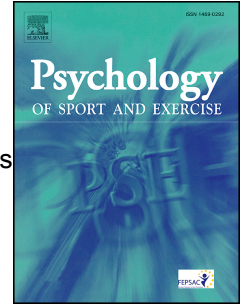


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Running head: A TRIPARTITE MEASURE OF COACH INTERPERSONAL BEHAVIORS

Conceptualizing and Testing a New Tripartite Measure of Coach Interpersonal Behaviors

Nikita Bhavsar<sup>1,2</sup>, Nikos Ntoumanis<sup>\*1,2</sup>, Eleanor Quested<sup>1,2</sup>, Daniel F. Gucciardi<sup>2,3</sup>, Cecilie Thøgersen-Ntoumani<sup>1,2</sup>, Richard M. Ryan<sup>4</sup>, Johnmarshall Reeve<sup>4</sup>, Philippe Sarrazin<sup>5</sup>,  
Kimberley J. Bartholomew<sup>6</sup>

<sup>1</sup>*School of Psychology, Curtin University;* <sup>2</sup>*Physical Activity and Well-Being Lab, Curtin University;* <sup>3</sup>*School of Physiotherapy and Exercise Science, Curtin University;* <sup>4</sup>*Institute for Positive Psychology & Education, Australian Catholic University;* <sup>5</sup>*SENS, Univ. Grenoble-Alpes;* <sup>6</sup>*School of Education and Lifelong Learning, University of East Anglia*

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**\*Address correspondence to:**

Nikos Ntoumanis

Physical Activity and Well-being Lab

School of Psychology, Curtin University,

GPO Box U1987, Perth, Western Australia, 6845

Australia

Telephone: +61 8 9266 3297

Email : nikos.ntoumanis@curtin.edu.au

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7 **Conceptualizing and Testing a New Tripartite Measure of Coach Interpersonal**

8 **Behaviors**

9

10

Abstract

11 **Objectives**

12 Various self-report measures based on Self-Determination Theory (Deci & Ryan, 1985; Ryan  
13 & Deci, 2017) have been developed to assess athletes' perceptions of their coaches' need  
14 supportive and thwarting behaviors. We propose that it is also conceptually important to  
15 distinguish between coaching behaviors that thwart and those that are indifferent to athletes'  
16 psychological needs. This distinction is useful, as we contend that athletes' degree of need  
17 frustration, and concomitant negative outcomes, are likely to be more pronounced in a  
18 coaching environment that actively thwarts (vs. is indifferent to) athletes' needs. In this three-  
19 study paper, we outline the conceptual rationale for, the development of, and initial validity  
20 evidence for a tripartite (need supportive, thwarting, and indifferent) measure of interpersonal  
21 behaviors of coaches (TMIB-C).

22 **Method**

23 In Study 1, we developed 54 candidate items and gathered evidence for their face and content  
24 validity with athletes and an expert panel. Competing factor models were tested in Study 2 to  
25 determine the best representation of the measure's factor structure. In Study 3, we tested the  
26 replication of such models and the nomological network surrounding the identified factors.

27 **Results**

28 In Study 2, a 22-item, three-factor structure (supportive, thwarting, and indifferent behaviors)  
29 using exploratory structural equation modeling, demonstrated acceptable fit, good  
30 standardized factor loadings, factor correlations in the expected directions, and acceptable  
31 estimates of internal consistency. This model was replicated in Study 3. Tests of nomological  
32 networks showed that as expected, need indifference was a weaker predictor of autonomy and  
33 competence need frustration as compared to need thwarting, and the only significant  
34 predictor of irrelevant thoughts. Unexpectedly however, need indifference, when compared to

35 need thwarting, was as good a predictor of exhaustion and a better predictor of relatedness  
36 frustration.

37 **Conclusions**

38 Evidence supports the TMIB-C as a parsimonious and promising measure of athletes'  
39 perceptions of coach interpersonal behaviors. Our tripartite conceptualization and measure  
40 should be further tested in terms of its predictive utility in order to advance conceptual  
41 understanding and intervention efforts targeting interpersonal behaviors in sport, and  
42 potentially other life domains.

43 *Key words:* self-determination theory; scale development; exploratory structural equation  
44 modeling; psychometric testing; need support; need thwarting

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

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

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

67 In this three-study paper, we further distinguish between coaching behaviors that  
68 actively undermine athletes’ psychological needs and those that are indifferent to such needs.  
69 We explain why such a distinction can provide a more refined conceptual understanding of

70 (coaching) interpersonal behaviors with potential applied implications, and how each  
71 behavior might relate to different outcomes for athletes. To this end, we present the  
72 development of, and initial validity evidence for, a new tripartite measure of athletes'  
73 perceptions of their coaches' supportive, thwarting, and indifferent interpersonal behaviors.

#### 74 **Self-Determination Theory and Coach Interpersonal Behaviors**

75 Coaches exhibit characteristics of need supportive interpersonal behaviors when they  
76 communicate with athletes in ways that are supportive of their basic psychological needs for  
77 autonomy, competence, and relatedness. Social agents use *autonomy supportive behaviors*  
78 when they recognize and nurture others' inner motivational resources, such as their goals and  
79 preferences (Katz & Assor, 2007; Reeve, 2009). For instance, coaches can be autonomy  
80 supportive by offering athletes choices within agreed boundaries, showing attempts to  
81 understand their perspectives, providing them with personally meaningful rationales for task  
82 engagement, encouraging their input in decision making processes, and giving them  
83 opportunities for self-initiated behavior (Mageau & Vallerand, 2003; Ntoumanis & Mallett,  
84 2014).

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

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

99            Through a plethora of studies, researchers have demonstrated positive associations  
100 between athletes’ perceptions of coach need supportive interpersonal behaviors and athletes’  
101 basic psychological need satisfaction (Adie et al., 2012), self-determined forms of motivation  
102 (Amorose & Anderson-Butcher, 2007), and positive outcomes such as well-being (Adie,  
103 Duda, & Ntoumanis, 2008), persistence (Pelletier, Fortier, Vallerand, & Briere, 2001), and  
104 improved performance (Cheon et al., 2015).

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

115            *Competence thwarting* has previously been described using the term “chaos” in the  
116 SDT literature (e.g., Skinner et al., 2005; Smith, Quested, Appleton, & Duda, 2016).  
117 According to Skinner et al. (2005), chaotic behaviors are inconsistent, disorganized,  
118 confusing, and lacking in direction. Competence thwarting has also been discussed in relation



119 to highlighting others' failures and conveying incompetence information to them (Sheldon &  
120 Filak, 2008). Coaches can thwart their athletes' need for competence by showing doubt in  
121 their capacity to improve in their sport, emphasizing their mistakes, being overly critical of  
122 them, and by repeatedly giving them negative feedback in public (Pulido et al., 2018; Rocchi  
123 et al., 2017).

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

131 Athletes' perceptions of coaches' need thwarting interpersonal behaviors have been  
132 associated with athlete need frustration (Bartholomew, Ntoumanis, Ryan, Bosch, &  
133 Thøgersen-Ntoumani, 2011; Haerens et al., 2018), non-self-determined forms of motivation  
134 (i.e., driven by contingencies, guilt, rules and demands; Pelletier et al., 2001; Rocchi et al.,  
135 2017), and negative outcomes such as somatic anxiety, worry, and concentration disruption  
136 (Ramis, Torregrosa, Viladrich, & Cruz, 2017).

### 137 **The Case for Coach Need Indifferent Interpersonal Behaviors**

138 Besides actively nurturing or undermining others' experiences of need satisfaction,  
139 social agents have also been described as being indifferent (Vansteenkiste & Ryan, 2013).  
140 However, existing conceptualizations and measures of maladaptive interpersonal behaviors  
141 do not distinguish between a behavior that reflects "active" or "direct" need thwarting by the  
142 social agent (e.g., coaches intimidating athletes), and a behavior that is "neutral", "passive",  
143 or "indifferent" to athletes' needs (e.g., coaches being unresponsive to athletes' opinions).

144           As an example, consider the conceptualization of, and the items assessing the  
 145   construct of chaos, which is usually offered as an illustration of competence thwarting. In the  
 146   parenting literature, chaos refers to parenting that is permissive and erratic (Skinner et al.,  
 147   2005). A sample item for this dimension, from the Parent as Social Context Questionnaire  
 148   (Skinner, Wellborn, & Regan, 1986), is “When my parents say they will do something,  
 149   sometimes they don’t really do it”. Although such behaviors might impede others’ in their  
 150   goal achievement process, they differ from need thwarting behaviors, which describe  
 151   situations where one’s needs are “actively blocked” by a person in authority (Vansteenkiste  
 152   & Ryan, 2013). Thus, the conceptualization and measurement of chaotic behaviors is more  
 153   akin to need indifferent behaviors, rather than need thwarting ones. An example of the latter  
 154   would be a coach delivering scathing feedback to an athlete, criticizing his/her competence in  
 155   front of the entire team. Confounds of need thwarting and need indifferent behaviors can also  
 156   be found in the sport literature. For example, the conceptualization of competence thwarting  
 157   by Pulido et al. (2018) includes chaotic coaching behaviors, such as instances when coaches  
 158   supply athletes with a lot of information that is lacking in structure and clear objectives,  
 159   resulting in athletes failing to understand their tasks and responsibilities.

