true</i>	Healthcare	1. Autonomy support	CFA
The Autonomy Supportive Coaching Questionnaire	Conroy & Coatsworth (2007)	9	1 = <i>not at all true</i> , 7 = <i>very true</i>	Youth sport	1. Athletes' input, 2. Praise for autonomous behaviour	CFA
Controlling Coach Behaviours Scale	Bartholomew et al. (2010)	15	1 = <i>strongly disagree</i> , 7 = <i>strongly agree</i>	Youth sport	1. Controlling use of rewards, 2. Negative conditional regard, 3. Intimidation, 4. Excessive personal control	CFA
Interpersonal Supportiveness Scale-Coach	Wilson et al. (2009)	18	1 = <i>not at all true</i> , 4 = <i>somewhat true</i> , 7 = <i>very true</i>	Sport	1. Autonomy support, 2. Structure, 3. Interpersonal involvement	CFA
Empowering and Disempowering Motivational Climate Questionnaire-Coach	Appleton et al. (2016)	31	1 = <i>strongly disagree</i> , 5 = <i>strongly agree</i>	Youth sport	1. Task-involving, 2. Autonomy-supportive, 3. Socially-supportive, 4. Ego-involving, 5. Controlling coaching	CFA, ESEM, Bifactor ESEM
Interpersonal Behaviours Questionnaire in Sport	Rocchi, Pelletier, & Desmarais, (2017)	24	1 = <i>do not agree at all</i> , 7 = <i>completely agree</i>	Sport	1. Autonomy support, 2. Autonomy thwarting, 3. Competence support, 4. Competence thwarting, 5. Relatedness support, 6. Relatedness thwarting	CFA

Coaches Interpersonal Style Questionnaire	Pulido et al. (2018)	22	1 = <i>strongly disagree</i> , 5 = <i>strongly agree</i>	Youth sport	1. Autonomy support, 2. Autonomy thwarting, 3. Competence support, 4. Competence thwarting, 5. Relatedness support, 6. Relatedness thwarting	ESEM
Situations-in-Sport Questionnaire	Delrue et al. (2019)	15	1 = <i>does not describe my coach at all</i> , 7 = <i>describes my coach extremely well</i>	Sport	1. Autonomy support, 2. Structure, 3. Control, 4. Chaos	MDS

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*Note.* CFA = confirmatory factor analysis, ESEM = exploratory structural equation modelling, MDS = multidimensional scaling.



The Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Ryan, & Deci, 1996) is one measure that is frequently adapted for use in the sport context (e.g., Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011; Reinboth, Duda, & Ntoumanis, 2004). The original questionnaire consists of 15 items that were developed to examine perceptions of the extent to which patients consider their health care providers to be autonomy supportive. A six-item short-version of the measure is also commonly used. A sample item from the questionnaire is “My physician encourages me to ask questions”. In the original study, participants reported their answers using a 5-point rating scale ranging from 1 = *not true at all* to 5 = *very true*. The scale developers employed factor analysis to provide evidence for the internal structure of the responses to the items of the measure, in which a one-factor solution was favoured. This one-factor was labelled autonomy support. Upon closer inspection, however, it becomes apparent that the items not only assess perceptions of autonomy support, but also those of competence support (e.g., “My physician conveys confidence in my ability to make changes”), and relatedness support (e.g., “I feel that my physician accepts me”).

The Autonomy Supportive Coaching Questionnaire (ASCQ; Conroy & Coatsworth, 2007) is a sport-specific measure to assess youth athletes’ perceptions of their coaches’ autonomy supportive behaviours. Responses to the nine-item measure were shown to be best represented by the dimensions of interest in athletes’ input and praise for autonomous behaviour when tested using confirmatory factor analysis (CFA). Athletes’ respond to the items using a 7-point scale ranging from 1 = *not at all true*, 7 = *very true*. Illustrative examples of items are “My coaches offer me choices about what we do in practice” and “My coaches praise me for the things I choose to do in practice”.

To assess athletes’ perceptions of their coaches’ autonomy thwarting behaviours, Bartholomew et al. (2010) developed the Controlling Coach Behaviours Scale (CCBS). The CCBS is a 15-item measure assessing the four dimensions of coaches’ controlling use of rewards, negative conditional regard, intimidation, and excessive personal control. Athletes respond to the items using a 7-point scale ranging from 1 = *strongly disagree*, 7 = *strongly agree*. The four-factor internal structure of the responses to the items of the CCBS was first tested using exploratory factor analyses (EFA), and subsequently verified using confirmatory factor analysis

(CFA). A sample item from the measure is “My coach intimidates me into doing the things he/she wants me to do”.

Wilson et al. (2009) developed the Interpersonal Supportiveness Scale-Coach (ISS-C), an 18-item measure of athletes’ perceptions of coach provided autonomy, structure, and involvement. Athletes respond to items such as “My coach provides clear feedback about my progress” using a 7-point rating scale with the anchors 1 = *not at all true*, 4 = *somewhat true*, and 7 = *very true*. The scale developers employed a three-phase CFA (e.g., Hoffman, 1995; Joreskog, 1993) to assess the internal structure of responses to items of the ISS-C. However, they reported correlations as high as .94 between the need support subscales. As a result, the researchers argued for further examinations of the independence of the supports for the three needs. Recently, Stenling, Ivarsson, Hassmen, and Lindwall (2015) re-examined the dimensionality of the responses to the items of ISS-C. In this investigation, exploratory structural equation modelling (ESEM), a more contemporary analytic method to CFA, was employed, only to confirm that the responses to the items of this measure are best represented by the general dimension of need support, instead of need specific sub-dimensions.

Developers of the above-mentioned instruments have utilised a single theory (i.e., SDT) to inform the development of their measures. Appleton, Ntoumanis, Quested, Viladrich, and Duda (2016) assessed coach-created motivational climate using a broader theoretical basis which combines SDT and Achievement Goal Theory (Nicholls, 1989). The Empowering and Disempowering Motivational Climate Questionnaire-Coach (EDMCQ-C, Appleton et al., 2016) comprises of 31 items to examines junior athletes’ perceptions of five dimensions of coach-created motivational climate; task-involvement, autonomy-support, social-support, ego-involvement, and controlling coaching. Athletes respond to items such as “My coach thought that it is important that players participate in this sport because the players really want to” (autonomy-support), and “My coach was less supportive of players when they were not training and/or playing well” (control) using a 5-point rating scale (1 = *strongly disagree*, 5 = *strongly agree*). Appleton and colleagues (2016) first employed CFA to reduce their item pool. Subsequently, a number of alternative models such as hierarchical and bifactor CFA, and ESEM, were tested. Results revealed that the ESEM models demonstrated better model-to-data fit (ranging from acceptable to excellent) as compared to the CFA models, but parameter estimates of

the ESEM models were found to be problematic. On re-testing, the bifactor ESEM model fared marginally better than the ESEM, and hierarchical ESEM models, however, parameter estimates continued to be problematic. The scale developers concluded that there was no statistical model that could accurately represent the factor structure of the EDMCQ, and termed the measure a “work in progress” (Appleton et al., 2016, p. 64).

Measures that distinguish between the support and thwarting of each of the three needs have been developed only recently. Rocchi, Pelletier, Cheung et al. (2017) developed the Interpersonal Behaviours Questionnaire, a 24 item-measure of perceptions of interpersonal behaviours in the general population, responses to which were found to be best represented by a six-factor structure of autonomy support and thwarting, competence support and thwarting, and relatedness support and thwarting, using a series of CFAs. Evidence for this six-factor internal structure was subsequently tested in the sport domain (IBQ in Sport, Rocchi, Pelletier, & Desmarais, 2017). Athletes respond to items such as “My coach points out that I will likely fail” using a 7-point format (1 = *do not agree at all*, 7 = *completely agree*). The researchers reported moderately high correlations between some of the subscales (e.g.,  $r = .74$  between competence and relatedness support, and  $r = .71$  between autonomy and relatedness support). Although the IBQ in Sport provides distinct assessments of six need specific behaviours, some of its items are conceptually more akin to need indifferent behaviours than need thwarting behaviours. For example, a closer look at the items pertaining to the relatedness thwarting subscale indicates inclusion of items that do not reflect active hostility, rejection, or conditional regard, which are key characteristics of relatedness thwarting (Standage et al., 2019; Vansteenkiste & Ryan, 2013). Instead, these items are better indicators of need indifference (e.g., “My coach is distant when we spend time together”).

The Coaches Interpersonal Style Questionnaire (CIS-Q; Pulido et al., 2018) is yet another measure of athletes’ perceptions of the six coach interpersonal behaviours. The questionnaire consists of 22-items to capture the supporting and thwarting of each of the three needs. Items begin with the stem “During practices, our coach...”, and athletes respond to items such as “Encourages strong relationships between teammates at all times” using a 5-point response format (1 = *strongly disagree*, 5 = *strongly agree*). Pulido and colleagues employed ESEM to assess the internal structure of the responses to the items of the CIS-Q, compared to the CFAs

used by Rocchi and colleagues (2017). However, similar to Rocchi, Pelletier, Cheung et al. (2017), they also reported moderately high factor correlations between the dimensions of relatedness and competence support ( $r = .78$ ), between relatedness and competence thwarting ( $r = .75$ ). One important limitation of the CIS-Q is the use of items that assess athletes' personal experience of need frustration, instead of capturing the need thwarting behaviours of coaches. Illustrative examples are items pertaining to the competence thwarting subscale (e.g., during practices, our coach "...sometimes makes me feel incompetent") and relatedness thwarting subscale (e.g., during practices, our coach "...makes me feel rejected by him/her sometimes"). Confounding of need thwarting and need indifferent behaviours is also evident in the conceptualisations and items put forth by Pulido and colleagues. For example, chaotic coaching behaviours (e.g., when coaches supply athletes with a lot of information that is lacking in structure and clear objectives, resulting in athletes failing to understand their tasks and responsibilities) are considered to be an aspect of competence thwarting.

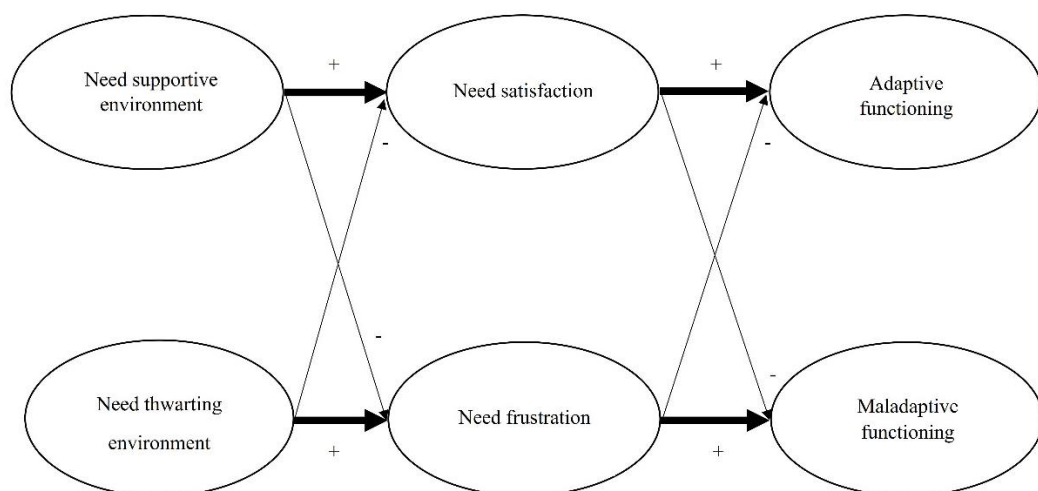
The helicopter model (Aelterman et al., 2018) represents a methodologically different approach to what has generally been witnessed in SDT-based research pertaining to coach behaviours. This model was examined in relation to coaches' interpersonal behaviours by Delrue and colleagues (2019). The researchers focused on the motivating behaviours of autonomy support and structure, and the demotivating behaviours of control and chaos. First, a vignette -based instrument, the 15-item Situations-in-Sport Questionnaire was developed using multidimensional scaling. Athletes responded to these vignettes using a 7-point response format ranging from 1 = *does not describe my coach at all* to 7 = *describes my coach extremely well*. The four coach behaviours were found to be ordered along two axes of a) need supportiveness and thwarting, and b) high and low directiveness. The four behaviours were thus grouped into four quadrants and arranged in a circular pattern. The four behaviours of autonomy support, structure, control, and chaos could each be further classified into two sub-areas (i.e., participative and attuning behaviours, guiding and clarifying behaviours, demanding and domineering behaviours, and abandoning and awaiting behaviours, respectively). With this approach, the researchers present a more advanced and interconnected view of coach interpersonal behaviours, with permutations of different behaviours supporting or thwarting athletes' needs to varying degrees. Although it aims to provide a more holistic view

of some, it fails to address other important coach behaviours (e.g., those that would mainly impact athletes' need for relatedness (i.e., behaviours pertaining to relatedness support and relatedness thwarting)).

It thus becomes clear from a review of the numerous self-report measures developed in this area that researchers continually work towards improving conceptualisations and measures of perceptions of interpersonal behaviours. By developing and testing initial validity evidence for the scores of a measure that assess all three overarching behaviours (i.e., need support, thwarting, and indifference), researchers can examine if the three behaviours are operationally distinct, and if they are differently implicated in predicting outcomes of adaptive, maladaptive, and diminished functioning, respectively.

### Psychological Need States

As mentioned in the previous section, perceived contextual need support facilitates basic psychological need satisfaction, which is an essential condition for growth and wellness. In contrast, perceived contextual need thwarting results in experiences of need frustration, which leads to greater ill-being and deleterious outcomes. The need states of satisfaction and frustration are thus considered to form the core of SDT (Vansteenkiste & Ryan, 2013).



*Figure 1.2.* SDT model of need satisfaction and frustration (Adapted from Vansteenkiste & Ryan, 2013)

*Note.* Primary relations are denoted by bold lines

Substantial modifications in the conceptualisation and measurement of the need states can be observed in the past decade in realm of SDT-based literature. Early on, the measurement of need satisfaction was guided by a unidimensional approach, examined by scores that ranged from high to low. High levels of need satisfaction were considered to be predictive of adaptive outcomes. Through a plethora of studies, researchers have demonstrated psychological need satisfaction in sport to be associated with various indices of adaptive functioning including subjective vitality (Adie, Duda, & Ntoumanis, 2008, Mack et al., 2011), positive affect (Mack et al., 2011; Quested & Duda, 2010), self-esteem (Amorose, Anderson-Butcher, & Cooper, 2009; Coatsworth & Conroy, 2009), and positive developmental experiences (Taylor & Bruner, 2012). In contrast, low scores on measures of need satisfaction were considered to be predictive of increased maladaptive outcomes (e.g., burnout; Hodge, Lonsdale, & Ng, 2008). Some researchers, however, were unable to corroborate this pattern of associations (e.g. Gagné et al., 2003; Quested & Duda, 2010).

Bartholomew, Ntoumanis, Ryan, and Thøgersen-Ntoumani (2011) argued that these results were erratic because low scores on measures of need satisfaction were inaccurate representations of the intensity of need frustration experienced when such needs are actively undermined by social agents. Instead, these scores might only be representative of *dissatisfaction* with the degree to which a person's needs are being met in that moment. To elucidate their position, the researchers offered the example of a female athlete who feels incompetent in her sport. Incompetence, they argued, might be the result of the athlete's lack of skills. It could also be the result of receiving disparaging feedback from her coach. According to Bartholomew, Ntoumanis, Ryan, and Thøgersen-Ntoumani (2011), the former represents an experience of low need satisfaction (termed as need dissatisfaction by the researchers), and the latter reflects the experience of need frustration.

Bartholomew and colleagues were the first to assess empirically need frustration through a pioneering study in which they developed and provided initial validity evidence for the scores derived from the Psychological Need Thwarting Scale (PNTS), a new measure of need frustration in sport (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). The researchers also further demonstrated that need frustration was a better predictor of maladaptive outcomes, such as disordered eating, relative to psychological need satisfaction (Bartholomew, Ntoumanis, Ryan,

Bosch et al., 2011). These researchers originally termed *need frustration* as *need thwarting* for consistency with the writings of Ryan and Deci (2000). However, the term need frustration has come to be more prevalent in recent SDT theorising to refer to the negative experiential need state of having one's needs undermined, whereas need thwarting is now used to refer to the undermining behaviours of others in one's social context (e.g., Ryan & Deci, 2017). In sport, need frustration has been shown to be associated with outcomes such as burnout (Balageur et al., 2012; González, García-Merita, Castillo, & Balaguer, 2016), disordered eating, exhaustion, and depression (Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011). This dual process model facilitated the notion of need satisfaction as the *bright side* of human functioning, which results in adaptive outcomes, and need frustration as *dark side* of human functioning, which results in maladaptive outcomes (Cheon et al., 2019; Vansteenkiste & Ryan, 2013).

**The case for need unfulfilment.** While making the case for the dual process model, Bartholomew and colleagues (2011) proposed that a distinction should be made between the experience of need dissatisfaction (described as “low need satisfaction”, p. 78) and of need frustration. The researchers hypothesised that need frustration would be more likely to lead to maladaptive outcomes, as compared to need dissatisfaction. However, they did not substantiate this claim. Costa, Ntoumanis and Bartholomew (2015) tested the empirical distinction of this claim in the domain of interpersonal relationships. The researchers first developed 15 items to assess the third need state (defined as “lack of need satisfaction”, p. 12). Six items of the Basic Psychological Needs Satisfaction Scale (BPNS, Ilardi et al., 1993) were modified, and nine new items were written. Illustrative examples of items are “I generally don't feel free to choose how to do things for myself” (autonomy dissatisfaction), “I often do not feel able in what I do” (competence dissatisfaction), and “I usually feel uneasy around other people” (relatedness dissatisfaction). The internal structure of the subscale scores was tested using CFA. Next, need dissatisfaction was differentiated from low need satisfaction and high need frustration using multi-trait multi-method CFA (MTMM; CFA) analysis. Subsequently, using structural equation modelling (SEM), the researchers demonstrated that diminished functioning in interpersonal relationships was better predicted by need frustration than by need dissatisfaction. They did, however, find need dissatisfaction to have poor predictive value, as it did not predict either outcome of interpersonal competence (indicative of optimal

functioning) or interpersonal sensitivity (indicative of diminished functioning) in a unique manner.

Diminished functioning in the education context was examined in a recent investigation by Cheon and colleagues (2019). The researchers suggested that maladaptive behaviours in the classroom are manifested in two ways: a) reactivity and oppositional defiance manifested by anger or disruption of classroom activities, or b) passiveness and impoverished or diminished functioning reflected by boredom or disengagement. Cheon et al. (2019) argued that defiant functioning arises on experiencing need frustration, which results from experiencing a need thwarting environment. On the other hand, diminished functioning is a consequence of experiencing need dissatisfaction, due to exposure to a need indifferent learning environment. In line with this reasoning, the researchers speculated the work of Costa et al. (2015) as unsuccessful in demonstrating the unique predictive value of need dissatisfaction potentially due to the use of an inaccurate outcome measure (i.e., interpersonal sensitivity). In this study, Cheon and colleagues (2019) endeavoured to demonstrate what Costa et al. (2015) had originally set out to confirm; that dissatisfaction (for the need for autonomy) could explain unique variance in the outcome of student disengagement. In their classroom-based intervention study, the researchers were able to demonstrate students' differential responding to autonomy satisfaction, frustration, and dissatisfaction using ESEM. Autonomy dissatisfaction was also found to predict unique variance in an outcome of diminished functioning (classroom disengagement) along with low autonomy satisfaction and low autonomy frustration, thus making the case for the consideration of not just one (need satisfaction) or two (need satisfaction and frustration), but three need states (need satisfaction, frustration, and dissatisfaction). However, in this study, the measurement of the three states was limited to the need for autonomy only.

SDT-based researchers have mainly referred to the experience of a lack of need fulfilment using the term need dissatisfaction (e.g. Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Costa et al., 2015; Cheon et al., 2019). However, the word dissatisfaction is an antonym of satisfaction (Merriam-Webster Dictionary), suggesting the two are opposites. Additionally, some researchers have used the term dissatisfaction to imply the experience of need frustration (e.g., Sheldon & Hilpert, 2012; Neubauer & Voss, 2016, 2018). As such, in this thesis, I use the term *need unfulfilment* to capture the experience of a lack of need fulfilment,



and need frustration to refer to the experience of having one's needs actively blocked in a particular context.

**Self-report measures of psychological need states in sport and other domains.** The number of self-report measures developed to assess need satisfaction in a variety of contexts speak for the initial appeal of the construct for SDT-based researchers. Self-report measures of need satisfaction have been developed in domains including education (e.g., Activity-Feelings States, AFS; Reeve & Sickenius, 1994), work (e.g., Basic Needs Satisfaction at Work Scale, BNSW-S, Deci et al., 2001; Work-related Basic Need Satisfaction Scale, W-BNS, Van den Broek et al., 2010), and exercise (Basic Psychological Needs in Exercise Scale, BPNES, Vlachopoulos & Michailidou, 2006; Psychological Need Satisfaction in Exercise Scale, PNSES, Wilson, Rogers, Rodgers, & Wild, 2006).

Ng and colleagues (2011) developed, and provided initial validity evidence the Basic Needs Satisfaction in Sport Scale (BNSSS), the first sport-specific measure of need satisfaction. The internal structure of adult athletes' responses to the 20 items of the BNSSS was assessed using CFA, and was found to be representative of the satisfaction of three dimensions of autonomy (autonomy - choice, autonomy - internal perceived locus of control [IPLOC], autonomy - volition), alongside that of competence and relatedness. Athletes respond to items such as "I feel skilled in my sport" (competence satisfaction), and "In my sport, I feel close to other people" (relatedness satisfaction) using a 7-point rating scale ranging from 1 = *not at all true*, 7 = *very true*. Ng et al. (2011), did, however, report factor correlations as high as .83 between the subscales of the BNSSS.

As described previously, the 12-item PNTS (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011) is a sport-specific measure of need frustration. The internal structure of youth athletes' responses to items was tested using CFA, and found to consist of three subscales of autonomy (e.g., "I feel pushed to behave in certain ways"), competence ("There are times when I am told things that make me feel incompetent"), and relatedness ("I feel other people dislike me") frustration. Athletes express the extent to which they disagree or agree to such items, which begin with the stem "In my sport..." using a 7-point rating scale ranging from 1 = *strongly disagree* to 7 = *strongly agree*. Yet again, subscales of the measure were found to have a substantial overlap, indicated by factor correlations as high as .83.

Following the interest in the bright, as well as the dark side experiences of the basic psychological needs, Chen et al. (2015) developed, and provided initial validity evidence for the scores derived from, the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS), a general measure to assess both these need states simultaneously. The 24-item BPNSFS was developed using CFA. Participants respond to items such as “I feel I can successfully complete difficult tasks” using a 5-point response format ranging from 1 = *completely disagree* to 5 = *completely agree*. Chen et al. (2015) found participant responses to be best represented by six subscales pertaining to autonomy satisfaction and frustration, competence satisfaction and frustration, and relatedness satisfaction and frustration. Evidence for the internal structure of the BPNSFS scores was demonstrated in a culturally diverse sample. Subsequently, researchers have frequently adapted this measure for investigations in sport (Li, Ivarsson, Lam, & Sun, 2019), physical education (e.g., Haerens, Aelterman, Vansteenskiste, Soenens, & Petegem, 2015), and exercise (Emm-Collison, Standage, & Gillison, 2016).

The Balanced Measure of Psychological Needs (BMPN; Sheldon & Hilpert, 2012) is a domain general measure of need satisfaction that is also frequently employed for investigations in the sport domain (e.g., Lundqvist & Ragli, 2015; Schüller, Wegner, & Knechtle, 2014; Sheldon, Zhaoyang, & Williams, 2013). MTMM CFA with two method factors of need satisfaction and dissatisfaction (referred to by the scale developers as “the salient absence of the experiences” of need satisfaction, p. 442), and three needs factors of autonomy, competence, and relatedness was employed to assess the internal structure of the responses to the 18 items of the measure. Sample items include “I felt a strong sense of contact with people who care for me, and whom I care for” (relatedness satisfaction), and “I was lonely” (relatedness dissatisfaction). Participants rate how true each statement is for them using a 5-point rating scale (1 = *no agreement*, 3 = *some agreement*, 5 = *much agreement*).

An overview of the questionnaires discussed in this section is presented in Table 1.2.

Table 1.2. *Commonly Utilised Self-report Measures of Need States in Sport*

Name	Authors	Items	Response categories	Context	Dimensions	Analyses
Basic Psychological Need Satisfaction in Sport Scale	Ng et al. (2011)	20	1 = <i>not at all true</i> , 7 = <i>very true</i>	Sport	1. Autonomy - choice, 2. Autonomy - IPLOC, 3. Autonomy - volition), 4 competence satisfaction, 5. relatedness satisfaction	CFA
Psychological Need Thwarting in Sport Scale	Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani (2011)	12	1 = <i>strongly disagree</i> , 7 = <i>strongly agree</i>	Youth sport	1. Autonomy frustration, 2. Competence frustration, 3. Relatedness frustration	CFA
Basic Psychological Need Satisfaction and Frustration Scale	Chen et al. (2015)	24	1 = <i>not at all true</i> , 7 = <i>very true</i>	Domain general	1. Autonomy satisfaction, 2. Autonomy frustration, 3. Competence satisfaction, 4. Competence frustration, 5. Relatedness satisfaction, 6. Relatedness frustration	CFA
The Balanced Measure of Psychological Needs	Sheldon & Hilpert (2012)	18	1 = <i>no agreement</i> , 3 = <i>some agreement</i> , 5 = <i>much agreement</i>	Domain general	1. Need satisfaction 2. Need dissatisfaction	MTMM; CFA

*Note.* CFA = confirmatory factor analysis, ESEM = exploratory structural equation modelling, MDS = multidimensional scaling.

Items of the aforementioned measures should be considered in light of some lingering conceptual issues. Instead of assessing the feeling states (need satisfaction or need frustration), researchers typically employ some items that assess the social context (referring to need support or need thwarting behaviours of the social agent). For instance, consider the relatedness satisfaction item “There are people in my sport who care about me” from the BNSSS. A review of the definitions of need support and need satisfaction makes it clear that this item entirely reflects the actions of others, and not how these actions make one feel. An example of a need thwarting item used to assess need dissatisfaction is “There were people telling me what I had to do” (BMPN; Sheldon & Hilpert, 2012).

A related issue worth consideration is that when items of these measures do not assess the social context in a direct manner, they refer to them indirectly. In the case of the PNTS, some items appear to assess personal experiences of need frustration emanating from the actions of others in one’s social contextual (e.g., “There are times when I am told things that make me feel incompetent”) instead of purely assessing how these actions make one feel. It should be noted that such items do not assess the social context by itself. An example an item purely assessing the social context would be an item indicating that an athlete is told by their coach that they are incompetent. Being told that one is incompetent is quite different from feeling incompetent, and the former might not necessarily lead to the latter. Previously, researchers have demonstrated measures of the socio-contextual environment (controlling behaviours) and the experience of need frustration (measure using the PNTS) to be correlated in a modest manner (e.g., Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011; Balaguer et al., 2012; Gillet et al., 2012; Stebbings, Taylor, Spray, & Ntoumanis, 2012). The PNTS, has nonetheless, been critiqued for inclusion of references to one’s social context (Taylor, 2015).

A final theme of significance is that of conflation of items assessing need frustration and need unfulfilment in existing measures of the need states. To illustrate, consider the dissatisfaction subscale of the BMPN. Not only does this subscale include items that assess need frustration (e.g., “I had a lot of pressures I could do without”), but also items that assess a lack of need fulfilment (i.e., need unfulfilment, e.g., “I felt unappreciated by one or more people”). As need frustration and need unfulfilment might be differently implicated in predicting outcomes of

maladaptive and diminished functioning respective (e.g., Cheon et al., 2019), it is important to separate the assessments of the two need states.

It thus becomes evident that researchers are interested in assessing both the satisfaction and frustration of the basic psychological needs. Existing measures assessing the need states are limited to the independent assessment of need satisfaction and frustration, using the BNSSS (Ng. et al., 2011) and PNTS (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011), which have different response category anchors, and have been developed based on responses from distinct samples. General measures of need satisfaction and frustration (BMPN, Sheldon & Hilpert, 2012; BPNSFS, Chen et al., 2015) are also routinely adapted to sport (e.g., Li, Ivarsson, Lam, & Sun, 2019; Lundqvist & Ragli, 2015) without first testing if the internal structure holds when examined in a sample of athletes. Additionally, items of measures developed in other domains may not be as pertinent to athletes. A logical next step would thus be to develop, and provide initial validity evidence for the scores derived from, a sport-specific scale that accurately assesses not just athlete need satisfaction and frustration, but also need unfulfilment.

### **Key Aspects of Developing and Evaluating Measurement Instruments**

Scores derived from measurement instruments can only be considered to be applicable to or valuable for making conclusions when they demonstrate validity evidence (Messick, 1998). Validity is thus essential to the development, testing, and employment of any measurement instrument (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 2014; Chan, 2014). Validation procedures employed by researchers in the domain of sport and exercise psychology have been critiqued for the use of obsolete definitions and conceptualisations (Zhu, 2012). Gunnell et al. (2014) conducted a review of the scale validation research articles published in the *Journal of Sport and Exercise Psychology* (JSEP) between 2002 and 2012 in order to determine the manner in which researchers reported validity information. Results revealed that in general, investigators failed to use validity theories/validation frameworks to guide their work. A few misconceptions were noted to be prevalent in the investigations included in their review. For instance, researchers frequently suggested validity to be a property of instruments, mentioned different *types* of validity, and reported one property of validity evidence

under different names (e.g., considering convergent and concurrent validity evidence as the same idea). Such misconceptions can also be encountered in the validation process for the measures of interpersonal behaviours and psychological need states described in this introduction. For example, references to validity as a property of the instrument (e.g., “results supported the IBQ and IBQ-Self are valid measures of interpersonal behaviours in sport”, Rocchi, Pelletier, & Desmarais, 2017) and to types of validity (e.g., *convergent validity* and *divergent validity*, Rocchi, Pelletier, & Desmarais, 2017; *concurrent validity* Pulido et al., 2018; *predictive validity*, Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011) can be observed. The following section is aimed at describing the recommended validation practices.

Validity represents the quality of conclusions or assertions derived from the scores of measurement instruments (Chan, 2014). In order for these inferences to be considered trustworthy, it is important that scores of measurement instruments exhibit validity evidence. Validation is a continuing process of garnering evidence to substantiate the suitability and significance of the conclusions inferred from the scores of the instruments (Zumbo, 2007). In order to ascertain the evidence researchers already have, and the evidence that still needs to be obtained, Zhu (2012) recommends the use of a validation framework. Various frameworks are available to researchers for guiding their process of validation (e.g., AERA et al., 2014; Borsboom, Mellenbergh, & van Heerden, 2004; Kane, 2001; Messick, 1995; Zumbo, 2007). However, the use of the conceptualisations outlined in *The Standards for Educational and Psychological Testing* (The Standards; AERA et al., 2014) have been endorsed as one of the most practical and reliable approaches to examining score validity (Gunnell et al., 2014).

The most recent version of the *Standards* is clearly influenced by Messick’s (1989) unitary conception of validity (Chan, 2014). According to this perspective, multiple sources of validity evidence are required to sustain a validity assertion. In other words, validity does not encompass distinct types; score validity is instead informed by different sources. According to the *Standards*, there are five sources of evidence. These include evidence based on content, internal structure, relations to other variables, response processes, and consequences.

An instrument's content is informed by all the items in it, the manner in which they are phrased and presented, the categories used by individuals to respond to these items, and the way in which the instrument is administered and scored (Chan, 2014). Content evidence results from the association between the instrument's content, and the construct under scrutiny (Chan, 2014). One source of this kind of evidence is face validity evidence, or what an instrument appears to measure on the surface, determined by the extent to which end users of the measure rate the items of the instrument as being appropriate in terms of the target construct (Anastasi, 1988). Sole reliance on face validity evidence has, however, been considered to be insufficient (DeVillis, 2012) as it involves lay persons' approvals of the comprehensiveness or applicability of the items (Lynn, 1986). Employment of experts to test the content relevance of items against a given definition of the construct in question serves as a more formal source of content validity evidence (DeVillis, 2012). Due to their strong foundation in theory, experts are likely to have a more comprehensive understanding to support their opinions. Experts can be invited to rate the extent to which the items correspond to their ascribed construct. Their ratings can be used to estimate the content validity index (CVI, Lynn, 1986), an indicator of agreement between experts (Polit, Beck, & Owen, 2007), acceptable levels of which are determined by considering the total number of experts who provide ratings. Ultimate decisions regarding item retention, modification, or deletion can be informed by these CVI values.

A second source of validity evidence according to the *Standards* is that based on internal structure. This involves testing the extent to which the items of measure correspond to the construct under scrutiny by examining the statistical relations between the items using, for example, factor analysis or item response theory (Chan, 2014). Factor analysis helps researchers to establish how many, and what type of unobservable variables, known as latent factors, influence responses to a set of observed items, known as indicators (Brown, 2015; DeVillis, 2012), and has emerged as the most extensively employed multivariate statistical tool (Brown, 2014). Both EFA and CFA serve the purpose of elucidating the relations among a greater number of items of a measure by using a smaller number of factors or unobservable variables known as latent variables (Flora & Flake, 2017). Researchers usually employ EFA as an investigative technique to identify the number of factors

in the preliminary stages of scale development (Brown, 2015; Flora & Flake, 2017). CFA is generally employed in the subsequent stages of scale development following the identification of an underlying structure (through the use of EFA, Brown, 2015), or in developing measurement instruments that have strong theoretical underpinnings (Hurley et al., 1997).

The key distinction between the two types of factor analyses is that the item cross-loadings on unintended factors that are usually constrained to be zero in CFA, are freely estimated in EFA (Marsh et al., 2014; Morin, Arens, & Marsh, 2016). Marsh and colleagues further emphasised that there are multiple causal factors for most items, which make it necessary to investigate item cross-loadings. When these cross-loadings are forced to be zero in CFAs, the correlations between the factors tend to be overestimated, which further results in undermining of discriminant validity evidence (Asparouhov & Muthen, 2009). CFA has been employed to assess the internal structure of the responses to items of numerous SDT-based measures of the socio-contextual environment and psychological need states, and moderately high to high factor correlations are evident between the subscales of many of these measures (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Ng et al., 2011; Rocchi, Pelletier, & Desmarais, 2017; Wilson et al., 2009)

ESEM (Asparouhov & Muthen, 2009) has been proposed as a technique that can help overcome the limitations associated with CFA. Through ESEM it is possible to combine EFA, CFA, and SEM in one analysis (Marsh et al., 2014). In ESEM, cross-loadings on unintended factors are permitted in a manner similar to EFA, and at the same time, the benefits of CFA, such as corrections of measurement errors in path coefficients, are retained (Myers, Ntoumanis, Gunnell, Gucciardi, & Lee, 2017). As a result of the allowance for cross-loadings, constructs can be assessed bearing in mind all of the information that is significant. Based on the aims of the analysis, ESEM can be used in either an exploratory or a confirmatory manner (e.g., through the use of target rotations, where cross-loadings can be freely estimated, however, they are specified to be close to zero, Asparouhov & Muthen, 2009), making it a versatile approach. Given that many instruments have factors that are correlated, Myers et al. (2017) recommend the use of ESEM for assessing the internal structure of a measure with two or more latent factors.



Items of theory-based multidimensional instruments are also often indicative of a general latent factor, and a number of latent sub-factors which are more specifically outlined (Myers, Martin, Ntoumanis, Cemili, & Bartholomew, 2014). For example, in the case of the basic psychological need states, two general factors of need satisfaction and frustration, and six specific sub-dimensions of autonomy satisfaction and frustration, competence satisfaction and frustration, and relatedness satisfaction and frustration can be observed. Researchers often test hierarchical models to examine constructs with such structures (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). With hierarchical models, however, the items are specified to load on to their specific subscales (identified as first-order factors), which then mediate the relations between the items and higher-order factors (McAbee, Oswald, & Connelly, 2014). A more direct and accommodating test of such structures can be conducted by employing bifactor models (Holzinger & Swineford, 1937; Reise, 2012). Through the use of bifactor models, it is possible to specify items to load on their corresponding specific sub-dimension (S-factors), as would be the case with CFA, and *at the same time* allow them to load on one or more general factors (G-factor). Bifactor models have recently been integrated with ESEM (e.g., Jennrich & Bentler, 2011, 2012; Morin, Arens, & Marsh, 2016), enabling the simultaneous examination of the existence of item cross-loadings as well as general and specific factors in a factorial structure. SDT-based researchers investigating the socio-contextual environment and the experiential need states are increasingly employing ESEM, bifactor modelling, and bifactor ESEM as the factor analytic methods of choice, both in, and outside of sport (e.g., Myers et al., 2014; Pulido et al., 2018; Toth-Kiraly et al., 2018)

The third source of validity evidence is informed by relations to other constructs (the *Standards*, AERA et al., 2014). This often involves tests of predictive validity evidence, or examinations of the nomological network surrounding the constructs of interest. Tests of nomological networks, according to Bagozzi (1981), are the “degree to which predictions in a formal theoretical network containing a construct of interest are confirmed” (p. 327). The difference between evidence for predictive and nomological networks is that the former encompasses the relations between a single factor and another sole antecedent or consequence, whereas the latter allows for examinations of various antecedent and consequence variables

within a network (Hagger, Gucciardi, & Chatzisarantis, 2017). To illustrate, researchers have examined relations between perceptions of interpersonal behaviours and psychological need states (e.g., Pulido et al., 2018, Rocchi, Pelletier, & Desmarais, 2017), and psychological need states and outcomes of well-being and ill-being (e.g., Chen et al., 2015).

Another source of validity evidence to be considered at this stage is that of discriminant validity. Generally, discriminant validity evidence is sought by assessing correlations between two instruments assessing different constructs, comprising of validity evidence based on relations to other variables (Gunnell et al., 2014). However, discriminant validity can also be conceptualised in terms of the correlations between the different subscales of the same instrument (e.g., Brown, 2015; Kline, 2011). In the event that researchers chose to use alternative conceptualisations of discriminant validity evidence, Gunnell et al. (2014) recommend that they refer to appropriate literature to substantiate their analyses.

The fourth and the fifth sources of validity evidence in line with the *Standards* are those based on response processes and consequences, respectively. Validity evidence based on response processes concerns the degree to which the participant ratings correspond to the target construct by examining the manner in which the raters comprehend, and respond to the items of a measure, by using, for example, think aloud procedures (Chan, 2014). Validity evidence based on consequences involves the impact of using test scores in the intended or unintended manner (e.g., inferences derived from the scores of a measure would be undermined if used in an unintended manner, Chan, 2014). The final two sources of validity evidence are not as common. Gunnell et al. (2014) reported only one validation study published in JSEP between 2002-2012 to have included evidence based on response processes; none of the studies reported evidence based on testing consequences.

The reliability of the scores of an instrument is also an important psychometric property to assess when accruing validity evidence, as it is an attribute of the data, whereas validity is an attribute of the inferences (Zumbo, 2007). Coefficient alpha (Cronbach, 1951) is the most commonly reported reliability index in social sciences research (Flake, Pek, & Hehman, 2017). It has, however, been

suggested that assessment using Cronbach's alpha might lead to under- or over-estimation of score reliability (Huysamen, 2006; Sijtsma, 2009). Resultantly, researchers have begun to employ Raykov's composite reliability coefficient (RHO; Raykov, 1997) as a more desirable coefficient to attain improved estimates (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011).

Researchers are not required to demonstrate that all the sources of validity evidence described above have been tested as a part of one investigation (AERA et al., 2014; Gunnell et al., 2014). Instead, it has been recommended that researchers highlight sources of validity evidence that are feasible to test, and those that are of consequence for the inferences made on the basis of the scores of the instruments in that particular enquiry. As such, various sources of validity evidence will be tested in this thesis in accordance with the *Standards* (AERA et al., 2014). In addition, evidence for reliability of the subscale scores will also be examined, and evidence for discriminant validity will be sought through examinations of the factor correlations between the subscales of each of the new measures in line with the recommendations of Brown (2015) and Kline (2011).

### **Overview of Thesis**

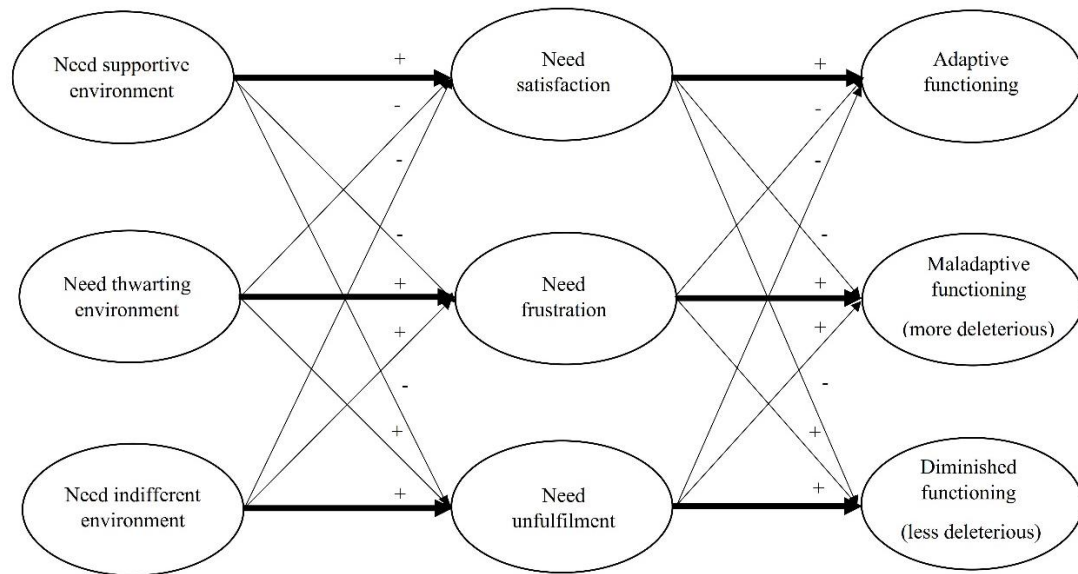
A review of conceptual (Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013) and empirical (e.g., Pulido et al., 2018; Rocchi, Pelletier, & Desmarais, 2017) developments presented in the previous sections suggests that individuals in position of authority (e.g., coaches) can interact with others (e.g., athletes) using adaptive and maladaptive interpersonal behaviours. Perceptions of contextual need support are associated with greater levels of need satisfaction among individuals. Need satisfaction is subsequently associated with indices of adaptive functioning, growth, and wellness. Contrastingly, perceptions of contextual need thwarting are associated with heightened need frustration among individuals, which, in turn, further contributes to malfunctioning and ill-being.

Existing conceptualisations and measures of need thwarting in sport include behaviours that actively thwart athletes' basic psychological needs, as well as behaviours that are relatively passive or neutral towards athletes' needs (i.e., need indifferent behaviours). Need indifferent interpersonal behaviours warrant their own independent assessment alongside need supportive and thwarting behaviours, as such

behaviours might not relate to athlete need frustration as robustly as need thwarting would. In terms of athlete outcomes, as speculated by Cheon et al. (2019), need thwarting may better predict darker outcomes of maladaptive functioning, whereas need indifference may better predict less deleterious outcomes of diminished functioning.

In the case of the basic psychological need states, evidence for the consideration of need unfulfilment as the third need state, beyond those of need satisfaction and frustration, is growing (e.g., Costa et al., 2015; Cheon et al., 2019). Current assessments, however, only allow for the examination of the two need states of satisfaction and frustration using two different questionnaires (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Ng et al., 2011). In order to examine the two need states simultaneously, researchers commonly adapt non-sport-specific measures of need satisfaction and frustration (e.g., Li et al., 2019) without first testing if the internal structure of these measures holds in the athletic sample. Items of such domain general measures might also not be of particular relevance to athletes' experiences in sport. Finally, items of existing measures demonstrate conceptual problems (e.g., confounding of interpersonal behaviours and need states), which bring into question the quality of the inferences made based on their responses. It is important to conceptually and empirically distinguish need unfulfilment from need satisfaction and frustration as each experience is speculated to be associated with distinct contextual factors (need satisfaction is predicted by perceived contextual need support, need frustration by perceived contextual need thwarting, and need unfulfilment by perceived contextual need indifference), and each need state brings about distinct outcomes (need satisfaction predicts adaptive functioning, need frustration predicts maladaptive functioning, and need unfulfilment predicts diminished functioning; Cheon et al., 2019).

Expanding interpersonal behaviours to include need supportive, thwarting, and indifferent interpersonal behaviours, and need states to include need satisfaction, frustration, and unfulfilment, would facilitate future examinations of three different motivational trajectories from 1) perceived need support to need satisfaction and adaptive outcomes, 2) perceived need thwarting to need frustration and maladaptive outcomes, and 3) perceived need indifference to need unfulfilment and outcomes of diminished functioning (See Figure 3).



*Figure 1.3.* The tripartite model of interpersonal behaviours and need states  
 Note. Primary relations are denoted in bold.

The empirical investigations undertaken in this thesis begin with the examination of perceived coach interpersonal behaviours. In Chapter 2, through a series of three studies, I present the conceptual rationale for the consideration of need indifference, a third category of interpersonal behaviours alongside need support and need thwarting. Subsequently, I present the development of, and initial validity evidence for the scores derived from, the Tripartite Measure of Interpersonal Behaviours-Coach (TMIB-C); a self-report measure of athletes' perceptions of coaches' need supportive, thwarting, and indifferent behaviours.

Athletes' basic psychological need states are investigated in Chapter 3. Through two studies, I present the conceptual rationale for the consideration of need unfulfilment, a third category of need states alongside need satisfaction and need frustration. To this end, I present the development of, and initial validity evidence for the scores derived from, the Psychological Need States in Sport Scale (PNSS-S); a self-report measure of athletes' experiences of need satisfaction, frustration, and unfulfilment.

In Chapter 4, I summarise the findings of Chapter 2 and Chapter 3, and discuss the implications of these results for theoretical advancement and applied work. Methodological considerations and recommendations for future research are also proposed. In sum, the two empirical chapters consisting of five studies, along

with the dissertation discussion are expected to lead to refined conceptualisations and measures of the key constructs of interpersonal behaviours and psychological need states. Such a tripartite approach is expected to enable a more nuanced understanding of the SDT motivational sequence, when considered alongside motivational regulations, and outcomes pertaining to adaptive, maladaptive, and diminished functioning, in sport and potentially other life domains.

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## **Chapter 2: Conceptualising and Testing a New Tripartite Measure of Coach Interpersonal Behaviours**

*“I never found anyone who fulfilled my needs, a lonely place to be...”*

Whitney Houston eloquently sang about how behaviours of others can sometimes be inadequate to fulfil one’s needs, in her rendition of Michael Masser and Linda Creed’s 1976 song, “The Greatest Love of All”. With respect to psychological needs, Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan and Deci, 2017) based researchers have, to date, examined behaviours of individuals in key positions (e.g., coaches) that are supportive or thwarting of others’ (e.g., athletes’) basic psychological needs. However, as illustrated by the above lyrics, an individual may also find himself or herself in situations where significant others are unfulfilling of, or indifferent to his or her needs. In this chapter, for the first time in the SDT literature, I conceptualise and measure such need indifferent behaviours, and contextualise this research within the domain of sports coaching.

In sport, it is commonly acknowledged that the coach plays a key role in shaping athletes’ performance, and the quality of their psychological experiences (Adie, Duda, & Ntoumanis, 2012; Mageau & Vallerand, 2003). A number of self-report measures exist that draw from SDT to assess athletes’ perceptions of their coaches’ interpersonal behaviours (the terms *behaviours* and *styles* have often been used interchangeably e.g., Pulido, Sánchez-Oliva, Leo, Sánchez-Cano, & García-Calvo, 2018; Rocchi, Pelletier, & Desmarais, 2017). A broad distinction has been made between adaptive (need supportive) and maladaptive (need thwarting) interpersonal behaviours (e.g., Hancox, Quested, Thøgersen-Ntoumani, & Ntoumanis, 2015; Ntoumanis, Quested, Reeve, & Cheon, 2017), which can be further classified into behaviours that are need-specific (e.g., autonomy, competence, and relatedness supportive, and autonomy, competence, and relatedness thwarting).