160           Similar problems exist with the conceptualization and measurement of the construct  
 161   of cold behaviors, which is often described as relatedness thwarting (e.g., Skinner et al.,  
 162   2005; Pulido et al., 2018; Rocchi et al., 2017). Cold behaviors include being distant with  
 163   others, unavailable when needed, disinterested in others’ thoughts and feelings, and not  
 164   listening to what others have to say (Pulido et al., 2018; Rocchi et al., 2017; Sheldon & Filak,  
 165   2008). This conceptualization is ambiguous, as it is not clear if being cold is the result of  
 166   being disinterested or weary of others (which is more of a relatedness indifferent behavior),  
 167   or due to hostility, rejection, or conditional regard towards others, which are characteristics of  
 168   relatedness thwarting (Standage et al., 2019; Vansteenkiste & Ryan, 2013).

169           Only a few attempts have been made to include need “neutral” items in SDT-  
170 informed experiments, all outside of sport (e.g., Kinnaefick, Thøgersen-Ntoumani, & Duda,  
171 2016; Tessier, Sarrazin, & Ntoumanis, 2008). However, there was no strong theoretical  
172 explanation in these papers as to what such “neutral” behaviors represented, and how they  
173 related to psychological needs and key motivation-related outcomes.

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

187           In this paper, we propose that besides employing need supportive and need thwarting  
188 behaviors, coaches can also adopt need indifferent behaviors towards their athletes. Need  
189 indifference is demonstrated when a coach is inattentive to his/her athletes’ basic  
190 psychological needs. Need indifferent behaviors are proposed to be less motivationally  
191 damaging in comparison to need thwarting behaviors, because they do not actively  
192 undermine the three psychological needs.

193            *Autonomy indifference* comprises of behaviors where a coach shows disinterest in  
 194 athletes’ perspectives, wants, and preferences. Coaches can be indifferent towards their  
 195 athletes’ need for autonomy by, for example, being unresponsive to their opinions.  
 196            *Competence indifference* consists of behaviors illustrating negligence from the coach in  
 197 creating conditions that will help athletes to progress, and feel capable and successful. One  
 198 way in which coaches can be indifferent to their athletes’ need for competence is by creating  
 199 a chaotic environment, or by setting uniform tasks that do not take into consideration  
 200 athletes’ differences in skill level. Finally, *relatedness indifference* involves behaviors  
 201 exemplifying inattentiveness from the coach towards the quality of the coach-athlete  
 202 relationship. Keeping to themselves without asking questions about athletes’ welfare is one  
 203 way in which coaches could be indifferent towards athletes’ need for relatedness.

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

216            **Self-Report Questionnaires to Measure Interpersonal Behaviors in Sport and Other**  
 217            **Life Settings**

218 The conceptualization of the three basic psychological needs within the SDT  
219 framework is unique, such that even though each need is considered to be important in its  
220 own right, all three needs are regarded as interdependent and expected to be highly correlated  
221 (Ryan & Deci, 2017). Accordingly, examinations of the dimensionality of interpersonal  
222 behaviors targeting these needs have been guided by two approaches. The first is a  
223 unidimensional approach, where items assessing all three needs are presented as a single  
224 factor. The second is a multidimensional approach, where items pertaining to each of the  
225 three needs are presented as distinct factors.

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

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

255 Another recently developed multidimensional measure is the Coaches Interpersonal  
256 Style Questionnaire (CIS-Q; Pulido et al., 2018). The 22-item, six-factor questionnaire also  
257 assesses coach supportive and thwarting interpersonal behaviors for each of the needs of  
258 autonomy, competence, and relatedness. Although Pulido and colleagues used contemporary  
259 methods (i.e., ESEM) in their scale development effort, they also reported moderately high  
260 factor correlations between relatedness and competence support ( $r = .78$ ), and between  
261 relatedness and competence thwarting ( $r = .75$ ). Further, this scale was developed with male  
262 athletes, from a single sport (soccer), with no evidence of replication of this factor structure  
263 with an independent sample of athletes. Another limitation of the measure is that all of the  
264 items in the competence thwarting subscale, and few in the relatedness thwarting subscale  
265 appear to capture athletes’ experiences of need frustration, instead of coach behaviors that are  
266 competence/relatedness thwarting (e.g., During practices, our coach “... proposes situations

267 that make me feel incapable”, “... makes me feel rejected by him/her sometimes”). The  
 268 relatedness thwarting subscale of the CIS-Q also includes an item that reflects need  
 269 indifference as opposed to need thwarting (“During practices, our coach ...is sometimes  
 270 indifferent to me”).

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

286 **Present Research**

287 The objective of the present series of studies was to develop and provide initial  
 288 validity evidence for a new multidimensional measure of athletes’ perceptions of their  
 289 coaches’ need supportive, thwarting, and indifferent interpersonal behaviors. We named this  
 290 measure the Tripartite Measure of Interpersonal Behaviors-Coach (TMIB-C). Over three  
 291 studies, we examined various sources of validity evidence outlined by *The Standards for*

292 *Educational and Psychological Testing* (The Standards; developed by the American  
293 Educational Research Association [AERA], American Psychological Association [APA], and  
294 National Council on Measurement in Education [NCME], 2014). In Study 1, we focused on  
295 item creation and selection, in addition to face and content validity evidence for the items of  
296 the new measure. In Study 2, we provided evidence for the internal structure of the measure  
297 by comparing several theoretically justifiable factorial models using CFA, ESEM, and  
298 bifactor CFA and ESEM. We also provided evidence for the reliability and discriminant  
299 validity of the subscale scores. Finally, in Study 3, we re-tested the factorial structure of the  
300 scale with an independent sample and provided initial evidence for its nomological validity.

### 301 **Study 1**

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

### 307 **Method**

308 We searched electronic databases to identify existing self-report and observational  
309 SDT-informed measures of interpersonal behaviors / socio-contextual environment in the  
310 areas of sport, exercise, education, and parenting. Keywords included “need support”, “need  
311 supportive climate”, “autonomy support”, “controlling”, “need thwarting”, “observed need  
312 thwarting”, “motivational climate”, “interpersonal style”, and “self-determination theory”.  
313 Twelve measures were identified through this search, and inspection of their reference lists  
314 led to the identification of 10 additional measures (see **Error! Reference source not found.**).  
315 Items of these twelve measures were collated to form the initial pool of 359 items.



316 An important initial step in developing measurement instruments is creating a clear  
 317 and sufficiently detailed narrative for the constructs of interest (Clark & Watson, 2019). We  
 318 adapted existing definitions or conceptualizations of need supportive and thwarting  
 319 behaviors, and wrote new definitions for need indifferent behaviors (see Table 1). Removal  
 320 of duplicate items, similarly worded items, and items that were deemed unsuitable for a self-  
 321 report measure specific to coaching, resulted in a reduced pool of 42 items. We subsequently  
 322 classified these items as being supportive (18 items), thwarting (17 items), or indifferent  
 323 (seven items) towards each of the three needs. We modified the wording of the original items  
 324 in order to make them suitable for sport. The need indifferent items were items that were  
 325 originally proposed as need thwarting by the researchers who developed the included scales  
 326 (e.g., “My coach lets things get chaotic”). Based on the definitions developed for the purpose  
 327 of this study, however, we classified this as being indifferent. In addition, we created nine  
 328 new items, for example “My coach keeps to himself/herself”, to tap need indifferent  
 329 behaviors. In order to maximize the quality of these items, we followed guidelines for item  
 330 wording (DeVellis, 2012). Namely, we ensured that the items were straightforward, easy to  
 331 read for the target population, brief, and avoided items that were double-barreled or items  
 332 with nearly identical content. Through this process, we created an initial pool of 51 items.  
 333 The perceived relevance to sport and clarity of the items in this pool was subsequently tested  
 334 in a group of athletes, and after further changes, by a panel of SDT experts.

335 <Insert Table 1 here>

### 336 **Participants**

337 The athlete sample ( $N = 20$ ) consisted of six female and 14 male Australian athletes,  
 338 who were, on average, 19.70 years of age ( $SD = 2.83$ ). Athletes represented individual and  
 339 team sports including Australian football league (AFL), rugby, athletics, netball, lacrosse,  
 340 rowing, karate, soccer, and basketball. Athletes were competitive at the club ( $n = 11$ ), state ( $n$

341 = 7), or national ( $n = 2$ ) level. Average competitive experience was 7.55 years ( $SD = 4.717$ ).  
342 On average, athletes trained 2.90 times a week ( $SD = 1.74$ ) and had been training with their  
343 current main coaches for 1.79 years ( $SD = 1.61$ ).

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

### 349 **Procedure**

350 After gaining ethical approval for all three studies in this paper from the principal  
351 researcher's University Ethics Committee, we contacted coaches and management  
352 committees of sporting bodies in Perth, Western Australia, to request that they invite their  
353 athletes to participate. To be eligible, athletes were required to be over 14 years of age, train  
354 with a coach at least once a week, compete regularly during the sport season, and be  
355 proficient in English. The purpose of the study was explained to interested athletes before  
356 they were invited to participate in a semi-structured interview. Prior to interviews, we  
357 obtained written participant consent, and parental consent where appropriate.

358 The interviews allowed for collection of both quantitative and qualitative data. We  
359 presented the athletes with the pool of 51 items and requested them to consider their general  
360 experiences of the "manner" in which coaches (their own or those of others in the case that  
361 some of the items were inapplicable to their coach) interact with athletes. At first, we asked  
362 them to rate the relevance of each item to the sport domain using a dichotomous scale  
363 (*Applicable* vs. *Inapplicable*). For the items that were found to be applicable to sport  
364 (implying that coaches might communicate in such a manner), we further asked them to rate  
365 the items in terms of clarity, using a 7-point scale (1 = *not at all clear* to 7 = *very clear*). In

366 cases where an item was rated below 5 on clarity, a researcher discussed what was  
367 problematic with the athlete and asked them to share their thoughts on to how to make the  
368 item (or part thereof) clearer. Finally, the researcher also encouraged the participants to  
369 describe any other coaching behaviors that they had experienced, which were not already  
370 represented by the item pool. Items were modified accordingly.

371 Next, we asked the SDT experts to rate the modified items to indicate the extent to  
372 which they thought each item matched its ascribed definition using a 5-point scale (1 = *poor*  
373 *match*, 5 = *excellent match*). Experts were requested to indicate if they thought any item also  
374 made a good, great or excellent match (i.e., ratings of 3, 4 or 5) for a non-intended factor, in  
375 an effort to identify items which could potentially cross-load in a future factor analysis.  
376 Finally, they were invited to share their opinions on alternative wording for items, propose  
377 additional items, and to provide feedback on the suggested definitions of need indifferent  
378 behaviors. We used the experts' ratings to calculate the Content Validity Index (CVI; Lynn,  
379 1986) for each item and to reach decisions for retention, revision, or elimination of items. To  
380 calculate each item's CVI, we divided the number of experts who rated the item as a *good*  
381 *match*, *very good match*, or an *excellent match* (i.e. a rating of 3, 4 or 5) by the total number  
382 of experts on the panel.

### 383 **Results and Discussion**

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

390 Following the expert panel review, 51 of the 54 items in the revised item pool  
391 exhibited a CVI that was over or in the vicinity of the agreement level proposed by Lynn  
392 (1986) for six or more experts (i.e.  $CVI \approx .80$ ; see also Polit, Beck, & Owen, 2007). We made  
393 minor revisions to some of these items to accommodate experts' comments regarding item  
394 improvement. Although three items had low or very low CVIs (.62, .35, and .25,  
395 respectively), these items were not deemed irrelevant or worthy of deletion in any of the  
396 experts' qualitative comments. As such, we decided to retain these items, modify their  
397 wording, and earmarked them for possible deletion in Study 2, if they were found to be  
398 problematic again.

## 399 Study 2

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

## 404 Method

### 405 Participants

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

### 413 Procedure

414 We used procedures similar to those utilized in Study 1 to recruit athletes.

## 415 **Measures**

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

## 426 **Data Analyses**

427 As there is theoretical and empirical support for modeling the broad interpersonal  
428 behaviors as a single factor (e.g., overarching dimension of need support), or according to  
429 need specific dimensions (e.g., autonomy, competence, and relatedness support), both of  
430 these approaches were used to inform our tests of the factorial structure of the TMIB-C. As  
431 previously mentioned, the stringent requirement in CFA of zero cross-loadings between items  
432 and non-intended factors results in overestimated factor correlations, a concern that may be  
433 dealt with using ESEM, bifactor models, or a fusion of the two (Morin, Arens, & Marsh,  
434 2016). In ESEM, it is recognized that items may be associated with constructs other than  
435 those they are intended to measure (Morin et al., 2016). Thus, all cross-loadings can be  
436 estimated through the use of ESEM, resulting in factor correlations that are less inflated in  
437 comparison to those obtained via CFA (Aspourahav & Muthen, 2009). It is also important to  
438 test bifactor models (Holzinger & Swineford, 1937; Reise, 2012) in examining interpersonal

439 behaviors. Substantively, a bifactor model enables one to test simultaneously the presence of  
440 a global factor that explains covariance among all items and specific dimensions that explain  
441 covariance among subsets of indicators that are distinct to the general construct (Chen,  
442 Hayes, Carver, Laurenceau, & Zhang, 2012). Practically, testing bifactor solutions and  
443 comparing them against CFA and ESEM solutions is useful in deciding whether global  
444 factors (e.g., need support) are accompanied by need-specific factors (autonomy,  
445 competence, & relatedness) or whether global factors are sufficient on their own. Lastly,  
446 bearing in mind that items are often associated with constructs other than the ones they are  
447 intended to measure, and also that items may tap a specific factor as well as a more global  
448 construct, a merger of ESEM with bifactor models enables the simultaneous examination of  
449 the presence of item cross-loadings as well as global and specific factors in a factorial  
450 structure. We thus tested twelve theoretically justifiable configurations of the factorial  
451 structure using CFA, ESEM, and bifactor CFA, and ESEM (See Table 2 and Supplementary  
452 File 2). All statistical analyses were conducted in Mplus 8.0 (Muthén & Muthén, 1998-2017).

453 In the CFA models, we allowed items to load on their predefined factors only, and  
454 suppressed cross-loadings on unintended factors. Factors were allowed to correlate. We used  
455 target rotation to test ESEM models. In other words, we defined factors in a manner similar to  
456 the CFA models, however, we allowed cross-loadings to be freely estimated while specifying  
457 them to be close to zero (Browne, 2001). In the case of the bifactor CFA models, we let items  
458 load on their predefined S-factors and G-factors. S-factors were specified as orthogonal. G-  
459 factors were allowed to correlate with one another in cases where there were two or more (A.  
460 Morin, personal communication, December 18, 2017). Finally, we estimated the bifactor  
461 ESEM models in a manner similar to bifactor CFA models, however, we allowed for all  
462 cross-loadings for the S-factors to be freely estimated using an orthogonal target rotation  
463 (Reise, 2012).

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

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

## 480 **Results and Discussion**

### 481 **Item distribution**

482 First, the scoring distributions of the 54 items were examined for univariate normality.  
 483 Median values for skewness and kurtosis were .748 (range -4.307 to .146) and 1.228 (-1.090  
 484 to 20.774). The high positive kurtosis values for some items indicate that participant  
 485 responses to these items were concentrated in the middle of the response scale and were  
 486 sparse towards the tails (Tabachnick & Fidell, 2012). Departures from normality are  
 487 common in the area of social and psychological sciences (Cain, Zhang, & Yuan, 2017).  
 488 Subsequent analyses were conducted using a robust maximum likelihood estimator (MLR)

489 which provides robust fit indices and standard errors in the case of non-normality and  
490 performs well with variables with a minimum of five response categories (Bandalos, 2014;  
491 Rhemtulla, Brosseau-Laird, & Savalei, 2012).

492 **Factorial structure**

493 Goodness-of-fit indices for all 12 models tested are reported in Table 2. None of the  
494 models achieved good fit and some did not converge. In terms of the ESEM models for  
495 potential nine-factor solutions, an examination of the parameter estimates further suggested  
496 multiple items with poor standard factor loadings ( $< .30$ ) and/or unintended cross-loadings ( $>$   
497  $.20$ ), the removal of which would result in only one or two items per interpersonal behavior.  
498 The only models that demonstrated clean fitting solutions in terms of zero to few cross-  
499 loadings between items and non-intended factors were ESEM model 5 (three factors) and  
500 bifactor ESEM model 12 (one general-factor and three specific-factors). Both these models  
501 also demonstrated acceptable standardized factor loadings and factor correlations in expected  
502 directions. In the case of the bifactor ESEM model 12, this structure also exhibited a well-  
503 defined G-factor as well as S-factors.

504 < Insert Table 2 here >

505 We thus decided to revert to the original item pool of 54 items in order to pull  
506 together items that would support either of these two solutions, with factors representing  
507 overall need supportive, thwarting, and indifferent coaching behaviors. Item selection began  
508 with one-factor CFAs for each of these three broad coach interpersonal behaviors. The CFA  
509 approach was justified in that the measure was based on a strong theoretical framework, and  
510 the aim of this analysis was to select items that load primarily on their intended constructs so  
511 as to have more distinct measures of the three broad interpersonal behaviors. After removing  
512 problematic items, our end goal was to re-run the three-factor ESEM Model (Model 5) and



513 bifactor ESEM Model with one G-factor and three S-factors (Model 12), with the chosen  
514 items from the unidimensional CFAs, in order to achieve improved model-to-data fit.