In this three-study chapter, I further distinguish between coaching behaviours that actively undermine athletes’ psychological needs and those that are indifferent to such needs. I explain why such a distinction can provide a more refined conceptual understanding of (coaching) interpersonal behaviours with potential applied implications, and how each behaviour might relate to different outcomes for athletes. To this end, I present the development of, and initial validity evidence for, a new

tripartite measure of athletes' perceptions of their coaches' supportive, thwarting, and indifferent interpersonal behaviours.

### **Self-Determination Theory and Coach Interpersonal Behaviours**

Coaches exhibit characteristics of need supportive interpersonal behaviours when they communicate with athletes in ways that are supportive of their basic psychological needs for autonomy, competence, and relatedness. Social agents use *autonomy supportive behaviours* when they recognize and nurture others' inner motivational resources, such as their goals and preferences (Katz & Assor, 2007; Reeve, 2009). For instance, coaches can be autonomy supportive by offering athletes choices within agreed boundaries, showing attempts to understand their perspectives, providing them with personally meaningful rationales for task engagement, encouraging their input in decision making processes, and giving them opportunities for self-initiated behaviour (Mageau & Vallerand, 2003; Ntoumanis & Mallett, 2014).

*Competence support* has previously been described under the term *structure* in the SDT literature (e.g., Curran et al., 2013; Grolnick & Ryan, 1989, Mageau & Vallerand, 2003; Skinner, Johnson, & Snyder, 2005), referring to how social agents can convey clear expectations and information to others to help them reach desired goals and outcomes. Competence support also involves behaviours that guide individuals in feeling capable of tackling challenging situations and/or experiencing meaningful success (Matosic, Ntoumanis & Quested, 2016). This can be done by helping them to set realistic goals, by providing constructive and thorough feedback (Ntoumanis & Mallett, 2014), and encouraging learning and improvement of skills (Rocchi et al., 2017).

*Relatedness supportive behaviours* have been described using the terms *interpersonal involvement* (e.g., Grolnick & Ryan, 1989) and *warmth* (e.g., Skinner et al., 2005) in the SDT literature to refer to demonstrations of caring, affection, and emotional availability. Coaches can support their athletes' sense of relatedness by being empathetic, showing interest, and providing them with care and support (Pulido et al., 2018; Rocchi et al., 2017).

Through a plethora of studies, researchers have demonstrated positive associations between athletes' perceptions of coach need supportive interpersonal behaviours and athletes' basic psychological need satisfaction (Adie et al., 2012),

self-determined forms of motivation (Amorose & Anderson-Butcher, 2007), and positive outcomes such as well-being (Adie, Duda, & Ntoumanis, 2008), persistence (Pelletier, Fortier, Vallerand, & Briere, 2001), and improved performance (Cheon et al., 2015).

In contrast, coaches adopt need thwarting interpersonal behaviours when they communicate with athletes in ways that undermine their needs for autonomy, competence, and relatedness. *Autonomy thwarting behaviours* (also known as *controlling* coaching behaviours, e.g., Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010) include those that pressure others to think, feel, and behave in set manners, and which are dismissive of, or devalue, others' perspectives (Reeve, 2009). Coaches can thwart their athletes' need for autonomy by applying excessive personal control in situations that are not directly relevant to the athlete's sport participation, and using coercive strategies so that tasks are performed in certain ways, by using intimidating language, employing rewards to control athletes' behaviours, and being conditionally accepting (Bartholomew et al., 2010).

*Competence thwarting* has previously been described using the term *chaos* in the SDT literature (e.g., Skinner et al., 2005; Smith, Quested, Appleton, & Duda, 2016). According to Skinner et al. (2005), chaotic behaviours are inconsistent, disorganized, confusing, and lacking in direction. Competence thwarting has also been discussed in relation to highlighting others' failures and conveying incompetence information to them (Sheldon & Filak, 2008). Coaches can thwart their athletes' need for competence by showing doubt in their capacity to improve in their sport, emphasizing their mistakes, being overly critical of them, and by repeatedly giving them negative feedback in public (Pulido et al., 2018; Rocchi et al., 2017).

*Relatedness thwarting behaviours* have previously been described as being *cold* (e.g., Skinner et al., 2005), for instance, by being aloof and inattentive towards others, or being unavailable when needed. Relatedness thwarting behaviours have also been described using the term *rejection* (e.g., Skinner et al., 2005), exemplified by demonstrating aversion and active dislike towards others. Coaches can also thwart their athletes' sense of relatedness by being critical and hostile towards them, and purposefully excluding them from activities (Standage, Curran, & Rouse, 2019).

Athletes' perceptions of coaches' need thwarting interpersonal behaviours have been associated with athlete need frustration (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Haerens et al., 2018), non-self-determined

forms of motivation (i.e., driven by contingencies, guilt, rules and demands; Pelletier et al., 2001; Rocchi et al., 2017), and negative outcomes such as somatic anxiety, worry, and concentration disruption (Ramis, Torregrosa, Viladrich, & Cruz, 2017).

**The case for coach need indifferent interpersonal behaviours.** Besides actively nurturing or undermining others' experiences of need satisfaction, social agents have also been described as being indifferent (Vansteenkiste & Ryan, 2013). However, existing conceptualisations and measures of maladaptive interpersonal behaviours do not distinguish between a behaviour that reflects *active* or *direct* need thwarting by the social agent (e.g., coaches intimidating athletes), and a behaviour that is *neutral*, *passive*, or *indifferent* to athletes' needs (e.g., coaches being unresponsive to athletes' opinions).

As an example, consider the conceptualisation of, and the items assessing the construct of chaos, which is usually offered as an illustration of competence thwarting. In the parenting literature, chaos refers to parenting that is permissive and erratic (Skinner et al., 2005). A sample item for this dimension, from the Parent as Social Context Questionnaire (Skinner, Wellborn, & Regan, 1986), is "When my parents say they will do something, sometimes they don't really do it". Although such behaviours might impede others' in their goal achievement process, they differ from need thwarting behaviours, which describe situations where one's needs are *actively blocked* by a person in authority (Vansteenkiste & Ryan, 2013). Thus, the conceptualisation and measurement of chaotic behaviours is more akin to need indifferent behaviours, rather than need thwarting ones. An example of the latter would be a coach delivering scathing feedback to an athlete, criticising his or her competence in front of the entire team. Confounds of need thwarting and need indifferent behaviours can also be found in the sport literature. For example, the conceptualisation of competence thwarting by Pulido et al. (2018) includes chaotic coaching behaviours, such as instances when coaches supply athletes with a lot of information that is lacking in structure and clear objectives, resulting in athletes failing to understand their tasks and responsibilities.

Similar problems exist with the conceptualisation and measurement of the construct of cold behaviours, which is often described as relatedness thwarting (e.g., Skinner et al., 2005; Pulido et al., 2018; Rocchi et al., 2017). Cold behaviours include being distant with others, unavailable when needed, disinterested in others' thoughts and feelings, and not listening to what others have to say (Pulido et al.,

2018; Rocchi et al., 2017; Sheldon & Filak, 2008). This conceptualisation is ambiguous, as it is not clear if being cold is the result of being disinterested or weary of others (which is more of a relatedness indifferent behaviour), or due to hostility, rejection, or conditional regard towards others, which are characteristics of relatedness thwarting (Standage et al., 2019; Vansteenkiste & Ryan, 2013).

Only a few attempts have been made to include need neutral items in SDT-informed experiments, all outside of sport (e.g., Kinnafock, Thøgersen-Ntoumani, & Duda, 2016; Tessier, Sarrazin, & Ntoumanis, 2008). However, there was no strong theoretical explanation in these papers as to what such neutral behaviours represented, and how they related to psychological needs and key motivation-related outcomes.

Recently, Quedstedt, Ntoumanis, Stenling, Thøgersen-Ntoumani, and Hancox (2018) made a case for need indifferent behaviours in developing the Need-Relevant Instructor Behaviours Scale (NIBS), an observational scale to assess need supportive, thwarting, and indifferent behaviours of exercise instructors. The researchers theorized need indifferent behaviours as being deficient of any need supportive or need thwarting attributes. An example is that of an exercise class instructor shouting “keep going” to the exercise class participants, without any empathy, enthusiasm, or specific feedback. It should be noted, however, that the NIBS has been developed in the context of group exercise, and, more importantly, is an observational measure, aiding the *objective* assessment of the socio-contextual environment. Within the SDT framework, it is the subjective interpretation of the socio-contextual environment that is purported to influence individuals’ behaviours and related outcomes, and thus, self-report measures that capture perceptions of need indifferent behaviours are also needed.

In this chapter, I propose that besides employing need supportive and need thwarting behaviours, coaches can also adopt need indifferent behaviours towards their athletes. Need indifference is demonstrated when a coach is inattentive to his or her athletes’ basic psychological needs. Need indifferent behaviours are proposed to be less motivationally damaging in comparison to need thwarting behaviours, because they do not actively undermine the three psychological needs.

*Autonomy indifference* comprises of behaviours where a coach shows disinterest in athletes’ perspectives, wants, and preferences. Coaches can be indifferent towards their athletes’ need for autonomy by, for example, being

unresponsive to their opinions. *Competence indifference* consists of behaviours illustrating negligence from the coach in creating conditions that will help athletes to progress, and feel capable and successful. One way in which coaches can be indifferent to their athletes' need for competence is by creating a chaotic environment, or by setting uniform tasks that do not take into consideration athletes' differences in skill level. Finally, *relatedness indifference* involves behaviours exemplifying inattentiveness from the coach towards the quality of the coach-athlete relationship. Keeping to themselves without asking questions about athletes' welfare is one way in which coaches could be indifferent towards athletes' need for relatedness.

This distinction between need thwarting and need indifferent coach interpersonal behaviours has important implications. Specifically, need thwarting coach interpersonal behaviours might relate more strongly to athlete need frustration than need indifferent coach interpersonal behaviours. Further, indifferent and thwarting coaching behaviours could predict athletes' behaviour, cognition, and affect differently. For example, because need indifferent behaviours do not actively block athletes' needs, they will better predict *less deleterious* or *less dark* outcomes (e.g., athlete disengagement, as represented by sport irrelevant thoughts or boredom), compared to those predicted by need thwarting (e.g., exhaustion, debilitating competitive anxiety). In sum, I propose that coaches can adopt behaviours that are need supportive, need thwarting, and need indifferent, which could potentially have unique implications in terms of athlete need satisfaction and frustration, motivation, and well-being/ill-being. As such, it would be worthwhile to measure these behaviours simultaneously.

**Self-report questionnaires to measure interpersonal behaviours in sport and other life settings.** The conceptualisation of the three basic psychological needs within the SDT framework is unique, such that even though each need is considered to be important in its own right, all three needs are regarded as interdependent and expected to be highly correlated (Ryan & Deci, 2017). Accordingly, examinations of the dimensionality of interpersonal behaviours targeting these needs have been guided by two approaches. The first is a unidimensional approach, where items assessing all three needs are presented as a single factor. The second is a multidimensional approach, where items pertaining to each of the three needs are presented as distinct factors.

With regards to the first approach, researchers have presented a one-factor model of need support that includes items assessing the support of all three needs (e.g., Health Care Climate Questionnaire, HCCQ; Williams, Grow, Freedman, Ryan, & Deci, 1996; Need Support for Exercise Scale, NSE; Markland & Tobin, 2010; Needs-Support Behaviours Scale, NSBS; Gucciardi, Weixian, Gibson, Ntoumanis, & Ng, in press). Through personal communication, we have established that the unidimensional approach was taken on the basis of very high factor correlations when a three-factor approach was tested (E. Deci, personal communication, September 3, 2015, in relation to the HCCQ by Williams et al., 1996; D. Markland, personal communication, July 3, 2017, in relation to the NSE by Markland & Tobin, 2010). High correlations between factors raise uncertainty regarding the discriminant validity evidence of the subscale scores of an instrument. In their paper, Gucciardi et al. (in press) reported poor discriminant validity evidence for a multi-dimensional structure of need support. In sport, correlations as high as .94 have been observed between the factors of the Interpersonal Supportiveness Scale-Coach (ISS-C; Wilson, Gregson, & Mack, 2009), which assess perceived autonomy support, structure, and involvement, indicating substantial overlap between the items of these subscales.

With regards to the multidimensional approach to measuring coach behaviours, the Interpersonal Behaviours Questionnaire in Sport (IBQ in Sport; Rocchi et al., 2017) is a 24-item six-factor measure of autonomy, competence, and relatedness support and thwarting. This six-factor scale was developed through a series of sequential Confirmatory Factor Analyses (CFA). Although CFA is suitable for scale development efforts with strong theoretical underpinnings (Hurley et al., 1997), it has a stringent requirement of zero cross-loadings of items on non-intended factors (Asparouhov & Muthén, 2009). This requirement often results in the elimination of conceptually relevant items that cross-load on unintended factors, and leads to inflated correlations among factors. For example, moderately high correlations around .74 have been reported between the need support subscales of the IBQ in Sport. Further, the IBQ in Sport uses items that refer to potentially relatedness indifferent interpersonal behaviours (e.g., “My coach is distant when we spend time together”, “My coach does not connect with me”) in order to assess relatedness thwarting.

Another recently developed multidimensional measure is the Coaches Interpersonal Style Questionnaire (CIS-Q; Pulido et al., 2018). The 22-item, six-



factor questionnaire also assesses coach supportive and thwarting interpersonal behaviours for each of the needs of autonomy, competence, and relatedness. Although Pulido and colleagues used contemporary methods (i.e., ESEM) in their scale development effort, they also reported moderately high factor correlations between relatedness and competence support ( $r = .78$ ), and between relatedness and competence thwarting ( $r = .75$ ). Further, this scale was developed with male athletes, from a single sport (soccer), with no evidence of replication of this factor structure with an independent sample of athletes. Another limitation of the measure is that all of the items in the competence thwarting subscale, and few in the relatedness thwarting subscale appear to capture athletes' experiences of need frustration, instead of coach behaviours that are competence/relatedness thwarting (e.g., During practices, our coach "... proposes situations that make me feel incapable", "... makes me feel rejected by him/her sometimes"). The relatedness thwarting subscale of the CIS-Q also includes an item that reflects need indifference as opposed to need thwarting ("During practices, our coach ...is sometimes indifferent to me").

The *helicopter* model (Aelterman et al., 2018) is a new perspective to measuring interpersonal behaviours. Delrue et al. (2019) took this to assess (de)motivating coaching behaviours associated with autonomy support, structure, control, and chaos. The researchers first developed a vignette-based instrument, the Situations-in-Sport Questionnaire using multidimensional scaling. Results showed that the four coach behaviours were best organized along two dimensions of a) need supportiveness and thwarting, and b) high and low directiveness, which classified the behaviours into four quadrants in a circular structure. Autonomy support, structure, control, and chaos were further divided into two sub-areas each (i.e., participative and attuning, guiding and clarifying, demanding and domineering, and abandoning and awaiting, respectively). Instead of considering coach behaviours as distinct (as has previously been the case in the SDT literature), the researchers presented a more refined and intertwined perspective, whereby combinations of different behaviours are more or less supportive or thwarting of athletes' needs. However, some coach behaviours are not assessed by the Situations-in-Sport Questionnaire. Specifically, coach behaviours relevant to the support or thwarting of the need for relatedness or the thwarting of competence are missing.

### **Present Research**

The objective of the present series of studies was to develop and provide initial validity evidence for a new multidimensional measure of athletes' perceptions of their coaches' need supportive, thwarting, and indifferent interpersonal behaviours. This measure was named the Tripartite Measure of Interpersonal Behaviours-Coach (TMIB-C). Over three studies, various sources of validity evidence outlined by The *Standards for Educational and Psychological Testing* (The *Standards*; developed by the American Educational Research Association [AERA], American Psychological Association [APA], and National Council on Measurement in Education [NCME], 2014), were examined. In Study 1, I focused on item creation and selection, in addition to testing face and content validity evidence of the responses to the items of the new measure. In Study 2, evidence for the internal structure of the measure was examined by comparing several theoretically justifiable factorial models using CFA, ESEM, and bifactor CFA and ESEM. Additionally, evidence for the reliability and discriminant validity of the subscale scores was also provided. Finally, in Study 3, the factorial structure of the scale was re-tested with an independent sample and initial evidence for its nomological validity was also examined.

### **Study 1**

In Study 1, I aimed to (a) create a pool of items to assess coach behaviours that would be supportive, thwarting, and indifferent to each of the three needs; (b) test the face validity evidence of the items by pilot testing them with athletes to explore their perceptions of the items' relevance to the sport domain as well as the clarity of wording; and (c) test the content validity evidence of the scores of the selected item pool by consulting a panel of experts.

#### **Study 1 Methods**

Electronic databases were searched to identify existing self-report and observational SDT-informed measures of interpersonal behaviours / socio-contextual environment in the areas of sport, exercise, education, and parenting. Keywords included "need support", "need supportive climate", "autonomy support", "controlling", "need thwarting", "observed need thwarting", "motivational climate", "interpersonal style", and "self-determination theory". Twelve measures were identified through this search, and inspection of their reference lists led to the

identification of 10 additional measures (see Appendix A). Items of these twelve measures were collated to form the initial pool of 359 items.

An important initial step in developing measurement instruments is creating a clear and sufficiently detailed narrative for the constructs of interest (Clark & Watson, 2019). Existing definitions were adapted for conceptualisations of need supportive and thwarting behaviours, and new definitions were written for need indifferent behaviours (see Table 2.1). Removal of duplicate items, similarly worded items, and items that were deemed unsuitable for a self-report measure specific to coaching, resulted in a reduced pool of 42 items. These items were subsequently classified as being supportive (18 items), thwarting (17 items), or indifferent (seven items) towards each of the three needs. In order to make the items suitable for sport, the wording of the original items was slightly modified. Items capturing need indifferent behaviours were items that had been originally proposed as need thwarting by the researchers who developed the included scales (e.g., “My coach lets things get chaotic”). Based on the definitions developed for the purpose of this study, however, such items were classified as being indifferent. In addition, nine new items were created to tap need indifferent behaviours (for example “My coach keeps to himself/herself”). Guidelines for item wording (DeVellis, 2012) were followed in order to maximise the quality of these items. Namely, I ensured that the items were straightforward, easy to read for the target population, brief, and avoided items that were double-barrelled or items with nearly identical content. Through this process, an initial pool of 51 items was created. The perceived relevance to sport and clarity of the items in this pool was subsequently tested in a group of athletes, and after further changes, by a panel of SDT experts.

Table 2.1. *Initial Definitions for Nine Dimensions of Coach Behaviours to Facilitate Item Creation*

Coach Behaviours	Initial definitions
Autonomy Supportive	Autonomy supportive behaviours on part of the coach involve identification, nurture, and development of athletes' inner motivational resources (Katz & Assor, 2007, Reeve, 2006) by prioritization and understanding of their perspectives (Reeve, 2009).
Autonomy Thwarting	Autonomy thwarting behaviours on part of the coach entail pressure for the athletes to think, feel, and behave in set ways (Reeve, 2009), and involve dismissal or devaluation of athlete perspectives (Barber, 1991).
Autonomy Indifferent	Autonomy neglecting* behaviours on part of the coach involve negligence or inattention towards athletes' perspectives and their inner motivational resources.
Competence Supportive	Competence supportive behaviours on part of the coach involve guidance to aid athletes feel capable of facing challenging situations and/or experiencing success (Matosic, Ntoumanis, & Quested, 2016).
Competence Thwarting	Competence thwarting behaviours on part of the coach entail communicating incompetence to the athletes, doubting their improvements, and highlighting their faults (Sheldon & Filak, 2008).
Competence Indifferent	Competence neglecting behaviours on part of the coach involve negligence or inattention towards providing adequate guidance, feedback, and organization to help athletes feel capable of facing challenges and/or experiencing success.
Relatedness Supportive	Relatedness supportive behaviours on part of the coach involve fostering a sense of connectedness with the athletes (Vansteenkiste, Niemiec, & Soenens, 2010).
Relatedness Thwarting	Relatedness thwarting behaviours on part of the coach entail active dislike or hostility towards the athletes (Skinner, Johnson, & Snyder, 2005).

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Relatedness Indifferent	Relatedness neglecting behaviours on part of the coach involve negligence or inattention towards promoting a sense of connectedness with the athletes.
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*Note.* \*Originally, the research team had proposed the label “neglect” for the new set of behaviours. It was, however, later changed to “indifferent”.

**Participants.** The athlete sample ( $N = 20$ ) consisted of six female and 14 male Australian athletes, who were, on average, 19.70 years of age ( $SD = 2.83$ ). Athletes represented individual and team sports including Australian football league (AFL), rugby, athletics, netball, lacrosse, rowing, karate, soccer, and basketball. Athletes were competitive at the club ( $n = 11$ ), state ( $n = 7$ ), or national ( $n = 2$ ) level. Average competitive experience was 7.55 years ( $SD = 4.717$ ). On average, athletes trained 2.90 times a week ( $SD = 1.74$ ) and had been training with their current main coaches for 1.79 years ( $SD = 1.61$ ).

Following further changes to the item pool based on athlete feedback, email requests were sent to 15 academics in order to invite them to test the content validity evidence of the item pool; eight accepted the invitation. These academics from five countries, were experts in SDT, with experience in scale development, and track records of publishing relevant research in the fields of sport and exercise psychology, education, work, or parenting.

**Procedure.** After gaining ethical approval for all three studies in this chapter from Curtin University ethics committee, coaches and management committees of sporting bodies in Perth, Western Australia were contacted to request them to invite their athletes to participate. To be eligible, athletes were required to be over 14 years of age, train with a coach at least once a week, compete regularly during the sport season, and be proficient in English. The purpose of the study was explained to interested athletes before they were invited to participate in a semi-structured interview. Prior to interviews, written participant consent and parental consent (where appropriate) was obtained.

The interviews allowed for collection of both quantitative and qualitative data. Athletes were presented with the pool of 51 items and were requested to consider their general experiences of the “manner” in which coaches (their own or those of others in the case that some of the items were inapplicable to their coach) interact with athletes. At first, I asked them to rate the relevance of each item to the sport domain using a dichotomous scale (*Applicable* vs. *Inapplicable*). For the items that were found to be applicable to sport (implying that coaches might communicate in such a manner), I further asked them to rate the items in terms of clarity, using a 7-point scale (1 = *not at all clear* to 7 = *very clear*). In cases where an item was rated below 5 on clarity, I discussed the problematic areas with the athletes and asked them to share their thoughts on how to make the items (or part thereof) clearer. Finally, I

also encouraged the participants to describe any other coaching behaviours that they had experienced, which were not already represented by the item pool. Items were modified accordingly.

Next, SDT experts were requested to rate the modified items to indicate the extent to which they thought each item matched its ascribed definition using a 5-point scale (1 = *poor match*, 5 = *excellent match*). Experts were requested to indicate if they thought any item also made a good, great or excellent match (i.e., ratings of 3, 4 or 5) for a non-intended factor, in an effort to identify items which could potentially cross-load in a future factor analysis. Finally, they were invited to share their opinions on alternative wording for items, propose additional items, and to provide feedback on the suggested definitions of need indifferent behaviours. Experts' ratings were used to calculate the Content Validity Index (CVI; Lynn, 1986) for each item and to reach decisions for retention, revision, or elimination of items. To calculate each item's CVI, I divided the number of experts who rated the item as a good match, very good match, or an excellent match (i.e. a rating of 3, 4 or 5) by the total number of experts on the panel.

### **Study 1 Results**

The athletes reported that all 51 coach behaviours were applicable to sport and that coaches interacted with athletes using the supportive, thwarting, and indifferent behaviours described by the 51 items. Three new items (one each for autonomy supportive, autonomy indifferent, and relatedness thwarting behaviours) were identified through the interviews and were added to the item pool. The wording for one item (for relatedness support) was rated as unclear and revised according to athlete feedback.

Following the expert panel review, 51 of the 54 items in the revised item pool exhibited a CVI that was over or in the vicinity of the agreement level proposed by Lynn (1986) for six or more experts (i.e.  $CVI \approx .80$ ; see also Polit, Beck, & Owen, 2007). Minor revisions were made to some of these items to accommodate experts' comments regarding item improvement. Although three items had low or very low CVIs (.62, .35, and .25, respectively), these items were not deemed irrelevant or worthy of deletion in any of the experts' qualitative comments. As such, a decision was made to retain these items, modify their wording, and earmarked them for possible deletion in Study 2, if they were found to be problematic again.

## Study 2

In Study 2, I aimed to (a) create a theoretically-based, parsimonious measure of supportive, thwarting, and indifferent coach interpersonal behaviours; (b) assess its factor structure using CFA, ESEM, and bifactor CFA and ESEM; and (c) examine the reliability and discriminant validity evidence of the subscale scores of the new measure.

### Study 2 Methods

**Participants.** The sample ( $N = 288$ ) consisted of 156 female and 132 male Australian athletes, with an average age of 17.93 years ( $SD = 4.56$ ). Athletes represented individual ( $n = 43$ ) and team ( $n = 245$ ) sports, such as swimming, triathlon, tennis, netball, AFL, soccer, synchronized swimming, lacrosse, volleyball, baseball, water polo, and basketball. Athletes were competing at the club ( $n = 235$ ), state ( $n = 44$ ), national ( $n = 7$ ), or international ( $n = 2$ ) level. Average competitive experience was 9.71 years ( $SD = 5.13$ ), with athletes had been training with their current main coach for an average of 1.36 years ( $SD = 1.88$ ).

**Measures.** I used the 54-item Tripartite Measure of Interpersonal Behaviours-Coach (TMIB-C) developed in Study 1 alongside a 7-point response format (1 = *strongly disagree*, 4 = *neither disagree nor agree*, 7 = *strongly agree*), which has also been employed in other measures of coach interpersonal behaviours (e.g., Rocchi et al., 2017). At the beginning of the questionnaire, participants were requested to consider their experiences with their current main coach during training and competitions over the past month, and to indicate the extent to which they disagreed or agreed with each statement, which began with the stem “My coach...”. The researcher emphasised to the participants that every coach has his or her own style and no one style is necessarily better than the other, thus inviting them to be as honest as possible with their responses.

**Procedure.** Procedures similar to those utilised in Study 1 were employed to recruit athletes.

**Data analyses.** As there is theoretical and empirical support for modelling the broad interpersonal behaviours as a single factor (e.g., overarching dimension of need support), or according to need specific dimensions (e.g., autonomy, competence, and relatedness support), both of these approaches were used to inform our tests of the factorial structure of the TMIB-C. The stringent requirement in CFA



of zero cross-loadings between items and non-intended factors results in overestimated factor correlations, a concern that may be dealt with using ESEM, bifactor models, or a fusion of the two (Morin, Arens, & Marsh, 2016). In ESEM, it is recognised that items may be associated with constructs other than those they are intended to measure (Morin et al., 2016). Thus, all cross-loadings can be estimated through the use of ESEM, resulting in factor correlations that are less inflated in comparison to those obtained via CFA (Asparouhov & Muthen, 2009). It is also important to test bifactor models (Holzinger & Swineford, 1937; Reise, 2012) in examining interpersonal behaviours. Substantively, a bifactor model enables one to test simultaneously the presence of a general factor that explains covariance among all items and specific dimensions that explain covariance among subsets of indicators that are distinct to the general construct (Chen, Hayes, Carver, Laurenceau, & Zhang, 2012). Practically, testing bifactor solutions and comparing them against CFA and ESEM solutions is useful in deciding whether general factors (e.g., need support) are accompanied by need-specific factors (autonomy, competence, and relatedness) or whether general factors are sufficient on their own. Lastly, bearing in mind that items are often associated with constructs other than the ones they are intended to measure, and also that items may tap a specific factor as well as a more general construct, a merger of ESEM with bifactor models enables the simultaneous examination of the presence of item cross-loadings as well as general and specific factors in a factorial structure. Thus, 12 theoretically justifiable configurations of the factorial structure were tested using CFA, ESEM, and bifactor CFA, and ESEM (See Table 2 and Appendix B). All statistical analyses were conducted in Mplus 8.0 (Muthén & Muthén, 1998-2017).

In the CFA models, I allowed items to load on their predefined factors only, and suppressed cross-loadings on unintended factors. Factors were allowed to correlate. I used target rotation to test ESEM models. In other words, I defined factors in a manner similar to the CFA models, however, I allowed cross-loadings to be freely estimated while specifying them to be close to zero (Browne, 2001). In the case of the bifactor CFA models, I let items load on their predefined S-factors and G-factors. S-factors were specified as orthogonal. G-factors were allowed to correlate with one another in cases where there were two or more (A. Morin, personal communication, December 18, 2017). Finally, I estimated the bifactor ESEM models in a manner similar to bifactor CFA models, however, I allowed for all cross-loadings

for the S-factors to be freely estimated using an orthogonal target rotation (Reise, 2012).

I used a multi-faceted approach to assess the adequacy of model-to-data fit by evaluating the  $\chi^2$  goodness-of-fit index, Tucker-Lewis index (TLI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square (SRMR). Guided by typical recommendations (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005; Marsh Hau, & Wen, 2004), CFI and TLI values of or greater than .90 and .95 were considered to be indicative of adequate and excellent fit, respectively. SRMR and RMSEA values smaller than .08 and .06 were indicative of acceptable and excellent model fit, respectively.

I used the recommendations of Comrey and Lee (1992) to guide the assessment of strength of factor loadings ( $> .71$  = “excellent”,  $>.63$  = “very good”,  $> .55$  = “good”,  $>.45$  = “fair”,  $<.30$  = “poor”). Raykov’s composite reliability coefficient ( $\rho$ ; Raykov, 1997) was used as an estimate of internal consistency for the subscale scores; values greater than .70 were considered acceptable (e.g., Nunnally, 1978). Evidence for discriminant validity was sought through an examination of correlations between the factors (Brown, 2015), where values  $> .80$  were deemed indicative of considerable overlap between the factors (John & Benet-Martinez, 2000).

## Study 2 Results

**Item distribution.** First, the scoring distributions of the 54 items were examined for univariate normality. Median values for skewness and kurtosis were .748 (range -4.307 to .146) and 1.228 (-1.090 to 20.774). The high positive kurtosis values for some items indicate that participant responses to these items were concentrated in the middle of the response scale and were sparse towards the tails (Tabachnick & Fidell, 2012). Departures from normality are common in the area of social and psychological sciences (Cain, Zhang, & Yuan, 2017). Subsequent analyses were conducted using a robust maximum likelihood estimator (MLR) which provides robust fit indices and standard errors in the case of non-normality and performs well with variables with a minimum of five response categories (Bandalos, 2014; Rhemtulla, Brosseau-Laird, & Savalei, 2012).

**Factorial structure.** Goodness-of-fit indices for all 12 models tested are reported in Table 2.2. None of the models achieved good fit and some did not converge. In terms of the ESEM models for potential nine-factor solutions, an examination of the parameter estimates further suggested multiple items with poor standard factor loadings ( $< .30$ ) and/or unintended cross-loadings ( $> .20$ ), the removal of which would result in only one or two items per interpersonal behaviour. The only models that demonstrated clean fitting solutions in terms of zero to few cross-loadings between items and non-intended factors were ESEM Model 5 (three factors) and bifactor ESEM Model 12 (one general-factor and three specific-factors). Both these models also demonstrated acceptable standardised factor loadings and factor correlations in expected directions. In the case of the bifactor ESEM Model 12, this structure also exhibited a well-defined G-factor as well as S-factors.

Table 2.2. *Goodness-of-fit Statistics for Alternative CFA, ESEM, and Bifactor Models Tested (Study 2)*

Model	$\chi^2$	<i>p</i>	<i>df</i>	CFI	TLI	SRMR	RMSEA [90% CI]
1. Three-factor CFA	3012.04	<.001	1374	.78	.77	.06	.06 [.06, .07]
2. Nine-correlated factors CFA	2918.54	<.001	1341	.79	.78	.059	.06 [.06, .07]
3. H-CFA(three-H, nine-L)	2965.38	<.001	1365	.79	.78	.06	.06 [.06, .07]
4. H-CFA(one-H, nine-L)	3442.54	<.001	1368	.73	.71	.08	.07 [.07, .08]
5. Three-factor ESEM	2960.48	<.001	1272	.78	.75	.054	.07 [.06, .07]
6. Nine-correlated factors ESEM	2055.47	<.001	981	.86	.79	.028	.06 [.06, .06]
7. Bifactor CFA (correlated three-G, nine-S)					DNC		
8. Bifactor CFA (one-G, nine-S)					DNC		
9. Bifactor CFA (one-G, three-S)	2825.63	<.001	1323	.80	.79	.08	.06 [.06, .06]
10. Bifactor ESEM (correlated three-G, nine-S)	1849.33	<.001	924	.88	.81	.030	.06 [.05, .06]
11. Bifactor ESEM (one-G, nine-S)	1902.53	<.001	936	.87	.80	.026	.06 [.06, .06]
12. Bifactor ESEM (one-G, three-S)	2578.88	<.001	1221	.82	.79	.042	.06 [.06, .06]

*Note.*  $\chi^2$  = Chi-square test of exact fit. *df* = degrees of freedom. *p* = probability. CFI = Comparative Fit Index. TLI = Tucker–Lewis index. SRMR = Standardised Root Mean Square Residual. RMSEA = Root Mean Square Error of Approximation. 90% CI = 90% confidence interval of the RMSEA. CFA = confirmatory factor analysis. H-CFA = Hierarchical CFA. H-factor = higher order factor estimated as a part of hierarchical model. L-factor = lower order factor estimated as a part of hierarchical model. ESEM = exploratory structural equation modelling. G-factor = global factor estimated as part of a bifactor model. S-factor = specific factor estimated as part of a bifactor model. DNC = did not converge

I thus decided to revert to the original item pool of 54 items in order to pull together items that would support either of these two solutions, with factors representing overall need supportive, thwarting, and indifferent coaching behaviours. Item selection began with one-factor CFAs for each of these three broad coach interpersonal behaviours. The CFA approach was justified in that the measure was based on a strong theoretical framework, and the aim of this analysis was to select items that load primarily on their intended constructs so as to have more distinct measures of the three broad interpersonal behaviours. After removing problematic items, the end goal was to re-run the three-factor ESEM Model (Model 5) and bifactor ESEM Model with one G-factor and three S-factors (Model 12), with the chosen items from the unidimensional CFAs, in order to achieve improved model-to-data fit.

As the mere retention of best-fitting items might not lead to a measure that is adequately representative of the target construct (Clark & Watson, 2019), my screening for model misspecification was conceptually and statistically informed. Conceptual details such as item overlap, the breadth of the concept, and adequate representation of items pertaining to each need were considered. Statistically, items with standardised factor loadings close to or below .30 and large modification indices (over 10), or multiple (two or more) moderate-sized modification indices were considered for deletion. Problematic items in each iteration were identified and removed from the analysis. I sought to ensure a balance of items of all three needs in each unidimensional model. A total of 32 items were removed through this process; 22 items were retained. The final unidimensional models for each of the three broad behaviours were found to have excellent fit and a balance of behaviours relevant to each of the three needs across each interpersonal behaviour (see Table 2.3).

Table 2.3. *Initial and Final Model Fit for Single-factor CFA and Three-factor ESEM Models (Study 2)*

Subscales	$\chi^2$	<i>df</i>	<i>p</i>	CFI	TLI	SRMR	RMSEA [90% CI]
One-factor CFAs							
Need Supportive							
Initial (19)	431.13	152	.000	.87	.85	.05	.08 [.07, .09]
Final (8)	39.95	20	.005	.96	.95	.03	.06 [.03, .08]
Need Thwarting							
Initial (18)	430.56	135	.000	.81	.78	.08	.09 [.08, .09]
Final (8)	21.27	20	.381	.99	.99	.03	.01 [.00, .05]
Need Indifferent							
Initial (17)	363.49	119	.000	.86	.84	.06	.08 [.07, .09]
Final (6)	15.44	9	.079	.98	.96	.03	.05 [.00, .09]
ESEM							
Three-factor (22)	271.48	168	.000	.95	.93	.03	.05 [.04, .06]
Bifactor one-G three-S (22)	238.25	149	.000	.95	.93	.03	.05 [.03, .06]

*Note.*  $\chi^2$  = Chi-square, *df* = degrees of freedom. *p* = probability. CFI = comparative fit index. TLI = Tucker-Lewis Index. SRMR = Root Mean Square Residual. RMSEA = Root Mean Square Error of Approximation. () = number of items in model. Initial = the model with all items. Final = the model with the problematic items removed. CFA = confirmatory factor analysis. ESEM = exploratory structural equation modelling. G-factor = global factor estimated as part of a bifactor model. S-factor = specific factor estimated as part of a bifactor model.

I subsequently re-ran Model 5 and Model 12 with the remaining 22 items<sup>1</sup>. The three-factor ESEM model was found to have acceptable fit [ $\chi^2(168) = 271.479$ ,  $p < .001$ , CFI = .95, TLI = .93, RMSEA = .04 (90% CI .03 - .05), SRMR = .03]. Standardised factor loadings were significant and in the range of .48 and .88 and subscales related to each other in expected ways (see Table 2.4). None of the items had significant cross-loadings on unintended factors that were larger than the standard factor loading. Factor correlations between need thwarting and need supportive behaviours, need supportive, and need indifferent behaviours, and need thwarting and need indifferent behaviours were -.67, -.67, and .62, respectively. Raykov's composite reliability coefficient (Raykov, 1997) was found to be .80 and above for all three subscales (see Table 2.5).

Table 2.4. *Factor Loadings, Standard Errors, Means, SDs, Kurtosis and Skewness for the Final 22 Items in the Three-factor Model (Study 2)*

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
<i>STEM: My coach...</i>								
<b>Need supportive behaviours</b>								
Takes interest in my welfare (R)	.75***			.09	5.73	1.29	-1.42	2.55
Shows that he/she understands my perspective (A)	.85***			.07	5.47	1.23	-0.92	1.08
Ensures that tasks are suited to my skill level (C)	.77***			.09	5.61	1.33	-1.21	1.56
Accepts me (R)	.48***			.13	6.17	1.07	-1.46	2.16
Encourages me to take my own initiative (A)	.67***			.10	5.87	1.17	-1.15	1.29
Shows care and concern (R)	.57***		-.22*	.10	5.94	1.24	-1.37	1.76
Explains the reasons when he/she asks me to do something (A)	.55***			.11	5.69	1.39	-1.31	1.54
Recognizes my efforts and accomplishments (C)	.67***			.09	5.80	1.20	-1.18	1.45
<b>Need thwarting behaviours</b>								
Deliberately ignores me (R)		.66***		.10	1.59	1.35	2.61	6.11
Makes it clear that I have little to contribute (C)		.53***		.11	1.65	1.34	2.45	5.65
Tries to control everything I do (A)		.67***		.08	1.63	1.18	2.31	5.31
Dismisses my opinion (A)		.65***		.10	1.54	1.18	2.69	7.25
Blames me when things don't go well (C)		.70***		.10	1.54	1.20	2.50	5.77
Makes it clear that he/she doesn't like me (R)		.86***		.08	1.27	.90	4.00	16.76
Uses guilt tactics to control what I do (A)		.88***		.08	1.35	.92	3.31	11.80



Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
Belittles my abilities (C)		<b>.84***</b>		.07	1.45	1.08	2.91	8.77
<b>Need indifferent behaviours</b>								
Keeps to himself/herself (R)			<b>.65***</b>	.10	2.17	1.53	1.35	.96
Is unresponsive to my opinions (A) (M)			<b>.55***</b>	.11	2.02	1.36	1.32	1.15
Sets activities that aren't challenging enough (C) (M)			<b>.64***</b>	.12	2.33	1.51	1.08	.39
Is indifferent to how I feel (R) (M)			<b>.69***</b>	.11	2.20	1.39	1.14	.78
Sets activities that lack variety (A)			<b>.65***</b>	.10	2.45	1.60	1.06	.35
Can be disorganised (C)			<b>.61***</b>	.12	2.24	1.52	1.19	.62

*Note.* Target loadings are in bold. For clarity purposes, only cross-loadings over .20 are reported. \*\*\* $p < .001$ , \* $p < .01$ . A = autonomy items, C = competence items, R = relatedness items, M = wording modified following three-factor ESEM, SE = standard errors, SD = standard deviation.

Table 2.5. *Factor Correlations and Composite Reliability for the Three-Factor ESEM Model with 22-items (Study 2)*

Subscales	Need Thwarting	Need Supportive	Need Indifferent
Need Thwarting	.90		
Need Supportive	-.67**	.86	
Need Indifferent	.62**	-.67**	.80

*Note.* Raykov's composite reliability coefficients are presented on the diagonal of the correlation matrix. \*\* $p < .001$ .

The bifactor ESEM model with one G- and three S-factors also demonstrated similar acceptable fit indices [ $\chi^2 = 238.247 (149)$ ,  $p < .001$ , CFI = .95, TLI = .93, RMSEA = .05 (90% CI (.03 - .06), SRMR = .03]. However, examination of factor loadings indicated that although there was a well-defined G-factor and S-factors for need supportive and indifferent behaviours, none of the items for the need thwarting behaviours had significant loadings. As such, a decision was made to retain the three-factor ESEM model (Model 5) and to re-test its factor structure with an independent sample of athletes.

Thus, at the end of Study 2, my assessment of coach interpersonal behaviours was informed by a tripartite approach (supportive, thwarting, and indifferent), which included a relative balance of behaviours tapping each of the three needs. Such an approach of collapsing the three needs into one overall score is in line with past measurement attempts (e.g., Markland & Tobin, 2010, and Williams et al., 1996 for need support), theoretically justified (see General Discussion), and it was a pragmatic choice as a nine-factor solution could not be established.

### Study 3

In Study 3, I first sought to re-test the three-factor ESEM structure that was favoured in Study 2 in a new sample of athletes. Based on Study 2, it was expected that the three-factor ESEM solution would hold when tested in a new sample of athletes. Subsequently, I sought to provide initial evidence for the nomological network surrounding the subscales of the TMIB-C by testing two different models for the relations between coach interpersonal behaviours and a) one positive (i.e., dedication) and two negative (i.e., exhaustion and irrelevant thoughts) athlete

outcomes, and b) athlete need satisfaction and frustration. Dedication, exhaustion, and irrelevant thoughts were chosen as outcome measures as I was interested in examining the relations between interpersonal behaviours and outcomes that have commonly been used before (e.g., dedication, exhaustion), but also measures that haven't been examined in the SDT literature (e.g., irrelevant thoughts). Based on past research linking need supportive and thwarting coach interpersonal behaviours, athlete need states, and outcomes of well-being and ill-being (e.g., Bartholomew et al., 2011; Pulido et al., 2018; Rocchi et al., 2017), I expected that sport dedication would be best predicted by need support. Exhaustion is a negative outcome that should be best predicted by need thwarting as it is an intensely adverse (darker) outcome. Irrelevant thoughts is also a negative outcome but not as strongly adverse as exhaustion, and would be best predicted by need indifference.

### **Study 3 Methods**

**Participants.** The sample ( $N = 352$ ) consisted of 169 female and 183 male competitive athletes, with an average age of 20.02 years ( $SD = 5.88$ ). Athletes represented individual ( $n = 76$ ) and team ( $n = 276$ ) sports such as athletics, cycling, AFL, and netball. Most of the athletes were Australian ( $n = 280$ ), and the remainder ( $n = 72$ ) reported their ethnicities as European, South African, British, New Zealander, North American, Chinese, Irish, Polynesian, or other not listed. Athletes were competitive at the club ( $n = 159$ ), state ( $n = 98$ ), national ( $n = 62$ ), or international ( $n = 33$ ) level. They had been competing in their respective sports for an average of 8.74 years ( $SD = 4.81$ ), and had been training with their respective main coaches for an average of 2.31 years ( $SD = 2.26$ ) on an average of 3.08 times per week ( $SD = 1.75$ ).

**Measures.** Athletes completed the following self-report measures either in-person ( $n = 206$ ) or online ( $n = 146$ ).

**Coach interpersonal behaviours.** The 22-item TMIB-C, developed in Studies 1 and 2, was used to assess athletes' perceptions of their coaches' interpersonal behaviours. The measure consisted of three factors of need support, need thwarting, and need indifference. Similar to Study 2, athletes were requested to consider their experiences with their current main coach over the past month, and indicate the extent to which they disagreed or agreed with each statement using a 7-point response format.

***Athlete need satisfaction and frustration.*** The 24-item Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) was used to examine athletes' experiences of basic psychological need satisfaction and frustration. The measure consists of six subscales (with four items each) that examine the satisfaction and frustration of each of the three basic psychological needs. Some examples of items are "I feel capable at what I do" (competence satisfaction), and "I feel that people who are important to me are cold and distant towards me" (relatedness frustration). Athletes were asked to think about their experiences in sport and indicate the extent to which they disagreed or agreed with each statement using a 5 - point rating scale (1 = *not at all true*, 5 = *completely true*).

The factor structure of the measure was confirmed using CFA and ESEM. The ESEM model resulted in negative residual variance for one item ("I feel that my decisions reflect what I really want"). Fit indices for the CFA model were indicative of acceptable model-to-data fit [ $\chi^2$  (236) = 503.278,  $p < .001$ , CFI = .93, TLI = .91, RMSEA = .06 (90% CI .05-.06), SRMR = .06]. Factor correlations were in the expected directions, ranging between - .76 and .66. Raykov's composite reliability coefficients were acceptable for all subscale scores (range .83 - .93). As such, the correlated six-factor CFA model was retained.

***Positive and negative athlete outcomes.*** The dedication subscale of the Athlete Engagement Questionnaire (Lonsdale, Hodge, & Jackson, 2007) was employed as a positive athlete outcome. The subscale consists of four items, to which participants responded using a 5-point rating scale (1 = *almost never*, 5 = *almost always*). An example item is "I am determined to achieve my goals in sport". Fit for the single-factor CFA model was excellent [ $\chi^2$  (2) = 4.650,  $p < .001$ , CFI = .99, TLI = .99, RMSEA = .06 (90% CI .00 - .14), SRMR = .06]. Raykov's composite reliability coefficient for the subscale score was .95.

The emotional/physical exhaustion subscale of the Athlete Burnout Questionnaire (Raedeke & Smith, 2001) was administered as an assessment of a darker athlete outcome. Participants responded to the five items that comprised the subscale using a 5-point response format (1 = *almost never*, 5 = *almost always*). An example of an item is "I have been feeling physically worn out from my sport". Fit for the single-factor CFA model was sound [ $\chi^2$  (5) = 34.355,  $p < .001$ , CFI = .96, TLI = .93, RMSEA = .13 (90% CI .09 - .17), SRMR = .03]. Raykov's composite reliability coefficient for the subscale score was .93.

Finally, the five-item irrelevant thoughts subscale of the Thought Occurrence Questionnaire for Sport (TOQS; Hatzigeorgiadis & Biddle, 2001) was used to assess cognitive interference (a less dark negative outcome). Participants responded to experiencing sport irrelevant thoughts about, for example, “Friends”, “Personal worries (e.g., school, work, relations)”, using a 7-point response format (1 = *never*, 7 = *very often*). Fit for the single-factor CFA model was excellent [ $\chi^2(5) = 21.449, p < .001, CFI = .97, TLI = .95, RMSEA = .08$  (90% CI .06 - .14), SRMR = .03]. Raykov’s composite reliability coefficient for the subscale score was .92.

**Procedure.** Athletes were recruited using a procedure similar to that in Studies 1 and 2. Additionally, the questionnaire was made available online on the Qualtrics platform and was advertised through social media. All participating athletes were eligible to go in to a prize draw to win shopping vouchers. Undergraduate student-athletes ( $n = 5$ ) at the School of Psychology at Curtin University were offered course credit for participation.

**Data analyses.** Data were analysed to test the scale structure, reliability and discriminant validity evidence, as well as evidence for nomological network surrounding the surrounding the subscales of the TMIB-C.