515         As the mere retention of best-fitting items might not lead to a measure that is  
516 adequately representative of the target construct (Clark & Watson, 2019), our screening for  
517 model misspecification was conceptually and statistically informed. Conceptual details such  
518 as item overlap, the breadth of the concept, and adequate representation of items pertaining to  
519 each need were considered. Statistically, items with standardized factor loadings close to or  
520 below .30 and large modification indices (over 10), or multiple (two or more) moderate-sized  
521 modification indices were considered for deletion. Problematic items in each iteration were  
522 identified and removed from the analysis. We sought to ensure a balance of items of all three  
523 needs in each unidimensional model. We removed a total of 32 items through this process; 22  
524 items were retained. The final unidimensional models for each of the three broad behaviors  
525 were found to have excellent fit and a balance of behaviors relevant to each of the three needs  
526 across each interpersonal behavior (see Table 3).

527         We subsequently re-ran Model 5 and Model 12 with the remaining 22 items<sup>1</sup>. The  
528 three-factor ESEM model was found to have acceptable fit [ $\chi^2(168) = 271.479, p < .001,$   
529  $CFI = .95, TLI = .93, RMSEA = .04$  (90% CI .03 - .05),  $SRMR = .03$ ]. Standardized factor  
530 loadings were significant and in the range of .48 and .88 and subscales related to each other  
531 in expected ways (see Table 4). None of the items had significant cross-loadings on  
532 unintended factors that were larger than the standard factor loading. Factor correlations  
533 between need thwarting and need supportive behaviors, need supportive, and need indifferent  
534 behaviors, and need thwarting and need indifferent behaviors were -.67, -.67, and .62,  
535 respectively. Raykov's composite reliability coefficient (Raykov, 1997) was found to be .80  
536 and above for all three subscales (see Table 5).

537 <Insert Table 3 here>

538 <Insert Table 4 here>

539 <Insert Table 5 here>

540 The bifactor ESEM model with one G- and three S-factors also demonstrated similar  
541 acceptable fit indices [ $\chi^2 = 238.247 (149)$ ,  $p < .001$ , CFI = .95, TLI = .93, RMSEA = .05  
542 (90% CI (.03 - .06), SRMR = .03]. However, examination of factor loadings indicated that  
543 although there was a well-defined G-factor and S-factors for need supportive and indifferent  
544 behaviors, none of the items for the need thwarting behaviors had significant loadings. As  
545 such, a decision was made to retain the three-factor ESEM model (Model 5) and to re-test its  
546 factor structure with an independent sample of athletes.

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

### 554 **Study 3**

555 In Study 3, we first sought to re-test the three-factor ESEM structure that was favored  
556 in Study 2 in a new sample of athletes. Based on Study 2, we expected that the three-factor  
557 ESEM solution would hold when tested in a new sample of athletes. Subsequently, we sought  
558 to provide initial evidence for the nomological network surrounding the subscales of the  
559 TMIB-C by testing two different models for the relations between coach interpersonal  
560 behaviors and a) one positive (i.e., dedication) and two negative (i.e., exhaustion and  
561 irrelevant thoughts) athlete outcomes, and b) athlete need satisfaction and frustration. We

562 chose dedication, exhaustion, and irrelevant thoughts as we were interested in examining the  
563 relations between interpersonal behaviors and conceptually relevant behavioral and cognitive  
564 outcomes. Based on past research linking need supportive and thwarting coach interpersonal  
565 behaviors, athlete need states, and outcomes of well-being and ill-being (e.g., Bartholomew et  
566 al., 2011; Pulido et al., 2018; Rocchi et al., 2017), we expected that sport dedication would be  
567 best predicted by need support. Exhaustion is a negative outcome that should be best  
568 predicted by need thwarting as it is an intensely adverse (“darker”) outcome. Irrelevant  
569 thoughts is also a negative outcome but not as strongly adverse as exhaustion, and would be  
570 best predicted by need indifference. We used outcomes that have commonly been used before  
571 (e.g., dedication, exhaustion), but also measures that haven’t been examined in the SDT  
572 literature (e.g., irrelevant thoughts).

## 573 **Method**

### 574 **Participants**

575 The sample ( $N = 352$ ) consisted of 169 female and 183 male competitive athletes,  
576 with an average age of 20.02 years ( $SD = 5.88$ ). Athletes represented individual ( $n = 76$ ) and  
577 team ( $n = 276$ ) sports such as athletics, cycling, AFL, and netball. Most of the athletes were  
578 Australian ( $n = 280$ ), and the remainder ( $n = 72$ ) reported their ethnicities as European, South  
579 African, British, etc. Athletes were competitive at the club ( $n = 159$ ), state ( $n = 98$ ), national  
580 ( $n = 62$ ), or international ( $n = 33$ ) level. They had been competing in their respective sports  
581 for an average of 8.74 years ( $SD = 4.81$ ), and had been training with their respective main  
582 coaches for an average of 2.31 years ( $SD = 2.26$ ) on an average of 3.08 times per week ( $SD =$   
583 1.75).

### 584 **Procedure**

585 We recruited athletes using a procedure similar to that in Studies 1 and 2.  
586 Additionally, the questionnaire was made available online on the Qualtrics platform and was

587 advertised through social media. All participating athletes were eligible to go in to a prize  
588 draw to win shopping vouchers. Undergraduate student-athletes ( $n = 5$ ) at the School of  
589 Psychology at the first author's university were offered course credit for participation.

## 590 **Measures**

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

593 **Coach Interpersonal Behaviors.** The 22-item TMIB-C, developed in Studies 1 and  
594 2, was used to assess athletes' perceptions of their coaches' interpersonal behaviors. The  
595 measure consisted of three factors of need support, need thwarting, and need indifference.  
596 Similar to Study 2, athletes were requested to consider their experiences with their current  
597 main coach over the past month, and indicate the extent to which they disagreed or agreed  
598 with each statement using a 7-point response format.

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

608 The factor structure of the measure was confirmed using CFA and ESEM. The ESEM  
609 model resulted in negative residual variance for one item ("I feel that my decisions reflect  
610 what I really want"). Fit indices for the CFA model were indicative of acceptable model-to-

611 data fit [ $\chi^2$  (236) = 503.278,  $p < .001$ , CFI = .93, TLI = .91, RMSEA = .06 (90% CI .05-.06),  
 612 SRMR = .06]. Factor correlations were in the expected directions, ranging between - .76 and  
 613 .66. Raykov's composite reliability coefficients for the subscales were acceptable for all  
 614 subscales (range .83 - .93). As such, the correlated six-factor CFA model was retained.

615 **Positive and Negative Athlete Outcomes.** The dedication subscale of the Athlete  
 616 Engagement Questionnaire (Lonsdale, Hodge, & Jackson, 2007) was employed as a positive  
 617 athlete outcome. The subscale consists of four items, to which participants responded using a  
 618 5-point rating scale (1 = *almost never*, 5 = *almost always*). An example item is "I am  
 619 determined to achieve my goals in sport". Fit for the single-factor CFA model was excellent  
 620 [ $\chi^2$  (2) = 4.650,  $p < .001$ , CFI = .99, TLI = .99, RMSEA = .06 (90% CI .00 - .14), SRMR =  
 621 .06]. Raykov's composite reliability coefficient for the subscale was .95.

622 The emotional/physical exhaustion subscale of the Athlete Burnout Questionnaire  
 623 (Raedeke & Smith, 2001) was administered as an assessment of a "darker" athlete outcome.  
 624 Participants responded to the five items that comprised the subscale using a 5-point response  
 625 format (1 = *almost never*, 5 = *almost always*). An example of an item is "I have been feeling  
 626 physically worn out from my sport". Fit for the single-factor CFA model was sound [ $\chi^2$  (5) =  
 627 34.355,  $p < .001$ , CFI = .96, TLI = .93, RMSEA = .13 (90% CI .09 - .17), SRMR = .03].  
 628 Raykov's composite reliability coefficient for the subscale was .93.

629 Finally, the five-item irrelevant thoughts subscale of the Thought Occurrence  
 630 Questionnaire for Sport (TOQS; Hatzigeorgiadis & Biddle, 2001) was used to assess  
 631 cognitive interference (a "less dark" negative outcome). Participants responded to  
 632 experiencing sport irrelevant thoughts about, for example, "Friends", "Personal worries (e.g.,  
 633 school, work, relations)", etc. using a 7-point response format (1 = *never*, 7 = *very often*). Fit  
 634 for the single-factor CFA model was excellent [ $\chi^2$  (5) = 21.449,  $p < .001$ , CFI = .97, TLI =

635 .95, RMSEA = .08 (90% CI .06 - .14), SRMR = .03]. Raykov's composite reliability  
 636 coefficient for the subscale was .92.