**Scale structure, reliability, and discriminant validity evidence.** The three factor ESEM model was re-tested<sup>2</sup> to assess the degree to which the factorial structure held when examined with a new sample of athletes. Similar to Study 2, model-to-data fit was determined using a multi-faceted approach. Raykov’s composite reliability coefficient was used as an estimate of internal consistency. An examination of the factor correlations between the three subscales served as evidence for discriminant validity.

**Structural equation modelling (SEM).** First, a six-factor model (three dimensions of coach interpersonal behaviours and three athlete outcomes) was estimated using a structural equation modelling (SEM) framework to explore the relations between the contextual and outcome variables. Subsequently, I tested a 12-factor model (three dimensions of coach interpersonal behaviours, six dimensions of athlete need satisfaction and frustration, and three athlete outcomes) using SEM to examine the relations between the contextual variables and need states. Yet again, a multi-faceted approach informed the assessment of model-to-data fit, with the same cut-off criteria described in Study 2. TMIB-C subscales were specified using the three-factor ESEM framework. As the test of an ESEM factor structure resulted in a

negative residual variance for an item of the BPNSFS, its subscales were specified as six CFA factors. Athlete outcomes were individual subscales from measures of athlete engagement, burnout, and cognitive interference, and were, hence, estimated as single-factor CFAs each. Items were used as factor indicators. All analyses were conducted in Mplus 8.0.

### **Study 3 Results**

**Item distribution.** Prior to the main analyses, data were screened for normality. Median values for skewness and kurtosis were 1.175 (range -1.86 to 4.04) and 2.115 (range .04 to 17.72) respectively. All analyses were conducted using MLR.

**Scale structure, reliability, and discriminant validity evidence.** The three-factor ESEM model was found to demonstrate good fit to the data [ $\chi^2(168) = 281.747, p < .001, CFI = .95, TLI = .93, RMSEA = .04$  (90% CI .03 - .05), SRMR = .03]. Standardised factor loadings were significant and ranged between .40 and .94. One item of the need indifference subscale (“My coach is unresponsive to my opinions”) demonstrated a significant cross-loading of .24 on the need thwarting factor. However, as this value was smaller than its factor loading on its intended subscale (.40), along with it conceptually being better representative of need indifference, this item was retained. Factor correlations between need thwarting and need supportive behaviours, need supportive and need indifferent behaviours, and between need thwarting and need indifferent behaviours were -.67, -.58, and .53, respectively. Estimates of internal consistency were acceptable (.77 - .88) for all three subscales. Standard factor loadings, cross-loadings, item means, standard deviations, skewness, kurtosis, factor correlations, and internal consistency estimates are reported in Table 2.6.

Table 2.6. *Factor Loadings, Standard Errors, Means, SDs, Kurtosis and Skewness for the TMIB-C Items (Study 3)*

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
<i>STEM: My coach...</i>								
Shows that he/she understands my perspective	<b>.66**</b>			.09	5.49	1.20	-.97	.96
Ensures that tasks are suited to my skill level	<b>.74**</b>			.07	5.70	1.29	-1.22	1.53
Takes interest in my welfare	<b>.79**</b>			.08	5.82	1.23	-1.35	2.35
Encourages me to take my own initiative	<b>.65**</b>			.10	5.91	1.12	-1.42	2.66
Recognizes my efforts and accomplishments	<b>.79**</b>			.09	5.92	1.17	-1.42	2.57
Accepts me	<b>.69**</b>			.09	6.31	1.00	-1.86	4.19
Explains the reasons when he/she asks me to do something	<b>.49**</b>			.08	5.75	1.32	-1.39	1.71
Shows care and concern	<b>.69**</b>			.08	6.01	1.18	-1.38	1.88
Tries to control everything I do		<b>.50**</b>		.13	2.18	1.48	1.27	.69
Makes it clear that I have little to contribute		<b>.49**</b>		.10	1.75	1.39	2.21	4.29
Deliberately ignores me		<b>.77**</b>		.09	1.45	1.14	3.25	10.65
Dismisses my opinion		<b>.65**</b>		.09	1.59	1.18	2.39	5.58
Blames me when things don't go well		<b>.67**</b>		.08	1.73	1.34	2.14	3.99
Makes it clear that he/she doesn't like me		<b>.94**</b>		.07	1.29	.92	4.04	17.72
Uses guilt tactics to control what I do		<b>.80**</b>		.09	1.47	1.06	2.84	8.20
Belittles my abilities		<b>.72**</b>		.08	1.54	1.19	2.66	6.99
Is unresponsive to my opinions		.24*	<b>.40**</b>	.08	2.17	1.39	1.24	.87

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
<i>STEM: My coach...</i>								
Sets activities that aren't challenging enough			<b>.75**</b>	.08	2.52	1.53	1.01	.27
Keeps to himself/herself			<b>.61**</b>	.09	2.23	1.45	1.23	.86
Sets activities that lack variety			<b>.71**</b>	.07	2.52	1.55	.96	.04
Can be disorganised			<b>.58**</b>	.08	2.30	1.50	1.20	.66
Is indifferent to how I feel			<b>.52**</b>	.08	2.25	1.38	1.15	.83
<b>Factor Correlations and Internal Consistency</b>	1	2	3					
Need Thwarting	.88							
Need Support	-.67**	.88						
Need Indifference	.53**	-.58**	.77					

*Note.* \*\* $p < .001$ ; \* $p < .005$ . Target loadings are in bold. For clarity purposes, only cross-loadings over .20 are reported. NS = need supportive behaviours, NT = need thwarting behaviours, NI = need indifferent behaviours. Raykov's composite reliability coefficients are presented on the diagonal of the correlation matrix.

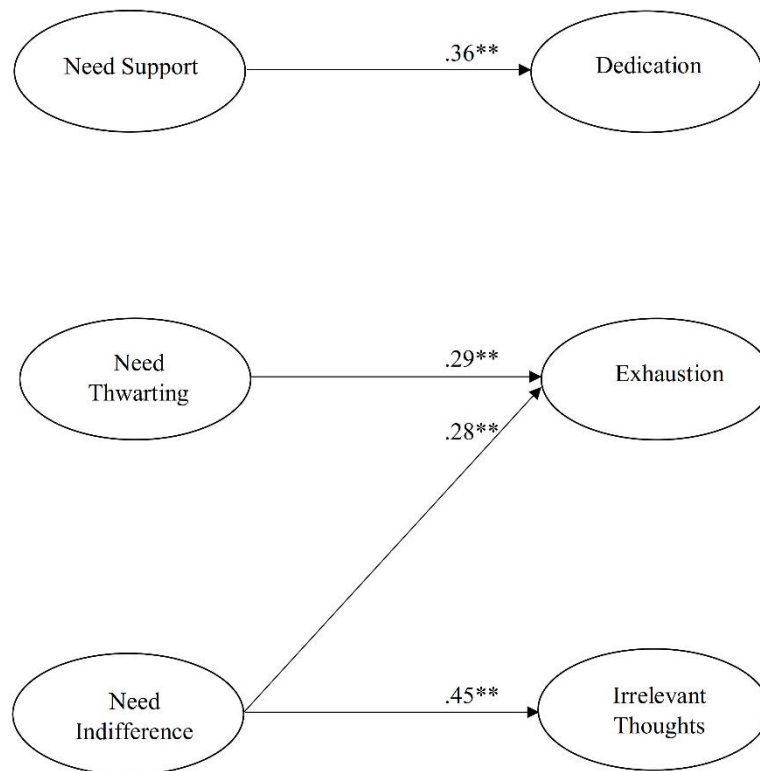


**SEM.** First, a correlational analysis was conducted to explore the associations between the three subscales of the TMIB-C, six subscales of the BPNSFS, and athlete outcomes (see Table 2.7). I then examined the relations between the three broad interpersonal behaviours and three athlete outcomes. Model fit was acceptable [ $\chi^2(541) = 881.96, p < .001, CFI = .95, TLI = .94, RMSEA = .04$  (90% CI .04 - .05), SRMR = .04]. Significant standardised path coefficients for the structural portion of the model are reported in Figure 2.1. As expected, perceived need support predicted dedication, and perceived need thwarting predicted exhaustion. Also, as expected, need indifference was the only significant predictor of irrelevant thoughts. Surprisingly, it was also as good predictor of exhaustion, as need thwarting was.

Table 2.7. *Correlational Analysis for Subscales/Measures Included in Study 3*

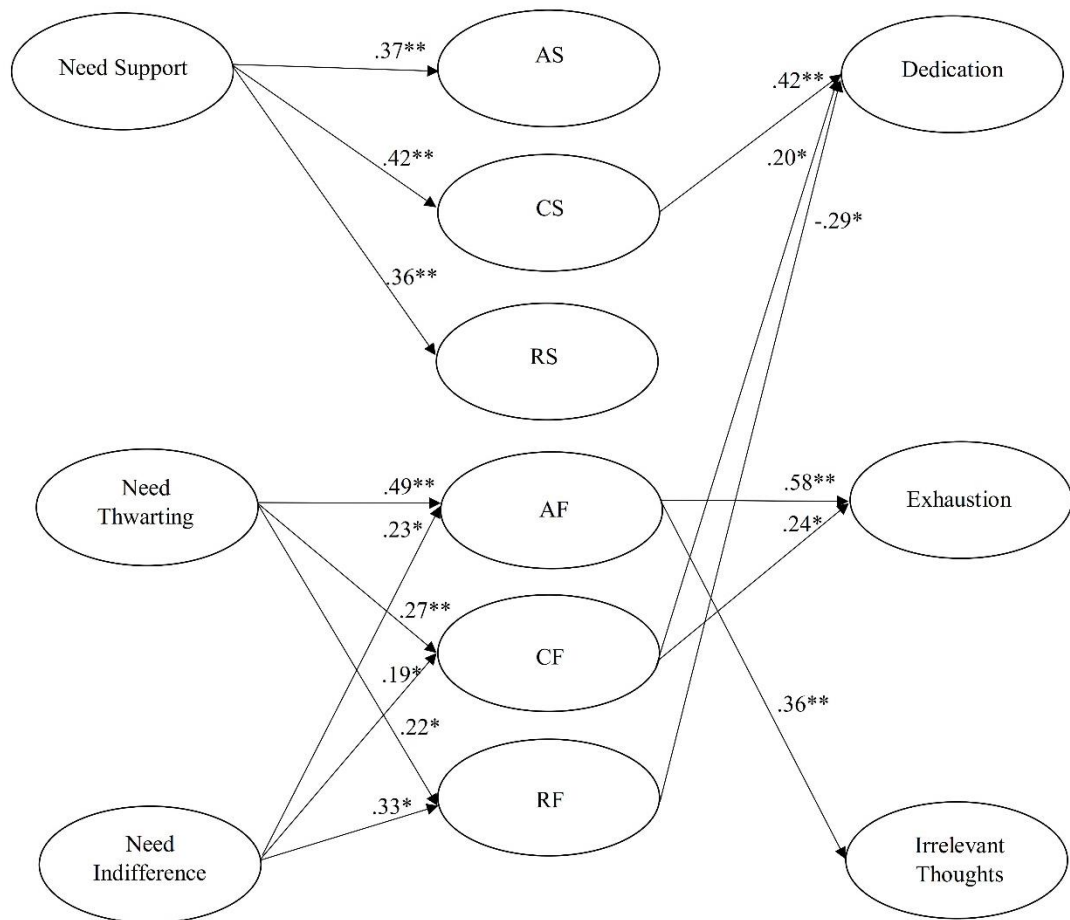
	1	2	3	4	5	6	7	8	9	10	11	12
1 NT	-	-.64**	.52**	-.45**	.59**	-.27**	.41**	-.26**	.43**	-.27**	.43**	.43**
2 NS	-.64**	-	-.56**	.50**	-.45**	.38**	-.35**	.37**	-.37**	.36**	-.32**	-.38**
3 NI	.52**	-.56**	-	-.37**	.44**	-.25**	.34**	-.33**	.46**	-.25**	.38**	.50**
4 AS	-.45**	.50**	-.37**	-	-.57**	.52**	-.41**	.49**	-.42**	.44**	-.37**	-.37**
5 AF	.59**	-.45**	.44**	-.57**	-	-.37**	.57**	-.34**	.51**	-.28**	.59**	.53**
6 CS	-.27**	.38**	-.25**	.52**	-.37**	-	-.56**	.50**	-.35**	.46**	-.32**	-.27**
7 CF	.41**	-.35**	.34**	-.41**	.57**	-.56**	-	-.32**	.44**	-.25**	.50**	.45**
8 RS	-.26**	.37**	-.33**	.49**	-.34**	.50**	-.32**	-	-.67**	.39**	-.32**	-.30**
9 RF	.43**	-.37**	.46**	-.42**	.51**	-.35**	.44**	-.67**	-	-.35**	.37**	.47**
10 DED	-.27**	.36**	-.25**	.44**	-.28**	.46**	-.25**	.39**	-.35**	-	-.21**	-.34**
11 EX	.43**	-.32**	.38**	-.37**	.59**	-.32**	.50**	-.32**	.37**	-.21**	-	.49**
12 IT	.43**	-.38**	.50**	-.37**	.53**	-.27**	.45**	-.30**	.47**	-.34**	.49**	-

*Note.* NT = need thwarting, NS = need supportive, NI = need indifferent, AS = autonomy satisfaction, AF = autonomy frustration, CS = competence satisfaction, CF = competence frustration, RS = relatedness satisfaction, RF = relatedness frustration, DED = dedication, EX = exhaustion, IT = irrelevant thoughts. \*\* Correlation is significant at the 0.01 level (two tailed).



*Figure 2.1.* SEM with need supportive, thwarting, and indifferent interpersonal behaviours, and dedication, exhaustion, and irrelevant thoughts.  
*Note.* \*\* $p < .01$ . Only significant structural paths are reported for simplicity purposes.

Subsequently, all 12 factors were entered into a SEM. The full model with three contextual factors, six needs factors, and three athlete outcomes demonstrated acceptable fit [ $\chi^2(1615) = 2749.12, p < .001, CFI = .90, TLI = .90, RMSEA = .04$  (90% CI .04 - .05), SRMR = .06]. Significant standardised path coefficients for the structural portion of the model are reported in Figure 2.2.



*Figure 2.2.* SEM with need supportive, thwarting, and indifferent interpersonal behaviours, six dimensions of the need states, dedication, exhaustion, and irrelevant thoughts

*Note.* \*\* $p < .01$ , \* $p < .05$ . AS = autonomy satisfaction; CS = competence satisfaction; RS = relatedness satisfaction; AF = autonomy frustration; CF = competence frustration; RF = relatedness frustration. Only significant structural paths are reported for simplicity purposes.

My description is focused on the paths between the interpersonal behaviours and the psychological needs, as the relations between the needs and the outcomes are irrelevant for the purposes of this study. As hypothesised, perceived need support predicted the satisfaction of all three needs in a significant manner. In contrast, perceived need thwarting predicted the frustration of all three needs. Perceived need indifference predicted autonomy frustration and competence frustration, but not as strongly as need thwarting did. Contrary to what was hypothesised, perceived need indifference predicted relatedness frustration better than perceived need thwarting.

### **General Discussion**

In this three-study chapter, I made a case for coach indifferent behaviours and presented the a) conceptual rationale for, b) development of, and c) initial validity evidence for a new SDT-based measure assessing athletes' perceptions of their coaches' need supportive, thwarting, and indifferent interpersonal behaviours. These studies provide preliminary evidence regarding the dimensionality, reliability, discriminant validity of the TMIB-C, and nomological network of constructs surrounding its subscales.

#### **Factorial Validity Evidence**

In our assessment of the factorial structure of the TMIB-C, I found that solutions pertaining to modelling of support, thwarting, and indifference, independently for each of the three needs, were not supported. Instead, I found support for a three-factor solution consisting of the overarching coaching behaviours of need support, need thwarting, and need indifference, within which there was a relative balance of need-specific behaviours.

This finding is not surprising, as the sub-dimensions of need support have been conceptualised as interrelated (Ryan, 1991), and moderately strong correlations have been observed among them previously (Niemic et al., 2006). The scale development literature is also rife with examples of researchers adopting a unidimensional approach and combining autonomy, competence, and relatedness supports into a single factor of need support in settings such as health care (Williams et al., 1996), exercise (Markland & Tobin, 2010), medical education (Gucciardi et al., in press), and work (Tavfelin & Stenling, 2018). In the context of sport, Stenling, Ivarsson, Hassmen, and Lindwall (2015) recently re-examined the dimensionality of the ISS-C (Wilson et al. 2009), and showed that the items of this measure are best

represented by the general dimension of need support, instead of need specific sub-dimensions. Our unidimensional approach is also in line with recent SDT reviews (e.g., Deci, Olafsen & Ryan, 2017), which bear references to overall *need supportive* and *need thwarting* environments, without often referring to need-specific dimensions.

At the level of the personal experience of the needs, Proposition IV within the Basic Psychological Needs Theory (BPNT) of SDT states that “basic need satisfactions of autonomy, competence, and relatedness will tend to positively relate to one another, especially at an aggregated level of analysis (i.e., across domains, situations, or time)” (Ryan & Deci, 2017, p. 249). That is, although the three needs are distinct in terms of their conceptualisations, they are empirically interrelated. The satisfaction or frustration of one need will often result in the satisfaction or frustration of the others, and high correlations are more likely when these experiences are examined in a cumulative manner within a given context, or collapsed over time. In terms of scale development efforts, instead of attempting to impose factorial structures where the needs are estimated to be orthogonal, Ryan and Deci (2017) urge researchers to bear in mind these associations between the needs, and observe “what the data tell us - namely, that these three basic needs, in the natural scheme of wellness, operate convergently. This is, after all, why all three are considered basic” (p. 249).

Such patterns of interrelatedness between the needs would also be expected to extend to the social environment, such that behaviours that are supportive of one need are also likely to be supportive of the others. For example, encouraging athletes to take their own initiatives is considered to be an important behaviour in supporting their need for autonomy. Athletes might also perceive this as a behaviour that supports their need for competence (e.g., “my coach recognises my efforts and accomplishments, and hence encourages me to take my own initiative”), as well as relatedness (e.g., “my coach likes me, and therefore encourages me to take my own initiative”).

Although I do not dismiss the potential utility of measuring need-specific coaching behaviours (particularly in experiments with factorial designs that aim to isolate their independent effects or in field interventions), I believe that such a parsimonious representation of the social environment is in line with theory and has practical utility in examining the role of supportive, thwarting or indifferent social

environments alongside other variables in studies testing nomological networks (e.g., contextual variables, psychological need states, motivation regulations, and indices of athlete cognition, behaviour, and affect).

I also sought to ascertain whether need indifferent behaviours could be operationally distinguished from need supportive and thwarting behaviours. In Study 1 and Study 2, I found moderate-sized correlations between need thwarting and need indifference ( $r = .62$ , and  $r = .53$ , respectively), and need support and need indifference ( $r = -.67$ , and  $r = -.58$ , respectively). These are factor correlations, which are not attenuated by measurement error, hence, they are larger than Pearson's correlations. In sum, the results from the tests of factorial structure substantiate my proposition for the consideration of the third category of need indifferent interpersonal behaviours.

### **Evidence for Nomological Network**

In terms of the relations between interpersonal behaviours and athlete outcomes, athletes who perceived that their coaches used a high level of need supportive strategies were more likely to report dedication to their sport. Athletes will potentially want to devote more time and energy to pursue their sport-relevant objectives if they perceive their coaches are able to provide them with personally relevant choices, genuinely appreciate the effort and hard work they put into training, and accept them in an unconditional manner. Dedication has previously been examined as a part of athlete engagement (Lonsdale, Hodge, & Jackson, 2007); perceived coach interpersonal behaviours have been found to correlate with athlete engagement (Curran, Hill, Hall, & Jowett, 2014; Curran, Hill, Ntoumanis, Hall, & Jowett, 2016).

I also found that athletes who perceived their coaches as need thwarting were more likely to report emotional and physical exhaustion in their sport. Experiencing active dislike, disparaging critique, and excessive control from the coach in an environment that is already physically and emotionally taxing, would potentially put athletes at risk of feeling fatigued. Exhaustion has been conceptualised to be a core dimension of athlete burnout (Gustafsson, Kenttä, & Hassmén, 2011), and researchers have previously found coach interpersonal behaviours to be associated with athlete burnout (e.g., Barcza-Renner, Eklund, Morin, & Habeeb, 2016).

Finally, athletes who perceived their coaches as need indifferent were likely to report sport irrelevant thoughts. On experiencing indifferent interpersonal

behaviours consisting of the coach being aloof, disorganised, or impassive to their opinions, athletes may come to be aware of the disconnection between their psychological needs and the activity at hand. Thus, they might (cognitively and/or behaviourally) disengage from it, and instead engage in other activities that may potentially be more relevant to their needs (for example, thinking about friends). Unexpectedly, I also found that need indifferent coaching predicted feelings of exhaustion. Perhaps on experiencing such coaching behaviours, athletes may also be convinced that they have been left on their own accord, and need to take charge of their own training. Athletes without appropriate guidance from the coach may resort to training inappropriately, overtraining, or not resting sufficiently, thus potentially predisposing themselves to exhaustion.

With regards to the relations between coaches' interpersonal behaviours and athletes' need states, in line with our expectations and findings of previous research (e.g., Pulido et al., 2018; Rocchi et al., 2017), athletes who perceived their coaches as need supportive were more likely to report autonomy, competence, and relatedness need satisfaction. Athletes who perceived their coaches to be need thwarting were more likely to experience autonomy, competence, and relatedness need frustration. Athletes who perceived their coaches to be need indifferent were also likely to experience autonomy and competence need frustration, but to a lesser extent as compared to perceived need thwarting coaching.

An unexpected finding was that perceived need indifference predicted relatedness frustration slightly better than perceived need thwarting. This finding might be due to the nature of some of the items of the relatedness frustration subscale of the BPNSFS (Chen et al., 2015). Instead of capturing the experiential state resulting from experiencing a need thwarting behaviours, two of the four items of this subscale assess athletes' need states that might be a result of experiencing indifferent interpersonal behaviours from others (e.g., "I feel that people who are important to me are cold and distant towards me" and "I feel the relationships I have are just superficial").

In sum, in terms of evidence of nomological networks, our findings were somewhat mixed. As expected, need indifference was a weaker predictor of autonomy and competence need frustration, and the sole significant predictor of irrelevant thoughts, however, unexpectedly, need indifference was as good as or a



better predictor than need thwarting was of exhaustion and relatedness need frustration, respectively.

### **Limitations, Future Directions, and Conclusions**

Although the findings from these three studies provide initial evidence supporting the suitability of the TMIB-C for the sport domain, the results should be considered in light of some limitations. First, the cross-sectional nature of these studies means that causal directions of the examined associations cannot be ascertained. Experimental designs adopting a factorial approach could aim to test the independent causal effects of the TMIB-C factors. Further, longitudinal examinations at multiple time-points (for example, over the course of a sport season) could aid the understanding of the fluctuation of these coaching behaviours over time. Another limitation of my work was that tests of nomological networks utilised self-report outcomes only; future research could include biological markers of well/ill-being (e.g., Quested, Bosch, Burns, Cumming, Ntoumanis, & Duda, 2011).

Ideographic methods (e.g., think aloud protocols) with athletes could provide valuable insights into what criteria they use to distinguish perceptions of need indifference from those of need support, and need thwarting, and the stability of such criteria under different contexts and time periods. The identification of a third class of coaching behaviours could help provide more targeted intervention approaches to reduce their occurrence. Future research could also examine the antecedents of coach interpersonal behaviours. Examinations of the differential antecedents of the three behaviours may help provide insight into what drives coaches to adopt such behaviours. For example, Cheon et al. (2019) posited that social agents adopt indifferent interpersonal behaviours because they are more attentive to their own needs and goals over those of others. In addition, it would be interesting to examine if different analytical methods such as multidimensional scaling (e.g., Tucker-Drob & Salthouse, 2009), and item response theory (e.g., Courvoisier & Etter, 2008) might be more appropriate to capture the multi-faceted nature of the need-specific coaching behaviours. Lastly, researchers could test the applicability of the items (or slight modifications of them) as well as the replication of our results in other domains such as healthcare, work, and education.

In conclusion, SDT-based research in sport as well as other life domains has only examined interpersonal behaviours in terms of those that are supportive and thwarting of others' basic psychological needs (e.g., Pulido et al., 2018; Rocchi et al.,

2017). The identification of such a tripartite conceptualisation of coaches' behaviours underscores that in addition to demonstrating behaviours that are supportive and thwarting of their athletes' basic psychological needs, coaches also exhibit behaviours that entail inattention towards athletes' needs. As demonstrated in this chapter, need indifferent behaviours are less motivationally damaging compared to need thwarting behaviours (in terms of the needs for autonomy and competence), and are the only category of behaviours to be associated with suboptimal outcomes, when examined alongside need support and need thwarting behaviours. I hope this tripartite conceptualisation and measurement can further advance conceptual understanding and intervention efforts on interpersonal behaviours in sport and potentially other life domains.

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### Footnotes

1. The other 10 models were also re-run with these 22 items. Although the CFA models with nine-factor solutions reached acceptable fit indices, they were rejected on the basis of lack of sufficient items per factor. The three-factor CFA also demonstrated good fit, however, the three-factor ESEM model was preferred as it yielded lower factor correlations. The rest of the models did not converge or demonstrated poor standard factor loadings or multiple large unintended cross-loadings.

2. Similar to Study 2, I re-tested all other factor models. Yet again, a model with acceptable fit for the nine coach interpersonal behaviours (Model 3) was rejected on the basis of lack of sufficient items per factor. The three-factor CFA (Model 1) demonstrated good model to data fit, however, factor correlations were higher than those for the three-factor ESEM model. Most of the other models (e.g., Models 4, 6, 7, 8, 9, 10, 11) did not converge. Model 12 (bifactor one-G, three-S) also demonstrated good model-to-data fit, however, yet again, the S-factor for need thwarting was problematic, with only two items that had significant intended factor loadings.

## Appendix A

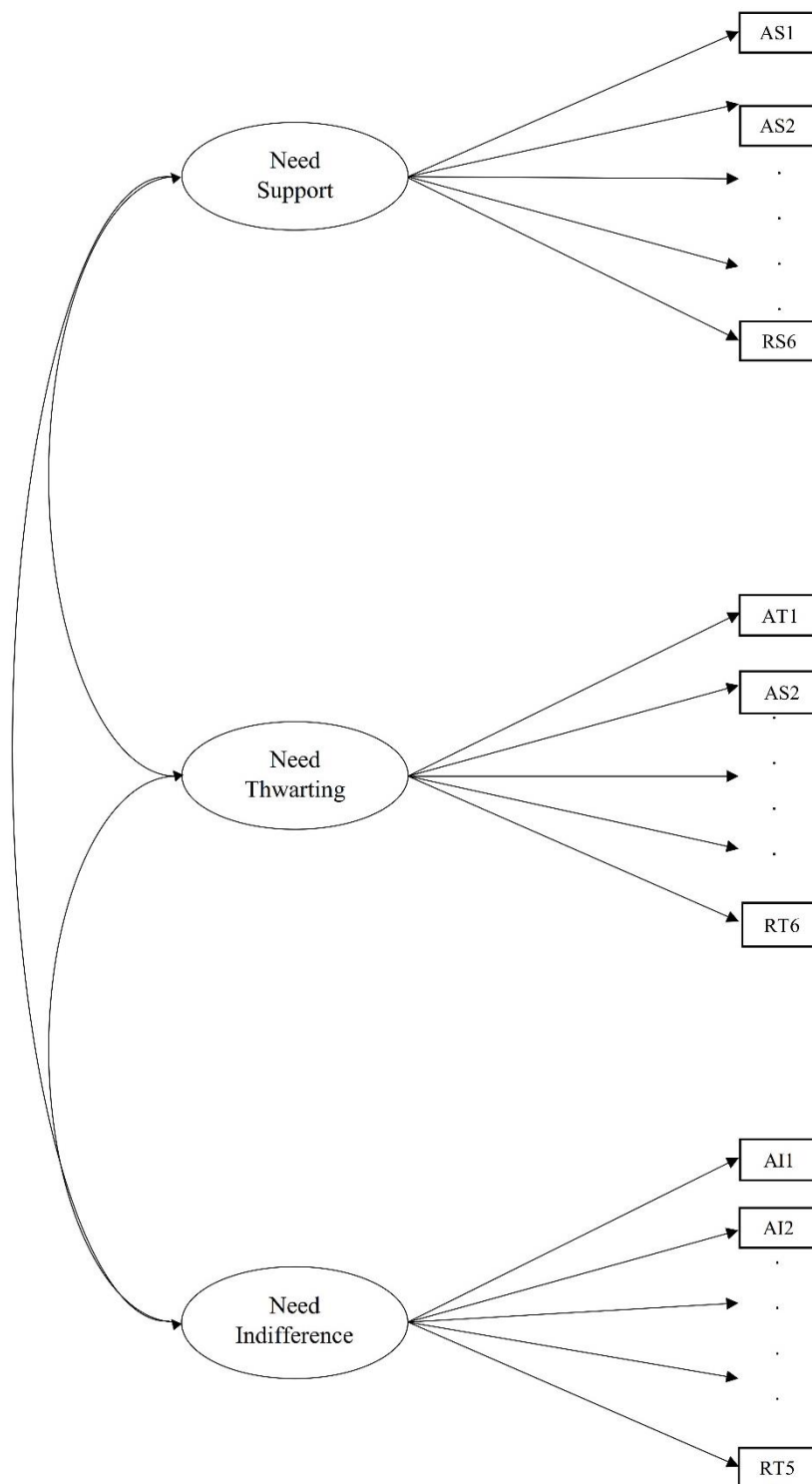
### Measures and Items used to Inform the Creation of the TMIB-C

Measures and items found by searching databases	Authors
Controlling Coaching Behaviour Scale (CCBS)	Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010
Teacher as Social Context Questionnaire (TASCQ)	Belmont, Skinner, Wellborn, & Connell, 1988
Perceived Autonomy Support Scale for Exercise Settings (PASSES)	Hagger, Chatzisarantis, Hein, Pihu, Soos, & Karsai, 2007
Health Care Climate Questionnaire (HCCQ)	Williams, Grow, Freedman, Ryan, & Deci, 1996
Autonomy-Supportive Coaching Questionnaire (ASCQ),	Conroy & Coatsworth, 2007
Need Support for Exercise Scale (NSE)	Markland & Tobin, 2010
Parent as Social Context Questionnaire (PASCQ)	Skinner, Wellborn, & Regan, 1986
Psychologically Controlling Teaching (PCT)	Soenens, Sierens, Vansteenkiste, Dochy, & Goossens, 2012
System for Observing Need-supportive Interactions in Physical Education (SONIPE)	Haerens et al., 2013
Multidimensional Motivational Climate Observation System (MMCOS)	Smith, et al., 2015
Empowering and Disempowering Motivational Climate Questionnaire (EDMCQ-C)	Appleton, Ntoumanis, Quested, Viladrich, & Duda, 2016
Interpersonal Supportiveness Scale-Coach (ISS-C)	Wilson, Gregson, & Mack, 2009
Caring Climate Scale	Newton et al., 2007
Teacher provided autonomy support and structure items put forth by Yang, Reeve, & Deci, 2010	Yang, Reeve, & Deci, 2010
MPOWER	Webster et al., 2013
Perceived Parental Autonomy Support Scale (P-PASS)	Mageau et al., 2015

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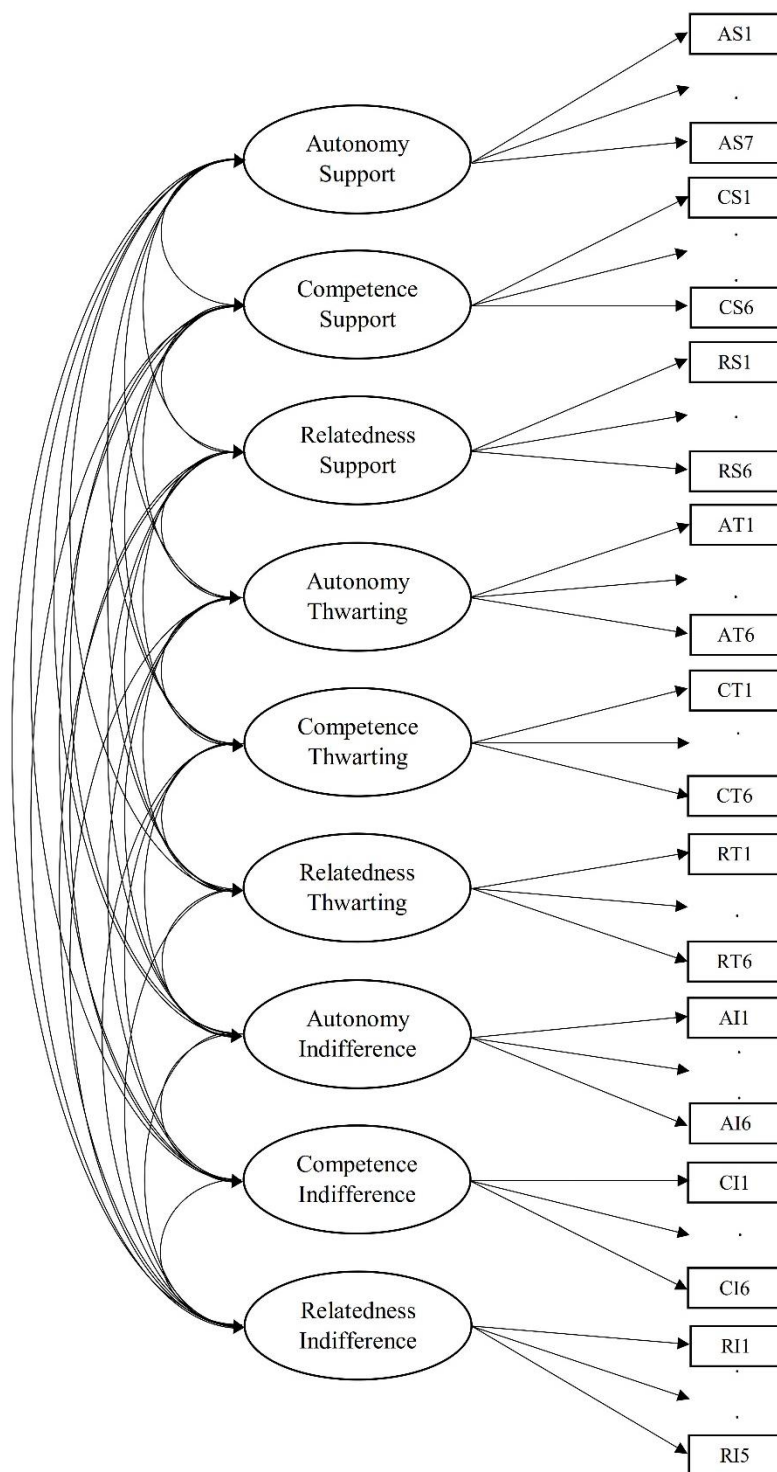
Measures and items found by searching databases	Authors
Parental Psychological Control	Barber, 1996
Perceptions of Parents Scale (POPS)	Grolnick, Deci, & Ryan, 1997
Social Support Questionnaire (SSQ)	Sarason, Sarason, Sheerin, & Pierce, 1987
Need thwarting teaching behaviours put forth by Van den Berghe et al., (2013)	Van den Berghe et al., 2013
Autonomy supportive and controlling behaviours by Reeve & Jang, 2006	Reeve & Jang, 2006
Learning Climate Questionnaire	Black & Deci, 2000

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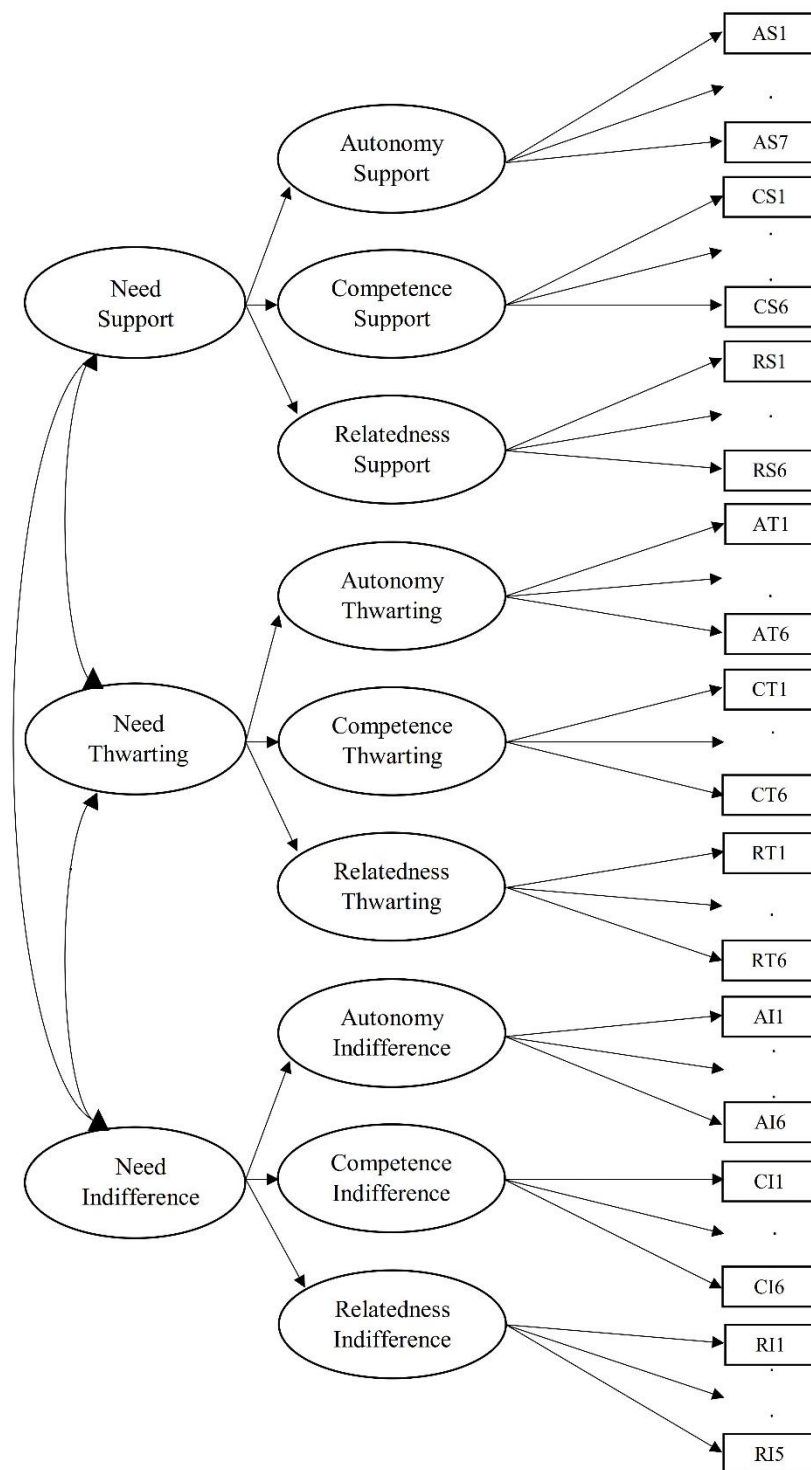
**Appendix B****Factor Models Tested in Study 2**

Model 1. Three-factor CFA

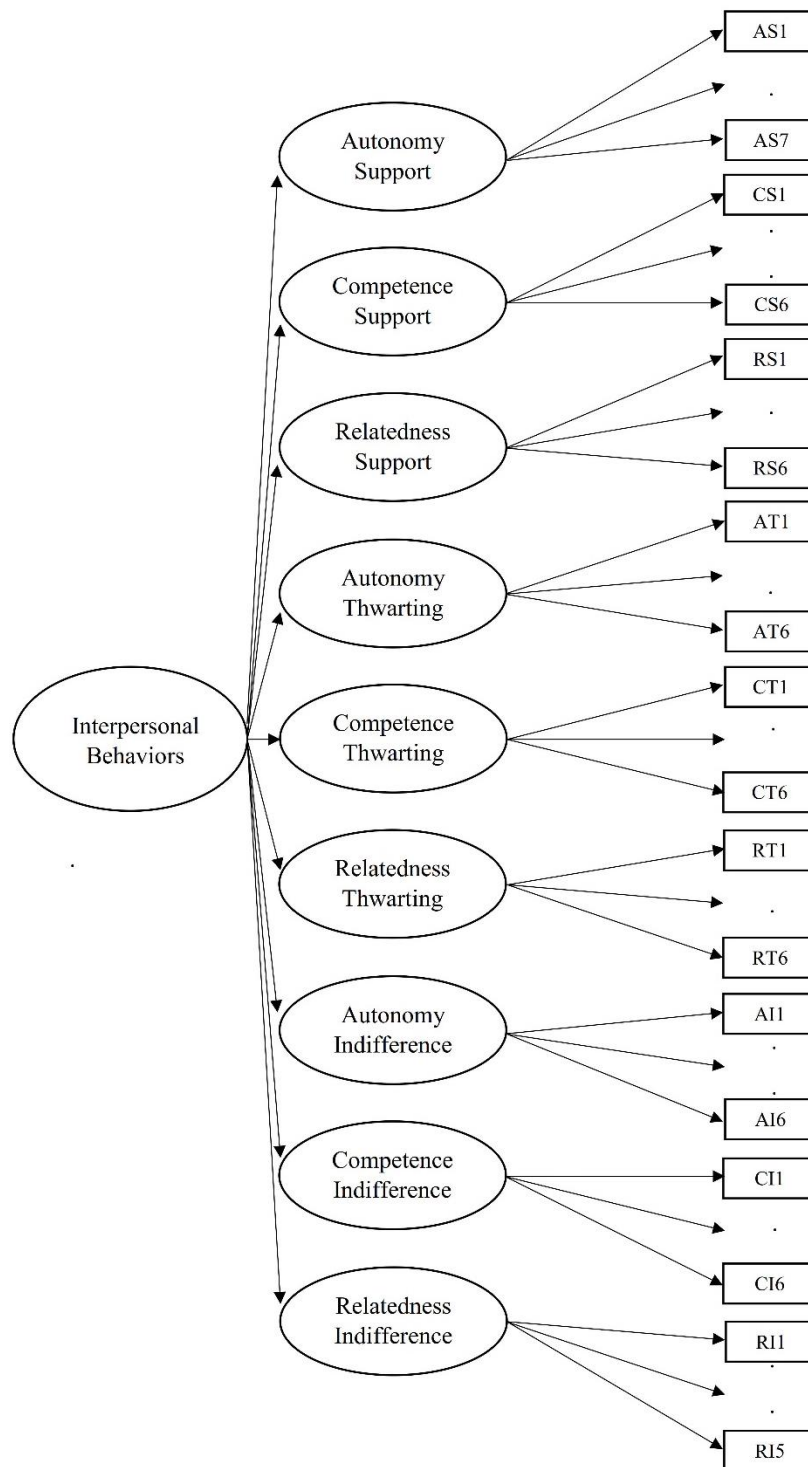




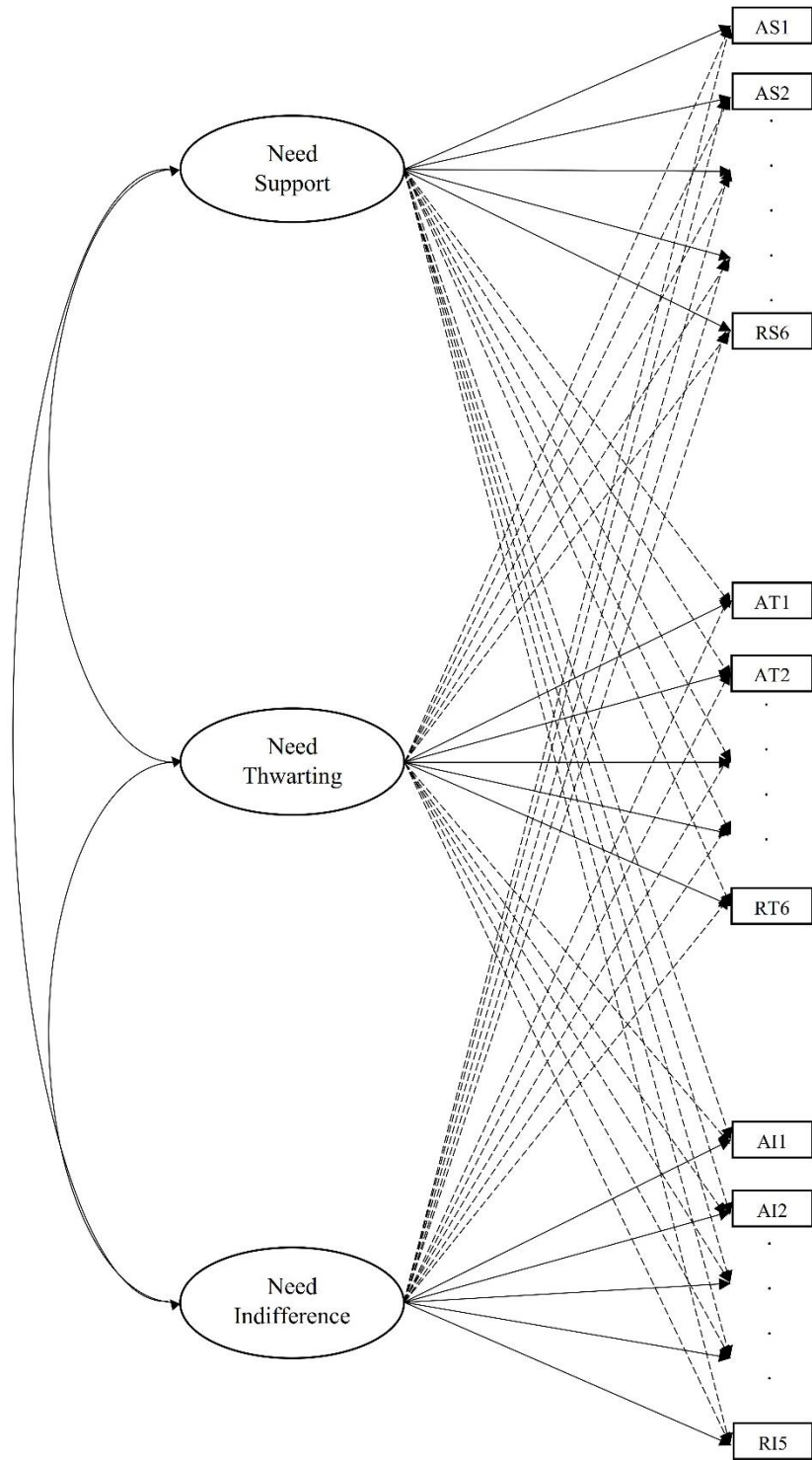
Model 2. Nine-correlated factors CFA



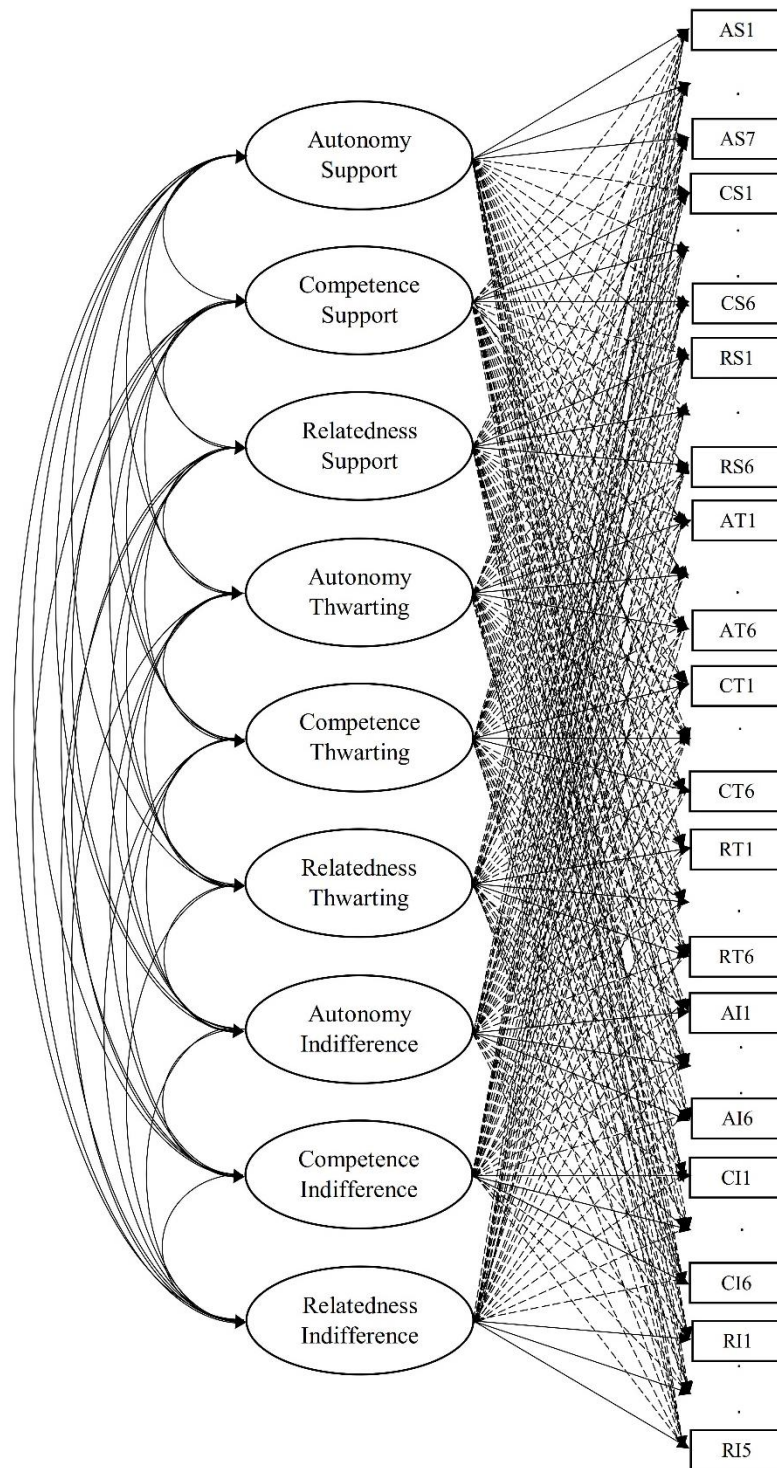
Model 3. H-CFA (three-H, nine-L)