637 **Data Analyses**

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

644 **Structural equation modeling (SEM).** We first estimated a six-factor model (three  
 645 dimensions of coach interpersonal behaviors and three athlete outcomes) using a structural  
 646 equation modeling (SEM) framework to explore the relations between the contextual and  
 647 outcome variables. Subsequently, we tested a 12-factor model (three dimensions of coach  
 648 interpersonal behaviors, six dimensions of athlete need satisfaction and frustration, and three  
 649 athlete outcomes) using SEM to examine the relations between the contextual variables and  
 650 need states. Yet again, a multi-faceted approach informed the assessment of model-to-data fit,  
 651 with the same cut-off criteria described in Study 2. TMIB-C subscales were specified using  
 652 the three-factor ESEM framework. As the test of an ESEM factor structure resulted in a  
 653 negative residual variance for an item of the BPNSFS, its subscales were specified as six  
 654 CFA factors. Athlete outcomes were individual subscales from measures of athlete  
 655 engagement, burnout, and cognitive interference, and were, hence, estimated as single-factor  
 656 CFAs each. Items were used as factor indicators. All analyses were conducted in Mplus 8.0.

657 **Results and Discussion**

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

661 **Scale Structure, Reliability and Discriminant Validity Evidence**

662 The three-factor ESEM model was found to demonstrate good fit to the data [ $\chi^2$  (168)  
 663 = 281.747,  $p < .001$ , CFI = .95, TLI = .93, RMSEA = .04 (90% CI .03 -.05), SRMR = .03].  
 664 Standardized factor loadings were significant and ranged between .40 and .94. One item of  
 665 the need indifference subscale (“My coach is unresponsive to my opinions”) demonstrated a  
 666 significant cross-loading of .24 on the need thwarting factor. However, as this value was  
 667 smaller than its factor loading on its intended subscale (.40), along with it conceptually being  
 668 better representative of need indifference, we retained this item. Factor correlations between  
 669 need thwarting and need supportive behaviors, need supportive and need indifferent  
 670 behaviors, and between need thwarting and need indifferent behaviors were -.67, -.58, and  
 671 .53, respectively. Estimates of internal consistency were acceptable (.77 - .88) for all three  
 672 subscales. Standard factor loadings, cross-loadings, item means, standard deviations,  
 673 skewness, kurtosis, factor correlations, and internal consistency estimates are reported in  
 674 Table 6.

675 <Insert Table 6 here>

676 **SEM**

677 First, we conducted a correlational analysis to explore the associations between the  
 678 three subscales of the TMIB-C, six subscales of the BPNSFS, and athlete outcomes (see  
 679 Table 7). We then examined the relations between the three broad interpersonal behaviors  
 680 and three athlete outcomes. Model fit was acceptable [ $\chi^2$  (541) = 881.96,  $p < .001$ , CFI = .95,  
 681 TLI = .94, RMSEA = .04 (90% CI .04 - .05), SRMR = .04]. Significant standardized path  
 682 coefficients for the structural portion of the model are reported in Figure 1. As expected,

683 perceived need support predicted dedication, and perceived need thwarting predicted  
684 exhaustion. Also, as expected, need indifference was the only significant predictor of  
685 irrelevant thoughts. Surprisingly, it was also as good predictor of exhaustion, as need  
686 thwarting was.

687 <Insert Table 7 here>

688 <Insert Figure 1 here>

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

694 <Insert Figure 2 here>

695 We focus our description on the paths between the interpersonal behaviors and the  
696 psychological needs, as the relations between the needs and the outcomes are irrelevant for  
697 the purposes of our study. As hypothesized, perceived need support predicted the satisfaction  
698 of all three needs in a significant manner. In contrast, perceived need thwarting predicted the  
699 frustration of all three needs. Perceived need indifference predicted autonomy frustration and  
700 competence frustration, but not as strongly as need thwarting did. Contrary to what was  
701 hypothesized, perceived need indifference predicted relatedness frustration better than  
702 perceived need thwarting.

## 703 **General Discussion**

704 In this three-study paper, we made a case for coach indifferent behaviors and  
705 presented the a) conceptual rationale for, b) development of, and c) initial validity evidence  
706 for a new SDT-based measure assessing athletes' perceptions of their coaches' need



707 supportive, thwarting, and indifferent interpersonal behaviors. These studies provide  
708 preliminary evidence regarding the dimensionality, reliability, discriminant validity of the  
709 TMIB-C, and nomological network of constructs surrounding its subscales.

#### 710 **Factorial Validity Evidence**

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

716 This finding is not surprising, as the sub-dimensions of need support have been  
717 conceptualized as interrelated (Ryan, 1991), and moderately strong correlations have been  
718 observed among them previously (Niemic et al., 2006). The scale development literature is  
719 also rife with examples of researchers adopting a unidimensional approach and combining  
720 autonomy, competence, and relatedness supports into a single factor of need support in  
721 settings such as health care (Williams et al., 1996), exercise (Markland & Tobin, 2010),  
722 medical education (Gucciardi et al., in press), and work (Tavfelin & Stenling, 2018). In the  
723 context of sport, Stenling, Ivarsson, Hassmen, and Lindwall (2015) recently re-examined the  
724 dimensionality of the ISS-C (Wilson et al. 2009), and showed that the items of this measure  
725 are best represented by the general dimension of need support, instead of need specific sub-  
726 dimensions. Our unidimensional approach is also in line with recent SDT reviews (e.g., Deci,  
727 Olafsen & Ryan, 2017), which bear references to overall “need supportive” and “need  
728 thwarting” environments, without often referring to need-specific dimensions.

729 At the level of the personal experience of the needs, Proposition IV within the Basic  
730 Psychological Needs Theory (BPNT) of SDT states that “Basic need satisfactions of

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

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

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

755 variables in studies testing nomological networks (e.g., contextual variables, psychological  
 756 need states, motivation regulations, and indices of athlete cognition, behavior, and affect).

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

#### 765 **Evidence for Nomological Network**

766 In terms of the relations between interpersonal behaviors and athlete outcomes,  
 767 athletes who perceived that their coaches used a high level of need supportive strategies were  
 768 more likely to report dedication to their sport. Athletes will potentially want to devote more  
 769 time and energy to pursue their sport-relevant objectives if they perceive their coaches are  
 770 able to provide them with personally relevant choices, genuinely appreciate the effort and  
 771 hard work they put into training, and accept them in an unconditional manner. Dedication has  
 772 previously been examined as a part of athlete engagement (Lonsdale, Hodge, & Jackson,  
 773 2007); perceived coach interpersonal behaviors have been found to correlate with athlete  
 774 engagement (Curran, Hill, Hall, & Jowett, 2014; Curran, Hill, Ntoumanis, Hall, & Jowett,  
 775 2016).

776 We also found that athletes who perceived their coaches as need thwarting were more  
 777 likely to report emotional and physical exhaustion in their sport. Experiencing active dislike,  
 778 disparaging critique, and excessive control from the coach in an environment that is already

779 physically and emotionally taxing, would potentially put athletes at risk of feeling fatigued.  
780 Exhaustion has been conceptualized to be a core dimension of athlete burnout (Gustafsson,  
781 Kenttä, & Hassmén, 2011), and researchers have previously found coach interpersonal  
782 behaviors to be associated with athlete burnout (e.g., Barcza-Renner, Eklund, Morin, &  
783 Habeeb, 2016).

784 Finally, athletes who perceived their coaches as need indifferent were likely to report  
785 sport irrelevant thoughts. On experiencing indifferent interpersonal behaviors consisting of  
786 the coach being aloof, disorganized, or impassive to their opinions, athletes may come to be  
787 aware of the disconnection between their psychological needs and the activity at hand. Thus,  
788 they might (cognitively and/or behaviorally) disengage from it, and instead engage in other  
789 activities that may potentially be more relevant to their needs (for example, thinking about  
790 friends). Unexpectedly, we also found that need indifferent coaching predicted feelings of  
791 exhaustion. Perhaps on experiencing such coaching behaviors, athletes may also be  
792 convinced that they have been left on their own accord, and need to take charge of their own  
793 training. Athletes without appropriate guidance from the coach may resort to training  
794 inappropriately, overtraining, or not resting sufficiently, thus potentially predisposing  
795 themselves to exhaustion.

796 With regards to the relations between coaches' interpersonal behaviors and athletes'  
797 need states, in line with our expectations and findings of previous research (e.g., Pulido et al.,  
798 2018; Rocchi et al., 2017), athletes who perceived their coaches as need supportive were  
799 more likely to report autonomy, competence, and relatedness need satisfaction. Athletes who  
800 perceived their coaches to be need thwarting were more likely to experience autonomy,  
801 competence, and relatedness need frustration. Athletes who perceived their coaches to be  
802 need indifferent were also likely to experience autonomy and competence need frustration,  
803 but to a lesser extent as compared to perceived need thwarting coaching.