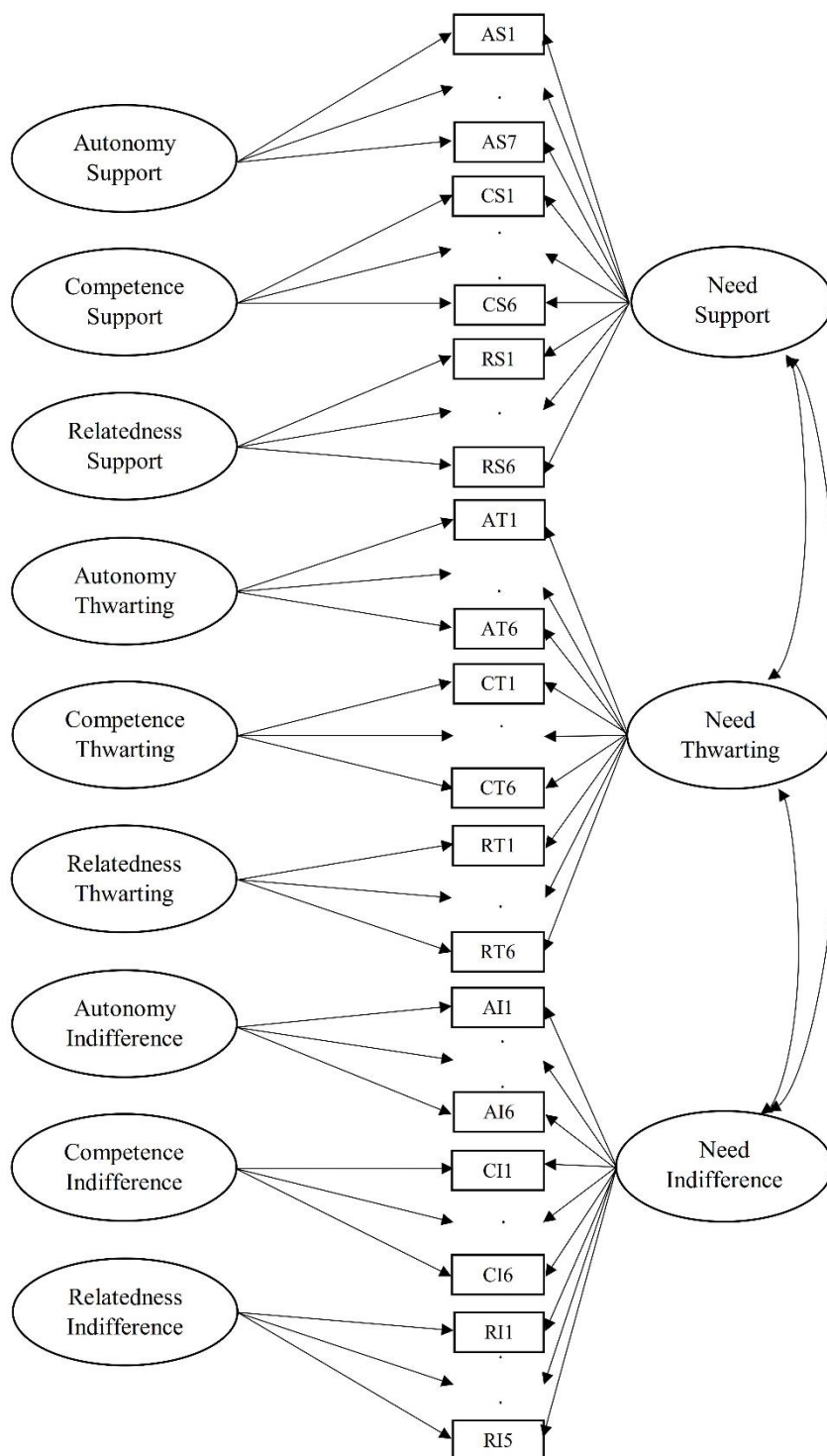
Model 4. H-CFA (one-H, nine-L)



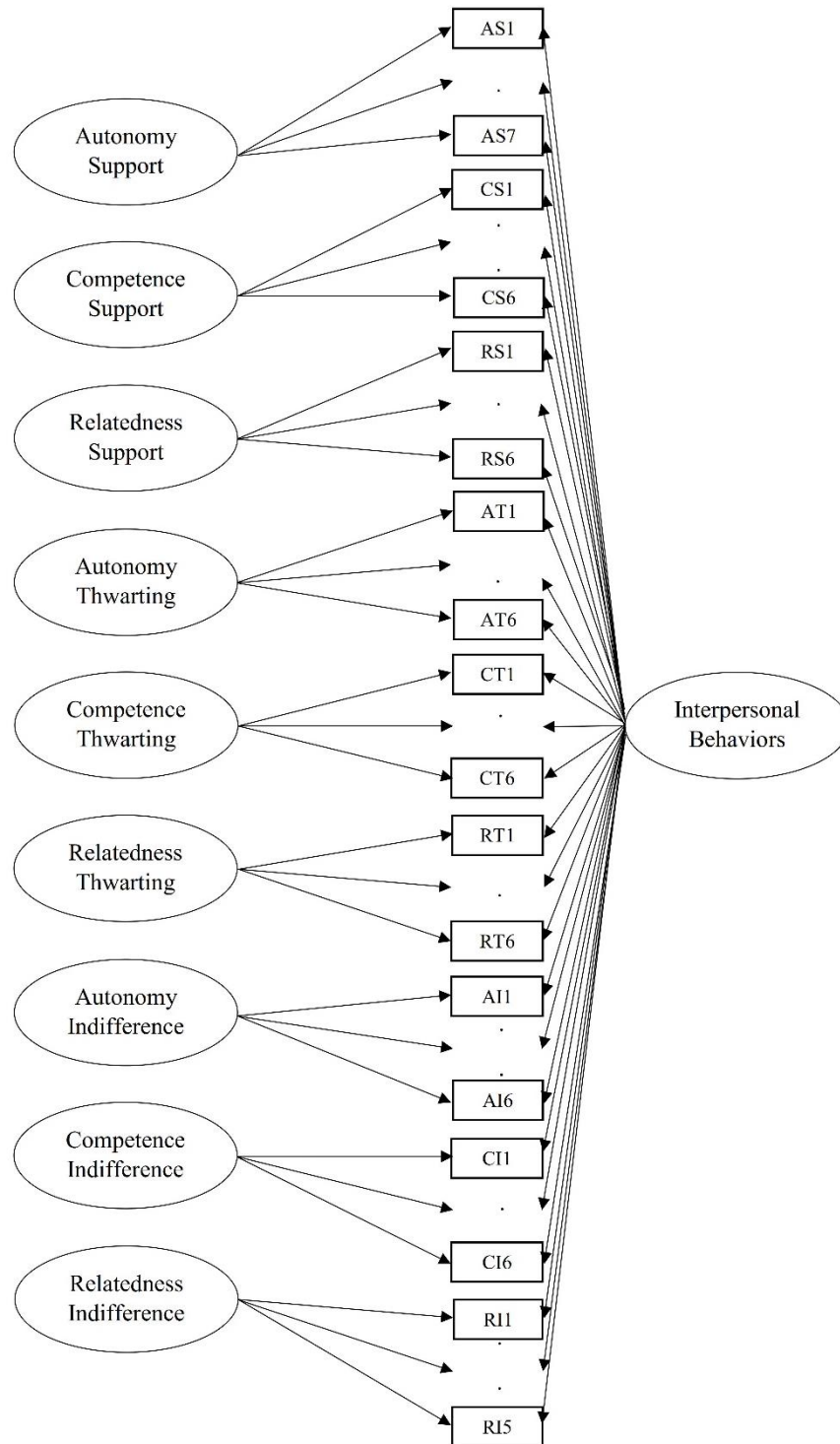
Model 5. Three-factor ESEM



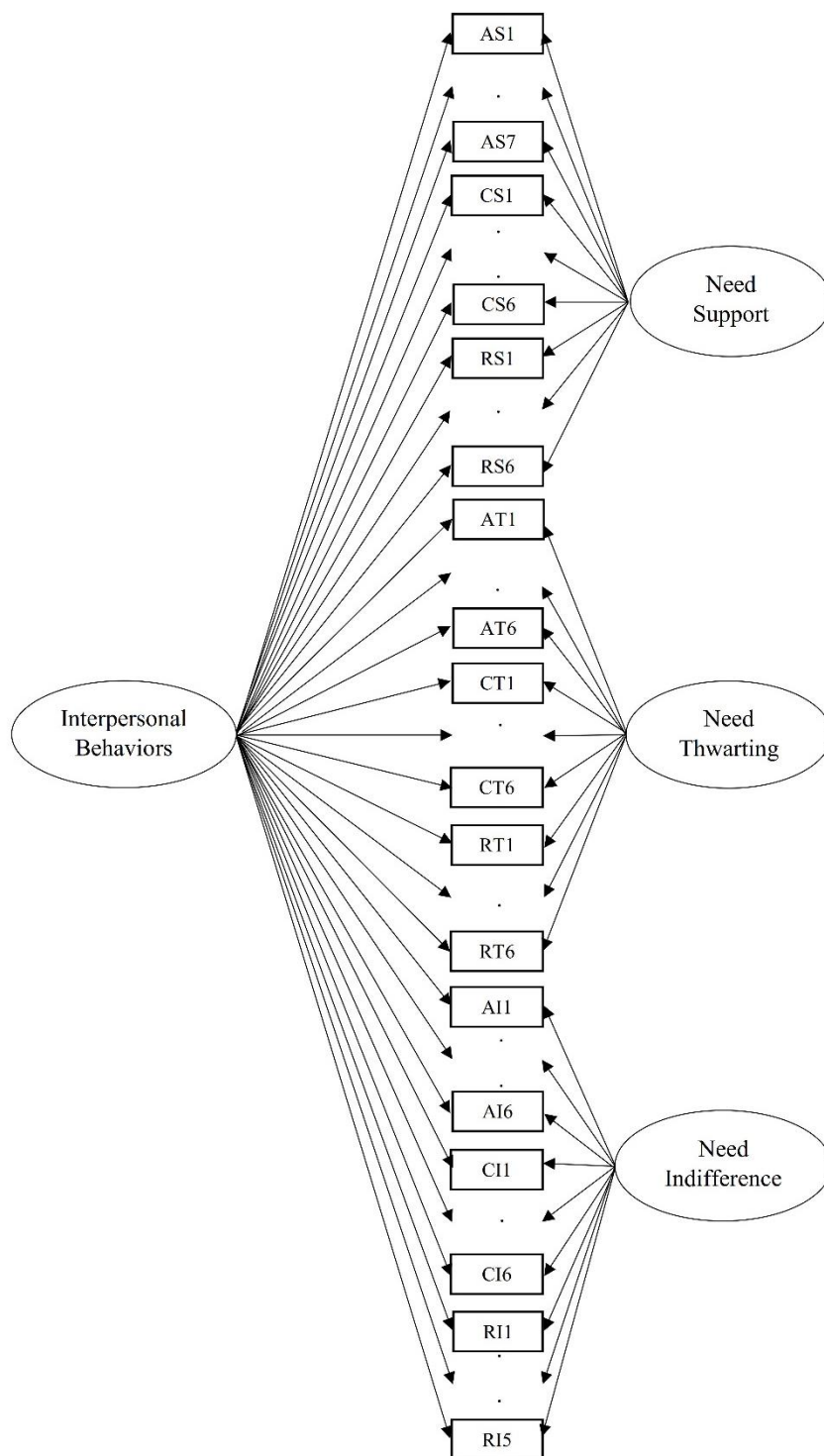
Model 6. Nine-correlated factors ESEM



Model 7. Bifactor CFA (correlated three-G, nine-S)

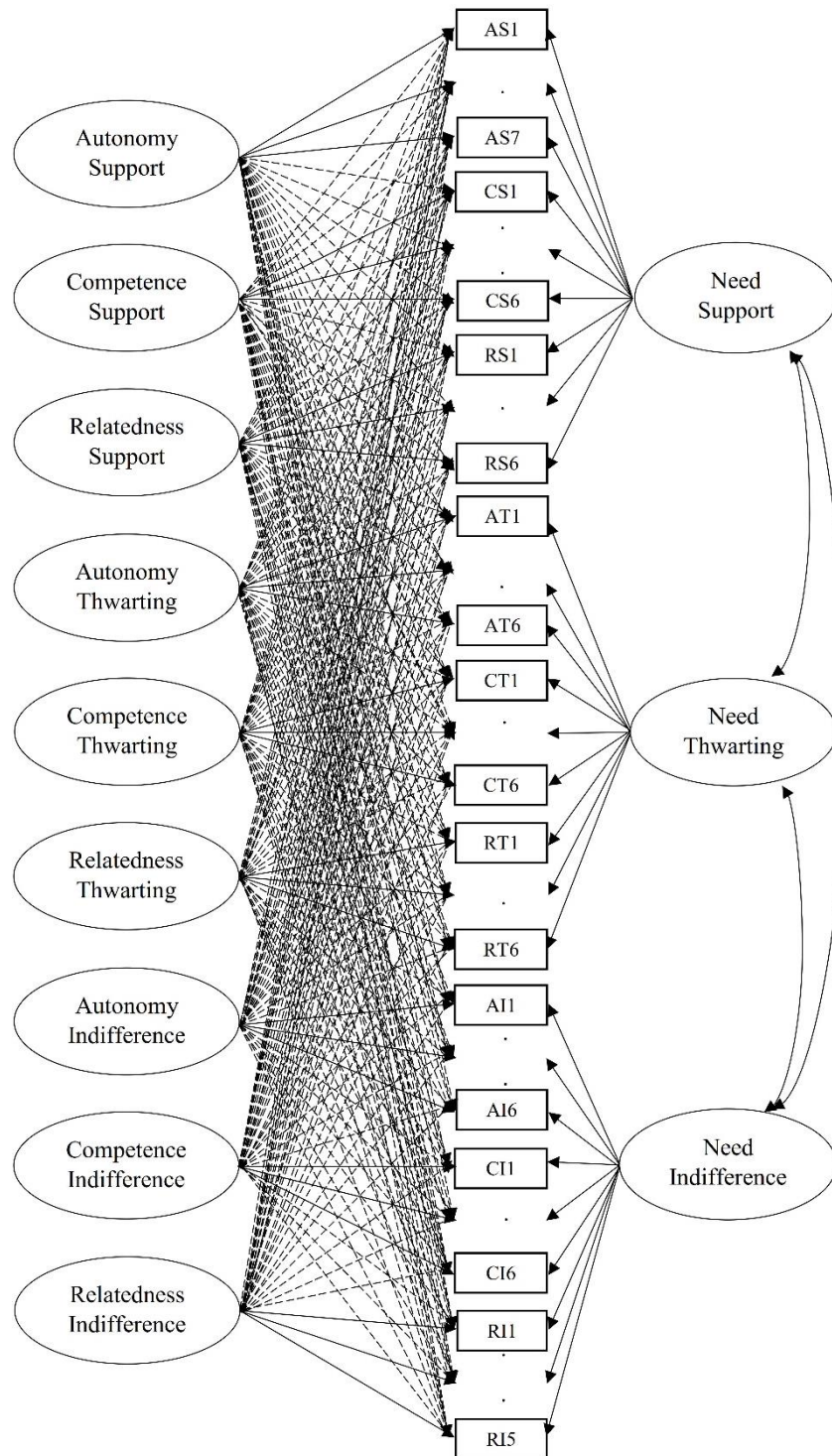


Model 8. Bifactor CFA (one-G, nine-S)

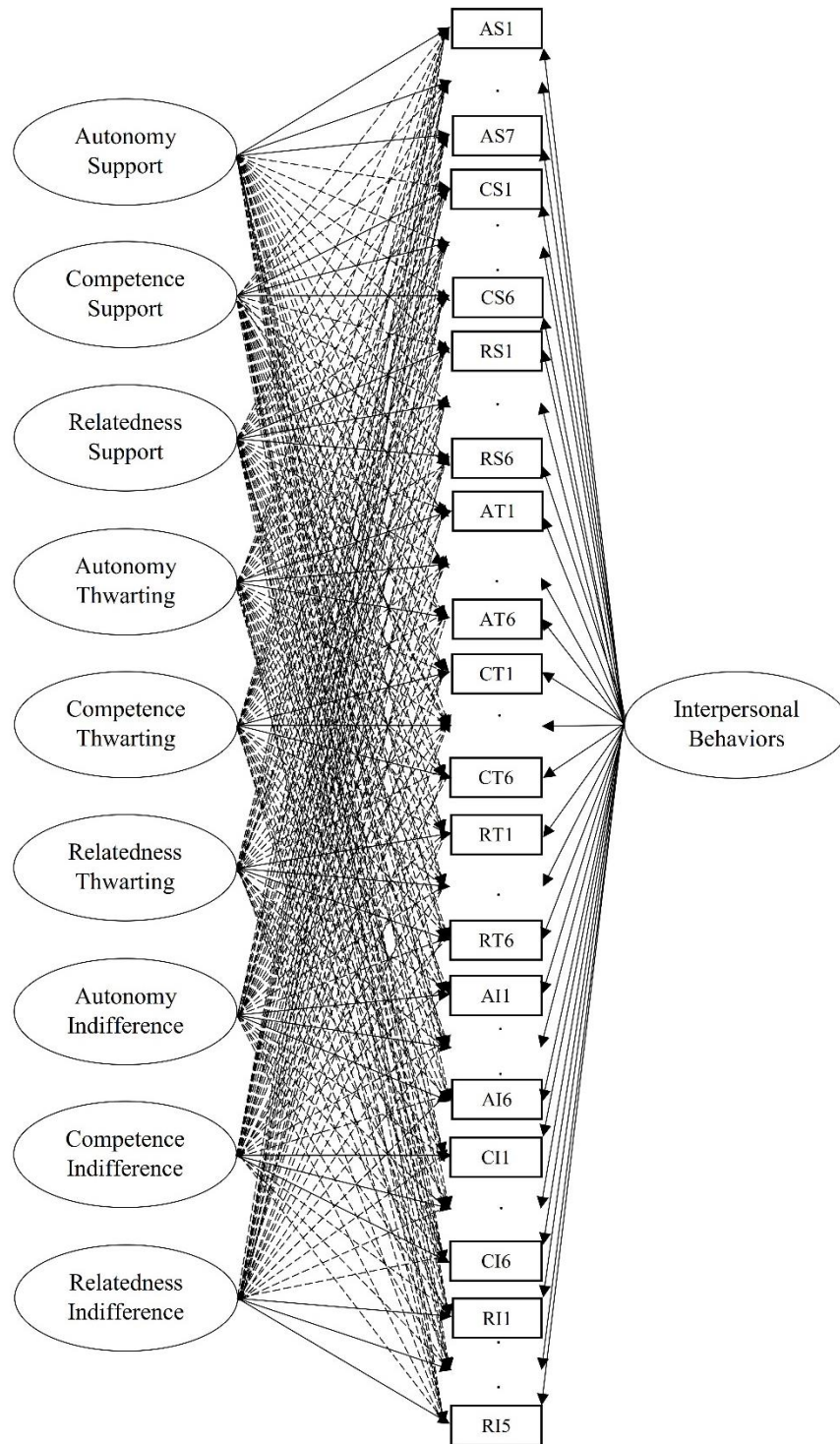


Model 9. Bifactor CFA (one-G, three-S)

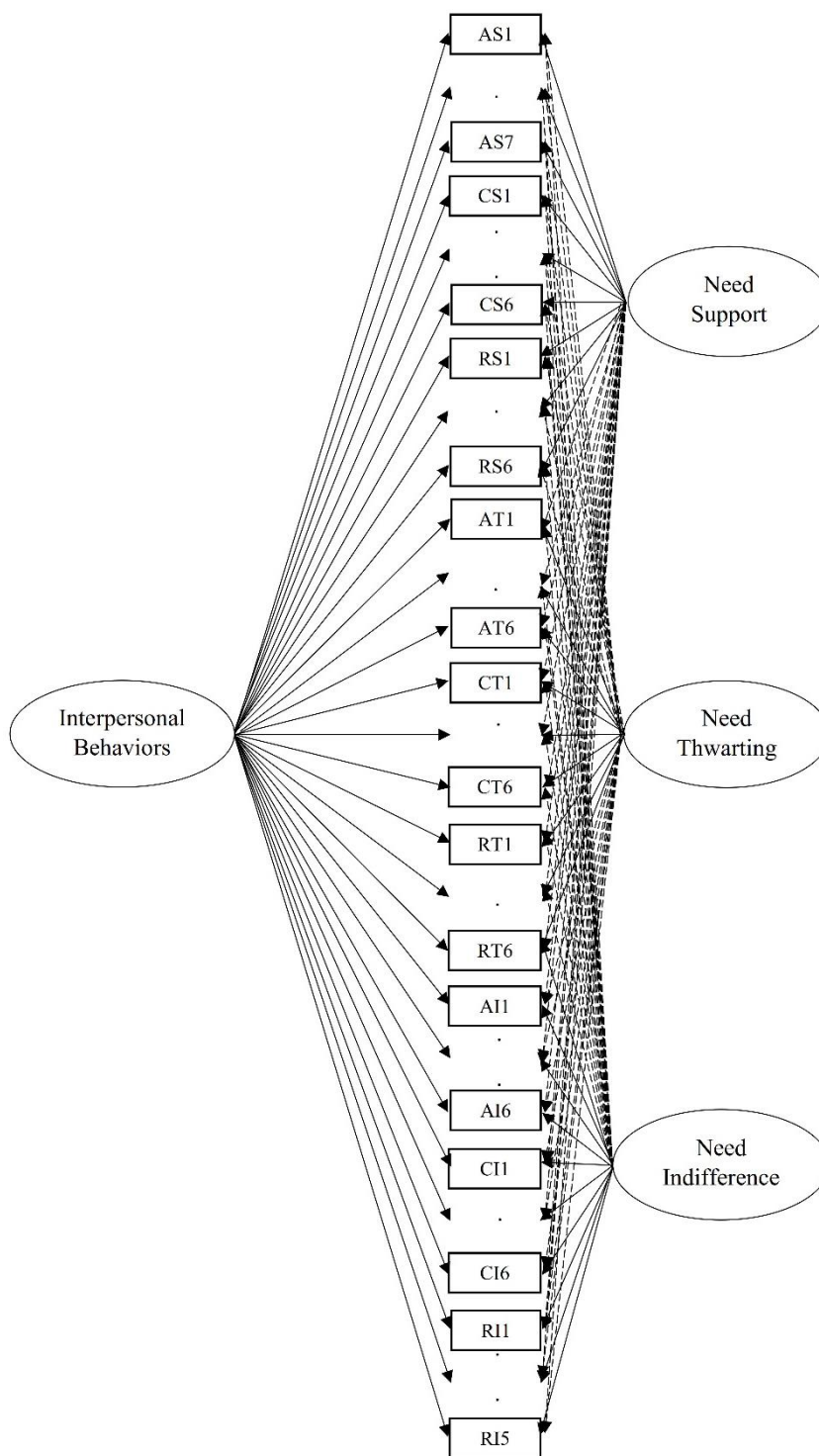




Model 10. Bifactor ESEM (correlated three-G, nine-S)



Model 11. Bifactor ESEM (one-G, nine-S)



Model 12. Bifactor ESEM (one-G, three-S)

Note: This chapter has been accepted for publication as a research article in *Psychology of Sport and Exercise*.

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### **Chapter 3: Measuring Psychological Need States in Sport: Theoretical Considerations and a New Measure**

Research grounded in Self-Determination Theory (SDT, Deci & Ryan, 1985; Ryan & Deci, 2017) has repeatedly focused on both the bright and dark side experiences of the three basic psychological needs, and explored their differential associations with motivation and psychological functioning (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013). Recently, researchers have also argued for the utility of assessing the unfulfilment of psychological needs as a third need state (e.g., Cheon et al., 2019; Costa, Ntoumanis, & Bartholomew, 2015), which, alongside need satisfaction and frustration, could aid a more comprehensive understanding of athlete motivation and well-being or ill-being. Existing investigations in sport, however, are either limited to the use of separate measures of perceived need satisfaction and need frustration (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Ng, Lonsdale, & Hodge, 2011), or involve adaptations of non-sport-specific measures (e.g., Chen et al., 2015) to assess both these need states simultaneously. Items of these measures also reflect references to interpersonal behaviours of significant others, as well as one's personal experiences that occur as a result of behaviours of significant others. In this two-study chapter, I aimed to address the gap in the literature pertaining to the absence of a single sport-specific measure of the three need states by developing and providing initial validity evidence for a new multidimensional measure of athletes' psychological need states of satisfaction, frustration, and unfulfilment.

#### **Basic Psychological Need Satisfaction, Frustration, and Unfulfilment**

Assessments of basic psychological need relevant constructs in the SDT literature have undergone significant advancements in recent times. Traditionally, the state of need satisfaction was the focus of the theory. Researchers considered it to be a unipolar construct, with scores ranging from low to high. High scores on measures of need satisfaction were associated with adaptive outcomes. For example, in the sport context, high need satisfaction was shown to be associated with outcomes such as autonomous motivation (e.g., Ntoumanis & Standage, 2009), subjective vitality (e.g., Adie, Duda, & Ntoumanis, 2008), positive affect (e.g., Mack et al., 2011), enjoyment (e.g., Quested et al., 2013), and positive developmental experiences (e.g.,

Taylor & Bruner, 2012). Contrastingly, low scores on measures of need satisfaction were associated with maladaptive outcomes. For example, in the context of sport, need satisfaction scores were found to be negatively associated with burnout (Hodge, Lonsdale, & Ng, 2008), and physical symptoms (Reinboth, Duda, & Ntoumanis, 2004). However, this pattern of results did not always hold, and some researchers found low need satisfaction scores to be unrelated to ill-being (e.g., Sheldon & Bettencourt, 2002; Reinboth & Duda, 2006; Quested & Duda, 2010).

The inconsistent results linking low need satisfaction to maladaptive outcomes were explicated by Bartholomew, Ntoumanis, Ryan, and Thøgersen-Ntoumani (2011), who asserted that experiencing low levels of need satisfaction was qualitatively different to experiencing need frustration<sup>1</sup>. The researchers illustrated their point with the example of a male athlete experiencing loneliness in his sport. Such an experience might be the result of the athlete's inability to meaningfully connect with his teammates, or because he had been subjected to purposeful exclusion by his teammates. According to the researchers, the former would be a case of low need satisfaction (or what the researchers referred to as *need dissatisfaction*), and the latter would be a case of need frustration. Psychological need frustration was thus conceptualised as the negative personal experiential state of feeling that one's needs are actively undermined by others in a given context (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Through this dual-process model, the researchers demonstrated need frustration to be a stronger (in an absolute sense) predictor of maladaptive outcomes relative to need satisfaction (e.g., burnout, disordered eating, depression, negative affect, and perturbed physical arousal; Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011).

Although Bartholomew and colleagues made a conceptually-based argument for the distinction between need frustration and need dissatisfaction, they did not empirically test if the two constructs had unique factorial structure and predictive value; this consideration was examined by Costa et al. (2015). The researchers developed and assessed items to capture need dissatisfaction (defined as a "lack of need satisfaction", p. 12) and demonstrated, using multi-trait multi-method confirmatory factor analysis (MTMM; CFA), that these items could be perceived differentially from those of need frustration in the context of interpersonal relationships. However, in testing for evidence of differential predictive utility using structural equation modelling (SEM), the authors reported need dissatisfaction to

have poor predictive effects, as it failed to predict the outcome measures of interpersonal competence (index of optimal functioning) and interpersonal sensitivity (index of diminished functioning) uniquely.

Costa and colleagues' (2015) attempt to assess the predictive ability of need dissatisfaction was speculated to be unsuccessful due to the outcomes they employed (Cheon et al., 2019). For instance, in the past, need frustration has been demonstrated to best predict *darker* outcomes associated with maladaptive functioning (e.g., burnout and disordered eating, Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011). Need dissatisfaction, on the other hand, was been proposed to be a better predictor of more passive forms of maladaptive functioning, such as disengagement and boredom (Cheon et al., 2019).

In the case of the need for autonomy, the utility of the third need state of dissatisfaction, along with that of satisfaction and frustration was recently tested by Cheon et al. (2019) in a classroom intervention study. The researchers proposed that maladaptive student behaviours can take two forms. Students can either demonstrate reactive and defiant functioning in the form of disruptive behaviour and oppositional defiance, or they can exhibit passive and diminished functioning, which could take the form of a lack of motivation, boredom or disengagement. Defiant functioning was hypothesised to be a consequence of need frustration. In contrast, student passivity or diminished functioning was expected to occur as a result of need dissatisfaction. The researchers were able to demonstrate that students' experiences of autonomy dissatisfaction were distinct from autonomy satisfaction and autonomy frustration by employing exploratory structural equation modelling (ESEM). Furthermore, autonomy dissatisfaction was found to predict unique variance in classroom disengagement (an outcome of diminished functioning) along with low autonomy satisfaction, and low autonomy frustration. Cheon and colleagues (2019) clarified that autonomy dissatisfaction and low autonomy satisfaction were not to be equated as they were found to load on to separate factors with few cross-loadings. Additionally, they highlighted that autonomy dissatisfaction and autonomy frustration may each bear on disengagement in two different ways; the former more likely to result in passive disengagement, and the latter more likely to result in active disengagement. Thus, by demonstrating the three autonomy-relevant experiential states to be operationally distinct, and the considerable unique predictive utility of autonomy dissatisfaction in student classroom disengagement, Cheon et al. (2019)

underscored the utility of examining not just one (need satisfaction) or two (need satisfaction and frustration), but three (need satisfaction, frustration, and dissatisfaction) need states.

The term need dissatisfaction has been used predominantly in the SDT literature (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Cheon et al., 2019; Costa et al., 2015) to refer to the lack of need fulfilment. Some researchers have, however, used the term dissatisfaction to refer to the experience of need frustration (e.g., Neubauer & Voss, 2016, 2018; Sheldon & Hilpert, 2012). For example, Neubauer and Voss (2018) stated that the dimensions of need satisfaction and dissatisfaction are psychometrically distinct constructs, and not just mere opposites of one another. According to the Merriam-Webster Dictionary, however, dissatisfaction implies the opposite of satisfaction. In an effort to avoid confusion, in this paper, I will henceforth use the term *need unfulfilment* to refer to the negative experiential state of a lack of need fulfilment, and *need frustration* to refer to the negative experiential state of perceiving one's needs to be actively being undermined in a given setting.

The case for the third state of need unfulfilment is further emphasized by an examination of the socio-contextual antecedents of the need states. The perceived interpersonal style of social agents within one's environment could influence one's experience of basic psychological need satisfaction, frustration, and unfulfilment (Cheon et al., 2019). It is well established that perceived need support from others results in need satisfaction, whereas perceived need thwarting results in need frustration (Vansteenkiste & Ryan, 2013). The experience of unfulfilment is speculated to result from interpersonal behaviours that are perceived to reflect need indifference on part of the social agent (Cheon et al., 2019). Need indifferent behaviours been posited to be neglectful of others' basic psychological needs; on experiencing such an interpersonal behaviour, one's needs are not actively thwarted, but instead, are overlooked (Cheon et al., 2019).

Illustrative examples of the experience of need unfulfilment in sport could include athletes feeling uncertain about their perspectives being valued, or experiencing ambiguity with regards to why they do certain tasks in training sessions (autonomy unfulfilment); feeling under-challenged and that they are not improving and achieving as much as they would like to (competence unfulfilment); or feeling as though they do not having much in common with others in their team, being



disinterested in their teammates, and feeling they do not quite “fit in” (relatedness unfulfilment).

**Existing self-report questionnaires of need states in sport and other life domains.** The original focus on only the construct of need satisfaction resulted in the development of numerous self-report measures to assess this need state in a variety of contexts such as education (e.g., Filak & Sheldon, 2003; Reeve & Sickenius, 1994), work (e.g., Basic Needs Satisfaction at Work Scale, BNSW-S, Deci et al., 2001; Work-related Basic Need Satisfaction Scale, W-BNS, Van den Broek et al., 2010), and exercise (Basic Psychological Needs in Exercise Scale, BPNES, Vlachopoulos & Michailidou, 2006; Psychological Need Satisfaction in Exercise Scale, PNSES, Wilson, Rogers, Rodgers, & Wild, 2006). For investigations with athletes, researchers simply adapted such measures to make them relevant to the sport context (e.g., Gagne, Ryan & Bargmann, 2003; Hodge, et al., 2008).

To address the issue of the absence of a sport-specific measure, Ng and colleagues (2011) developed and provided initial validity evidence for the Basic Needs Satisfaction in Sport Scale (BNSSS). The 20-item measure comprises five dimensions assessing autonomy satisfaction (three factors: choice, internal perceived locus of causality- IPLOC, and volition), competence satisfaction, and relatedness satisfaction. The first empirical assessment of need frustration as a distinct construct was conducted by Bartholomew and colleagues (2011) who developed and provided initial validity evidence for a measure of need frustration in sport (Psychological Need Thwarting Scale; PNTS). The researchers found support for a 12-item, three factor model assessing the frustration of each of the three basic psychological needs. Current assessment of these need states is limited to the measurement of satisfaction and frustration using the two aforementioned scales that have been developed based on different samples (i.e., the BNSSS with adult athletes and the PNTS with youth athletes), and have dissimilar scale anchors (1 = *not at all true* to 7 = *very true* for the BNSSS, and 1 = *strongly disagree* to 7 = *strongly agree* for the PNTS).

In non-sport contexts, researchers have recently examined both the positive and negative experiential need states simultaneously (e.g., Basic Psychological Need Satisfaction and Frustration Scale, BPNSFS, Chen et al., 2015; The Balanced Measure of Psychological Needs, BMPN, Sheldon & Hilpert, 2012; The Need Satisfaction and Frustration Scale, NSFS, Longo, Gunz, Curtis, & Farsides, 2016). For example, the 24-item BPNSFS assesses autonomy satisfaction and frustration,

competence satisfaction and frustration, and relatedness satisfaction and frustration. The scale developers provided evidence for the dimensionality of the measure across a culturally diverse sample. Although researchers have used this measure for investigations in sport (e.g., Li, Ivarsson, Lam, & Sun, 2019), physical education (e.g., Haerens, Aelterman, Vansteenskiste, Soenens, & Petegem, 2015), and exercise (Emm-Collison, Standage, & Gillison, 2016), items of these non-sport-specific measures may involve differential portrayal of the need states (Ng et al., 2011), and the context in which it has been developed might reflect experiences that might not be of particular relevance to athletes.

Additionally, a number of conceptual issues have been associated with the items of the scales currently available for use in research on this topic, both in and outside of the sport domain. One key issue with many of the existing measures of need states is their employment of some items that assess the social context (in terms of need support or need thwarting), instead of assessing the feeling states (in terms of need satisfaction or need frustration). In the sport context, for instance, the BNSSS includes the item “There are people in my sport who care about me” as an item tapping relatedness satisfaction, however, this item entirely reflects the actions of others in the form of relatedness support, without assessing how these actions make one feel. Another example of an item assessing behaviours of others instead of one’s feeling states is “There were people telling me what I had to do” from the BMPN (Sheldon & Hilpert, 2012). Some items in the PNTS tap personal experiences of need frustration as a result of actions of others’ in one’s social contextual (e.g., “There are times when I am told things that make me feel incompetent”); they do not assess the social context per se (an example of the latter would be an item which would indicate that an athlete is told by their coach that they are incompetent). Being told that one is incompetent is not the same as feeling incompetent because one might not necessarily lead to the other. Nevertheless, revisions to items of the PNTS so that they solely assess one’s personal experiences of need frustration, would be advantageous.

Some existing measures have limited utility because they include items that conflate need frustration and need unfulfilment. For example, the BMPN includes the subscale of dissatisfaction, which is defined as the “salient absence of the experiences” of autonomy, competence, and relatedness satisfaction (p. 442). However, the subscale includes items tapping need frustration (e.g., “I had a lot of

pressures I could do without”), as well as items potentially tapping need unfulfilment (e.g., “I felt unappreciated by one or more people”). As researchers have demonstrated need frustration to be a good predictor of “darker” outcomes (e.g., disordered eating, Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011), a more accurate representation of the experience of need frustration might be achieved from a subscale comprising only of items that capture the *darker* or more *deleterious* experiential states. An illustrative example of an item capturing the experience of competence frustration would be an athlete who feels like a failure. Competence unfulfilment, on the other hand, would be more appropriately assessed by items reflecting feelings that arise from lack of competence fulfilment; an example being an athlete who feels he or she cannot do all of the tasks in training.

Confirmatory factor analysis (CFA) has been identified to be the most pertinent approach for scale development efforts in this area because it assumes one leverages a strong theoretical base (Hurley et al., 1997; Williams, 1995). As such, CFA has been employed as the primary analytical technique to test the factorial structure of the need states in the measures described in this section. However, due to the stringent requirement of zero cross-loadings between items and non-intended factors, CFA may lead to overestimated correlations between factors and undermining of discriminant validity evidence (Marsh, Morin, Parker, & Kaur, 2014). For example, correlations as high as .83 have been observed among factors in both, the BNSSS and the PNTS.

ESEM (Asparouhov & Muthen, 2009), bifactor modelling, and a combination of the two can aid in managing the limitations associated with the use of CFA (Morin, Arens, & Marsh, 2016). First, in ESEM, it is acknowledged that items are not solely associated with the dimension that they have been developed to assess; they are also related to other non-intended dimensions. Cross-loadings between items and non-intended factors are admissible in ESEM, such that factor loadings are not as overestimated as compared to those resulting from CFA. Second, bifactor models (Holzinger & Swineford, 1937; Reise, 2012) have utility in examining multidimensional instruments as they allow for concurrent estimation of one or more general-factors (e.g., need satisfaction) that explain the covariance among all items, as well as more specific-factors (e.g., autonomy, competence, and relatedness satisfaction) which explicate the commonality among item sub-dimensions over and above the general factor (Chen, Hayes, Carver, Laurenceau, & Zhang, 2012; Myers,

Martin, Ntoumanis, Cemili, & Bartholomew, 2014). By juxtaposing bifactor models against CFA or ESEM models, researchers can ascertain whether general-factors alone are adequate, or if they function alongside specific-factors. Third, bifactor ESEM models can be advantageous as they not only allow for the presence of cross-loadings between items and non-intended factors, but also simultaneously enable the assessment of general and specific factors.

### **Present Research**

A systematically developed measure of all three need states, with items that are all pertinent to sport participation, is necessary for psychometrically sound assessments of these key constructs in sport and therefore a more comprehensive understanding of the athletic experience. I aimed to develop and test the initial validity evidence for scores of the Psychological Need States in Sport-Scale (PNSS-S), a new multidimensional measure assessing athletes' experiences of need satisfaction, frustration and unfulfilment, separately for autonomy, competence, and relatedness. Over two studies, I aimed to assess validity evidence based on internal structure and relations to other variables in accordance with the *Standards for Educational and Psychological Testing* (The *Standards*; developed by the American Educational Research Association [AERA], American Psychological Association [APA], and National Council on Measurement in Education [NCME], 2014). Additionally, I sought to examine evidence for reliability and discriminant validity of the subscale scores of the PNSS-S.

### **Study 1**

The aim of Study 1 was to (a) develop a pool of items to assess need satisfaction, frustration, and unfulfilment among athletes, and (b) determine evidence for internal structure, internal consistency, and discriminant validity of the subscale scores of the new measure.

### **Study 1 Methods**

**Participants.** The sample consisted of 301 competitive athletes ( $N_{male} = 92$ ,  $N_{female} = 209$ ), with an average age of 20.27 years ( $SD = 7.36$ ), recruited in the United Kingdom ( $n = 195$ ) and in Australia ( $n = 106$ ). Athletes competed in a variety of individual and team sports such as Australian football, soccer, swimming, and netball. One hundred and seventy-nine athletes were competitive at the club level, 19

at the university level, 47 at the regional/state level, 27 at the county level, 20 at the national level, and six at the international level at the time of the study. Three athletes did not report the level at which they competed. Athletes reported an average competitive experience of 9.43 years ( $SD = 7.29$ ), trained on average 2.47 times a week ( $SD = 1.56$ ), and had been training with their current main coach for 1.95 years ( $SD = 3.16$ ).

**Measures.** The PNSS-S items were designed to examine athletes' experiences of satisfaction, frustration, and unfulfilment of their three basic psychological needs for autonomy, competence, or relatedness. Sixteen items were written to assess the satisfaction of the needs. The content of these items was informed by existing self-report measures of need satisfaction in sport or similar contexts (e.g., BNSSS, Ng et al., 2011; BPNES, Vlachopoulos & Michailidou, 2006; PNSES, Wilson, Rogers, Rodgers, & Wild, 2006, autonomy items collated by Standage, Duda, & Ntoumanis, 2003; the competence subscale of the Intrinsic Motivation Inventory, IMI, McAuley, Duncan, & Tammen, 1980, and the acceptance subscale of the Need for Relatedness Scale, NRS - 10, Richer & Vallerand, 1998). Items began with the stem "In my main sport, I...". An example of an item assessing autonomy satisfaction is "have the freedom to make training decisions". Items were carefully written to avoid explicit references to the social context (e.g., "feel supported").

Items of the PNTS (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011) were refined so as to reflect the darker experience of need frustration while avoiding references to the social context (e.g., "feel useless" and "feel isolated"). Only one of the PNTS items was retained; five others were updated in terms of their wording. Nine completely new items were written. Thus, a total of 15 items were written to assess need frustration.

Finally, 15 items for need unfulfilment were written by our research team. Need unfulfilment was defined as the feeling state of one's needs being set aside or neglected (Cheon et al., 2019) and "feeling that something is not as good as it should be" (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011, p. 78). An example for competence unfulfilment is "feel that I am not good enough". Recommendations by DeVellis (2012) informed the item writing process. Items were kept brief, were not double-barrelled, did not borrow heavily from any one existing

measure, did not tap multiple needs, and did not explicitly refer to the social context. The initial item pool is listed in Appendix A.

A 7-point response scale with the anchors 1 = *strongly disagree*, 4 = *neither disagree nor agree*, 7 = *strongly agree* was employed. The 7-point response format is congruent with previous measures assessing these constructs in sport (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Ng et al., 2011). Seven-point rating scales are also in line with survey takers' preferences and perform well in terms of their discriminative power (Preston & Coleman, 2000). Prior to survey administration, participants were advised to consider their experiences in competition and in training and indicate the degree to which they disagreed or agreed with each statement. Participants were assured that there were no right or wrong responses to encourage honest responses.

**Procedure.** Ethical approval was obtained for both studies in this paper from the Curtin University ethics committee. Subsequently, sports club committee members and coaches were contacted in order to explain the purpose of the study and to invite their athletes to participate. In some cases, athletes were contacted directly. Athletes were eligible if they trained with a coach at least once a week, competed regularly during the sport season, and were over 14 years of age. Participation in the study was voluntary. Parental consent was sought for participants in the age group 14-17 years. All athletes completed a consent form prior to taking the survey, which was administered in person either before or after a training session.

**Data analyses.** The factorial structure of the new measure was examined using CFA, ESEM, and bifactor CFA and ESEM. The factor structures tested were theoretically justifiable and targeted the three states of satisfaction, frustration, and unfulfilment as well as just the two states of satisfaction and frustration (see Appendix B, Models 1-24), separately for the needs of autonomy, competence, and relatedness. Statistical analyses were conducted in Mplus 8.0 (Muthén & Muthén, 1998 - 2017).

For CFA models, latent factors were permitted to correlate, with cross-loadings of items on unintended factors being constrained to zero. Similar to CFA, in the case of ESEM models, items were allowed to load on their predefined latent factors, but cross-loadings were freely estimated, albeit they were targeted to be as close as possible to zero using target rotations (Browne, 2001). For the bifactor CFA models, items could load on their predefined general-factors (G-factors) and specific-

factors (S-factors). S-factors were designated as orthogonal. If a model had multiple G-factors, these were estimated as correlated. Lastly, bifactor ESEM models were operationalized in manner similar to the bifactor CFA models, with the exception of employing orthogonal bifactor target rotation for the S-factors (Reise, 2012).

Goodness-of-fit was evaluated using the  $\chi^2$  goodness-of-fit index, Comparative Fit Index (CFI), Tucker-Lewis index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square (SRMR). Adequate and excellent model-to-data fit was indicated by CFI and TLI values of or greater than .90 and .95 respectively, and RMSEA and SRMR values of or smaller than .08 and .06, respectively (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005; Marsh, Hau, & Wen, 2004). The strength of factor loadings was informed by the recommendations put forth by Comrey and Lee (1992) (i.e.,  $> .71$  = “excellent”,  $> .63$  = “very good”,  $> .55$  = “good”,  $> .45$  = “fair”,  $< .30$  = “poor”). The internal consistency of the subscale scores was determined through an assessment of Raykov’s composite reliability coefficient (RHO; Raykov, 1997). In line with the recommendation by Nunnally (1978), internal consistency estimates greater than .70 were deemed adequate. Factor correlations were examined for evidence of discriminant validity (Brown, 2015), with values of or over .80 suggesting substantial overlap amongst the factors of the measure (John & Benet-Martinez, 2000).

## Study 1 Results

**Item distributions.** Prior to the factor analyses, data were scanned for univariate normality. Median values for skewness and kurtosis for the 46 items were .581 and .816 respectively, and ranged from -2.00 to 3.41 for skewness, and -1.00 to 8.00 for kurtosis. Given the presence of a few large values, data were analysed using a robust maximum likelihood estimator (MLR). MLR yields robust fit indices and standard errors in the case of non-normal data and operates well when categorical variables with a minimum of five response categories are employed (Bandalos, 2014; Rhemtulla, Brosseau-Laird, & Savalei, 2012).

**Configurations involving the three need states (satisfaction, frustration, and unfulfilment).** Results of the factor analyses for need satisfaction, frustration, and unfulfilment are reported in Table 3.1. In total, 12 models pertaining to various configurations of the three need states were tested. Most of these models

demonstrated poor model-data fit, some did not converge, and problems were encountered with other models for which information relevant to model fit (e.g., standard errors) could not be calculated. Increasing the number of iterations and changing the convergence criteria failed to resolve problems with model convergence and model fit. An examination of the parameter estimates of the models that did converge indicated several items with poor standard factor loadings ( $<.30$ ) and cross-loadings on unintended factors ( $>.20$ ) that were larger than the target factor loadings. At this stage, items assessing the new dimension of need unfulfilment were also examined on their own (i.e., without those assessing need satisfaction and frustration). Model results are presented in Appendix C. The three-factor ESEM solution demonstrated promise, although it did not reach an acceptable TLI level. Internal consistency estimates based on this model were found to be adequate, with Raykov's composite reliability coefficient for autonomy unfulfilment = .71, competence unfulfilment = .75, and relatedness unfulfilment = .80. These results indicated that the issue was not that the need unfulfilment items were inappropriate, but that there was no evidence to demonstrate that need unfulfilment could be modelled as a distinct need state when tested alongside the need satisfaction and frustration. As there was no acceptable model involving all three states that was supported by the data, the focus of the study shifted to assessing the two experiential states of need satisfaction and frustration (for which there is considerable support in the literature, e.g., Chen et al., 2015).



Table 3.1. *Goodness-of-fit Statistics for Alternative CFA, ESEM, and Bifactor Models (Study 1)*

Model	$\chi^2$	<i>p</i>	<i>df</i>	CFI	TLI	SRMR	RMSEA [90% CI]
<b>Models involving three need states</b>							
1. Three-factor CFA	2824.822	<.001	986	.70	.69	.08	.08[.08, .08]
2. Nine-correlated factors CFA	2286.183	<.001	953	.78	.77	.08	.07[.06, .07]
3. H-CFA (Three-H, nine-L)	2479.336	<.001	977	.76	.74	.08	.07[.07, .07]
4. H-CFA (one-H,nine-L)	2687.855	<.001	980	.72	.71	.09	.08[.07, .08]
5.Three-factor ESEM	2684.475	<.001	900	.71	.67	.06	.08[.08, .08]
6. Nine-correlated factors ESEM	1319.624	<.001	657	.89	.83	.03	.06[.05, .06]
7. Bifactor CFA (correlated three-G, nine-S)					DNC		
8. Bifactor CFA (one-G, nine-S)	2494.206	<.001	943	.75	.72	.08	.07 [.07, .08]
9. Bifactor CFA (one-G three-S)	2691.925	<.001	946	.72	.69	.13	.08[.07, .08]
10. Bifactor ESEM (correlated three-G, nine-S)	1116.509	<.001	608	.92	.86	.02	.05[.05, .06]
11. Bifactor ESEM (one-G, nine-S)					.*		
12. Bifactor ESEM (one-G, three-S)					.*		
<b>Models involving two need states</b>							
13. Two-factor CFA	1406.126	<.001	433	.75	.73	.08	.09[.08, .09]
14. Six-correlated factors CFA	1045.020	<.001	419	.84	.82	.07	.07[.06, .08]
15.H-CFA (two-H, six-L)	1183.338	<.001	427	.81	.79	.08	.08[.07, .08]
16. H-CFA (one-H, six-L)					DNC		
17. Two-Factor ESEM	1336.331	<.001	404	.76	.73	.07	.09[.08, .09]

18. Six correlated-factors ESEM	556.471	<.001	294	.93	.89	.02	.05 [.05, .06]
19. Bifactor CFA (two-G, six-S)					DNC		
20. Bifactor CFA (one-G, six-S)					DNC		
21. Bifactor CFA (one-G, two-S)	1164.733	<.001	403	.81	.78	.13	.08[.07, .08]
22. Bifactor ESEM (correlated two-G, six-S)	458.463	<.001	262	.95	.91	.02	.05[.04, .06]
23. Bifactor ESEM (one-G, six-S)					-*		
24. Bifactor ESEM (one-G, two-S)	1028.655	<.001	375	.83	.79	.04	.08[.07, .08]

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*Note.*  $\chi^2$  = Chi-square test of exact fit, CFI = Comparative Fit Index, TLI = Tucker–Lewis index, RMSEA = Root Mean Square Error of Approximation, 90% CI = 90% confidence interval of the RMSEA, CFA = confirmatory factor analysis, H-CFA = Hierarchical CFA, H-factor = higher order factor estimated as a part of hierarchical model, L-factor = lower order factor estimated as a part of hierarchical model, ESEM = exploratory structural equation modelling, G-factor = global factor estimated as part of a bifactor model, S-factor = specific factor estimated as part of a bifactor model, DNC = did not converge, -\* = The standard errors of the model parameter estimates could not be computed: The model may not be identified.

**Configurations involving the two need states (satisfaction and frustration).** Of the 12 models that were tested pertaining to the two need states, only one model (Model 22; Bifactor ESEM with two G- and six S-factors) demonstrated acceptable fit [ $\chi^2 = 458.463$  (262),  $p < .001$ , CFI = .95, TLI = .91, SRMR = .02, RMSEA = .05 (90% CI .04, .056)]. However, an examination of the factor loadings indicated that the G-factor of need frustration had only two salient significant loadings above .30, whereas the G-factor of need satisfaction had no items with significant factor loadings. Further examination of the S-factors indicated that autonomy satisfaction S-factor had no items with significant factor loadings, making this model unsuitable. One model that seemed promising, even though it did not reach an acceptable TLI level, was Model 18 (Six-factor correlated ESEM model). In this model, all factors demonstrated at least three items with significant loadings over .30 on their target factors, only a few items exhibited unintended cross-loadings, and all factor correlations were in expected directions.

At this stage, a decision was made to first examine one-factor CFAs for the factors in this model, systematically remove problematic items, and then re-run the six-factor ESEM model with the best performing items. For these analyses, CFA was seen as an appropriate approach, given that the goal was to select items with strong primary factor loadings to ultimately inform the final six-correlated factor ESEM model. In doing so, for all the CFAs, model misspecification was identified through assessments of standardised factor loadings and modification indices. Alongside these statistical criteria, the conceptual coverage of the items was also considered (i.e., ensuring that the remaining items captured autonomy, competence, and relatedness). Items with standardised factor loadings below .30, as well as items with multiple (two or more) moderate-sized or large modification indices (over 10) were taken into consideration for deletion. As such, 10 of the 31 items were deleted in a systematic manner in several iterations. The resultant one-factor models had excellent fit (see Table 3.2).

Table 3.2. *Initial and Final Model Fit for Single-factor CFA and Six-factor ESEM Models (Study 1)*

Models	$\chi^2$	<i>df</i>	<i>p</i>	CFI	TLI	SRMR	RMSEA [90% CI]
<b>AF CFA</b>							
Initial (5)	15.97	5	.007	.95	.91	.03	.08 [.04, .013]
Final (3)	.000	0	.000	1.00	1.00	.01	.00 [.00, .00]
<b>CF CFA</b>							
Initial and final (4)	2.145	2	.34	1.00	1.00	.01	.02 [.00, .12]
<b>RF CFA</b>							
Initial (6)	19.293	9	.023	.96	.93	.03	.06 [.02, .10]
Final (4)	1.951	2	.377	1.00	1.00	.01	.00[.00, .11]
<b>AS CFA</b>							
Initial (5)	31.520	5	.000	.90	.80	.07	.13[.09, .18]
Final (3)	.000	0	.000	1.00	1.00	.00	.00[.00, .00]
<b>CS CFA</b>							
Initial (5)	29.006	5	.000	.93	.86	.05	.13[.08, .17]
Final (4)	1.935	2	.380	1.00	1.00	.01	.00[.00, .11]
<b>RS CFA</b>							
Initial (6)	17.028	9	.048	.98	.96	.03	.05[.00, .09]
Final (3)	.000	0	.000	1.00	1.00	.00	.00[.00, .00]
<b>Final six-factor ESEM</b>	171.110	99	.000	.97	.94	.02	.05[.04, .06]

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*Note.*  $\chi^2$  = Chi-square, CFI = comparative fit index, TLI = Tucker-Lewis Index, SRMR = Root Mean Square Residual, RMSEA = Root Mean Square Error of Approximation, () = number of items in model, Initial = the model with all items, Final = the model with the problematic items removed, AS = autonomy satisfaction, AF = autonomy frustration, CS = competence satisfaction, CF = competence frustration, RS = relatedness satisfaction, RF = relatedness frustration, CFA = confirmatory factor analysis, ESEM = exploratory structural equation modelling.

Subsequently, the six-correlated factor ESEM model was re-tested with the remainder of the 21 items from the six one-factor CFA models (see Table 3.2). This revised model demonstrated good fit [ $\chi^2(99) = 171.110, p < .001, CFI = .97, TLI = .94, SRMR = .02, RMSEA .05$  (90% CI .04, .06)]. With the exception of two items (one each for competence satisfaction and relatedness satisfaction), standardised factor loadings were significant and above .30 (range .28 to .89; see Table 3.3). Few cross-loadings greater than .20 on unintended factors were present. Subscale correlations ranged from -.18 to .60 and were in the expected directions (see Table 3.4). Raykov's composite reliability coefficients are also reported in Table 3.4. Barring competence satisfaction (.66) and relatedness satisfaction (.52), these were over .70 for all subscale scores.

Table 3.3. *Factor Loadings, Cross-loadings, Standard Errors, Means, Skewness and Kurtosis for the 22 PNSS-S items (Study 1)*

Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor Loadings					
					AF	CF	RF	AS	CS	RS
<i>STEM: In my sport, I...</i>										
feel pushed to behave in certain ways	2.17	1.57	1.26	.56	<b>.61***</b>		.22**			
feel forced to follow training decisions	2.87	1.79	.38	-1.29	<b>.84***</b>					
feel forced to do training tasks that I would not choose to do	2.50	1.7	.80	-.54	<b>.71***</b>					
feel like a failure	1.80	1.22	1.88	3.30		<b>.58***</b>				-.20**
feel useless	1.57	1.12	2.26	4.69		<b>.80***</b>				
feel incapable	1.71	1.2	1.94	3.37		<b>.56***</b>		.21*		
feel hopeless	1.48	1.1	2.82	8.00		<b>.79***</b>				
feel disliked	1.50	1.08	2.66	7.13				<b>.73***</b>		
feel excluded	1.71	1.36	2.19	4.20				<b>.36**</b>		
feel isolated	1.51	1.11	2.46	5.42				<b>.63***</b>		
feel ignored	1.63	1.13	2.22	4.90				<b>.77***</b>		
feel free to make choices with regards to the way I train	5.18	1.55	-0.54	-.53					<b>.60*</b>	
have a say in how things are done	4.77	1.66	-.42	-.57					<b>.89**</b>	
have the freedom to make training decisions	4.77	1.55	-.28	-.56					<b>.69**</b>	
feel that I am capable	5.77	1.21	-1.08	.99			-.30*			<b>.58***</b>

Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor Loadings					
					AF	CF	RF	AS	CS	RS
<i>STEM: In my sport, I...</i>										
feel skilled	5.41	1.2	-.68	.50					<b>.86***</b>	
feel that I am improving	5.71	1.18	-1.05	1.22					<b>.34**</b>	.44***
am able to overcome challenges	5.64	1.07	-.83	.98					<b>.40**</b>	.26***
feel supported	5.86	1.14	-1.07	1.26			-.38***			<b>.64***</b>
feel valued	5.54	1.18	-.93	1.25					.54***	<b>.28*</b>
feel cared for	5.66	1.22	-.76	.07						<b>.54***</b>

*Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ . Target factor loadings are in bold. For clarity purposes, only significant cross-loadings over .20 are reported; AS = autonomy satisfaction, AF = autonomy frustration, CS = competence satisfaction, CF = competence frustration, RS = relatedness satisfaction, RF = relatedness frustration.



Table 3.4. *Factor Correlations and Composite Reliability for the Six-factor ESEM Model (Study 1)*

Subscales	Raykov's rho	1	2	3	4	5	6
(1) AS	.78	-					
(2) AF	.77	-.52***	-				
(3) CS	.66	.49***	-.13	-			
(4) CF	.78	-.18**	.44***	-.39	-		
(5) RS	.52	.41***	-.32***	.28**	-.30***	-	
(6) RF	.75	-.34***	.32***	-.35***	.60***	-.26**	-

*Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ . AS = autonomy satisfaction, AF = autonomy frustration, CS = competence satisfaction, CF = competence frustration, RS = relatedness satisfaction, RF = relatedness frustration.

The two items with standardised factor loadings below .30 (“I feel that I am improving”, and “I feel valued”) were deleted, and 10 new items were written in an effort to have a more equal number of items per subscale. It was expected that these new items would also help improve estimates for the two subscales with internal consistency estimates under .70 when examined in a new sample of athletes in Study 2.

## Study 2

The aims of Study 2 were two-fold. First, I aimed to test the revised item pool from Study 1 with an independent sample of athletes. Second, I also aimed to test the nomological network of the six dimensions of the psychological need states by examining their relations with perceived coach interpersonal behaviours and positive and negative athlete outcomes. Based on previous literature linking perceptions of coach need support and thwarting to athlete need satisfaction and frustration (e.g., Pulido, Sanchez-Oliva, Sanchez-Miguel, Amado, & Garcia-Calvo, 2018; Rocchi, Pelletier, & Desmarais, 2017), it was hypothesised that perceived coach autonomy support would primarily predict athlete autonomy satisfaction, perceived coach competence support would primarily predict athlete competence satisfaction, and perceived coach relatedness support would primarily predict athlete relatedness

satisfaction. Contrastingly, it was hypothesised that perceived coach autonomy thwarting would primarily predict athlete autonomy frustration, perceived coach competence thwarting would primarily predict athlete competence frustration, and perceived coach relatedness thwarting would primarily predict athlete relatedness frustration.

In terms of the relations between the need states and athlete outcomes, based on previous literature in sport and other domains (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Chen et al., 2015; Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013), it was hypothesised that satisfaction of each of the three needs would predict the positive athlete outcomes of dedication and positive affect independently. Contrastingly, the frustration of each of the three needs was hypothesised to predict the negative athlete outcomes of exhaustion and negative affect independently.

## Study 2 Methods

**Participants.** The sample consisted of 333 competitive athletes recruited in Australia ( $N_{male} = 183$ ,  $N_{female} = 150$ ), with an average age of 19.99 years ( $SD = 5.43$ ). Athletes represented a number of individuals and team sports such as Australian football, basketball, and athletics. One hundred and ninety-nine athletes competed at the club level, 81 at the state level, 39 at the national level, and 14 competed internationally. They had been competing in their sports for 8.75 years ( $SD = 5.32$ ), had been training with their main coaches for 2.07 years ( $SD = 1.67$ ) on an average of 2.51 times per week ( $SD = 1.62$ ).

**Measures.** Athletes completed measures of their need states, perceptions of coaches' interpersonal behaviours, and positive and negative outcomes.

***Athlete need satisfaction and frustration.*** The 29-item PNSS-S developed in Study 1 was used to assess athletes' states of satisfaction and frustration across the three basic psychological needs. Similar to Study 1, athletes were requested to consider their general experiences in their main sport, and indicate the extent to which they disagreed or agreed with each statement using a 7-point response format (1 = *strongly disagree*, 4 = *neither disagree nor agree*, 7 = *strongly agree*).

***Coach interpersonal behaviours.*** The 24-item Interpersonal Behaviours Questionnaire in Sport (IBQ in Sport; Rocchi et al., 2017) was implemented to examine athletes' perceptions of their coaches' interpersonal behaviours. The

measure consists of six factors representing supportive and thwarting coach behaviours pertaining to the three basic psychological needs. The items began with the stem “My Coach...”. Illustrative items from the competence supportive and thwarting subscales include “Provides me valuable feedback”, and “Points out that I will likely fail”, respectively. Athletes indicated their disagreement or agreement with each statement using a 7-point response scale (1 = *do not agree at all* to 7 = *completely agree*). The six-factor structure of the IBQ in Sport was tested using ESEM. Model-to-data fit was found to be excellent [ $\chi^2(147) = 280.033, p < .001$ , CFI = .98, TLI = .96, SRMR = .01, RMSEA = .05 (90% CI .04, .06)]. Raykov’s reliability estimates for the subscale scores ranged from .82 to .91.

**Positive outcomes.** The dedication subscale of the Athlete Engagement Questionnaire (AEQ; Lonsdale, Hodge, & Jackson, 2007) was employed to assess dedication, which reflects “a desire to invest effort and time towards achieving goals one views as important” (p. 472). The subscale consists of four items, to which participants responded using a 5-point rating scale (1 = *almost never* - 5 = *almost always*). An example item is “I am determined to achieve my goals in sport”. Fit for the one-factor CFA model was excellent [ $\chi^2(2) = .511, p < .001$ , CFI = 1.000, TLI = 1.012, SRMR = .00, RMSEA = .00 (90% CI .00, .07)]. Ravkov’s composite reliability coefficient for the subscale score was .91.

The 10-item positive affect subscale of the 20-item short version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used as a second positive outcome. Athletes indicated the extent to which they had experienced emotions such as “excited” and “proud” over the past month using a 5-point scale ranging from (1 = *very slightly or not at all* - 5 = *extremely*). Fit for the one-factor CFA model was good [ $\chi^2(35) = 93.069, p < .001$ , CFI = .96, TLI = .95, SRMR = .03, RMSEA = .07 (90% CI .05, .09)]. Ravkov’s composite reliability coefficient for the subscale score was .93.

**Negative outcomes.** The emotional and physical exhaustion subscale of the Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) was administered as a negative athlete outcome. Participants responded to five items using a 5-point response format (1 = *almost never* - 5 = *almost always*). An example of an item is “I have been feeling physically worn out from my sport”. Fit for the one-factor CFA model was excellent [ $\chi^2(5) = 10.862, p < .001$ , CFI = .99, TLI = .98, SRMR = .02,

RMSEA = .06 (90% CI .00, .12)]. Raykov's composite reliability coefficient for the subscale score was .91.

The 10-item positive affect subscale of 20-item short version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was employed as the second negative athlete outcome. Athletes were requested to indicate the extent to which they had experienced emotions such as "upset" and "nervous" over the past month using the same 5-point response format as the positive affect subscale. Fit for the one-factor CFA model was poor [ $\chi^2(35) = 130.507, p < .001, CFI = .87, TLI = .83, SRMR = .06, RMSEA = .09$  (90% CI .07, .12)]. Raykov's composite reliability coefficient for the subscale score .83.

**Procedure.** Athletes were recruited using procedures similar to those described in Study 1. In addition to collecting data in person, the questionnaire was also made available online, via Qualtrics, and was advertised through social media. All participating athletes were eligible to go into a prize draw to win shopping vouchers. Undergraduate student athletes ( $n = 5$ ) at the School of Psychology at Curtin University were offered course credit (2 points) for participation.

**Data analyses.** Data were analysed to examine evidence for the internal structure of the scale scores, reliability, discriminant validity, and nomological network surrounding the subscales of the PNSS-S.

**Scale structure, reliability, and discriminant validity evidence.** The revised six-factor ESEM solution was tested<sup>2</sup> to examine whether the factor structure held when assessed with a new sample of athletes. Similar to Study 1, a multifaceted approach informed model-to-data fit, Raykov's reliability coefficient served as an estimate of internal consistency, and correlations between the subscales served as evidence of discriminant validity.

**Structural equation modelling (SEM).** Four separate analyses were conducted to examine the relations between a) dimensions of need support and need satisfaction, b) dimensions of need satisfaction and the outcomes of dedication and positive affect, c) dimensions of need thwarting and need frustration, and d) dimensions of need frustration and the outcomes of exhaustion and negative affect. Researchers have previously taken a similar approach in order to avoid issues of multicollinearity that may arise from including all the variables in the same analysis (e.g., Chen et al., 2015); I faced problems with net suppression effects when

attempting to analyse all variables together. All analyses were completed in Mplus 8.0.

## Study 2 Results

**Item distribution.** Data were screened for normality before conducting the main analyses. Median values for skewness and kurtosis were -.306 and 1.544, respectively. Skewness values ranged from -1.868 to 1.971, and kurtosis values ranged from -1.137 to 4.637. As such, all analyses were conducted using MLR.

**Scale structure, reliability, and discriminant validity evidence.** Fit indices for the six-factor ESEM model were indicative of good fit [ $\chi^2(247) = 438.72, p < .001$ , CFI = .97, TLI = .95, SRMR = .02, RMSEA = .05 (90% CI .04, .06)]. Standardised factor loadings were found to be statistically significant and ranged from .35 to .86. Six items had significant cross-loadings over .20 on unintended factors (e.g., “I am able to overcome challenges”, a competence satisfaction item, had a cross loading of .35 on the autonomy satisfaction subscale, and the autonomy frustration item “feel excessive pressure” had a cross-loading of .29 on the competence frustration subscale). However, in all such instances, cross-loadings were lower than intended factor loadings, and hence not considered to be overly problematic. Factor correlations were in the expected directions, and internal consistency estimates were above the recommended value of .70 for all subscales scores. Standardised factor loadings, cross-loadings, item means, standard deviations, skewness, kurtosis are reported in Table 3.5. Factor correlations and internal consistency estimates are reported in Table 3.6.

Table 3.5. Factor Loadings, Standard Errors, Means, SDs, Kurtosis and Skewness for 29-item PNSS-S (Study 2)

Items	Factor loadings						SE	Means	SD	Skewness	Kurtosis
	AS	AF	CS	CF	RS	RF					
<i>STEM: In my sport, I...</i>											
Feel free to make choices with regards to the way I train	<b>.71</b>						.07	5.52	1.97	-1.36	1.58
Have a say in how things are done	<b>.35</b>	-.32					.11	5.19	1.39	-.88	.15
Have the freedom to make training decisions	<b>.52</b>	-.25	.27				.10	5.19	1.39	-.94	.42
Pursue goals that are my own	<b>.71</b>						.08	5.81	1.22	-1.52	2.82
Feel like I can be myself	<b>.63</b>					-.22	.08	5.70	1.30	-1.27	1.47
Feel pushed to behave in certain ways		<b>.72</b>					.05	2.61	1.56	.92	-.26
Feel forced to follow training decisions	-.22	<b>.69</b>					.05	2.86	1.57	.69	-.57
Feel forced to do training tasks that I would not choose to do		<b>.53</b>					.05	2.45	1.45	1.10	.44
Feel excessive pressure		<b>.56</b>		.29			.06	2.54	1.52	1.05	.19
Must do what I am told		<b>.76</b>		-.21			.05	3.16	1.83	.47	-1.14
Feel that I am capable			<b>.79</b>				.10	5.83	1.16	-1.65	3.36
Feel skilled			<b>.54</b>				.08	5.53	1.17	-1.24	1.95
Am able to overcome challenges	.35		<b>.40</b>				.09	5.76	1.06	-1.57	3.76
Feel confident that I can do well			<b>.45</b>	-.26			.08	5.60	1.12	-1.35	2.38
Feel that I am good			<b>.86</b>				.10	5.62	1.22	-1.39	2.26
Feel like a failure				<b>.58</b>			.09	2.24	1.29	1.24	1.01
Feel useless				<b>.67</b>			.08	2.13	1.21	1.47	2.32

Items	Factor loadings						SE	Means	SD	Skewness	Kurtosis
	AS	AF	CS	CF	RS	RF					
<i>STEM: In my sport, I...</i>											
Feel incapable				<b>.71</b>			.10	2.10	1.23	1.51	2.16
Feel hopeless				<b>.77</b>			.10	1.95	1.17	1.65	2.91
Feel supported					<b>.76</b>		.08	6.07	1.25	-1.87	3.28
Feel cared for					<b>.84</b>		.07	5.91	1.22	-1.52	2.24
Feel connected					<b>.84</b>		.07	5.86	1.16	-1.40	2.08
Feel accepted					<b>.81</b>		.06	5.95	1.16	-1.65	3.19
Like the people around me					<b>.65</b>		.08	5.98	1.16	-1.72	3.42
Feel disliked						<b>.80</b>	.06	2.25	1.23	1.54	2.92
Feel excluded						<b>.74</b>	.05	2.26	1.28	1.51	2.48
Feel isolated						<b>.73</b>	.07	2.32	1.40	1.53	2.48
Feel ignored						<b>.84</b>	.05	2.28	1.30	1.36	1.84
Feel dismissed						<b>.69</b>	.08	2.17	1.22	1.56	2.71

*Note.* Factor loadings in this table are all significant at  $p < .01$ . Target loadings are in bold. For clarity purposes, only cross-loadings over .20 are reported. AS = autonomy satisfaction, AF = autonomy frustration, CS = competence satisfaction, CF = competence frustration, RS = relatedness satisfaction, RF = relatedness frustration.

Table 3.6. *Factor Correlations and Composite Reliability for PNSS-S subscales (Study 2)*

Subscales	Raykov's rho	1	2	3	4	5	6
(1) AS	.73	-					
(2) AF	.79	-.40	-				
(3) CS	.76	.54	-.37	-			
(4) CF	.78	-.53	.41	-.67	-		
(5) RS	.89	.61	-.43	.67	-.68	-	
(6) RF	.87	-.45	.27	-.52	.70	-.68	-

*Note.* Factor correlations are significant at  $p < .01$ . AS = autonomy satisfaction, AF = autonomy frustration, CS = competence satisfaction, CF = competence frustration, RS = relatedness satisfaction, RF = relatedness frustration. Raykov's composite reliability coefficients are presented on the diagonal of the correlation matrix.



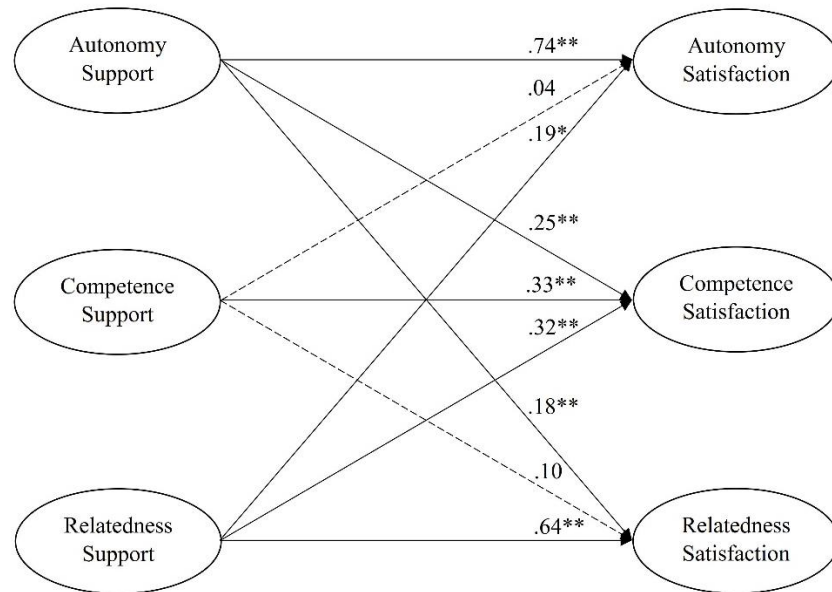
**SEM.** First, a correlational analysis was conducted to explore the associations between the variables (see Table 3.7). Next, the relations between the variables entered in the SEM were examined. Model-to-data fit was found to be acceptable [ $\chi^2(267) = 745.712, p < .001, CFI = .93, TLI = .90, SRMR = .04, RMSEA = .07$  (90% CI [.07, .08])] in the case of the six-factor model with three subscales pertaining to perceptions of coaches' need supportive behaviours and the three athlete need satisfaction subscales. Autonomy satisfaction was primarily predicted by perceived autonomy support, competence satisfaction was primarily predicted by perceived competence support, and relatedness satisfaction was primarily predicted by perceived relatedness support. Significant standardised path coefficients for the structural portion of the model are reported in Figure 3.1.

Table 3.7. *Correlational Analysis for Subscales/Measures Included in Study 2*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 AS	-	-.63**	.69**	-.60**	.63**	-.48**	.76**	-.57**	.62**	-.57**	.66**	-.59**	.57**	-.48**	.59**	-.52**
2 AF	-.63**	-	-.50**	.60**	-.58**	.45**	-.52**	.80**	-.42**	.54**	-.59**	.63**	-.46**	.57**	-.56**	.51**
3 CS	.69**	-.50**	-	-.77**	.72**	-.64**	.67**	-.47**	.73**	-.70**	.66**	-.63**	.67**	-.55**	.65**	-.60**
4 CF	-.60**	.60**	-.77**	-	-.71**	.74**	-.59**	.54**	-.67**	.85**	-.60**	.65**	-.63**	.66**	-.63**	.66**
5 RS	.63**	-.58**	.72**	-.71**	-	-.68**	.63**	-.51**	.66**	-.67**	.79**	-.72**	.57**	-.54**	.65**	-.59**
6 RF	-.48**	.45**	-.64**	.74**	-.68**	-	-.57**	.40**	-.58**	.68**	-.53**	.64**	-.58**	.57**	-.52**	.59**
7 ASup	.76**	-.52**	.67**	-.59**	.63**	-.57**	-	-.58**	.71**	-.65**	.63**	-.60**	.63**	-.52**	.59**	-.55**
8 AThw	-.57**	.80**	-.47**	.54**	-.51**	.40**	-.58**	-	-.45**	.56**	-.55**	.61**	-.43**	.48**	-.51**	.46**
9 CSup	.62**	-.42**	.73**	-.67**	.66**	-.58**	.71**	-.45**	-	-.75**	.69**	-.63**	.63**	-.49**	.61**	-.55**
10 CThw	-.57**	.54**	-.70**	.85**	-.67**	.68**	-.65**	.56**	-.75**	-	-.61**	.65**	-.63**	.61**	-.60**	.62**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
11 RSup	.66**	-.59**	.66**	-.60**	.79**	-.53**	.63**	-.55**	.69**	-.61**	-	-.79**	.51**	-.47**	.62**	-.54**
12 RThw	-.59**	.63**	-.63**	.65**	-.72**	.64**	-.60**	.61**	-.63**	.65**	-.79**	-	-.52**	.54**	-.61**	.55**
13 Dedication	.57**	-.46**	.67**	-.63**	.57**	-.58**	.63**	-.43**	.63**	-.63**	.51**	-.52**	-	-.49**	.60**	-.54**
14 Exhaustion	-.48**	.57**	-.55**	.66**	-.54**	.57**	-.52**	.48**	-.49**	.61**	-.47**	.54**	-.49**	-	-.57**	.58**
15 PA	.59**	-.56**	.65**	-.63**	.65**	-.52**	.59**	-.51**	.61**	-.60**	.62**	-.61**	.60**	-.57**	-	-.59**
16 NA	-.52**	.51**	-.60**	.66**	-.59**	.59**	-.55**	.46**	-.55**	.62**	-.54**	.55**	-.54**	.58**	-.59**	-

*Note.* AS = autonomy satisfaction; AF = autonomy frustration; CS = competence satisfaction; CF = competence frustration; RS = relatedness satisfaction; RF = relatedness frustration; ASup = autonomy support; Athw = autonomy thwarting; CSup = competence support; CThw = competence thwarting; RSup = relatedness support; RThw = relatedness thwarting; PA = positive affect; NA = negative affect.

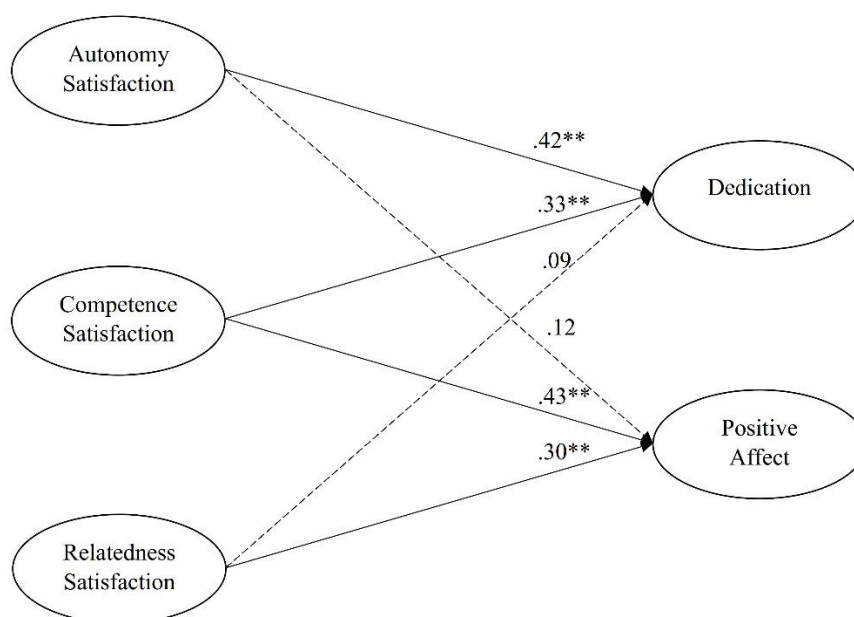


*Figure 3.1.* SEM with autonomy, competence, and relatedness support and autonomy, competence, and relatedness satisfaction

*Note.* Solid lines indicate significant paths; dotted lines indicate non-significant

paths. \*\* $p < .01$ ; \*  $p < .05$

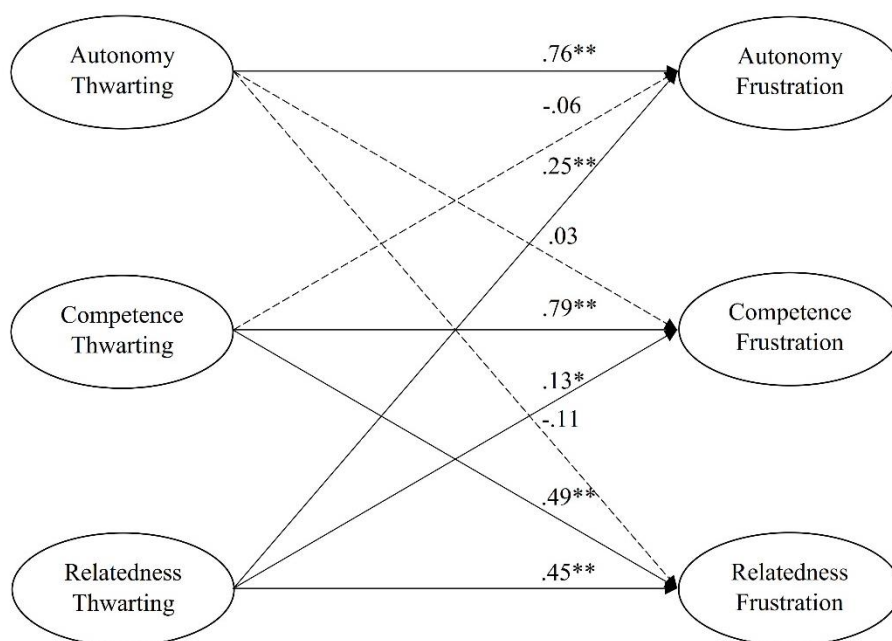
Model-to-data fit was found to be acceptable [ $\chi^2(343) = 765.357, p < .001$ , CFI = .93, TLI = .92, SRMR = .04, RMSEA = .06 (90% CI .05, .07)] for the five-factor model with the three athlete need satisfaction subscales and two outcomes of dedication and positive affect. Dedication was significantly predicted by autonomy and competence satisfaction, and positive affect by competence and relatedness satisfaction. Significant standardised path coefficients for the structural portion of the model are reported in Figure 3.2.



*Figure 3.2.* SEM with autonomy, competence, and relatedness satisfaction and positive outcomes

*Note.* Solid lines indicate significant paths; dotted lines indicate non-significant paths. \*\* $p < .01$ ; \* $p < .05$

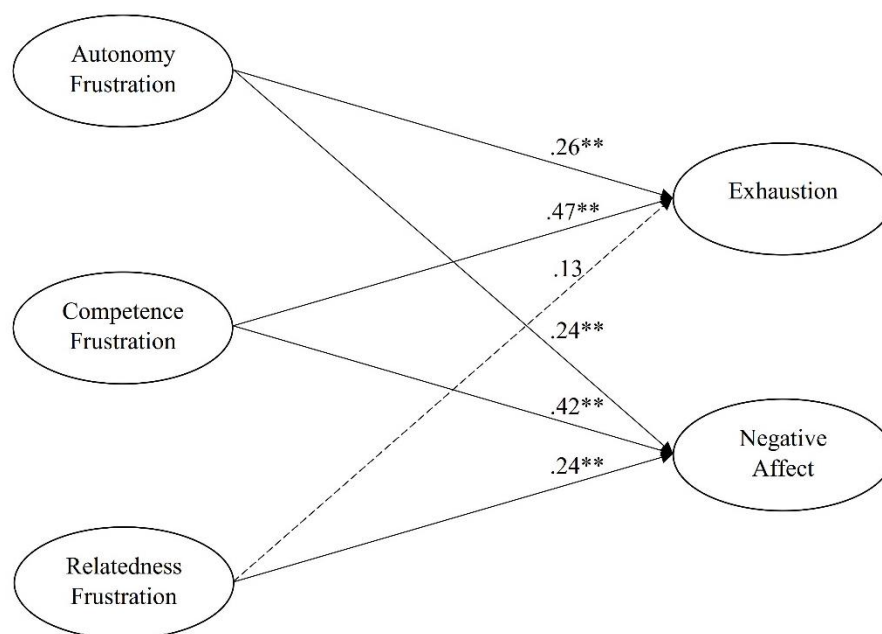
Model-to-data fit was found to be excellent [ $\chi^2(244) = 354.479, p < .001$ , CFI = .98, TLI = .97, SRMR = .02, RMSEA = .04 (90% CI .03, .04)] in the case of the six-factor model with three subscales pertaining to perceptions of coaches' need thwarting behaviours and the three athlete need frustration subscales. Autonomy frustration was primarily predicted by perceived autonomy thwarting, and competence frustration was primarily predicted by perceived competence thwarting. Unexpectedly, relatedness frustration was marginally better predicted by perceived competence thwarting than by perceived relatedness thwarting. Significant standardised path coefficients for the structural portion of the model are reported in Figure 3.3.



*Figure 3.3.* SEM with autonomy, competence, and relatedness thwarting and autonomy, competence, and relatedness frustration

Note. Solid lines indicate significant paths; dotted lines indicate non-significant paths. \*\* $p < .01$ ; \*  $p < .05$

Model-to-data fit was found to be acceptable [ $\chi^2(345) = 585.433, p < .001$ , CFI = .95, TLI = .94, SRMR = .04, RMSEA = .05 (90% CI .04, .05)] for the five-factor model with the three athlete need frustration subscales and two outcomes of exhaustion and negative affect. Exhaustion was significantly predicted by autonomy and competence frustration, and negative affect by autonomy, competence, and relatedness frustration. Significant standardised path coefficients for the structural portion of the model are reported in Figure 3.4.



*Figure 3.4.* SEM with autonomy, competence, and relatedness frustration and negative outcomes

*Note.* Solid lines indicate significant paths; dotted lines indicate non-significant paths. \*\* $p < .01$ ; \*  $p < .05$

## General Discussion

Since the development of the PNTS (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011), SDT-based research on psychological needs has increasingly demonstrated the importance of focusing on both experiences of need satisfaction and need frustration. Recently, researchers have also argued for the utility of assessing a third need state, that of unfulfilment. These theoretical developments have resulted in continued refinement of the terminology used in this area as well as attempts to develop measures that operationalise these key constructs. The present work aimed to further extend these efforts and address the conceptual and psychometric issues that have been associated with existing measures in this area. Specifically, given the absence of a sport-specific measure to examine experiences of both need satisfaction and need frustration, and the growing interest in the potential utility of assessing need unfulfilment, I aimed to develop a new multidimensional measure assessing athletes' experiences of satisfaction, frustration, and unfulfilment, separately for autonomy, competence, and relatedness needs.

### Dimensionality of the Need States

One of the aims of this chapter was to clearly conceptualise and systematically assess need unfulfilment, the third state which has garnered increasing interest over the recent years (e.g., Cheon et al., 2019; Costa et al., 2015), alongside those of need satisfaction and need frustration. I tested various theoretically plausible configurations of the three need states using CFA, ESEM, and bifactor analyses, yet none of the representations pertaining to the simultaneous assessment of satisfaction, frustration, and unfulfilment were supported by the data. At this stage, the evidence for the existence of need unfulfilment as a distinct construct appears to be mixed. Support for its existence is based on Costa et al.'s (2015) finding via MTMM analysis that need unfulfilment is empirically distinct from need satisfaction and frustration. Furthermore, in the case of the need of autonomy, unfulfilment was shown to have unique utility in predicting disengagement, an outcome of diminished functioning by Cheon et al. (2019). However, findings from this chapter indicate a lack evidence that need unfulfilment is distinct from need satisfaction and frustration. In addition, Costa et al. (2015) found need unfulfilment to have poor predictive value. Perhaps the items that were created to assess need unfulfilment in this Chapter were not operationalised in a manner that rendered them adequately distinguishable



from those of need satisfaction and frustration. Although the items were clearly distinct to our research team, and were appropriate when tested on their own (without the need satisfaction and need thwarting items), it is possible that athletes are not able to see such distinctions and, therefore, perhaps this line of work has limited practical value.

In light of the extant supporting literature for a model involving the two need states of satisfaction and frustration (e.g., Chen et al., 2015), I subsequently shifted the focus of the study towards developing and providing initial validity evidence for the first sport-specific measure of these two need states. Of all the theoretically justifiable configurations that were tested, a six-factor solution involving the satisfaction and frustration of each of the three basic psychological needs, appeared promising. Following some modifications in Study 1, the cross-validation of this revised model was supported in Study 2.

In essence, the results indicated that athletes' responses to the PNSS-S items could be best explained by a model comprising six dimensions of autonomy satisfaction and frustration, competence satisfaction and frustration, and relatedness satisfaction and frustration, scores of all of which were internally reliable. Aligned with similar findings from non-sport-specific contexts (e.g., Chen et al., 2015; Cordeiro, Paixao, Lens, Lacante, & Luyckx, 2016; Longo et al., 2016), results of this research suggest that athletes' need states are comprised of six dimensions that are distinct, yet correlated, and should hence be assessed independently.

### **Evidence for Nomological Network**

In an effort to provide initial evidence for the nomological network surrounding the subscales of the PNSS-S, I examined the relations between the need states, perceived coach interpersonal behaviours, and positive and negative athlete outcomes. Autonomy, competence, and relatedness satisfaction were primarily predicted by their corresponding contextual factors of perceived coach autonomy, competence, and relatedness support, respectively. In contrast, autonomy and competence frustration were primarily predicted by their corresponding contextual factors of perceived coach autonomy, and competence thwarting, respectively. These findings are in line with theory (e.g., Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013) and previous investigations linking perceptions of interpersonal behaviours to the need states (e.g., Pulido et al., 2018; Rocchi et al., 2017).

Contrary to my hypothesis, relatedness frustration was slightly better predicted by perceived competence thwarting, as compared to relatedness thwarting. An examination of the items of the relatedness thwarting subscale of the IBQ in sport (Rocchi et al., 2017) could help explain this finding. The subscale includes items that are better representative of what Cheon et al. (2019) refer to as need indifference (e.g., “My coach is distant when we spend time together”), as opposed to actively thwarting of it (e.g., an example of such an item would be “My coach rejects me”). In comparison to need thwarting, which involves active undermining of others’ basic psychological needs, need indifference is proposed to only “set aside” others’ needs (Cheon et al., 2019). Resultantly, need indifference may not predict need frustration with the same strength as need thwarting behaviours. Competence thwarting may have emerged as a stronger predictor of relatedness frustration given that the need for competence has been found to be particularly salient in the context of sport (e.g., Adie, Duda, & Ntoumanis, 2012). Additionally, as the need-specific dimensions of interpersonal behaviours are stipulated to be interrelated (e.g., Ryan, 1991; Ryan & Deci, 2017), competence thwarting may have emerged as a stronger predictor as a result of the inadequacy of the relatedness thwarting subscale.

In terms of the relations between the dimensions of the need states and athlete outcomes, the satisfaction of autonomy and competence needs predicted athlete dedication in a significant manner, whereas the satisfaction of competence and relatedness needs predicted positive affect in a significant manner. Dedicating time and energy to sport-related aspirations and deriving positive emotions from sport engagement are likely consequences for athletes who experience a sense of self-directedness, effectance, and connectedness in their sport. The satisfaction of all three basic psychological needs is considered to be indispensable for well-being (Deci & Ryan, 2000), and researchers have previously examined athlete experiences of need satisfaction as key motivational precursors to athlete engagement (Curran, Hill, Hall, & Jowett, 2014; Lonsdale et al., 2007), and positive affect (Mack et al., 2011).

The results indicated that the relations between relatedness satisfaction and athlete dedication, and autonomy satisfaction and positive affect, were non-significant. In their investigation of the antecedents of athlete engagement in sport, Hodge, Lonsdale and Jackson (2009) did not find the need for relatedness to play a substantial role in terms of predicting engagement (of which dedication is a key

component), when compared to the other two needs. Moreover, Reinboth et al., (2004) found relatedness to be unrelated to athlete outcomes. Cognitive Evaluation Theory (CET), a sub-theory of SDT, emphasises the distal role of relatedness satisfaction in the maintenance of intrinsic motivation (Deci & Ryan, 2000). It is likely that subsequent outcomes (such as dedication and engagement) are also implicated (Reinboth et al., 2004). Autonomy satisfaction has previously been found to be unrelated to positive affect in sport and related domains when assessed using the positive emotions subscale of the PANAS (e.g., Gunnell et al., 2013; Mack et al., 2011; McDonough & Crocker, 2007). It might be the case that the items of the PANAS are better suited to capture the positive emotions resulting from the experiences of effectance/mastery and connectedness with others, over those resulting from feeling volitional or self-directed in one's sporting pursuits.

In terms of the relations between need frustration subscales and negative outcomes, autonomy and competence frustration predicted athlete exhaustion in a significant manner, whereas frustration of each of the three needs predicted negative affect in a significant manner. Feeling isolated, being forced to have to train in certain ways, and thinking of oneself as a failure are likely to predispose athletes to extreme fatigue and adverse emotions, and need frustration has been shown to be implicated in these maladaptive athlete outcomes (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). In line with the results reported by Hodge et al. (2008) regarding the weak role of the need for relatedness in the development of athlete burnout (of which exhaustion is key component), I found a non-significant relation between relatedness frustration and exhaustion. This result, along with the non-significant association between relatedness and dedication, highlights the distal role of the need for relatedness in the development of athlete outcomes.

The consistency and strength with which the experiential states pertaining to the need for competence predicted positive and negative athlete outcomes as compared to autonomy and relatedness satisfaction and frustration add to the evidence for its salience in sport and related settings (e.g., Adie et al., 2012; Gunnell et al., 2013; Ntoumanis, 2001; Reinboth, Duda, & Ntoumanis, 2004; Standage et al., 2003). In sum, these results correspond to propositions outlined in SDT (e.g., Vansteenkiste & Ryan, 2013) and subsequent findings in support of need satisfaction and need frustration being distinct constructs, with need satisfaction dimensions mainly predicting indices of well-being, and need frustration dimensions mainly

predicting indices of ill-being (e.g., Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011; Chen et al., 2015).