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

812 In sum, in terms of evidence of nomological networks, our findings were somewhat  
813 mixed. As expected, need indifference was a weaker predictor of autonomy and competence  
814 need frustration, and the sole significant predictor of irrelevant thoughts, however,  
815 unexpectedly, need indifference was as good as or better predictor than need thwarting was of  
816 exhaustion and relatedness need frustration, respectively.

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

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

828 Ideographic methods (e.g., “think aloud” protocols) with athletes could provide  
829 valuable insights into what criteria they use to distinguish perceptions of need indifference  
830 from those of need support, and need thwarting, and the stability of such criteria under  
831 different contexts and time periods. The identification of a third class of coaching behaviors  
832 could help provide more targeted intervention approaches to reduce their occurrence. Future  
833 research could also examine the antecedents of coach interpersonal behaviors. Examinations  
834 of the differential antecedents of the three behaviors may help provide insight into what  
835 drives coaches to adopt such behaviors. For example, Cheon et al. (2019) posited that social  
836 agents adopt indifferent interpersonal behaviors because they are more attentive to their own  
837 needs and goals over those of others. In addition, it would be interesting to examine if  
838 different analytical methods such as multidimensional scaling (e.g., Tucker-Drob &  
839 Salthouse, 2009), and item response theory (e.g., Courvoisier & Etter, 2008) might be more  
840 appropriate to capture the multi-faceted nature of the need-specific coaching behaviors.  
841 Lastly, researchers could test the applicability of the items (or slight modifications of them)  
842 as well as the replication of our results in other domains such as healthcare, work, and  
843 education. We hope this tripartite conceptualization and measurement can further advance  
844 conceptual understanding and intervention efforts on interpersonal behaviors in sport and  
845 potentially other life domains.

846 References

- 847 Adie, J., Duda, J. L., & Ntoumanis, N. (2008). Autonomy support, basic need satisfaction and  
848 the optimal functioning of adult male and female sport participants: A test of basic  
849 needs theory. *Motivation and Emotion*, *32*, 189-199. doi:  
850 0.1016/j.psychsport.2011.07.008
- 851 Adie, J., Duda, J. L., & Ntoumanis, N. (2012). Perceived coach autonomy support, basic need  
852 satisfaction and the well- and ill-being of elite youth soccer players: A longitudinal  
853 investigation. *Psychology of Sport and Exercise*, *13*, 51-59. doi:  
854 10.1016/j.psychsport.2011.07.008
- 855 Aelterman, N. Vansteenkiste, M., Soenens, B., Fontaine, J., Haerens, L., & Reeve, J. (2018).  
856 Towards a fine-grained understanding of need-supportive and need-thwarting  
857 teaching: The merits of a gradual approach. *Journal of Educational Psychology*.  
858 Advance online publication. doi: 10.1037/edu0000293
- 859 American Educational Research Association (AERA), American Psychological Association  
860 (APA), & National Council on Measurement in Education (NCME). (2014).  
861 *Standards for educational and psychological testing*. Washington, DC: American  
862 Educational Research Association.
- 863 Amorose, A. J., & Anderson-Butcher, D. (2007). Autonomy-supportive coaching and self-  
864 determined motivation in high school and college athletes: A test of self-  
865 determination theory. *Psychology of Sport and Exercise*, *8*, 654-670.  
866 doi:10.1016/j.psychsport.2006.11.003
- 867 Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural*  
868 *Equation Modeling: A Multidisciplinary Journal*, *16*, 397-438. doi:  
869 10.1080/10705510903008204

- 870 Bandalos, D. L. (2014). Relative performance of categorical diagonally weighted least  
871 squares and robust maximum likelihood estimation. *Structural Equation Modeling*,  
872 *21*, 102-116. doi: 10.1080/10705511.2014.859510
- 873 Barcza-Renner, K., Eklund, R. C., Morin, A. J., & Habeeb, C. M. (2016). Controlling  
874 coaching behaviors and athlete burnout: Investigating the mediating roles of  
875 perfectionism and motivation. *Journal of sport & exercise psychology*, *38*, 30-44. doi:  
876 10.1123/jsep.2015-0059
- 877 Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C.  
878 (2011). Self-determination theory and diminished functioning: the role of  
879 interpersonal control and psychological need thwarting. *Personality and Social*  
880 *Psychology Bulletin*, *37*, 1459-1473. doi: 10.1123/jsep.32.2.193
- 881 Bartholomew, K. J., Ntoumanis, N., Thøgersen-Ntoumani, C. (2010). The controlling  
882 interpersonal Style in a coaching context: Development and initial validation of a  
883 psychometric scale. *Journal of Sport and Exercise Psychology*, *32*, 193-216. doi:  
884 10.1177/0146167211413125
- 885 Brown, T. A. (2015). *Methodology in the social sciences. Confirmatory factor analysis for*  
886 *applied research (2nd ed.)*. New York, NY, US: Guilford Press.
- 887 Browne, M. (2001). An overview of analytic rotation in exploratory factor analysis.  
888 *Multivariate Behavioral Research*, *36*, 111–150. doi:  
889 10.1207/S15327906MBR3601\_05
- 890 Cain, M. K., Zhang, Z., Yuan, K.-H. (2017). Univariate and multivariate skewness and  
891 kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior*  
892 *Research Methods*, *49*, 1716-1735. doi:10.3758/s13428-016-0814-1
- 893 Chen, F. F., Hayes, A., Carver, C. S., Laurenceau, J. P., & Zhang, Z. (2012). Modeling  
894 general and specific variance in multifaceted constructs: A comparison of the bifactor



- 895 model to other approaches. *Journal of Personality*, 80, 219-251. doi: 10.1111/j.1467-  
896 6494.2011.00739.x
- 897 Chen, B., Mouratidis, A., Ryan, R. M., Sheldon, K.M., Soenens, B., Van Petegem, S. &  
898 Verstuyf, J., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-  
899 Deeder, J., Duriez, B., Lens, W., & Matos, L. (2015). Basic psychological need  
900 satisfaction, need frustration, and need strength across four cultures. *Motivation and*  
901 *Emotion*, 39, 216-236. doi: 10.1007/s11031-014-9450-1
- 902 Cheon, S. H., Reeve, J., Lee, J., & Lee, Y. (2015). Giving and receiving autonomy support in  
903 a high-stakes sport context: A field-based experiment during the 2012 London  
904 Paralympic Games. *Psychology of Sport and Exercise*, 19, 1-11. doi:  
905 10.1016/j.psychsport.2015.02.007
- 906 Cheon, S. H., Reeve, J., Lee, Y., Ntoumanis, N., Gillet, N., Kim, B. R., & Song, Y.-G.  
907 (2019). Expanding autonomy psychological need states from two (satisfaction,  
908 frustration) to three (dissatisfaction): a classroom-based intervention study. *Journal of*  
909 *Educational Psychology*, 11, 685-702. doi: 10.1037/edu0000306
- 910 Clark, L. A., & Watson, D. (2019). Constructing validity: New developments in creating  
911 objective measuring instruments. *Psychological Assessment*. Advance online  
912 publication. doi: 10.1037/pas0000626
- 913 Comrey, A. L., & Lee, H. B. (1992). A first course in factor analysis. Hillsdale, NJ: Erlbaum.
- 914 Courvoisier, D., & Etter, J.-F. (2008). Using item response theory to study the convergent  
915 and discriminant validity of three questionnaires measuring cigarette dependence.  
916 *Psychology of Addictive Behaviors*, 22, 391-401. doi: 10.1037/0893-164X.22.3.391
- 917 Curran, T., Hill, A. P., Hall, H. K., & Jowett, G. E. (2014). Perceived coach behaviors and  
918 athletes' engagement and disaffection in youth sport: The mediating role of the

- 919 psychological needs. *International Journal of Sport Psychology*, 45, 559–580. doi:  
920 10.7352/IJSP2014.45.559
- 921 Curran T., Hill A. P., & Niemiec C. P. (2013). A conditional process model of children's  
922 behavioral engagement and behavioral disaffection in sport based on self-  
923 determination theory. *Journal of Sport and Exercise Psychology*, 35, 30-43. doi:  
924 10.1123/jsep.35.1.30
- 925 Curran, T, Hill, A. P., Ntoumanis, N., Hall, H. K., & Jowett, G. E. (2016). A three-wave  
926 longitudinal test of self-determination theory's mediation model of engagement and  
927 disaffection in youth sport. *Journal of Sport and Exercise Psychology*, 38, 15-29. doi:  
928 10.1123/jsep.2015-0016
- 929 Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-determination theory in work  
930 organizations: The state of a science. *Annual Review of Organizational Psychology*  
931 *and Organizational Behavior*, 4, 19-43. doi: 10.1146/annurev-orgpsych-032516-  
932 113108
- 933 Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human*  
934 *behavior*. New York: Plenum Press.
- 935 Delrue, J., Reynders, B., Vande Broek, G., Aelterman, N., De Backer, M., Decroos, S., De  
936 Muynck, G.-J., Fontaine, J., Franssen, K., van Puyenbroeck, S., Haerens, L., &  
937 Vansteenkiste, M. (2019). Adopting a helicopter-perspective towards motivating and  
938 demotivating coaching: A circumplex approach, *Psychology of Sport and Exercise*,  
939 40, 110-126. doi: 10.1016/j.psychsport.2018.08.008
- 940 DeVellis, R.F. (2012). *Scale development: Theory and applications* (3rd ed.). Thousand  
941 Oaks, CA: SAGE.

- 942 Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-  
943 regulation and competence: A social contextual perspective. *Journal of Educational*  
944 *Psychology, 81*, 143-154. doi: 10.1037/0022-0663.81.2.143
- 945 Gucciardi, D.F., Weixian, J. C., Gibson, W., Ntoumanis, N., & Ng, L. (in press).  
946 Motivational climate in the classroom: Factorial and convergent validity evidence of  
947 the Need Support Behaviors Scale with health science students. *European Journal of*  
948 *Psychological Assessment*.
- 949 Gustafsson, H., Kenttä, G., & Hassmén, P. (2011). Athlete burnout: An integrated model and  
950 future research directions. *International Review of Sport and Exercise Psychology, 4*,  
951 3–24. doi: 10.1080/1750984X.2010.541927
- 952 Haerens, L., Vansteenkiste, M., De Meester, A., Delrue, J., Tallir, I., Vande Broek, G., Goris,  
953 W., & Aelterman, N. (2018). Different combinations of perceived autonomy support  
954 and control: identifying the most optimal motivating style. *Physical Education and*  
955 *Sport Pedagogy, 23*, 16–36. doi: 10.1080/17408989.2017.1346070
- 956 Hancox, J. E., Quested, E., Thøgersen-Ntoumani, C., & Ntoumanis, N. (2015). An  
957 intervention to train group exercise class instructors to adopt a motivationally  
958 adaptive communication style: a quasi-experimental study protocol. *Health*  
959 *Psychology and Behavioral Medicine, 3*, 190-203. doi:  
960 10.1080/21642850.2015.1074075
- 961 Hatzigeorgiadis, A., & Biddle, S. J. H. (2001). Athletes' perceptions of how cognitive inter-  
962 ference during competition influences concentration and effort. *Anxiety, Stress and*  
963 *Coping, 14*, 411–429. doi: 10.1080/10615800108248364
- 964 Holzinger, K. J., & Swineford, S. (1937). The bifactor method. *Psychometrika, 2*, 41–54. doi:  
965 10.1123/tsp.23.2.186

- 966 Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling:  
967 Guidelines for determining model fit. *The Electronic Journal of Business Research*  
968 *Methods*, 6, 53 – 60.
- 969 Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure  
970 analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*,  
971 6, 1-55. doi: 10.1080/10705519909540118
- 972 Hurley, A., Scandura, T., Schriesheim, C., Brannick, M., Seers, A., Vandenberg, R., &  
973 Williams, L. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues,  
974 and alternatives. *Journal of Organizational Behaviour*, 18, 667-683. doi:  
975 10.1002/(SICI)1099-1379(199711)18:6<667::AID-JOB874>3.0.CO;2-T
- 976 John, O., & Benet-Martínez, V. (2000). Measurement: reliability, construct validation, and  
977 scale construction. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods*  
978 *in social and personality psychology* (pp. 339-369): Cambridge University Press.
- 979 Katz, I., & Assor, A. (2007). When choice motivates and when it does not. *Educational*  
980 *Psychology Review*, 19, 429-442. doi: 10.1007/s10648-006-9027-y
- 981 Kinnafick, F. E., Thøgersen-Ntoumani, C., & Duda, J. (2016). The effect of need supportive  
982 text messages on motivation and physical activity behaviour. *Journal of Behaviour*  
983 *Medicine*, 39, 574-586. doi: 10.1007/s10865-016-9722-1
- 984 Lonsdale, C., Hodge, K., & Jackson, S. (2007). Athlete engagement: II. Development and  
985 initial validation of the Athlete Engagement Questionnaire. *International Journal of*  
986 *Sport Psychology*, 38, 471-492. doi: 10.1037/t50268-000
- 987 Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*,  
988 35, 382-385.
- 989 Mageau, G. A., & Vallerand, R. J. (2003). The coach–athlete relationship: a motivational  
990 model. *Journal of Sports Sciences*, 21, 883-904. doi: 10.1080/0264041031000140374

- 991 Markland, D., Tobin, V. J. (2010). Need support and behavioural regulations for exercise  
992 among exercise referral scheme clients: The mediating role of psychological need  
993 satisfaction. *Psychology of Sport and Exercise, 11*, 91-99. doi:  
994 10.1016/j.psychsport.2009.07.001
- 995 Marsh, H. W., Hau, K.-T., & Grayson, D. (2005). Goodness of fit evaluation in structural  
996 equation modeling. In A. Maydeu-Olivares & J. McArdle (Eds.), *Psychometrics. A*  
997 *Festschrift for Roderick P. McDonald* (pp. 275-340). Hillsdale, NJ: Erlbaum.
- 998 Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In search of golden rules: Comment on  
999 hypothesis-testing approaches to cutoff values for fit indexes and dangers in  
1000 overgeneralizing Hu & Bentler (1999). *Structural Equation Modeling, 11*, 320-341.  
1001 doi: 10.1207/s15328007sem1103\_2
- 1002 Masser, M., & Creed, L., (1976). The greatest love of all [Recorded by Whitney Houston].  
1003 On *Whitney Houston* [CD]. USA: Arista.
- 1004 Matosic, D., Ntoumanis, N., & Quested, E. (2016). Antecedents of need supportive and  
1005 controlling interpersonal styles from a self-determination theory perspective: A  
1006 review and implications for sport psychology research. In M. Raab, P. Wylleman, R.  
1007 Seiler, A. M. Elbe, & A. Hatzigeorgiadis (Eds.), *Sport and exercise psychology*  
1008 *research: From theory to practice* (pp. 145-180). San Diego, CA, US: Elsevier  
1009 Academic Press. doi: 10.1016/B978-0-12-803634-1.00007-8
- 1010 Morin, A. J. S., Arens, A. K., & Marsh, H. W. (2016). A bifactor exploratory structural  
1011 equation modeling framework for the identification of distinct sources of construct-  
1012 relevant psychometric multidimensionality. *Structural Equation Modeling, 23*, 116-  
1013 129. doi: 10.1080/10705511.2014.961800
- 1014 Muthén, L. & Muthén, B. (1998-2017). *Mplus user's guide* (8<sup>th</sup> ed.). Los Angeles, CA:  
1015 Muthén & Muthén.

- 1016 Niemiec, C., Lynch, M., Vansteenkiste, M., Bernstein, J., Deci, E., & Ryan, R. (2006). The  
1017 antecedents and consequences of autonomous self-regulation for college: a self-  
1018 determination theory perspective on socialization. *Journal of Adolescence*, 29, 761–  
1019 775. doi: 10.1016/j.adolescence.2005.11.009
- 1020 Ntoumanis, N., & Mallett, C. (2014). Motivation in sport: A self-determination theory  
1021 perspective. In A. Papaioannou, & D. Hackfort (Eds.), *Routledge companion to sport  
1022 and exercise psychology: Global perspectives and fundamental concepts* (pp. 67-82).  
1023 Taylor and Francis.
- 1024 Ntoumanis, N., Quested, E., Reeve, J., Cheon, S.H. (2018). Need supportive communication:  
1025 Implications for motivation in sport, exercise, and physical activity. In B. Jackson, J.  
1026 A. Dimmock, & J. Compton (Eds.), *Persuasion and communication in sport, exercise,  
1027 and physical activity* (pp.155-169). Abigdon, UK: Routledge.
- 1028 Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York, NY: McGraw-Hill.
- 1029 Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Brière, N. M. (2001). Associations among  
1030 perceived autonomy support, forms of self-regulation, and persistence: A prospective  
1031 study. *Motivation and Emotion*, 25, 279-306. doi: 10.1023/A:1014805132406
- 1032 Polit, E. F., Beck, T. T., & Owen, S.V. (2007). Is the CVI an acceptable indicator of content  
1033 validity? Appraisal and recommendations. *Research in Nursing & Health*, 30, 459-  
1034 467. doi: 10.1002/nur.20199
- 1035 Pulido, J. J., Sánchez-Oliva, D., Leo, F. M., Sánchez-Cano, J., & García-Calvo, T. (2018).  
1036 Development and validation of coaches' interpersonal style questionnaire.  
1037 *Measurement in Physical Education and Exercise Science*, 22, 25-37. doi:  
1038 10.1080/1091367X.2017.1369982
- 1039 Quested, E., Bosch, J. A., Burns, V. E., Cumming, J., Ntoumanis, N., & Duda, J. L. (2011).  
1040 Basic psychological need satisfaction, stress-related appraisals, and dancers' cortisol