### **Limitations, Future Directions, and Conclusions**

The results of these studies should be interpreted in light of a few caveats. First, the cross-sectional nature of the design raises issues of common method variance and prevents any causal inferences (e.g., Podsakoff, Mackenzie, Lee, & Podsakoff, 2003). Researchers could overcome this issue by employing longitudinal or experimental research designs and objective assessments of athlete outcomes (e.g., objective performance, biological indices of well-being; cf. Quested, Bosch, Burns, Cumming, Ntoumanis, & Duda, 2011). Second, I provided validity evidence based on internal structure and relations to other variables, but did not test the evidence for face and content validity. This was done bearing in mind that some of the original questionnaires that informed the item development process had consulted with athletes/expert panels (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Ng et al., 2011). Factor analyses conducted in this chapter indicated that although there was no issue with the need unfulfilment items when they were tested on their own, there was no evidence to demonstrate that need unfulfilment could be modelled as a distinct need state alongside those of need satisfaction and frustration. Perhaps cognitive interviewing techniques such as the think-aloud method (Ericsson & Simon, 1993; Green & Gilhooly, 1996) may help discern why. Previously, researchers have utilised the think-aloud technique to explore respondents' thought processes as they completed questionnaires that lacked comprehensive psychometric assessment (e.g., tests of reliability and validity evidence; Darker & French, 2009), or questionnaires that had been adapted to different contexts (e.g., Hancox, Quested, & Duda, 2015). Researchers interested in employing this method could ask athletes to explicitly verbalise what they think about as they respond to each item of the original PNSS-S item pool. After transcription of these interviews, difficulties identified by athletes could, for instance, be interpreted using stages of survey response identified by Tourangeau, Rips, and Rasiko (2000), as demonstrated by Hancox et al. (2015). These are the stages of comprehension (understanding and interpretation), retrieval, judgement, and responding. Such a study could prove useful in testing the content validity evidence of the original PNSS-S items and in understanding if and how athletes differentiate between the three need states. Such a methodology might also lead to future

modifications of the content of the scale. Given that athletes' responses to the items did not distinguish between the constructs of need unfulfilment, need satisfaction and need frustration, researchers might also benefit from employing differential data analytic strategies. For example, item response theory (IRT) may aid the understanding of how athletes respond to the each of the items, and has been suggested to be suitable approach in the case of research examining the key constructs embedded within the SDT framework (Standage et al., 2019).

Despite these limitations, this chapter adds to the literature on motivation in sport. The PNSS-S represents the first sport-specific measure of all six athlete need states in sport. In the past, researchers have relied on examining athletes' need states by adapting measures developed in other life domains, or combined separate questionnaires to assess need satisfaction and frustration. More importantly, numerous conceptual issues relating to confounding of the social context and need states have been identified with items of such measures. Researchers in sport can now utilise a measure that contains items that are brief, that exclusively tap athletes' experience of their needs, and are all meaningful to the sport domain. In addition, I recorded my unsuccessful efforts to measure athletes' experiences of need unfulfilment, alongside their experiences of need satisfaction and need frustration. I hope this attempt serves as an example in terms of open science and transparency in methods and reporting, without bias and personal preferences obscuring what is reported, and aids other researchers who may be interested in pursuing this line of work in understanding what did and did not work.

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### Footnotes

1. Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani (2011) referred to need frustration as need thwarting in that manuscript. Thereafter, the term need frustration was widely adopted in the SDT literature to refer to one's personal experience, whereas need thwarting was used to refer to the undermining actions of significant others in one's social context).

2. I also re-tested all the other models from Study 1 involving the different configurations of need satisfaction and frustration (i.e. Models 13-24). Models 16, 20-23 did not converge. Models 13 and 17 were rejected on the basis of inadequate model-to-data fit. Models 14 and 15 had adequate fit, however, they were rejected due to high correlations between factors. Model 19 demonstrated adequate fit, however, only had one significant loading on the S-factor of competence satisfaction. The standard errors of the model parameter estimates could not be computed in the case of Model 24

## Appendix A

### Initial Pool of 46 PNSS-S Items (Study 1)

---

Stem: In my sport I...

---

#### **Autonomy Satisfaction**

feel that I participate because I want to  
 feel free to make choices with regards to the way I train  
 have a say in how things are done  
 do activities that interest me  
 have the freedom to make training decisions

#### **Competence Satisfaction**

am satisfied with my progress  
 feel that I am capable  
 feel skilled  
 feel that I am improving  
 am able to overcome challenges

#### **Relatedness Satisfaction**

feel supported  
 feel listened to  
 feel valued  
 feel cared for  
 feel included as an important part of the group/team  
 feel valued as an important member of my group/team

#### **Autonomy Frustration**

am not free to make choices with regards to the way I train  
 feel pushed to behave in certain ways  
 feel forced to follow training decisions  
 feel a lot of unwanted pressure  
 feel forced to do training tasks that I would not choose to do

#### **Competence Frustration**

feel like a failure  
 feel useless  
 feel incapable  
 feel hopeless

#### **Relatedness Frustration**



feel rejected  
feel brushed aside  
feel disliked  
feel excluded  
feel isolated  
feel ignored

**Autonomy Unfulfilment**

find many of the activities set for me are boring  
am unsure as to why we do certain tasks in training  
contribute little to training decisions  
am unclear if my ideas are valued  
am confused as to when I can make decisions

**Competence Unfulfilment**

feel under-challenged  
feel like I have achieved less than I would have liked to  
feel like I have improved less than I would have liked to  
feel that I am not good enough  
am not satisfied with my level of competence

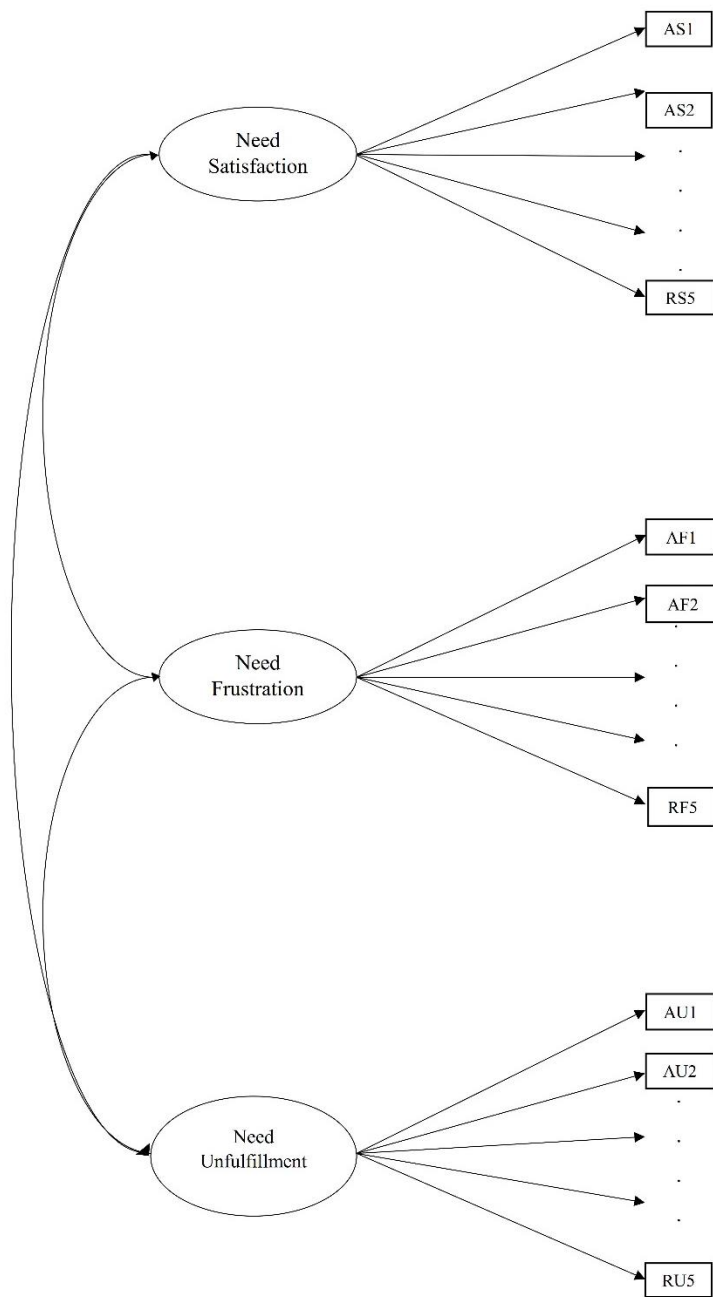
**Relatedness Unfulfilment**

have little in common with others  
have little shared interest with others  
feel I don't quite fit in with the others  
have no close friends  
feel like my teammates know little about me

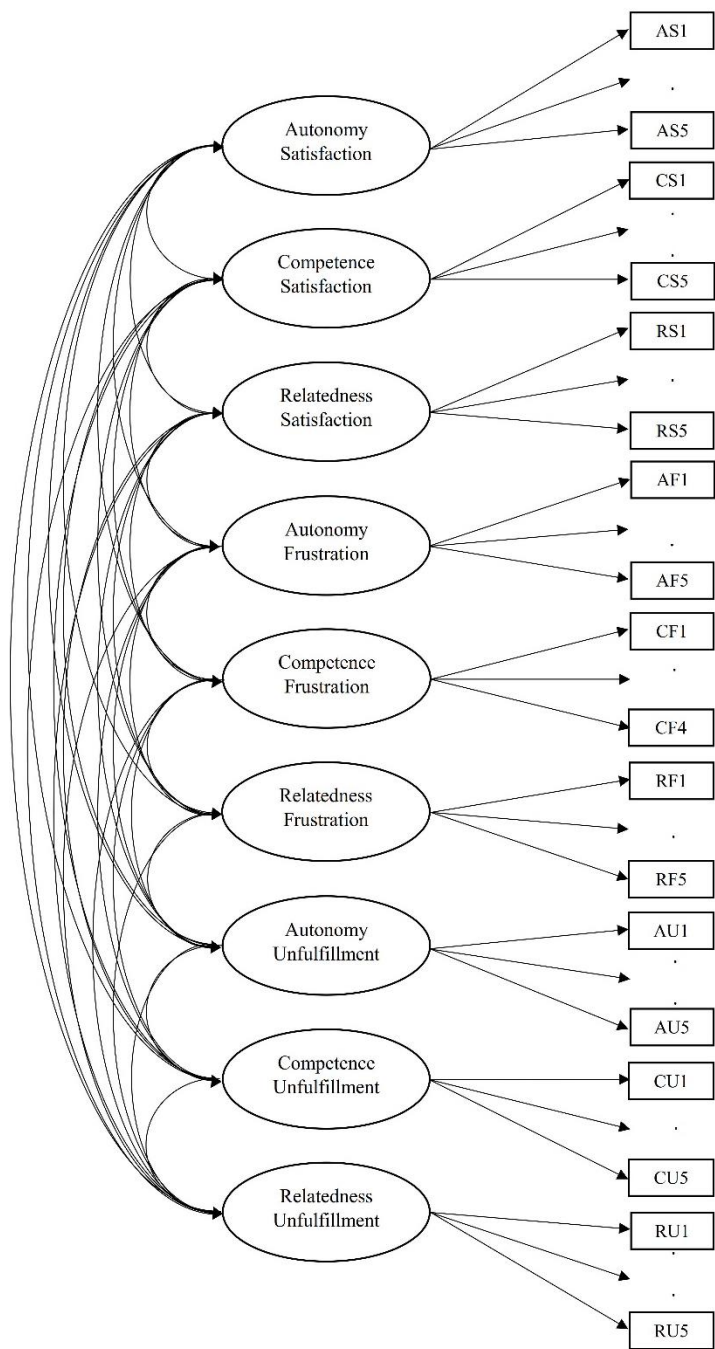
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**Appendix B**

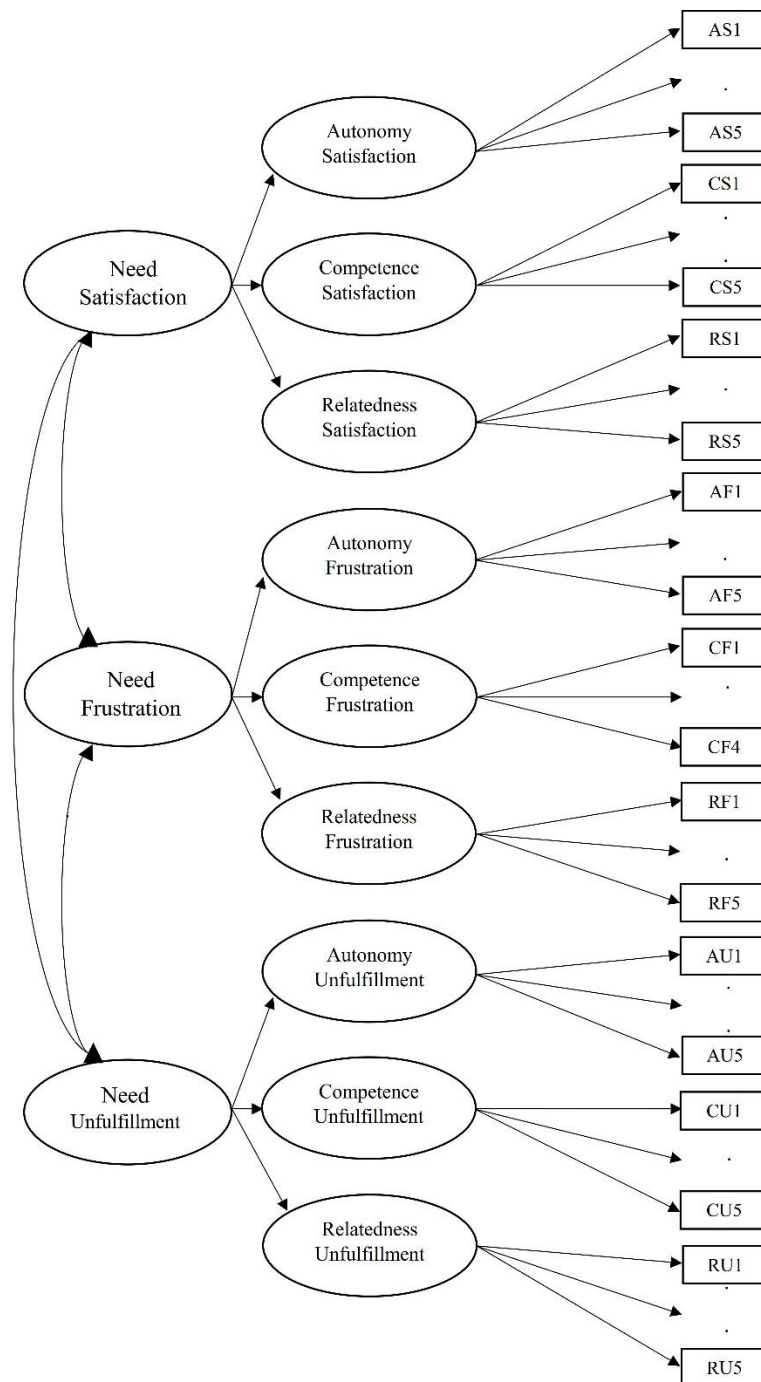
## Factor Models Tested in Study 1



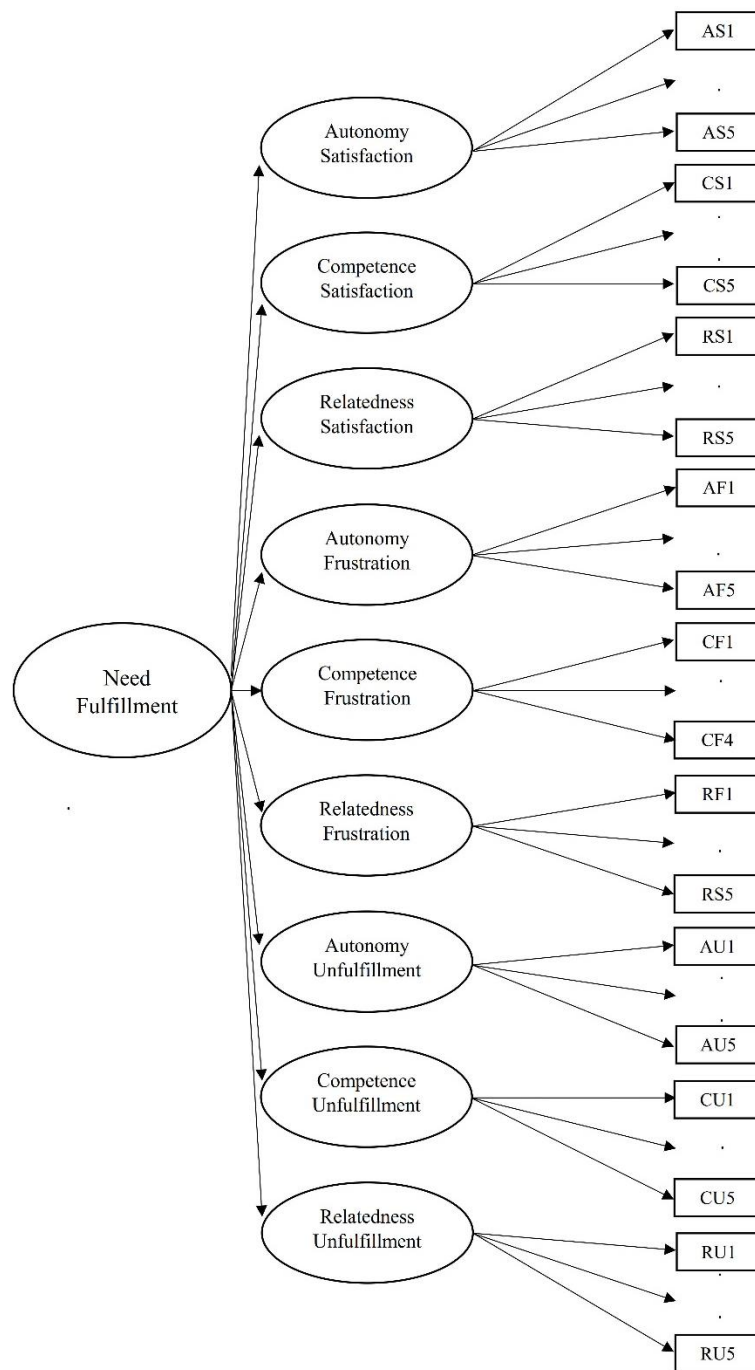
Model 1. Three-factor CFA model



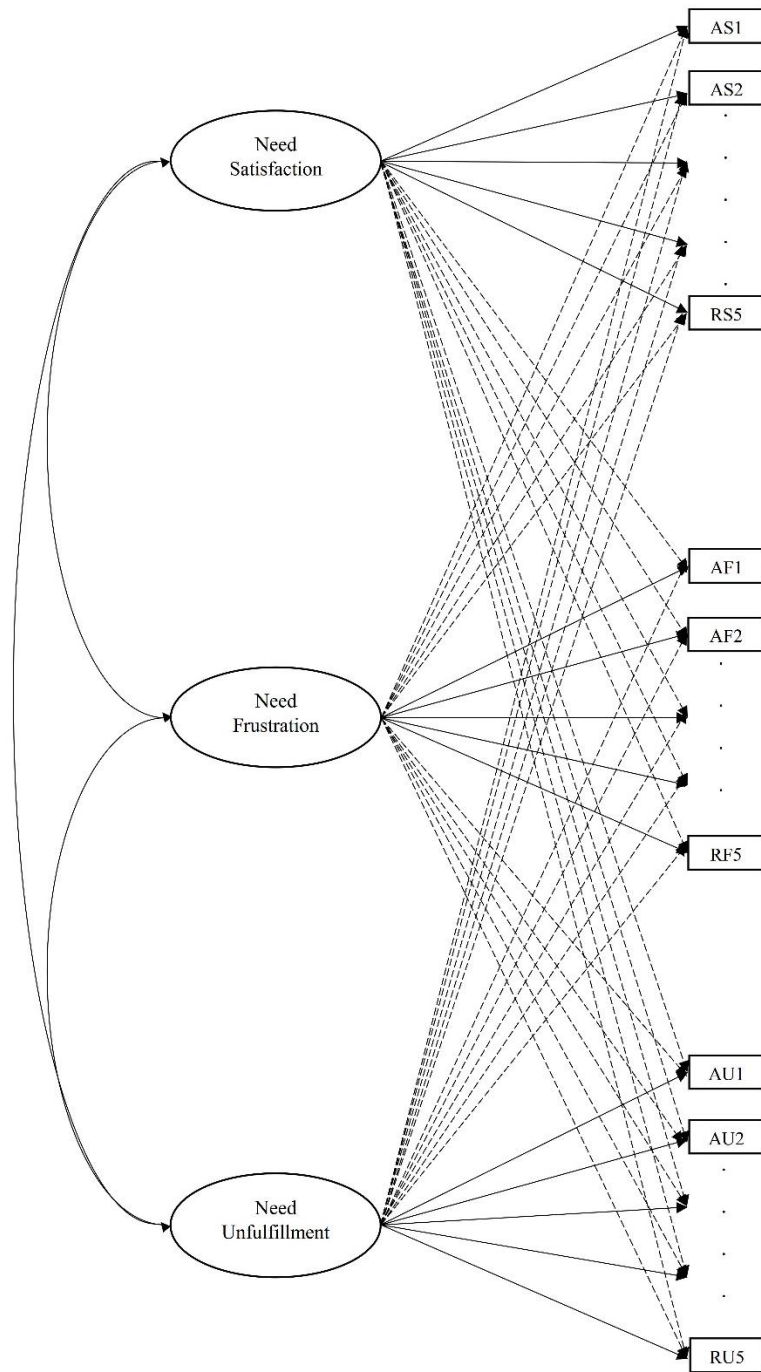
Model 2. Nine correlated factors CFA model



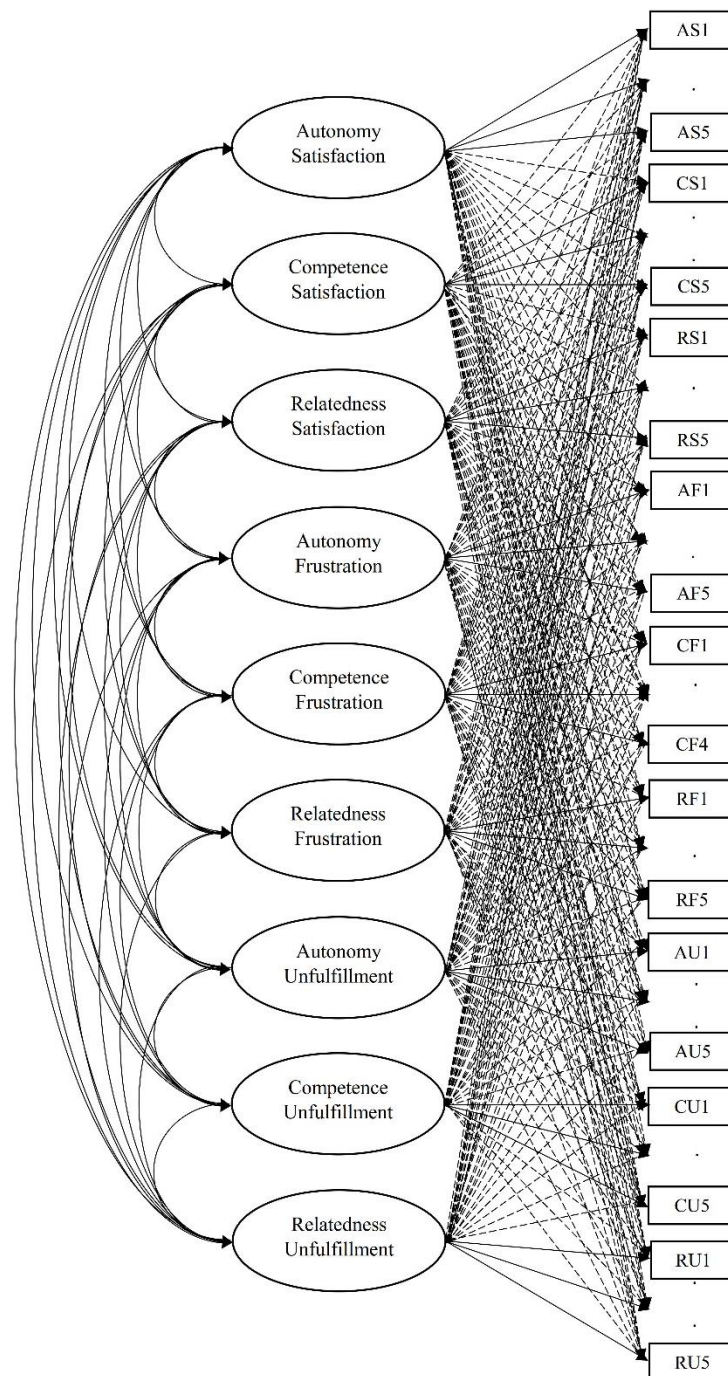
Model 3. Three higher order, nine lower order hierarchical CFA model



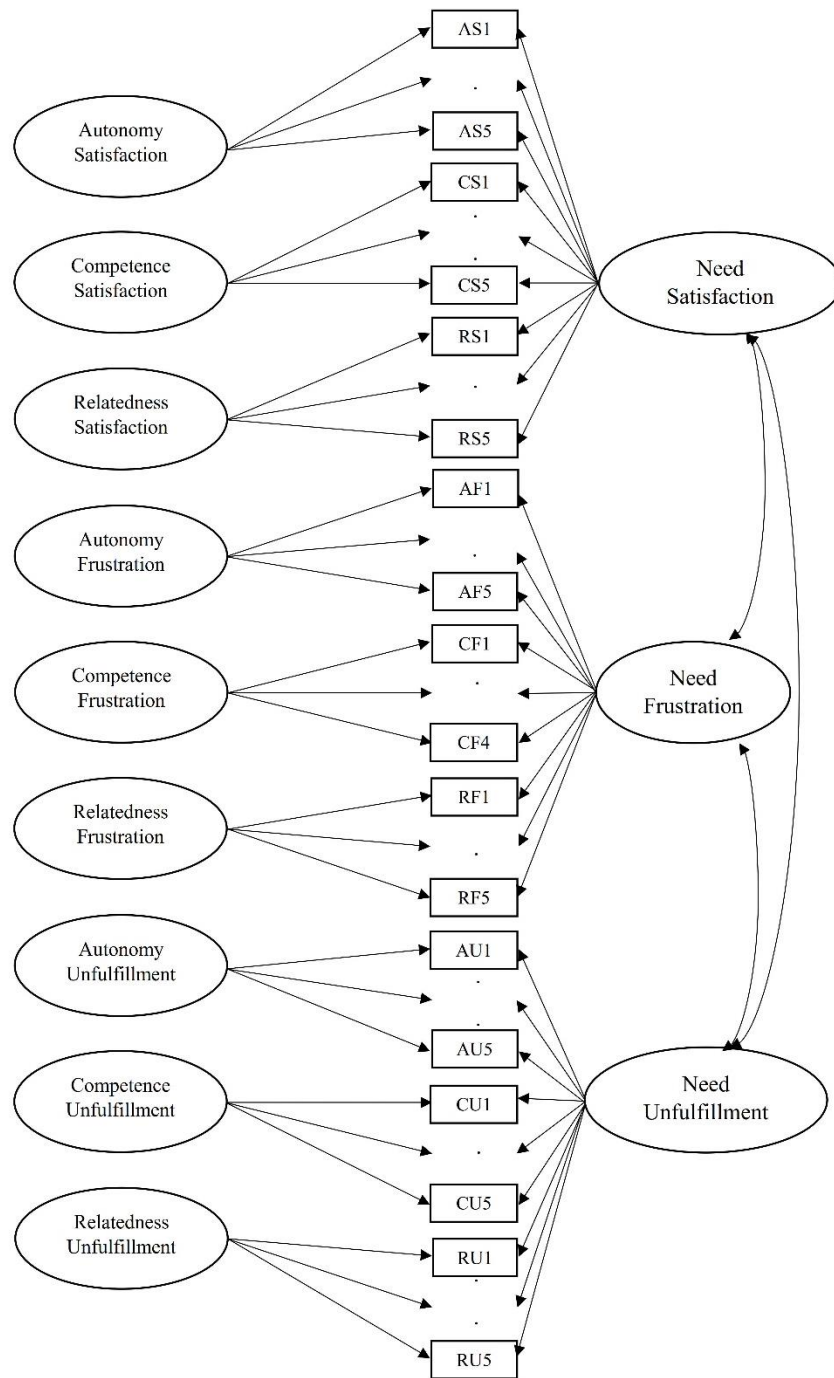
Model 4. One higher order, nine lower order hierarchical CFA model



Model 5. Three-factor ESEM model

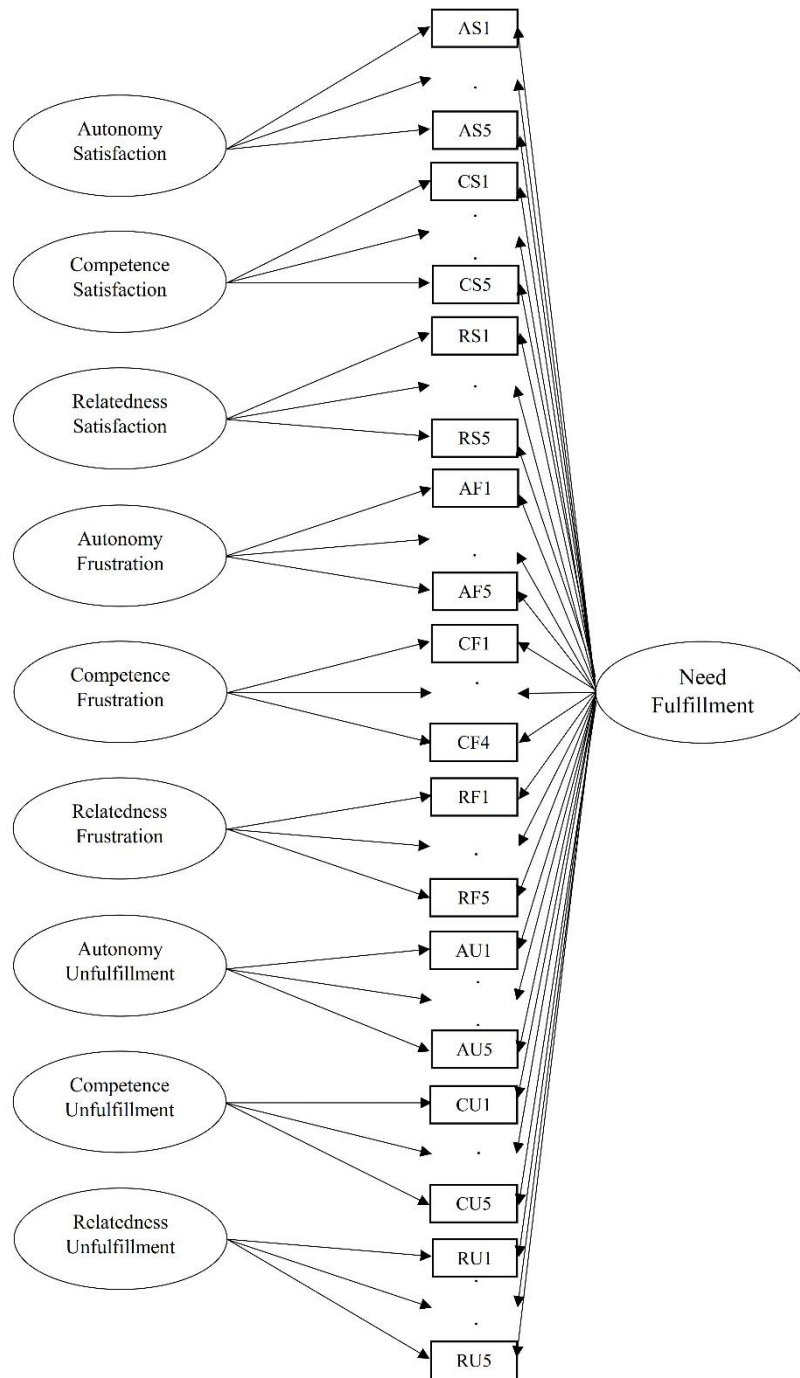


Model 6. Nine correlated factors ESEM model

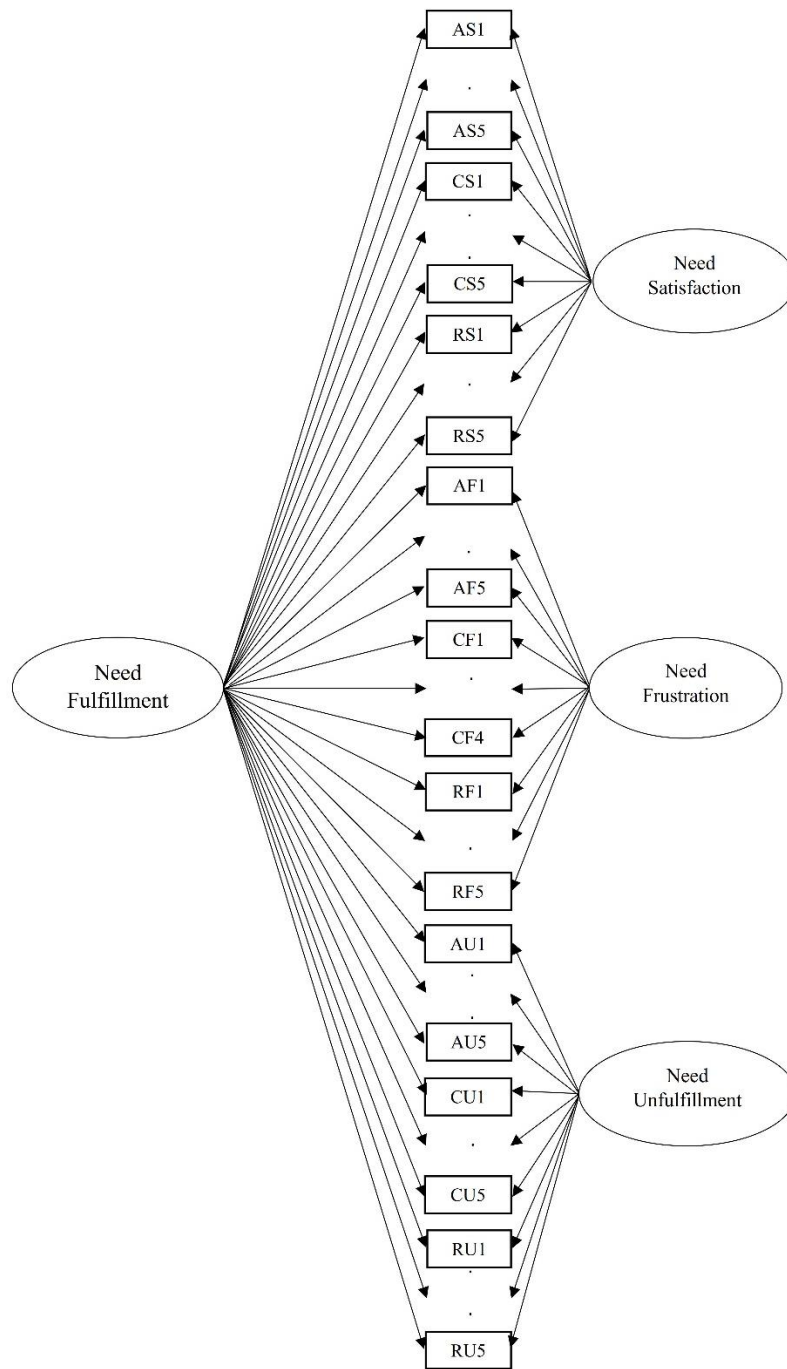


Model 7. Bifactor CFA model with three general-factors and nine specific-factors

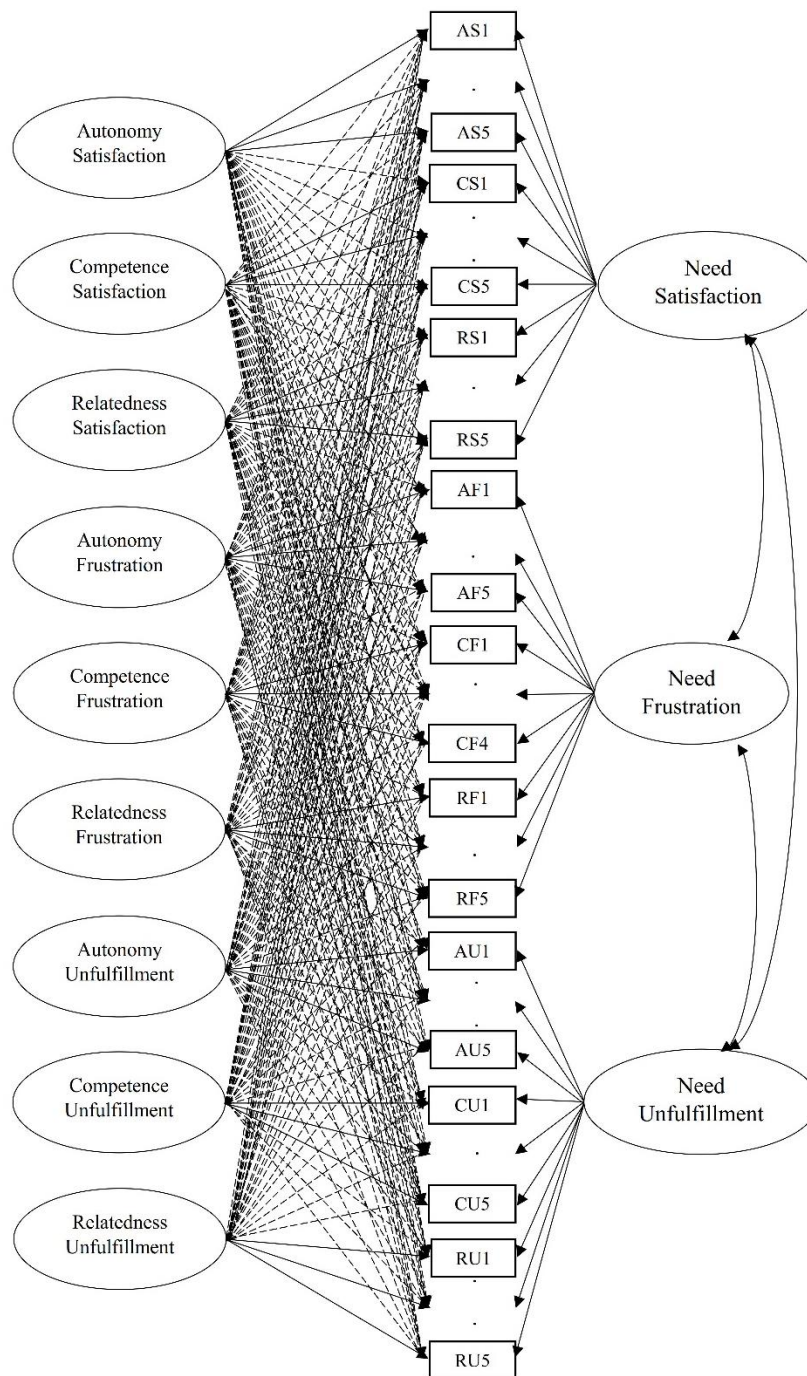




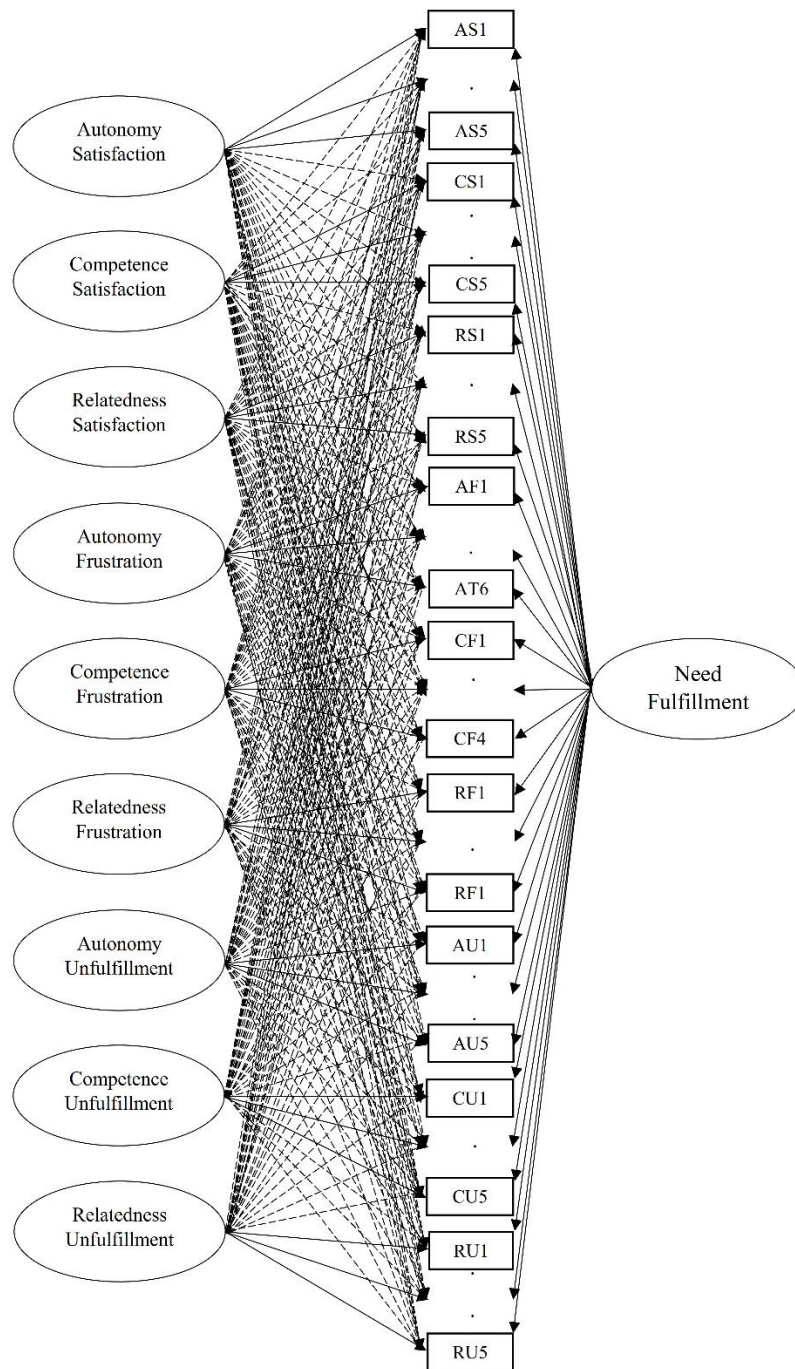
Model 8. Bifactor CFA model with one general-factor and nine specific-factors



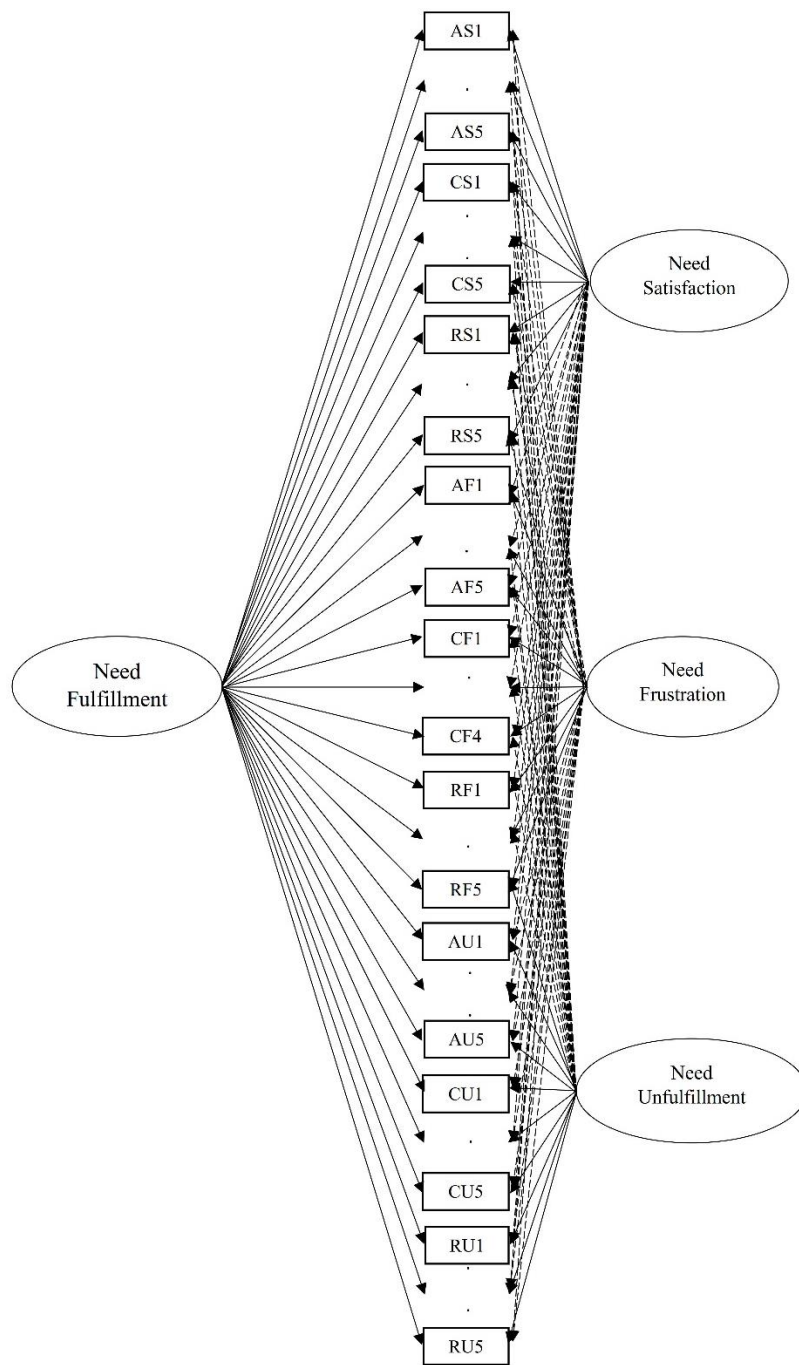
Model 9. Bifactor CFA model with one general-factor and three specific-factors



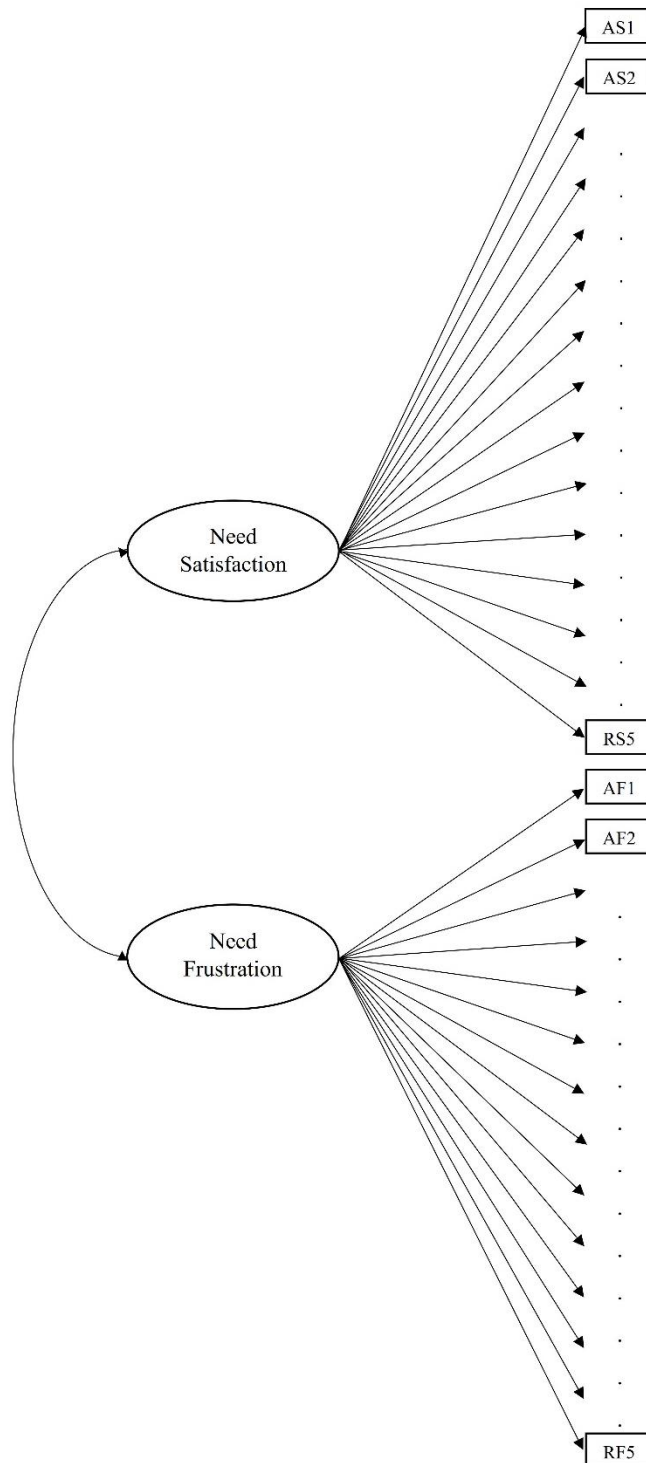
Model 10. Bifactor ESEM model with three general-factors and nine S-factors



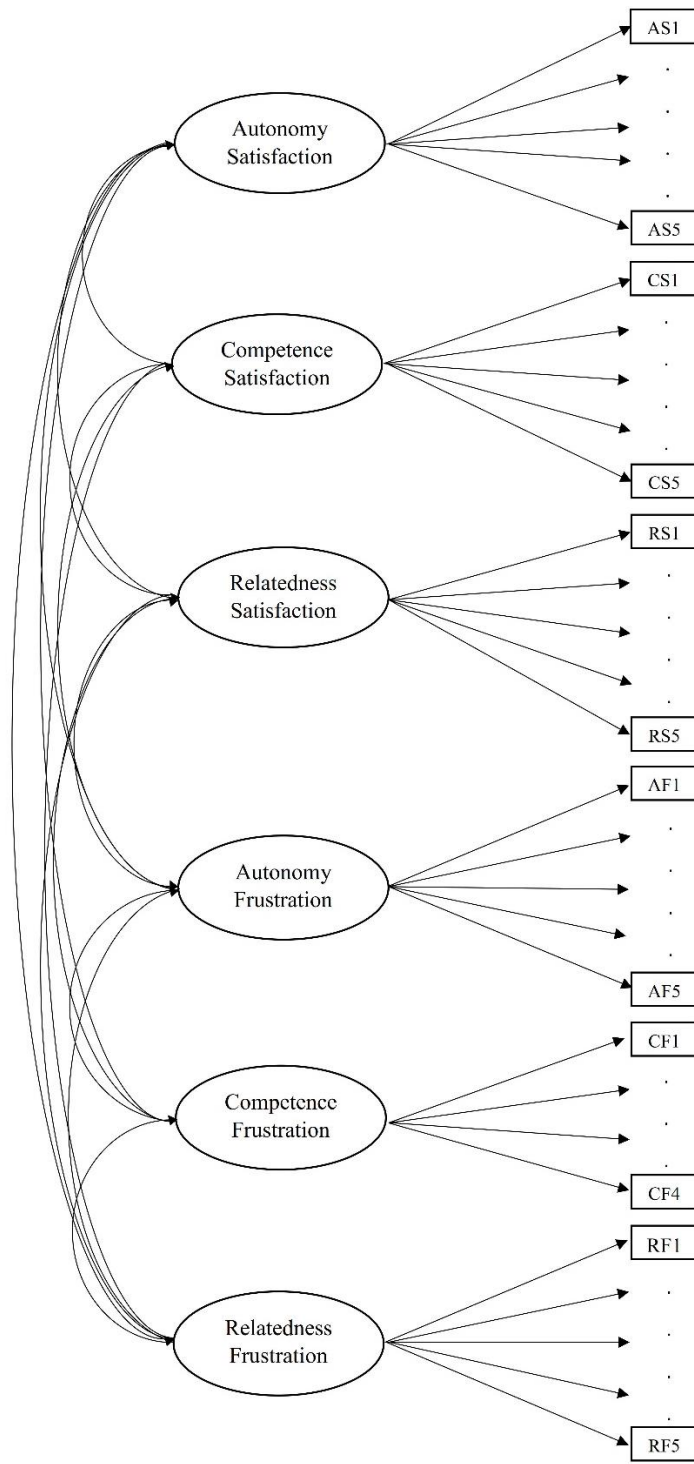
Model 11. Bifactor ESEM model with one general-factor and nine specific-factors



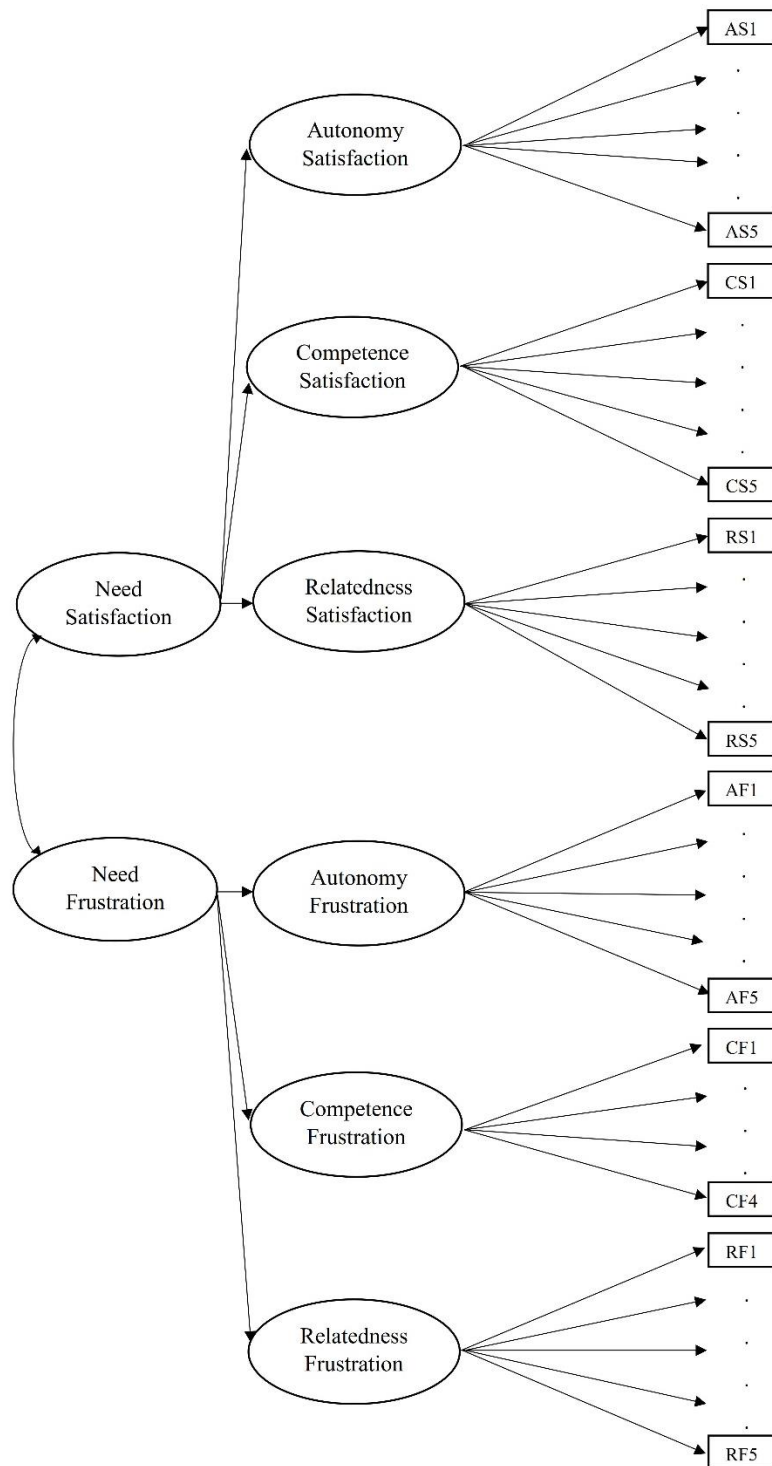
Model 12. Bifactor ESEM model with one general-factor and three specific-factors



Model 13. Two-factor CFA Model

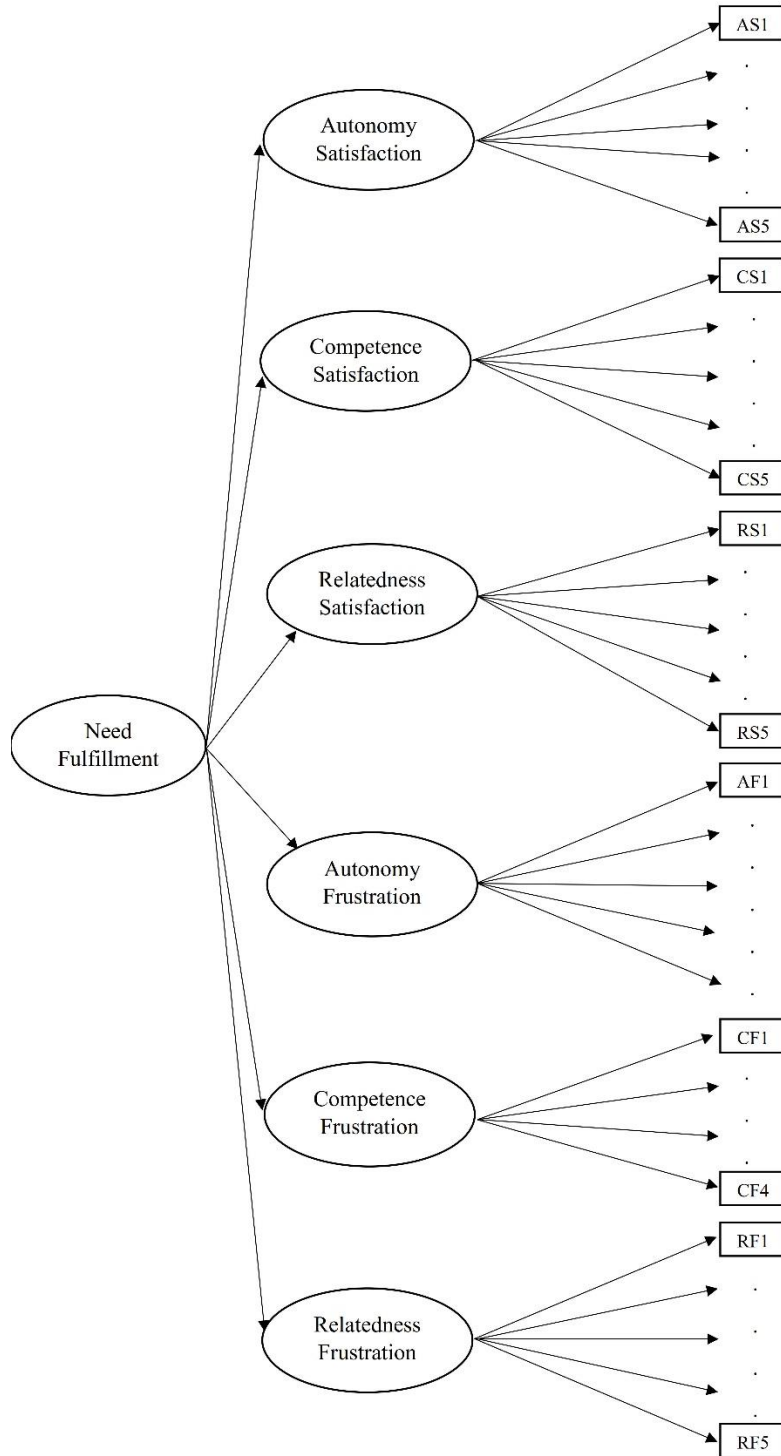


Model 14. Six correlated factors CFA model

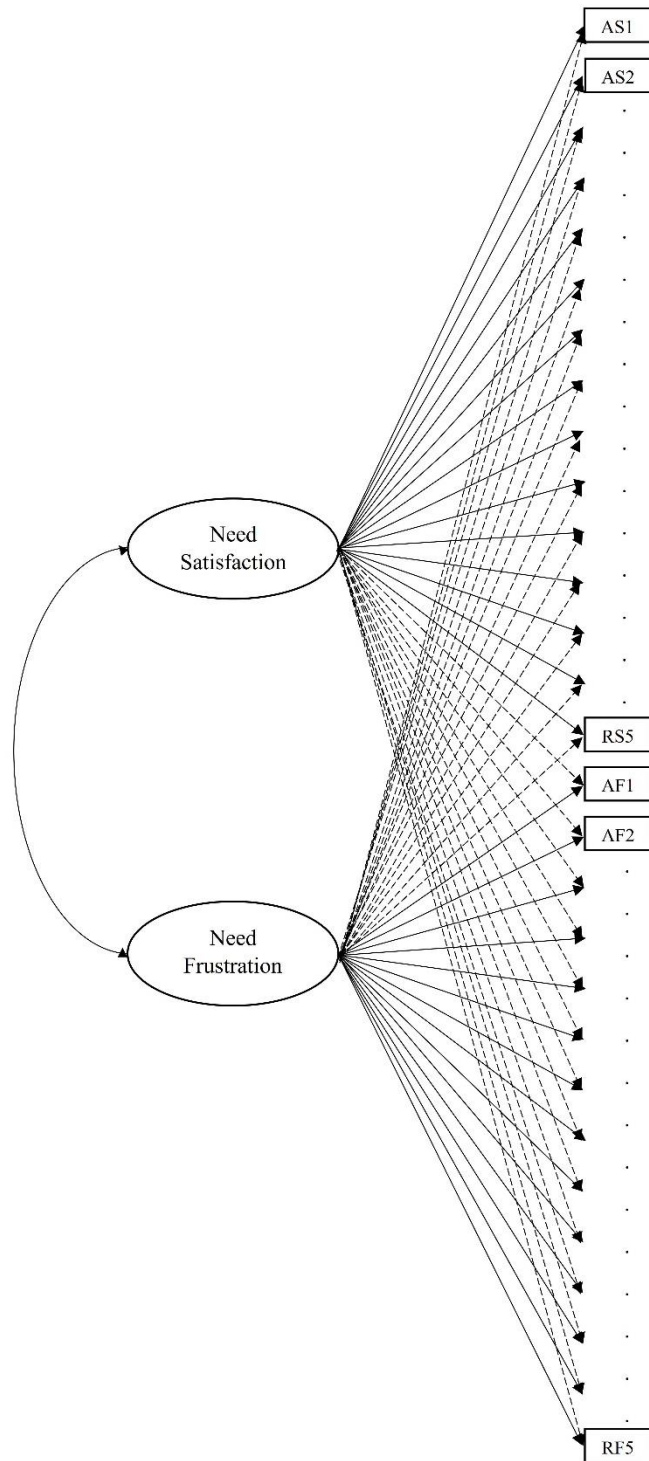


Model 15. Two higher-order; six lower-order hierarchical CFA model

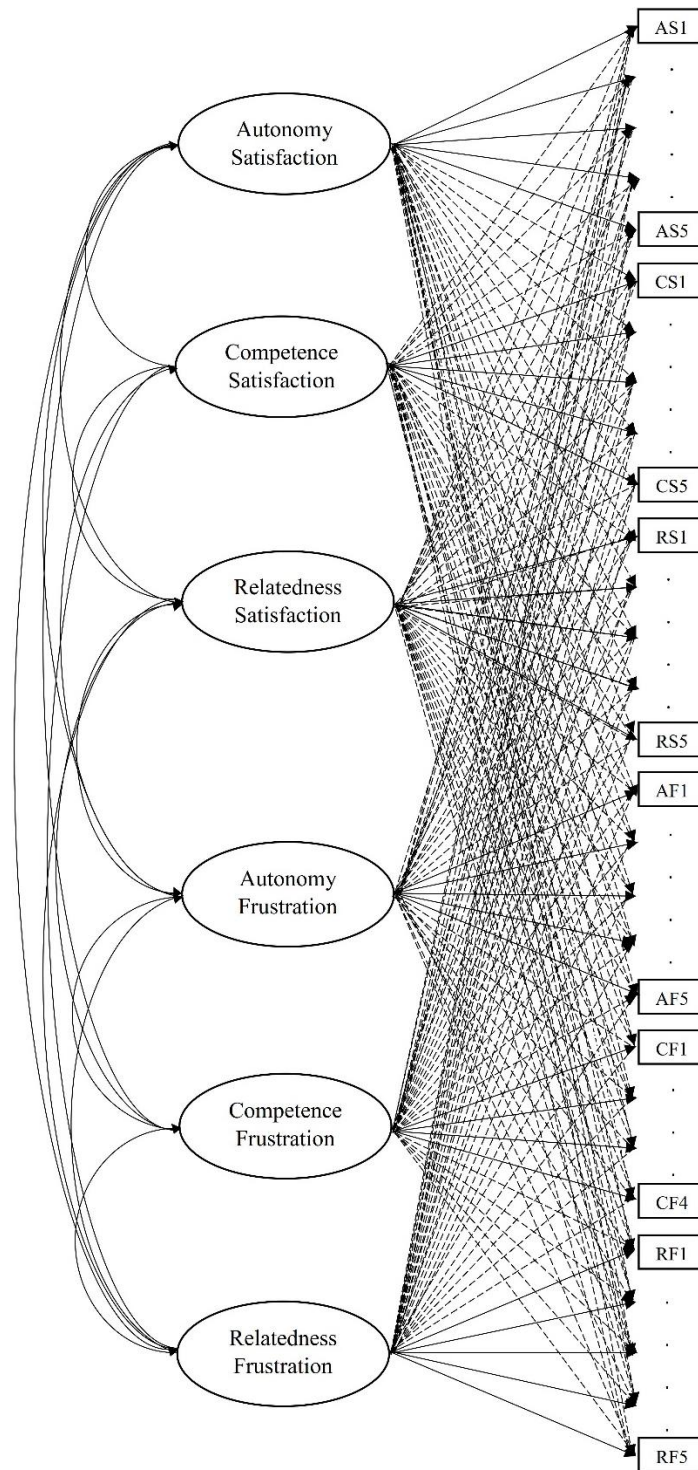




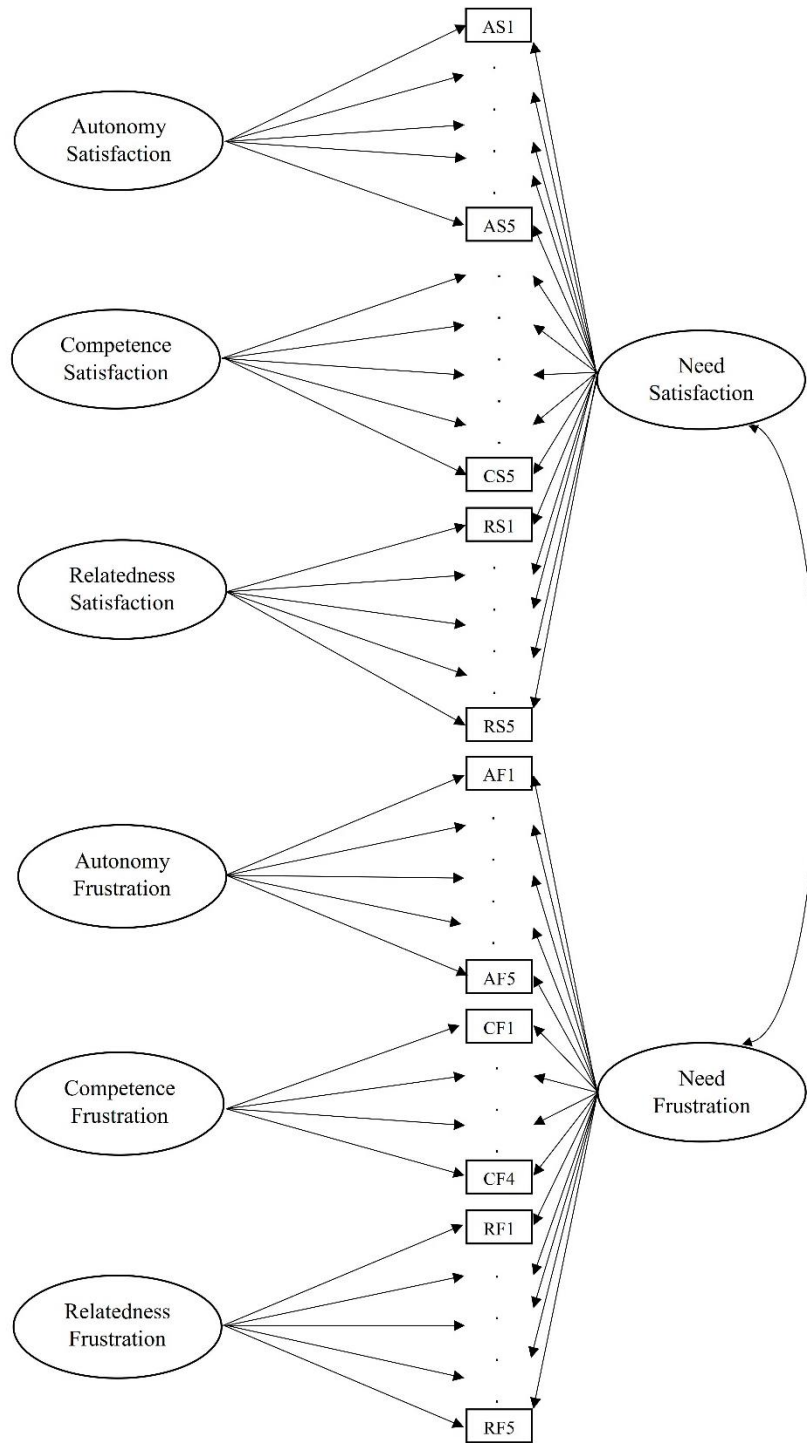
Model 16. One higher-order; six lower-order hierarchical CFA model



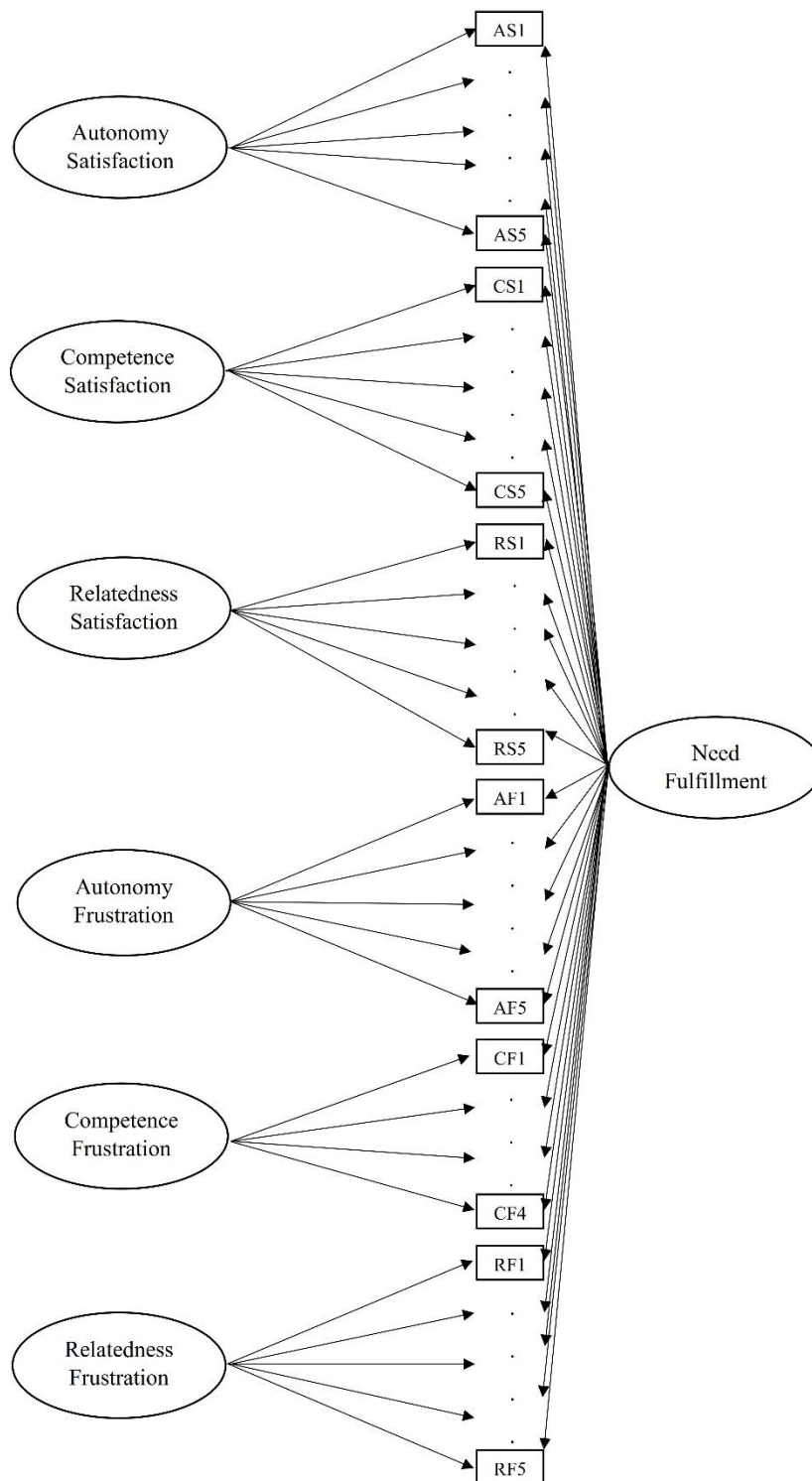
Model 17. Two factor ESEM model



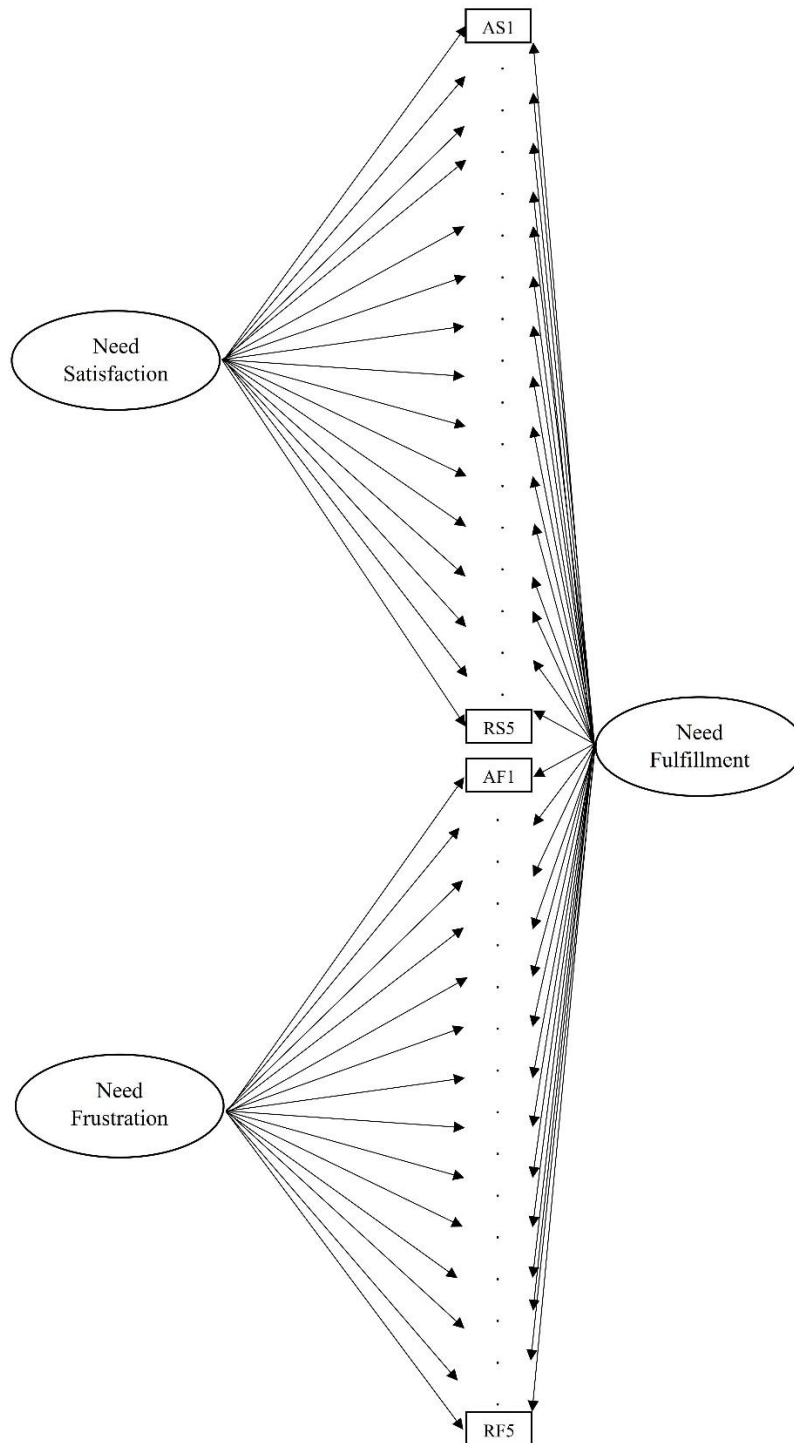
Model 18. Six correlated factors ESEM model



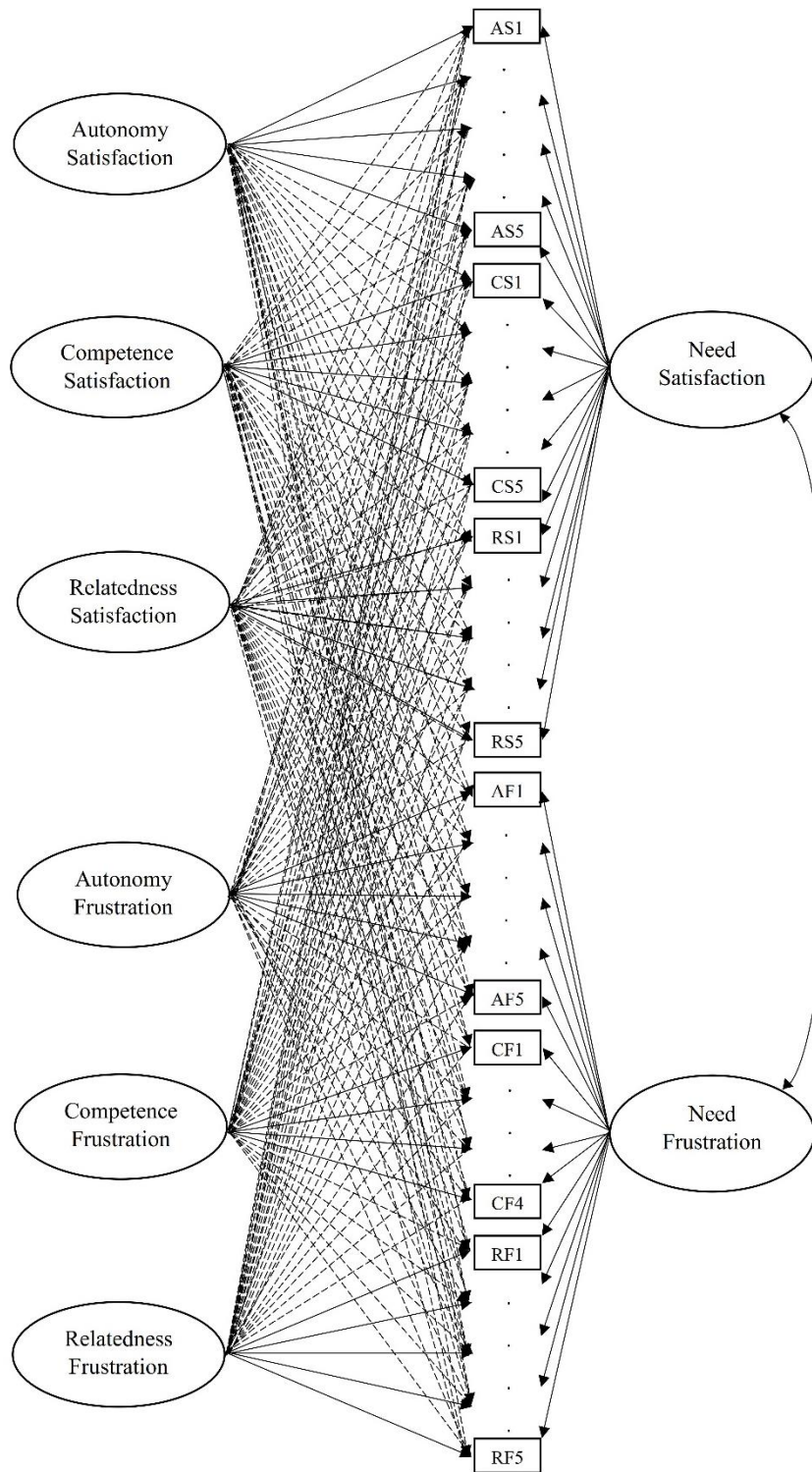
Model 19. Bifactor CFA model with two general-factors and six specific-factors



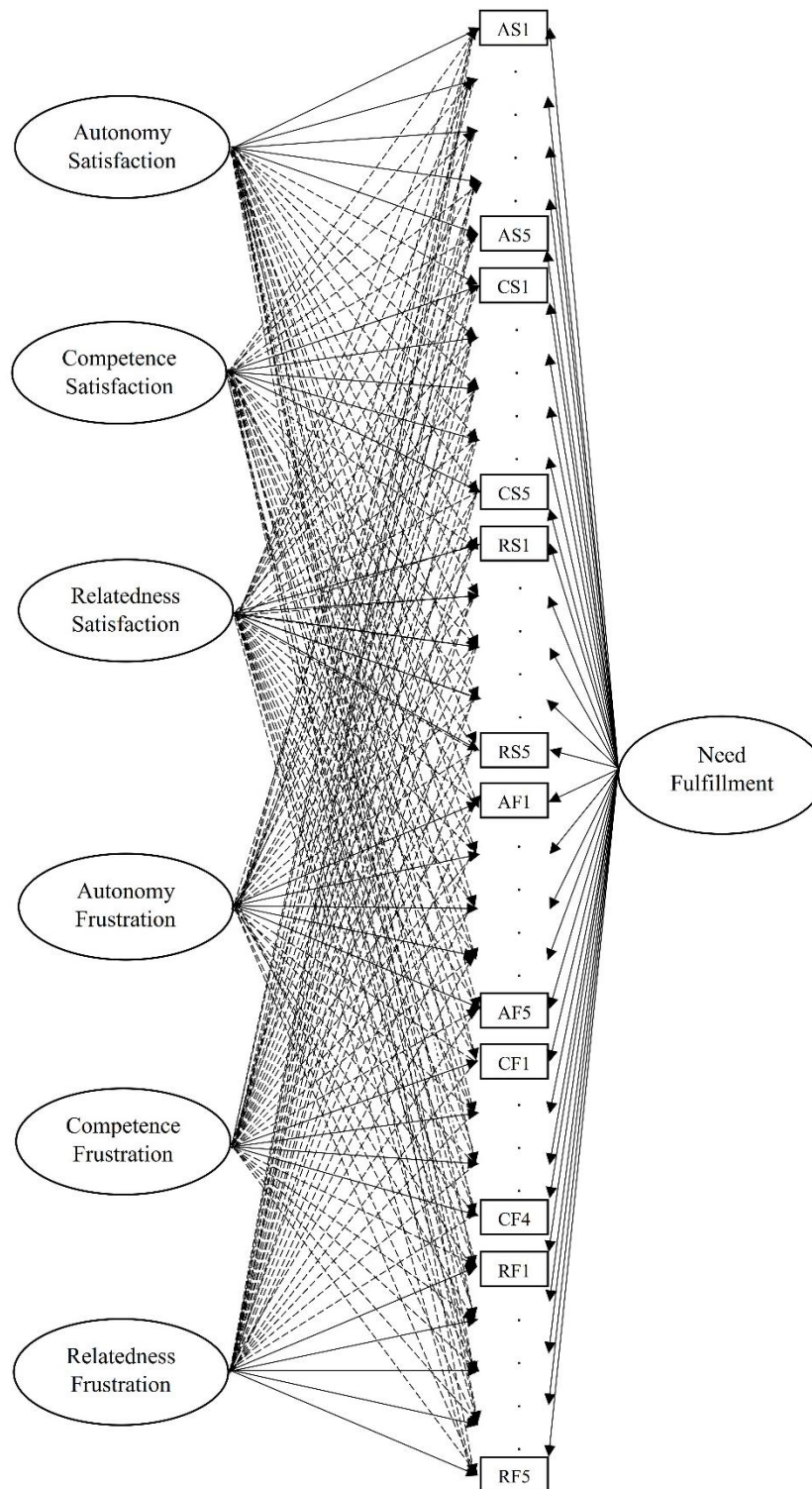
Model 20. Bifactor CFA model with one general-factor and six specific-factors



Model 21. Bifactor CFA Model with one general-factor and two specific-factors

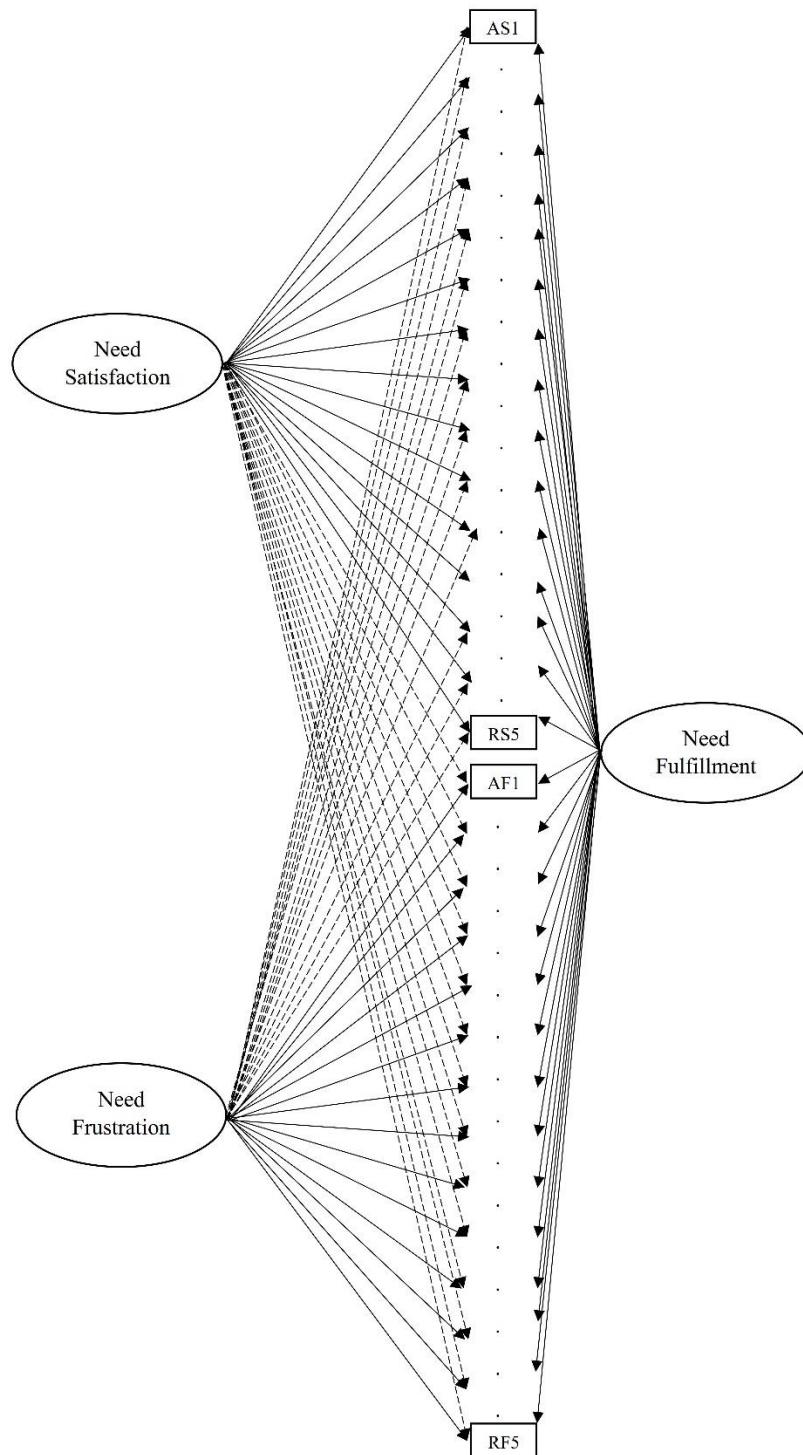


Model 22. Bifactor ESEM model with two general-factors and six specific-factors



Model 23. Bifactor ESEM model with one general-factor and six specific-factors





Model 24. Bifactor ESEM model with one general-factor and two specific-factors

### Appendix C

Table 3.8. *Goodness-of-fit for Models Tested using Need Unfulfilment Items*

Model	$\chi^2$	<i>p</i>	<i>df</i>	CFI	TLI	SRMR	RMSEA [90% CI]
1. 3-factor CFA	332.427	<.001	.87	.79	.74	.08	.10 [.09,.11]
2. H-CFA(1-H, 3-L)	332.427	<.001	87	.79	.74	.08	.10 [.09,.11]
3.3-factor ESEM	151.591	<.001	63	.92	.87	.04	.07[.05,.08]
4. Bifactor CFA (1-G 3-S)	293.270	<.001	.75	.81	.73	.08	.10[.09,.11]
5. Bifactor ESEM (1-G, 3-S)				_*			

Notes.  $\chi^2$  = Chi-square test of exact fit; *p* = probability; *df* = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker–Lewis index; RMSEA = Root Mean Square Error of Approximation; 90% CI = 90% confidence interval of the RMSEA; CFA = confirmatory factor analysis; H-CFA = Hierarchical CFA; H-factor = higher order factor estimated as a part of hierarchical model; L-factor = lower order factor estimated as a part of hierarchical model; ESEM = exploratory structural equation modelling; G-factor = global factor estimated as part of a bifactor model; S-factor = specific factor estimated as part of a bifactor model; -\* = The standard errors of the model parameter estimates could not be computed. The model may not be identified.

Note: This chapter has been submitted for publication as a research article. A preprint of the article can be found under the following reference:

Bhavsar, N., Bartholomew, K. J., Quested, E., Gucciardi, D. F., Thøgersen-Ntoumani, C., Reeve, J., Sarrazin, P., & Ntoumanis, N. (2019). Measuring psychological need states in sport: Theoretical considerations and a new measure. doi: 10.31234/osf.io/f8gzy

## **Chapter 4: Thesis Discussion**

In accordance with the Self-Determination Theory (SDT; Deci & Ryan 1985; Ryan & Deci, 2017) framework, the quality of athletes' motivation in sport is determined by two factors: their perceptions of their coaches' interpersonal behaviours and their own experiential need states. My objectives in this thesis were to refine existing conceptualisations and propose two new self-report measures of these two key constructs. These objectives were achieved through five studies, described in Chapters 2 and 3. In Chapter 2, a tripartite measure of athletes' perceptions of their coaches' need supportive, thwarting, and indifferent interpersonal behaviours was developed, and initial evidence for test scores obtained with this measure was provided. In Chapter 3, a six-factor measure of athletes' need states of satisfaction and frustration of autonomy, competence, and relatedness was developed, and initial evidence for the validity of test scores obtained with this measure was presented. An overview of the five studies that comprised the two chapters is presented in Table 4.1.

Table 4.1. *Overview of Studies*

Chapters	Chapter 2			Chapter 3	
Studies	1	2	3	1	2
Purpose	(a) Create pool of items to assess need supportive, thwarting, and indifferent coach behaviours; (b) Test face validity evidence of items via pilot tests with athletes; (c) Test content validity evidence of the scores of selected item pool by consulting an expert panel.	(a) Create a theoretically-based, parsimonious measure of supportive, thwarting, and indifferent coach interpersonal behaviours; (b) Assess its factor structure using CFA, ESEM, and bifactor CFA and ESEM; (c) Examine reliability and discriminant validity evidence of the subscale scores.	(a) Re-test three-factor ESEM structure that was favoured in Study 2 in a new sample of athletes; (b) Examine initial evidence for the nomological network surrounding TMIB-C subscales.	(a) Develop pool of items to assess athlete need satisfaction, frustration, and unfulfilment; (b) Determine factorial validity, internal consistency, and discriminant validity evidence of the subscale scores.	(a) Test revised item pool from Study 1 with an independent sample of athletes; (b) Test the nomological network surrounding PNSS-S subscales.
Design	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional
Participants	Competitive athletes <i>N</i> = 20 Expert panel <i>N</i> = 8	Competitive athletes <i>N</i> = 288	Competitive athletes <i>N</i> = 353	Competitive athletes <i>N</i> = 301	Competitive athletes <i>N</i> = 333

Chapters	Chapter 2			Chapter 3	
Studies	1	2	3	1	2
Items/ Questionnaires	51 items drawn from existing measures, and newly written items targetting need support, thwarting, and indifferent interpersonal behaviours tested with athletes  54 items targeting need support, thwarting, and indifference tested with athletes further examined by expert panel	22-item TMIB-C	22-item TMIB-C  24-item BPNSFS (Chen et al.,2015)  4-item Dedication subscale of the AEQ (Lonsdale, Hodge, & Jackson, 2007)  5-item emotional/physical exhaustion subscale of the ABQ (Raedeke & Smith, 2001)  5-item irrelevant thoughts subscale of the TOQS (Hatzigeorgiadis & Biddle, 2001)	46-item PNSS-S informed by items of existing measures of need satisfaction, frustration, and unfulfilment, and newly developed items	29-item PNSS-S  24-item IBQ in Sport (Rocchi, Pelletier, & Desmarais, 2017)  4-item Dedication subscale of the AEQ (Lonsdale, Hodge, & Jackson, 2007)  5-item emotional/physical exhaustion subscale of the ABQ (Raedeke & Smith, 2001)  10-item positive affect subscale, and 10-item negative affect subscale of the PANAS (Watson, Clark, & Tellegen, 1988)
Analysis	CVI Analysis	CFA, ESEM, Bifactor CFA, Bifactor ESEM	CFA, ESEM, SEM	CFA, ESEM, Bifactor CFA, Bifactor ESEM	CFA, ESEM, SEM

*Note:* TMIB-C = Tripartite Measure of Interpersonal Behaviours-Coach; PNSS-S = Psychological Need States in Sport Scale; BPNSFS = Basic Psychological Need Satisfaction and Frustration Scale; IBQ = Interpersonal Behaviours Questionnaire; Athlete Engagement Questionnaire; ABQ = Athlete Burnout Questionnaire; TOQS = Thought Occurrence Questionnaire for Sport; PANAS = Positive and Negative Affect Schedule; CVI = content validity index; CFA = confirmatory factor analysis; ESEM = exploratory structural equation modelling; SEM = structural equation modelling.

## Key Findings in Chapter 2

Chapter 2 was dedicated to the examination of the formative role of significant others in one's social context. Coaches can influence their athletes' motivation and experiences in sport by means of their interpersonal behaviours (Langan, Lonsdale, Blake, & Toner, 2015; Mageau & Vallerand, 2003). As noted in Chapter 2, the ways in which coaches interact with their athletes were initially examined in terms of coach behaviours that supported and thwarted athletes' need for autonomy (Ntoumanis, 2012). Assessments of behaviours that support and thwart each of the three needs have been developed only recently (e.g., Pulido et al., 2018). These interpersonal behaviours are typically referred to as *need supportive* and *need thwarting* (e.g., Rocchi, Pelletier, Cheung, Baxter, & Beaudry, 2017).

Findings from Chapter 2 add to the literature on interpersonal behaviours by suggesting that, besides engaging in need supportive and thwarting behaviours, sports coaches also adopt behaviours that are indifferent to their athletes' basic psychological needs. Indifferent interpersonal behaviours are described as those involving inattention towards athletes' needs for autonomy, competence, and relatedness. Existing narratives and items of interpersonal behaviours often conflate need indifferent and need thwarting behaviours. The difference between the two is that need indifferent behaviours are more *passive* towards others' needs compared to need thwarting behaviours, which involve a more direct blocking of others' needs (e.g., Vansteenkiste & Ryan, 2013). Illustrative examples of such behaviours from sport and other life domains were described in Chapter 2. Thus, in Chapter 2, a case was made for the independent assessment of three overarching types of interpersonal behaviours: need supportive, need thwarting, and need indifferent. The Tripartite Measure of Interpersonal Behaviours-Coach (TMIB-C), a self-report measure of athletes' perceptions of their coaches' interpersonal behaviours, was created and initial evidence for the validity of the responses to its items was demonstrated over three studies.

Initially, in Study 1, a pool of 51 items was created based on existing SDT-based measures of interpersonal behaviours as well as newly developed items. Next, evidence for face and content validity was compiled by testing the items with athletes, and subsequently with a panel of SDT experts. Athletes found all items that were written to represent need supportive, thwarting, and indifferent behaviours to



be applicable to sport. In other words, athletes reported that coaches did interact with athletes in ways that conveyed acknowledgement of, active disregard for, as well as inattention towards their basic psychological needs. Modifications to accommodate athletes' suggestions included revising an item and adding three new items.

Subsequently, the items were examined by a panel of experts. At this stage, three of the 54 items were found to demonstrate lower than recommended estimates of the content validity index (CVI; Lynn 1986) and were revised according to the experts' suggestions.

In Study 2, evidence for the dimensionality of the new measure was examined by testing factor models of differing theoretical configurations. Following post-hoc modifications in the form of item deletion, 22 items of the TMIB-C were found to represent a three-factor ESEM solution when modelling data from a large sample of competitive athletes. This three-factor model with the overarching behaviours of need support, thwarting, and indifference could be successfully replicated in Study 3 when these items were tested with a different sample of athletes. Over two studies, estimates for the internal consistency of the subscale scores were found to be over the recommended value of .70 (Nunnally, 1978), and inspections of the factor correlations between the subscale scores attested discriminant validity evidence (Brown, 2015) as factor correlations were found to be under .80 (John & Benet-Martinez, 2000).

Evidence for the nomological network surrounding the three subscales was also provided in Study 3. In making the case for need indifferent behaviours, I contended that it was important to distinguish between the three broad behaviours as they might be differently implicated in predicting athlete need states, and key outcomes of cognition, affect, and behaviour. Tests of nomological networks largely supported this claim. As expected, and in accordance with theoretical propositions and past research (e.g., Barcza-Renner, Eklund, Morin, & Habeeb, 2016; Curran, Hill, Ntoumanis, Hall, & Jowett, 2016; Pulido et al., 2018; Rocchi et al., 2017), athletes' perceptions of need supportive and thwarting coach behaviours predicted the satisfaction and frustration of the three needs, and outcomes of dedication and exhaustion, respectively. As hypothesised, athletes' perceptions of need indifferent coaching behaviours proved to be a weaker predictor of autonomy and competence frustration relative to need thwarting. The dimension of perceived need indifferent coaching behaviours was also the sole dimension of the social context to

significantly predict athletes' self-reported irrelevant thoughts, which was considered to be an outcome of diminished functioning (i.e., a deleterious outcome of lesser intensity as compared to exhaustion). Surprisingly, perceptions of need indifference predicted relatedness frustration better than need thwarting, and exhaustion as well as need thwarting.

The three studies presented in Chapter 2 provide initial support for the case that the current conceptualisation of coach interpersonal behaviours as need supportive and need thwarting can be expanded to accommodate the third dimension of need indifference. In this chapter, the three overarching behaviours were shown to be operationally distinct, and to be differentially implicated in terms of athletes' need states, and positive and negative athlete outcomes.

### **Key Findings in Chapter 3**

The experiential need states of need satisfaction and frustration are considered to be the crux of SDT (Vansteenkiste & Ryan, 2013). The satisfaction of the three basic psychological needs of autonomy, competence, and relatedness, which results from perceived need support from significant others in the social environment, is considered to be fundamental for individuals to experience optimal functioning, growth and wellness. In contrast, the frustration of these needs, which results from perceived contextual need thwarting, is expected to lead to compromised personal growth and development, ill-being and maladaptive functioning. Thus, a complete understanding of the factors influencing athletes' quality of motivation, and their well-being and ill-being necessitates an examination of their perceptions of coaches' interpersonal behaviours (investigated in Chapter 2) as well as their own experiential needs states. Chapter 3 was dedicated to the investigation of athletes' basic psychological need states.

Following the dual process model of need satisfaction and need frustration (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011) examinations of both the bright and dark sides of the need states have been on the rise in the sport domain (e.g., Curran, Hill, Hall, & Jowett, 2014) and other life contexts (e.g., Chen et al., 2015). Prior to this model, researchers associated low scores on measures of need satisfaction with maladaptive outcomes and considered them to be indicative of need frustration. Bartholomew and colleagues presented a conceptual argument for the distinction between experiencing

low levels of need satisfaction and the experience of need frustration. According to the researchers, the former reflected dissatisfaction with the degree to which one's needs are being fulfilled at a given point in time (i.e. need unfulfilment), whereas the latter reflected the active blocking of one's needs by significant others. The dual process model thus spurred a new line of inquiry for the consideration of a third need state, i.e., unfulfilment. Need unfulfilment had previously been conceptualised as the experiential state that occurs when one's needs are set aside (Cheon et al., 2019). In this thesis, need unfulfilment was described a lack of need fulfilment. Researchers have demonstrated need unfulfilment to a) be operationally distinct from need satisfaction and need frustration (Costa, Ntoumanis, & Bartholomew, 2015), and b) have unique predictive utility in predicting disengagement, an outcome of diminished functioning (Cheon et al., 2019, in the case of the need for autonomy), warranting the simultaneous assessment of need satisfaction, frustration, and unfulfilment. A measure assessing these three need states would enable the testing of the proposition that need unfulfilment is a third separate need state beyond those of need satisfaction and frustration. In addition, specification of the three need states would enable researchers to test, in the future, distinct predictive paths from a) need support to need satisfaction and adaptive outcomes, b) need thwarting to need frustration and maladaptive outcomes, and c) need indifference via need unfulfilment to outcomes of diminished functioning. Outcomes of diminished functioning would be less deleterious as compared to the maladaptive outcomes predicted by need frustration.

Additionally, in sport, there existed no single measure of athletes' need states of need satisfaction, frustration, and unfulfilment. The two need states of satisfaction and frustration were assessed using separate self-report measures of satisfaction (e.g., Basic Needs Satisfaction in Sport Scale, BNSSS; Ng, Hodge, & Lonsdale, 2011) and frustration (e.g., Psychological Need Thwarting Scale, PNTS; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Employing these two questionnaires together might be problematic, as they have been developed using distinct samples with dissimilar demographic details (e.g., the PNTS was developed for use in the youth sport settings, whereas the BNSSS was developed for use with adults), and include different scale anchors for item responses (responses to the PNTS range from 1 = *strongly disagree* to 7 = *strongly agree*, and those for the BNSSS range from 1 = *not at all true* to 7 = *very true*). Additionally, few items from

these measures do not capture the target construct of one's own experiential need states, but instead capture behaviours of significant others in one's social network (e.g., Ng et al., 2011), or experiences occurring as a result of the actions of significant others in one's socio-contextual environment (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Researchers (e.g., Li, Ivarsson, Lam, & Sun, 2019; Lundqvist & Ragli, 2015) have also adapted measures of need satisfaction and frustration that had been developed for use in other life domains (e.g., Balanced Measure of Psychological Needs, Sheldon & Hilpert, 2012; Basic Psychological Need Satisfaction and Frustration Scale, Chen et al., 2015) to assess both these need states in the sport context without first testing evidence for validity and reliability in the sport setting. To address these limitations, the objective of Chapter 3 was to develop, and provide initial validity evidence for a context-specific self-report measure of three need states in sport: need satisfaction, need frustration, and need unfulfilment.

For this purpose, in Study 1, 46 items were developed, the content of which was informed by existing measures of need satisfaction and frustration. New items were written to assess need unfulfilment. Next, the dimensionality of athletes' responses to these items was examined. Results indicated that the attempt to assess all three need states was unsuccessful in that the configurations involving the three need states either failed to achieve good fit, or did not converge, or the standard errors of model parameter estimates could not be computed. A closer examination of the models with poor fit indicated the presence of multiple items with poor standard factor loadings and cross-loadings on unintended factors. As there has been extant support for the need states of satisfaction and frustration, a decision was made to leave aside the need unfulfilment dimension and seek support for a factorial solution for the configurations of just need satisfaction and frustration.

Following post-hoc modifications in Study 1, 21 items of the Psychological Need States in Sport Scale (PNSS-S) were found to be best represented by a six-factor ESEM solution involving autonomy satisfaction and frustration, competence satisfaction and frustration, and relatedness satisfaction and frustration. Scores of all but two subscales of competence and relatedness satisfaction demonstrated acceptable levels of internal consistency in Study 1, due to which two items were deleted and ten new items were written. In Study 2, the six-factor structure was successfully replicated when the final 29-item pool was tested with a new sample of

athletes. All subscale scores demonstrated estimates of internal consistency above the recommended criteria of .70 (Nunnally, 1978). Additionally, factor correlations were found to be under .80 (John & Benet-Martinez, 2000), thus attesting discriminant validity evidence (Brown, 2015).

Evidence for nomological network of the subscales of the PNSS-S was also presented in Study 2. The six need states were significantly predicted by perceptions of autonomy, competence, and relatedness supportive or thwarting behaviours in the expected manner. Furthermore, autonomy and competence need satisfaction significantly predicted dedication; and competence and relatedness need satisfaction significantly predicted positive affect. In contrast, autonomy and competence need frustration significantly predicted exhaustion, and all three need frustration states significantly predicted negative affect.

In sum, findings of Chapter 3 align well with the theoretical propositions of SDT (Vansteenkiste & Ryan, 2013) and previous research findings (e.g., Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011), corroborating the notion that need satisfaction represents the bright side of athlete functioning by being associated with contextual need support and adaptive outcomes, and need thwarting represents its dark side through associations with contextual need thwarting and maladaptive outcomes. The original objective of this chapter (demonstration of a tripartite conceptualisation and measure of the need states of satisfaction, frustration, and unfulfilment) was not achieved. However, evidence was presented for the first sport-specific measure of six distinct, yet, correlated states of the satisfaction and frustration of autonomy, competence, and relatedness needs.

### **Implications for Theory and Measurement**

In the SDT model of contextual influences, need states, and resultant outcomes, two motivational trajectories have been denoted (e.g., Vansteenkiste & Ryan, 2013). In the first pathway, individuals' perception of need support is considered to foster their experience of need satisfaction, which is considered a necessity for them to flourish, function optimally and experience well-being. The second path extends from perceived contextual need thwarting to bring about need frustration in individuals, which further results in maladaptive functioning and ill-being. Findings of both the chapters of this thesis consistently supported this proposition. Using structural equation modelling, perceived need supportive coach

behaviours were shown to be associated with athlete need satisfaction, dedication and positive affect, whereas perceived need thwarting coach behaviours were shown to be associated with athlete need frustration, exhaustion and negative affect.

The results of this thesis provide initial evidence of a third motivational trajectory, brought about by contextual need indifference, and thus have important implications for SDT. Previously, behaviours that were perceived as inattentive to others' needs were considered conceptually equivalent to behaviours that actively undermined such needs. In Chapter 2, this conceptual confusion of the two was illustrated using the constructs of chaotic and cold behaviours. Chaotic behaviours referred to permissive or erratic ways in which social agents may impede others' in their goal pursuits (Skinner, Johnson, & Snyder, 2005) such as providing athletes with a surplus of information without any structure, were considered to actively block athletes' basic psychological needs. (e.g., Pulido et al., 2018). Cold behaviours such as being distant towards others (Rocchi et al., 2017) were conceptually ambiguous, as it was unclear if they were employed out of a lack of interest in others, or aversion towards them. In Chapter 2, a conceptual distinction was made between need indifferent and need thwarting behaviours. Need indifference was described as inattention towards others' basic psychological needs. In contrast, need thwarting was described as the active obstruction of others' needs. Need indifference should be considered operationally distinct from need supportive and need thwarting behaviours, as in terms of measurement, their items were found to load on distinct factors that were moderately correlated with minimal cross-loadings between the factors.

A more important reason to consider need indifference as a third broad interpersonal behaviour concerns its associations with concomitant outcomes. Using structural equation modelling, results of Chapter 2 (see Study 3) indicated that need indifferent behaviours do not bring about a particularly intense experience of need frustration. In comparison, need thwarting behaviours result in a more severe experience of need frustration (as demonstrated by path coefficients that are larger in magnitude relative to need indifference in relation to the needs for autonomy and competence). Further, need indifference and need thwarting are differentially implicated in terms of maladaptive outcomes, with outcomes of impoverished/diminished functioning being solely associated with need indifference.

In Chapter 3, it was considered if such distinction could be made, conceptually and in terms of measurement, for three need states, that is, need satisfaction, frustration, and unfulfilment. Need unfulfilment was described as conceptually distinct from need frustration, as the former reflects the experience of a lack of need fulfilment, whereas the latter reflects the experience of having one's needs actively undermined by others (See Chapter 3). However, in terms of measurement, the three need states could not be demonstrated as distinct as none of the factor models pertaining to such solutions were found to have good fit to the data. In addition, items of such models had numerous cross-loadings on unintended factors, along with the presence of poor standard factor loadings (See Chapter 3, Study 1). Here, it is important to note when the need unfulfilment items were tested without the need satisfaction and need frustration items, the three-factor ESEM model of autonomy unfulfilment, competence unfulfilment, and relatedness unfulfilment demonstrated promise. Additionally, estimates of internal consistency for these three subscales were found to be adequate. These results are indicative of an issue with modelling all three need states together.

Does this lack of support for a tripartite model of the need states indicate that the state of need unfulfilment does not exist? Its existence could be argued for, based on the empirical work of Costa et al. (2015) and Cheon et al. (2019) in the interpersonal and educational domains, respectively. These researchers were able to demonstrate that need unfulfilment was a third need state separate from need satisfaction and frustration, and that it had unique predictive value in determining an outcome of diminished functioning (i.e., disengagement, when examined in relation to the need for autonomy). The lack of evidence for the presence of the need state based on the findings of Chapter 3 (Study 2) could, on the other hand, indicate that instead of representing a distinct construct, need unfulfilment simply represents low levels of need satisfaction and can be inferred from low scores on measures of need satisfaction. Consider, for instance, the item "Most of the days I feel a sense of accomplishment from what I do", employed by Costa et al. (2015) to assess need satisfaction, which intuitively comes across as the opposite of the item "I do not usually feel like I have achieved much from what I do" used to assess need unfulfilment. In fact, Cheon and colleagues (2019) have demonstrated low autonomy satisfaction to also have unique value (beyond autonomy unfulfilment and decreased autonomy frustration) in significantly predicting classroom disengagement. As such,

evidence for the consideration of need unfulfilment as a third need state beyond need satisfaction and frustration, appears to be mixed.

The next implication concerns the internal structure of the need states and surrounding socio-contextual environment. The dimensionality of the need states and interpersonal behaviours has vexed many an SDT-researcher: should the need-specific dimensions within the experiential states and overarching interpersonal behaviours be collapsed, or should they be considered distinct? Within SDT, the three basic psychological needs are portrayed as distinct constructs which are considered to be correlated, yet, individually valuable (Ryan & Deci, 2017). Some researchers have proposed multidimensional conceptualisations of the need states by presenting models in which these experiences are separated according to autonomy, competence, and relatedness needs (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Chen et al., 2015; Longo, Gunz, Curtis, & Farsides, 2015; Ng et al., 2011). Scores for the satisfaction of each of the three needs are, however, often averaged to produce an overall score of need satisfaction (e.g., Deci et al., 2001; Gagne, 2003). Need frustration has also been treated in a similar manner in investigations assessing numerous antecedent and consequence variables (e.g., Pulido et al., 2018; Rocchi et al., 2017). However, using an overall score of need satisfaction has been discouraged as it may imply that the needs are interchangeable, such that one need can make up for the lack of another (Van den Broek, Ferris, Chang, & Rosen, 2016). As mentioned in the introductory section of Chapter 2, composite as well as multidimensional approaches are also evident in the measurement of interpersonal behaviours. Some researchers have combined the three needs within a broad interpersonal behaviour (e.g., Markland & Tobin, 2010; Tafvelin & Stenling et al., 2018; Williams, Grow, Freedman, Ryan, & Deci, 1996), whereas others have developed measures in which interpersonal behaviours are modelled separately according to each need (e.g., Pulido et al., 2018, Rocchi et al., 2017). It thus becomes clear that interpersonal behaviours and basic psychological need states have been assessed using unidimensional (three needs collapsed into a single factor) as well as multidimensional (three needs modelled separately) approaches.

In the studies of this thesis, overarching interpersonal behaviours of need support, thwarting and indifference could not be further broken down into support, thwarting and indifference in relation to each need independently. However,



distinctions could be made between the satisfaction and frustration of each of the three needs. The dissimilarity in the dimensionality of interpersonal behaviours and need states is intriguing, given that they are considered to operate “in parallel” (Vansteenkiste, Niemiec, & Soenens, 2013 p.131). The social environment may have been best represented by three overarching interpersonal behaviours, and not their need-specific dimensions possibly because need indifferent behaviours were included alongside those of need support and need thwarting. Inclusion of the third class of behaviours could be considered to have added to the complexity of the model. Perhaps a model with need-specific dimensions of the socio-contextual environment would be supported if the socio-contextual environment is assessed only in terms of need support and need thwarting, as has been demonstrated in the cases of the Coaches Interpersonal Styles Questionnaire (Pulido et al., 2018) and Interpersonal Behaviours Questionnaire in Sport (Rocchi et al., 2017).

How, then, are need states and interpersonal behaviours best operationalised? The answer to this question lies in proposition IV of the Basic Psychological Needs Theory (Ryan & Deci, 2017). Although each of the three basic psychological needs are considered to be differentially conceptualised and important in their own right, they are also considered to be empirically interrelated. As elucidated in Chapter 2, when they are assessed in a summative fashion (e.g., over the sport season), high correlations (often the reason behind collapsing the distinct need factors into one overarching factor) will be evident among the needs, substantiating a composite assessment of the needs. This does not imply that the dearth of one need can be offset by the satisfaction of another need, but simply that because they are interrelated, they will likely be balanced when measured in a cumulative manner (Ryan & Deci, 2017). In terms of interpersonal behaviours, this proposition indicates that behaviours of social agents that support/thwart/are indifferent to one need will support/thwart/be indifferent to the others. Consider the example of dismissing athletes’ opinions, a behaviour that is often considered to be fundamental to the thwarting of the need for autonomy. Athletes might also recognise this as a behaviour that thwarts their need for competence (e.g., coach says that I don’t have much to contribute, which is why he or she dismisses my opinion), as well as their need for relatedness (e.g., coach makes it obvious that he or she doesn’t like me, and hence dismisses my opinion).

It would be beneficial for researchers developing psychometric measures of SDT-based interpersonal behaviours and need states to take into account that both types of approaches mentioned above are accommodated within SDT. The appropriateness of either approach would ultimately be informed by the objectives of the investigation. For example, separating supportive, thwarting, and indifferent interpersonal behaviours according to the three needs to have nine dimensions might serve to benefit experimental designs aimed at investigating the influence of each individual behaviour on outcomes of adaptive, maladaptive, and diminished functioning. The more prudent representation consisting of three overarching dimensions could prove to be adequate for investigations in which the interpersonal behaviours are studied in relation to varied concepts such as antecedents of interpersonal behaviours, need states, motivational regulations, and related outcomes that are embedded in the SDT motivational sequence (Gucciardi, Weixian, Gibson, Ntoumanis, & Ng, in press).

### **Implications for Practice**

Beyond the conceptual and measurement implications, the findings of this thesis also have implications for practice. One practical implication is targeted towards coach training programs. In 2018, the Australian Federal Government unveiled the Sport 2030 national plan. The objective of this ambitious plan is to make Australia “the world’s most active and healthy nation, known for our integrity and sporting success.” (Sport 2030, p. 1). Achieving sport excellence will involve, among other areas, a transformation of the work force in high performance settings, especially with regards to coaching and leadership so as to result in better performance. The influence of coaches in catalysing athlete outcomes has been corroborated by theory and extant research (e.g., Mageau & Vallerand, 2003). In Chapter 2 (Study 3) it was demonstrated that when athletes perceive their coaches to interact with them in need indifferent manners, they experience frustrated needs, but to a lesser extent (in the case of autonomy and competence) in comparison to the need frustration that results from need thwarting. Additionally, as a result of perceiving coaches as being need indifferent, athletes are unable to concentrate in sport (i.e. they experience sport-irrelevant thoughts) and they experience symptoms of exhaustion. SDT-based interventions could thus benefit from targeting need indifferent interpersonal behaviours to reduce the frequency with which coaches

engage in such behaviours (alongside increasing the use of need supportive behaviours and reducing that of need thwarting behaviours).

Researchers have previously examined the efficacy of intervention studies aimed at aiding individuals in positions of authority to become more autonomy-supportive towards others in the contexts such as education (Cheon, Reeve, & Moon, 2012; Tessier, Sarrazin, & Ntoumanis, 2010) and work (Hardré & Reeve, 2009). A meta-analysis of 19 studies by Su and Reeve (2011) corroborated the effectiveness of such intervention programs in assisting social agents to learn to be more autonomy supportive. Interventions for promoting need-supportive coach behaviours are, however, not as common in the sport context. One successful intervention to train coaches to become more autonomy supportive was conducted by Cheon, Reeve, Lee, and Lee (2015) in the context of elite sport leading up to the 2012 London Paralympic Games. The intervention targeting the coaches comprised three parts with aspects such as introduction to the nature of motivation in sport and coach interpersonal behaviours of autonomy support and control, practicing autonomy supportive behaviours, structuring training in autonomy supportive ways, group discussions, and one-on-one meetings between coaches and the first author. The researchers utilised coaches and athletes' self-report measures, raters' scores of coaches' behaviours, and assessed outcomes of motivation, engagement, functioning, and number of Olympic medals won. Results of the intervention suggested that athletes and coaches in the control group demonstrated a longitudinal decline in motivation, engagement, and functioning. No changes were observed in athletes and coaches participating in the intervention group in the eighth week of the intervention. The researchers additionally found those in the intervention group to have won significantly more medals relative to the control group. A limitation of this study was that coaches' autonomy supportive and controlling behaviours were rated using a bipolar scale. As a result, no conclusions could be made regarding the efficacy of the program in increasing autonomy supportive behaviours, decreasing controlling behaviours, or both.

In line with theory and extant research, another finding reported in this thesis was that when athletes perceive their coaches' interactions as need thwarting, they experience need frustration, and resultant deleterious cognitive, affective, and behavioural outcomes. As need supportive and thwarting behaviours can be experienced in the same training session, it is important to conduct interventions to

not only increase the use of need supportive interpersonal behaviours, but also to reduce the use of need thwarting behaviours. For instance, Langan, Blake, Toner, and Lonsdale (2015) conducted a cluster randomised controlled trial to assess the effects of a 12-week intervention for coaches on athlete motivation and burnout. Coaches in the intervention group were taught ten ways to increase their need supportive behaviours and reduce controlling behaviours, and could discuss their own experiences of attempting to implement these behaviours in six one-on-one meetings with the first author. Langan et al. (2015) found athletes in the intervention group to demonstrate little change in terms of motivation or symptoms of burnout as compared to the control group, in which athletes reported increases in amotivation and symptoms of burnout. In terms of observer reports of coach interpersonal behaviours, large increases in need supportive behaviours were reported for the coaches in the intervention group. Coaches in the control group demonstrated small increases in need supportive behaviours. However, no changes were reported in terms of a reduction of controlling behaviours for the intervention group as compared to the control group.

In *typical* SDT-based intervention programs such as those described above, there is no focus on need indifferent behaviours. Coaches do not know, and they are not taught that need indifferent behaviours have little motivational value, and in fact, can be motivationally damaging. It is also possible that using need indifferent behaviours hinders the implementation of need supportive behaviours (Quested et al., 2018). If need indifference represents a *missed opportunity* for the provision of need support (Quested et al., 2018), it could be valuable to train coaches to understand why need indifferent behaviours are not useful in terms of their motivation-related outcomes, and to instead use need supportive behaviours in those situations. Designing programs to reduce the frequency with which coaches utilise need indifferent behaviours may benefit from first understanding the reasons why coaches choose to utilise behaviours that lead to suboptimal and deleterious outcomes (albeit to a lesser extent those brought about by need thwarting). In the past, researchers have examined antecedents of coaches' need supportive and thwarting interpersonal behaviours. For example, coaches' own need states and motivational regulations as well as factors such as administrative support, athlete motivation, support from work colleagues, and work-life conflict have been shown to significantly influence coaches reported use of supportive and thwarting

interpersonal behaviours (Rocchi & Pelletier, 2017). A following logical line of inquiry would be to examine the distinctive antecedents that lead coaches to interact with their athletes in need indifferent manners.

In making the case for three need states, Cheon et al. (2019) proposed that social agents might adopt need indifferent behaviours because they are consumed by their own needs, aspirations, or worries. Preoccupation with one's own desires, goals and concerns is characteristic of narcissism (Krizan & Herlache, 2018). Narcissism is an interpersonal orientation that consists of the two factors of grandiosity and vulnerability; grandiose narcissism is typified by aggression and dominance (Miller et al., 2011). Vulnerable narcissism, on the other hand, is exemplified by inhibition, shyness, and social passivity (Ronningstam, 2009). Researchers have, however, only examined grandiose narcissism in relation to interpersonal behaviours because of its shared features with controlling coaching interpersonal behaviours (e.g., Matosic et al., 2016). It might be beneficial to examine the associations between vulnerable narcissism and coaches' need indifferent interpersonal behaviours given the similarities between the two. To illustrate, coaches adopting need indifferent behaviours keep to themselves (Chapter 2); while individuals high in vulnerable narcissism are shy, and tend to feel uneasy when they receive attention from others (Ronningstam, 2009). Narcissism, machiavellianism and psychopathy, which have shared traits such as that of emotional coldness, form the dark triad of socially aversive constructs of personality (Paulhus & Williams, 2002). As such, it would also be of interest to examine the differential implications of the other components of the dark triad as antecedents of need indifferent and need thwarting behaviours. Additional factors contributing to the use of need indifferent interpersonal behaviours could include a dearth of structure from sports management committees, coaches' own experiences of need unfulfilment (and resultant boredom and, disinterest), or perceptions of athletes being bored, disinterested, and uninvolved. Need indifferent behaviours could be also be witnessed in cases where coaches experience insufficient stimulation in training or competition. Interviews with coaches might help uncover the antecedents that drive them to employ such behaviours. Targeting such antecedents can be instrumental in facilitating need satisfaction and well-being in coaches, reducing the frequency with which they employ need indifferent behaviours, and subsequently nurturing need satisfaction and well-being in their athletes.

In Chapter 2, need indifferent interpersonal behaviours were operationalised as inattention towards athletes' basic psychological needs. This implies that coaches use less cognitive resources when using need indifferent behaviours in comparison to need supportive behaviours, where coaches are cognisant of athletes' needs. Need thwarting, in contrast, implies that coaches are aware of athletes' needs, yet, they actively disregard them. The prospect of need indifferent behaviours not being cognitively demanding has also been proposed by Quested et al. (2018) in their examination of such behaviours among group exercise instructors. These researchers suggested that it might be the case that need indifferent behaviours are employed out of habit. This might imply that coaches use need indifferent behaviours routinely, and perhaps even more commonly than need thwarting behaviours. Mindfulness and interest-taking are two topical themes examined within the SDT framework that could be of practical use in coach training programs targeting habitually used need indifferent behaviours. Mindfulness is defined as "open and receptive attention to what is occurring in the present" (Deci, Ryan, Schulz, Niemiec, 2015, p. 113). Coaches can develop awareness by being mindful of their interactions with their athletes, which would further allow them to attend to the stimuli in their environments in a motivated manner (in the form of interest-taking; Weinstein, Przybylski, & Ryan, 2012). Additionally, mindfulness and interest-taking play a key role in feeling autonomous (Deci & Ryan, 1980b, Deci et al., 2015), which, when examined in coaches, has been found to predict their reported use of need supportive interpersonal behaviours (Rocchi & Pelletier, 2017).

Results of Chapter 2 showed that perceptions of coach need indifferent behaviours predicted athlete need frustration and an inability to concentrate in sport. In Chapters 2 and 3, need thwarting coach interpersonal behaviours consistently predicted athlete need frustration, and negative outcomes such as exhaustion and negative affect. Although coaches' behaviours play a crucial role in influencing athletes' need states and related outcomes, athletes are also inherently equipped with capacities to behave in a self-determined manner and experience need satisfaction (e.g., Ryan, Legate, Niemiec, & Deci, 2012; Vansteenkiste & Ryan, 2013). Mindfulness training can also be beneficial for athletes who experience need indifferent and need thwarting coaching behaviours. Mindfulness training for athletes would enable them to be open to, and aware of experiences, both external (e.g., coach behaviours), and internal (e.g., how they feel physically or

psychologically), and appreciate them for what they are, without engaging in critical judgement (Brown, Ryan, & Cresswell, 2007; Schultz, Ryan, Niemiec, Legate, & Williams, 2015). Mindfulness has been proposed to promote increased need satisfaction (Proposition VIII, BPNT; Ryan & Deci, 2017). Additionally, in an investigation of managerial interpersonal behaviours and employee need satisfaction and well-being, Schultz et al. (2015) found mindfulness to partly protect individuals from socio-contextual environments that are non-need supportive, by alleviating the effects of need frustration, and concomitant ill-being.

### **Methodological Considerations**

As demonstrated in Chapter 2 (see Table 2.2), and Chapter 3 (see Table 3.1), of the 12 models tested to examine the dimensionality of interpersonal behaviours and 24 models tested to examine the dimensionality of the need states respectively, most failed to reach the recommended values for acceptable model-to-data fit (i.e. CFI and TLI values  $> .90$ , and RMSEA and SRMR values  $< .08$ ; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999; Marsh, Hau, & Grayson, 2005; Marsh, Hau, & Wen, 2004). When factor models fail to meet the recommended indices of fit, researchers often deem the fit indices to be extraneous and continue to use the specified model, or consider the fit indices to be crucial and hence discard their models, or adjust the models to improve the fit (Perry et al., 2015). Identifying the source of model misspecification often involves the examination of modification indices (MIs; Brown, 2015). According to Brown (2015), well-fitting models tend to generate small-sized MIs. In the event of poor fit, MIs can be used to identify parameters that can be freed to improve the fit. However, parameters should not be freed just to gain improved model fit. Researchers are encouraged to consult theory in order to substantiate their decisions.

In line with this suggestion, MIs were examined in an effort to identify sources of model misspecification with respect to promising models in both Chapters. The model re-specification was guided not just by the size of the item MIs, but also their conceptual coverage. For example, in Chapter 2, for the single-factor CFAs pertaining to need support, thwarting and indifference, it was ensured that the remainder of the items would sufficiently represent a balance of all three needs for each broad behaviour. Items were subsequently systematically removed from each iteration of the analyses. Thus, this process was driven by statistical criteria while

maintaining a strong theoretical foundation. Following this strategy, the three-factor ESEM model of interpersonal behaviours, and six-factor ESEM model of need states achieved good fit to the data.

These post-hoc modifications emphasise that developing psychometric instruments of interrelated constructs might be a complex endeavour. Transparency in methodology in the form of reporting problems of model misfit, and the steps taken to address such issues would serve to reassure other researchers engaged in similar ventures that scale development might not be a straightforward process, as well as encourage them to report similar details as part of their data analyses. Researchers could also pre-register protocols for the intended scale development and validation studies. This involves describing the expectations or hypotheses for the program of research, the intended methodology, and plans for analysing the data in advance so that they can be externally substantiated (van't Verr & Giner-Sorolla, 2016). By agreeing to commit to these in advance, and not updating analytic plans along the course of the studies depending on the results they obtain, researchers can contribute to improving the trustworthiness of their findings (Nosek, Ebersole, DeHaven, & Mellor, 2018), and the rigor of scale development methods.

The lack of support for the tripartite conceptualisation of the need states, i.e., need satisfaction, frustration, and unfulfilment is the focus of the next consideration. Demonstrating the presence of not just two, but three need states can have key theoretical and applied implications in sport. In the past, researchers have found support for the three need states to be operationalised as distinct factors (Cheon et al., 2019 in the case of the need for autonomy; Costa et al., 2015 for all three needs), alongside demonstrating the unique utility of autonomy unfulfilment in the prediction of diminished functioning (Cheon et al., 2019). Similar to students need states in the classroom setting (Cheon et al., 2019), athletes' need states can also vary over a period of time, for example, over the duration of the sport season. Further, it is apparent from Chapter 2 that coaches employ need indifferent interpersonal behaviours when they interact with their athletes. As such, it is important to examine if perceived need indifferent coaching behaviours engender experiences of need unfulfilment, and further lead to outcomes of passive and diminished functioning such as disaffection, and boredom which are frequently encountered in sport. Given the mixed evidence regarding the status of this need state, researchers are encouraged to further investigate this line of inquiry. The manner in which the items



assessing need unfulfilment were conceptualised could have potentially contributed to the lack of support for this need state in Chapter 3 (Study1). The operationalisation of the items of need unfulfilment was informed by previous descriptions of the construct put forth by other researchers. These descriptions included need unfulfilment as an experience of a lack of need fulfilment (Chapter 3), “feeling that something is not as good as it should be” (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011, p. 78), and a feeling state resulting from one’s needs being set aside (Cheon et al., 2019). Due to time constraints, the 15 items written to assess this dimension were not tested with athletes, but only examined by the research team. It is possible that the researchers’ interpretations of these items differed from those of athletes. Researchers interested in examining the third need state in athletes might benefit from first testing the items with a small sample of athletes to determine their relevance and clarity in the sport settings (as was demonstrated with the TMIB-C items in Chapter 2, Study1), and understand how they differentiate between the antecedents of adaptive, maladaptive, and diminished functioning. Further, as elaborated in Chapter 3, think-aloud procedures might also help shed light on athletes’ response processes, or the cognitive operations (e.g., comprehension, retrieval, judgment, and response; Tourangeau, Rips, & Rasinki, 2000) that they engage in when responding to the items (AERA et al., 2014).

The final methodological consideration is related to the use of factor analysis. Factor analysis is the most commonly employed statistical technique to assess the dimensionality of constructs in the area of sport and exercise (e.g., Gunnell et al., 2014), and has been the principal approach in testing the internal structure of all but one psychometric instrument reviewed in Chapter 1 (i.e., Situations-in-Sport Questionnaire; Delrue et al., 2019). In Chapter 2 (Study 2), the use of factor analysis did not allow for any permissible solution involving the need-specific dimensions of the three overarching interpersonal behaviours of need support, thwarting, and indifference. In Chapter 3, as previously mentioned (Study1, pages 151-152), no support was found for a tripartite conceptualisation of the three need states of satisfaction, frustration, and unfulfilment using factor analysis. This begs the question if there might be other statistical techniques that are better able to extricate the complex nature of these interrelated constructs.

The exploratory technique of multidimensional scaling (MDS; Borg, Groenen, & Mair, 2013) might represent one potential alternative. Factor analysis

enables the conceptualisation of somewhat correlated, but more or less distinct dimensions (Tucker-Drob & Salthouse, 2009). In MDS, distances between items are mapped in a geometric space, which allows researchers to graphically envisage the interrelations between the dimensions (Aelterman et al., 2018) in a more integrated manner (Delrue et al., 2019). Item response theory (IRT; Embretson & Reise, 2000) represents yet another statistical technique that might be particularly viable for selecting suitable items to test SDT constructs (Standage, Curran, & Rouse, 2019). IRT is independent of sample attributes (Petscher & Schatschneider, 2012), and may help understand how athletes respond to each individual item designed to measure need-specific dimensions of coach interpersonal behaviours or the three need states.

### **Limitations and Future Recommendations**

The first limitation of the present thesis is the sole reliance on data derived from self-report measures assessing athletes' perceptions of their coaches' interpersonal behaviours, their own need states, and positive and negative outcomes. When data emanates from a single source, the relations between the constructs under scrutiny can be under- or over-estimated due to common method bias (e.g., Podsakoff, MacKenzie, & Podsakoff, 2012). Common method bias might arise as a result of factors such as item social desirability, item ambiguity, response format and anchors, and length of the questionnaire (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Employing observational measures or *objective reports* in conjunction with self-report measures is one way of addressing this limitation (Smith et al., 2015). An observational measure assessing need supportive, thwarting, and indifferent interpersonal behaviours (although in the context of exercise, Qusted et al., 2018) already exists. However, numerous exploratory models were examined in this thesis, which made it was necessary to utilise data emanating from self-report to first test feasibility of the tripartite models. Additionally, as it is the subjective interpretation of others' behaviours that predominantly influences one's basic psychological need states, quality of motivation, and related outcomes within the SDT framework (Deci & Ryan, 1985), self-report measures of perceived interpersonal behaviours and psychological need states are also valuable. As initial support was found for the third category of interpersonal behaviours, data pertaining to athletes' perceptions of coaches' behaviours could be examined alongside raters' objective reports of such behaviours. This could help researchers identify discrepancies in the two sources and

facilitate better targeted intervention efforts. Researchers could also use observational reports of the three overarching coach interpersonal behaviours in conjunction with self-report measures of the six psychological need states and objective outcome variables such as sports performance or physiological indicators of well/ill-being (e.g., Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011).

The second limitation concerns the cross-sectional nature of the five studies included in this thesis. In the case of cross-sectional studies, causal directions of the observed associations cannot be ascertained. This issue can be alleviated by employing experimental research designs (e.g., Sheldon & Filak, 2008). Researchers could, for instance, manipulate the supportive, thwarting and indifferent dimensions of the interpersonal behaviours in puzzle solving or game learning tasks, which have typically been used in SDT-based experimental research. Participants might be taught how to play an interesting game such as 2048 or Boggle (e.g., Sheldon & Filak) with the experimenter communicating with them using the differing interpersonal behaviours. Various stages could be tested, for instance, when the game is introduced to the participants, while the participants are learning the game, and finally, a performance stage. This could allow for the examination of the independent causal effects of the three broad interpersonal behaviours on dependent measures such as the need states and outcomes such as engagement, likelihood to cheat, boredom, as well as objective performance in the game.

Another option is utilising diary studies (e.g., Bartholomew, Ntoumanis, Ryan, Bosch et al., 2011), where participants respond to the same questionnaires on a daily basis for an extended period of time. Diary studies may prove beneficial in understanding these motivational trajectories within persons, and in addressing limitations of relying on recalling information that arise from the employment of global self-report instruments (Bolger, Davis, & Rafaeli, 2003). For instance, if athletes train with their coaches approximately twice a week (as indicated in this thesis), they could complete assessments of their perceptions of coaches' interpersonal behaviours, their own need states, and outcome variables such as affect before and after their training sessions for a duration of four to five weeks. Such an examination would enable an understanding of the systematic associations between daily fluctuations of perceptions of coach behaviours, athletes' need states, and indices of adaptive, maladaptive, and diminished functioning. Besides daily fluctuations in these constructs, it would also be useful to examine fluctuations that

occur over time in athletes' functioning in relation to their experiences of need satisfaction and frustration, and their perceptions of coaches' interpersonal behaviours. Longitudinal examinations of the associations between the three overarching coach behaviours and six need states and concomitant outcomes of athlete functioning align with the temporal order that has been emphasised within SDT and tested in this thesis. It would be of interest to examine these variables at the start, half-way through, and the end of one or more sport seasons (e.g., Curran et al., 2016).

In Chapter 2, evidence for face, content, internal structure, discriminant validity, and nomological networks was presented. In Chapter 3, evidence for internal structure, discriminant validity, and nomological networks was assessed. Thus, the third limitation is that not all sources of validity evidence emphasised in the *Standards for Educational and Psychological Testing* (AERA et al., 2014) were tested in the two empirical chapters of this thesis. The demonstrated evidence is, however, sufficient in attesting the assertions that are made on the basis of the scores in this thesis (Kane, 2013). It is also important to note that the interpretations made on the basis of the TMIB-C and PNSS-S scores as a result of the different sources of validity evidence reported in Chapter 2 and Chapter 3 are limited to the tested sample of athletes, and to the context of sport. In order to extend these claims outside of sport, researchers are required to continue to gather validity evidence (Chan, 2014). As such, researchers are encouraged to conduct investigations involving translations and cross-cultural validations of the two measures. Additionally, validation in contexts such as exercise, education, and work would also help explain how these key constructs (need indifference, in particular) operate in various settings. As emphasised in the *Standards* (AERA et al., 2014), it might be worthwhile to commence such investigations by testing evidence based on response process (e.g., through the use of think-aloud protocols) to identify how items of the measures function when examined in varied samples such as cultural groups and individuals employed in diverse settings (e.g., exercisers, students, and employees).

The final recommendation concerns the distinct relations between the three overarching coach interpersonal behaviours and a broad range of outcomes of athlete cognition, behaviour, and affect. In particular, researchers seeking to clarify these associations may benefit from investigating need thwarting interpersonal behaviours in relation to other maladaptive outcomes of reactive or defiant functioning such as

anger and aggressive behaviour towards others (as demonstrated by Hein, Koka, & Hagger, 2015 in the school setting) and antisocial behaviour in sport (e.g., Kavussanu & Boardley, 2009). Need indifferent behaviours might, in contrast, be more pertinent to other outcomes of diminished functioning (e.g., boredom, disengagement or behavioural outcomes such as missed training sessions). Thus, new lines of research which consider the differential antecedents and outcomes of the tripartite model of interpersonal behaviours may provide a more comprehensive understanding of the motivational sequence.

## **Conclusions**

The current thesis aimed to present improved conceptualisations and measures of coaches' interpersonal behaviours and athletes' need states. Specifically, I proposed that the conceptualisation and measurement of coach interpersonal behaviours be extended to include need indifferent behaviours as the third category of interpersonal behaviours alongside need supportive and need thwarting behaviours. In Chapter 2, which comprised three studies, I was able to provide initial support for this tripartite model of interpersonal behaviours. With regards to athletes' need states, I proposed that the conceptualisation and measurement of basic psychological need states be extended to include need unfulfilment as the third need state, besides those of need satisfaction and need frustration. In Chapter 3, through two studies, I demonstrated that athlete need states are best represented by six correlated, yet distinct dimensions of the satisfaction and frustration of autonomy, competence, and relatedness. Although there was no issue with the appropriateness of the need unfulfilment items developed in this chapter, modelling need unfulfilment as a third need state alongside need satisfaction and frustration was unviable.

The findings of this thesis are in line with past research, and also add to the SDT-literature in sport. The TMIB-C will enable researchers to examine athletes' perceptions of coaches' need supportive, thwarting and indifferent interpersonal behaviours, and facilitate a comprehensive understanding of how these overarching behaviours are distinctly implicated in determining athlete basic psychological need satisfaction and frustration, and outcomes of adaptive, maladaptive, and diminished/suboptimal functioning. The six dimensions of the need states can now be examined using the PNSS-S, a sport-specific measure of athletes' need states

which consists of items that exclusively tap athletes' experience of their needs, and are all meaningful to the sport domain. The TMIB-C and PNSS-S are theoretically informed instruments that have been developed bearing in mind recent advances in measurement, so as to have high-quality indicators. Numerous conceptual, measurement, and practical implications, as well as methodological considerations are raised in light of the findings of this thesis, which I hope will facilitate future investigations of coaches' interpersonal behaviours and athletes' need states in sport settings, as well as in other life domains.

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Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear form any copyright owner who has been omitted or incorrectly acknowledged.



## Thesis Appendix A



Office of Research and Development

GPO Box U1987  
Perth Western Australia 6845

**Telephone** +61 8 9266 7863  
**Facsimile** +61 8 9266 3793  
**Web** [research.curtin.edu.au](http://research.curtin.edu.au)

18-Aug-2016

Name: Nikos Ntoumanis  
Department/School: School of Psychology and Speech Pathology  
Email: [Nikos.Ntoumanis@curtin.edu.au](mailto:Nikos.Ntoumanis@curtin.edu.au)

Dear Nikos Ntoumanis

**RE: Ethics approval**  
**Approval number: HRE2016-0221**

Thank you for submitting your application to the Human Research Ethics Office for the project **Item Development and Content Validation of the Supporting and Thwarting of Basic Psychological Needs (ST-BPN) scale**.

Your application was reviewed through the Curtin University low risk ethics review process.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **18-Aug-2016** to **17-Aug-2017**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Ntoumanis, Nikos	Supervisor
Quested, Eleanor	Supervisor
Gucciardi, Daniel	Supervisor
Thogersen-Ntoumani, Eva	Supervisor
Bhavsar, Nikita	Student

### Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:

- proposed changes to the approved proposal or conduct of the study
  - unanticipated problems that might affect continued ethical acceptability of the project
  - major deviations from the approved proposal and/or regulatory guidelines
  - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
  4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
  5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
  6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
  7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
  8. Data and primary materials must be retained and stored in accordance with the [Western Australian University Sector Disposal Authority \(WAUSDA\)](#) and the [Curtin University Research Data and Primary Materials policy](#)
  9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
  10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
  11. Ethics approval is dependent upon ongoing compliance of the research with the [Australian Code for the Responsible Conduct of Research](#), the [National Statement on Ethical Conduct in Human Research](#), applicable legal requirements, and with Curtin University policies, procedures and governance requirements
  12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

**Special Conditions of Approval**

None.

**This letter constitutes ethical approval only.** This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au) or on 9266 2784.

Yours sincerely



Dr Catherine Gangell  
Manager, Research Integrity

## Thesis Appendix B



Office of Research and Development

GPO Box U1987  
Perth Western Australia 6845

**Telephone** +61 8 9266 7863  
**Facsimile** +61 8 9266 3793  
**Web** research.curtin.edu.au

20-Feb-2017

Name: Nikos Ntoumanis  
Department/School: School of Psychology and Speech Pathology  
Email: Nikos.Ntoumanis@curtin.edu.au

Dear Nikos Ntoumanis

**RE: Ethics approval**  
**Approval number: HRE2017-0053**

Thank you for submitting your application to the Human Research Ethics Office for the project **Development and Validation of Two New Questionnaires assessing Athlete Experiences and Perceptions of Coach Interpersonal Behaviours in Sport**.

Your application was reviewed through the Curtin University low risk ethics review process.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **20-Feb-2017** to **19-Feb-2018**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Ntoumanis, Nikos	CI
Bhavsar, Nikita	Student
Bartholomew, Kimberley	Co-Inv
Gucciardi, Daniel	Supervisor
Thogersen-Ntoumani, Cecile	Supervisor
Quested, Eleanor	Supervisor

### Standard conditions of approval

1. Research must be conducted according to the approved proposal

2. Report in a timely manner anything that might warrant review of ethical approval of the project including:
  - proposed changes to the approved proposal or conduct of the study
  - unanticipated problems that might affect continued ethical acceptability of the project
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12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

**Special Conditions of Approval**

None.

**This letter constitutes ethical approval only.** This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au) or on 9266 2784.

Yours sincerely



Dr Catherine Gangel  
Manager, Research Integrity

## Thesis Appendix C



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07-Aug-2018

Name: Nikos Ntoumanis  
Department/School: School of Psychology  
Email: [Nikos.Ntoumanis@curtin.edu.au](mailto:Nikos.Ntoumanis@curtin.edu.au)

Dear Nikos Ntoumanis

**RE: Amendment approval**  
**Approval number: HRE2017-0053**

Thank you for submitting an amendment request to the Human Research Ethics Office for the project **Development and Validation of Two New Questionnaires assessing Athlete Experiences and Perceptions of Coach Interpersonal Behaviours in Sport**.

Your amendment request has been reviewed and the review outcome is: **Approved**

The amendment approval number is HRE2017-0053-04 approved on 07-Aug-2018.

The following amendments were approved:

1. The research team would like to register the studies on SONA. This would involve introduction of credit points for completion of the surveys. We are currently validating two questionnaires as a part of this project, each of which take up to 15 minutes to complete. As such, we would like to propose that students are offered one point for completing each survey package (total of up to 2 points for completing both). Students can choose if they want to participate in just one or both studies.
2. For other participants who are not eligible for the SONA studies, we would like to introduce two prize draws (one for each study). For each of the two studies, participants will be eligible to go in the draw to win one of six (6) Coles/Myer vouchers each valued at \$50 as a thank you for their participation. As such, a total of 12 vouchers worth \$600 will be introduced. Participants can choose if they want to participate in just one or both studies.

Any special conditions noted in the original approval letter still apply.

#### Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:
  - proposed changes to the approved proposal or conduct of the study
  - unanticipated problems that might affect continued ethical acceptability of the project
  - major deviations from the approved proposal and/or regulatory guidelines
  - serious adverse events

3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
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Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au) or on 9266 2784.

Yours sincerely



Catherine Gangell  
Manager, Research Integrity