- 1041 and anxiety responses. *Journal of Sport and Exercise Psychology*, 33, 828–846. doi:  
1042 10.1123/jsep.33.6.828
- 1043 Quested, E., Ntoumanis, N., Stenling, A., Thøgersen-Ntoumani, C., & Hancox, J. E. (2018).  
1044 The Need-Relevant Instructor Behaviours Scale (NIBS): Development and initial  
1045 validation. *Journal of Sport and Exercise Psychology*, 40, 259-268. doi:  
1046 10.1123/jsep.2018-0043
- 1047 Raedeke, T.D., & Smith, A.L. (2001). Development and preliminary validation of an athlete  
1048 burnout measure. *Journal of Sport and Exercise Psychology*, 23, 281-306. doi:  
1049 10.1123/jsep.23.4.281
- 1050 Ramis, Y., Torregrosa, M., Viladrich, C., & Cruz, J. (2017). The effect of coaches'  
1051 controlling style on the competitive anxiety of young athletes. *Frontiers in*  
1052 *psychology*, 8, 572. doi: 10.3389/fpsyg.2017.00572
- 1053 Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied*  
1054 *Psychological Measurement*, 21, 173-184. doi: 10.1177/01466216970212006
- 1055 Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how  
1056 they can become more autonomy supportive. *Educational Psychologist*, 737, 44, 159-  
1057 175. doi: 10.1080/00461520903028990
- 1058 Reise, S. P. (2012). Invited paper: The rediscovery of bifactor measurement models.  
1059 *Multivariate Behavioral Research*, 47, 667–696. doi: 10.1080/00273171.2012.715555
- 1060 Rhemtulla, M., Brosseau-Laird, P. E., & Savalei, V. (2012). When can categorical variables  
1061 be treated as continuous? A comparison of robust continuous and categorical SEM  
1062 estimation methods under suboptimal conditions. *Psychological Methods*, 17, 354-  
1063 373. doi: 10.1037/a0029315

- 1064 Rocchi, M., Pelletier, L., & Desmarais, P. (2017). The validity of the Interpersonal  
1065 Behaviours Questionnaire (IBQ) in sport. *Measurement in Physical Education and*  
1066 *Exercise Science, 21*, 15-25. doi: 10.1080/1091367X.2016.1242488
- 1067 Ryan, R. M. (1991). The nature of the self in autonomy and relatedness. In: J. Strauss & G.R.  
1068 Goethals (Eds), *The self: Interdisciplinary approaches* (pp. 208-238). Springer, New  
1069 York, NY. doi: 10.1007/978-1-4684-8264-5\_11
- 1070 Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory. Basic psychological needs in*  
1071 *motivation, development and wellness*. New York, NY: Guilford Press.
- 1072 Sheldon, K. M., & Filak, V. (2008). Manipulating autonomy, competence and relatedness  
1073 support in a game-learning context: New evidence that all three needs matter. *British*  
1074 *Journal of Social Psychology, 47*, 267-283. doi: 10.1348/014466607X238797
- 1075 Skinner, E., Johnson, S., & Snyder, T. (2005). Six dimensions of parenting: A motivational  
1076 model. *Parenting: Science and Practice, 5*, 175-235. doi:  
1077 10.1207/s15327922par0502\_3
- 1078 Skinner, E. A., Wellborn, J. G., Regan, C. (1986). *The Parents as Social Context*  
1079 *Questionnaire (PASCQ): Parent and child-reports of parent involvement, structure,*  
1080 *and autonomy support*. (Tech Rep.). Rochester, NY: University of Rochester.
- 1081 Smith, N., Quested, E., Appleton, P. & Duda, J. L. (2016). A review of observational  
1082 instruments to assess the motivational environment in sport and physical education  
1083 settings. *International Review of Sport and Exercise Psychology, 134-159*. doi:  
1084 10.1080/1750984X.2015.1132334
- 1085 Standage, M., Curran, T., & Rouse, P. (2019). Self-determination based theories of sport,  
1086 exercise, and physical activity motivation. In T. S. Horn & A. L. Smith (Eds.),  
1087 *Advances in sport and exercise psychology* (4th ed., pp. 289-311). Champaign, U. S.  
1088 A.: Human Kinetics.



- 1089 Stenling, A., Ivarsson, A., Hassmen, P., & Lindwall, M. (2015). Using bifactor exploratory  
1090 structural equation modeling to examine global and specific factors in measures of  
1091 sports coaches' interpersonal styles. *Frontiers in Psychology, 6*, 1-12. doi: doi:  
1092 10.3389/fpsyg.2015.01303
- 1093 Tabachnick, B. G. & Fidell, L. S. (2012). *Using multivariate statistics* (6th ed.). Boston, MA:  
1094 Pearson.
- 1095 Tafvelin, S., & Stenling, A. (2018). Development and initial validation of the Need  
1096 Satisfaction and Need Support at Work Scales: A validity-focused approach.  
1097 *Scandinavian Journal of Work and Organizational Psychology, 3*, 1–14. doi:  
1098 10.16993/sjwop.30
- 1099 Tessier, D., Sarrazin, P., & Ntoumanis, N. (2008). The effect of an experimental program to  
1100 support students' autonomy on the overt behaviours of physical education teachers.  
1101 *European Journal of Psychology of Education, 23*, 239-253. doi:  
1102 10.1007/BF03172998
- 1103 Tucker-Drob, E. M., & Salthouse, T. A. (2009). Confirmatory factor analysis and  
1104 multidimensional scaling for construct validation of cognitive abilities. *International*  
1105 *Journal of Behavioral Development, 33*, 277-285. doi: 10.1177/0165025409104489
- 1106 Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic  
1107 psychological need satisfaction and need frustration as a unifying principle. *Journal of*  
1108 *Psychotherapy Integration, 23*, 263-280. doi: 10.1037/a0032359
- 1109 Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996).  
1110 Motivational predictors of weight loss and weight-loss maintenance. *Journal of*  
1111 *Personality and Social Psychology, 70*, 115-126. doi: 10.1037/0022-3514.70.1.115

- 1112 Wilson, P. M., Gregson, J. P., & Mack, D. E. (2009). The importance of interpersonal style in  
1113 competitive sport: a self-determination theory approach. In C. H. Chang (Ed.),  
1114 *Handbook of sport psychology* (pp. 259-276). Hauppauge, NY; Nova Science.

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1115 Footnotes

1116 1. The other 10 models were also re-run with these 22 items. Although the CFA  
1117 models with nine-factor solutions reached acceptable fit indices, they were rejected on the  
1118 basis of lack of sufficient items per factor. The three-factor CFA also demonstrated good fit,  
1119 however, the three-factor ESEM model was preferred as it yielded lower factor correlations.  
1120 The rest of the models did not converge or demonstrated poor standard factor loadings or  
1121 multiple large unintended cross-loadings.

1122 2. Similar to Study 2, we re-tested all other factor models. Yet again, a model with  
1123 acceptable fit for the nine coach interpersonal behaviors (Model 3) was rejected on the basis  
1124 of lack of sufficient items per factor. The three-factor CFA (Model 1) demonstrated good  
1125 model to data fit, however, factor correlations were higher than those for the three-factor  
1126 ESEM model. Most of the other models (e.g., Models 4, 6, 7, 8, 9, 10, 11) did not converge.  
1127 Model 12 (bifactor one-G, three-S) also demonstrated good model-to-data fit, however, yet  
1128 again, the S-factor for need thwarting was problematic, with only two items that had  
1129 significant intended factor loadings.

Table 1

*Initial Definitions for Nine Dimensions of Coach Behaviors (to Facilitate) Item Creation*

Coach Behaviors	Initial definitions
Autonomy Supportive	Autonomy supportive behaviors 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 behaviors 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* behaviors on part of the coach involve negligence or inattention towards athletes' perspectives and their inner motivational resources.
Competence Supportive	Competence supportive behaviors 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 behaviors on part of the coach entail communicating incompetence to the athletes, doubting their improvements, and highlighting their faults (Sheldon & Filak, 2008).

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Competence Indifferent	Competence neglecting behaviors 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 behaviors on part of the coach involve fostering a sense of connectedness with the athletes (Vansteenkiste, Niemiec, & Soenens, 2010).
Relatedness Thwarting	Relatedness thwarting behaviors on part of the coach entail active dislike or hostility towards the athletes (Skinner, Johnson, & Snyder, 2005).
Relatedness Indifferent	Relatedness neglecting behaviors 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 behaviors. It was, however, later changed to “indifferent”.

Table 2

*Goodness-of-Fit Statistics for Alternative CFA and ESEM 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]

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*Note:*  $\chi^2$  = Chi-square test of exact fit. *df* = degrees of freedom. *p* = probability. CFI = Comparative Fit Index. TLI = Tucker–Lewis index. SRMR = Standardized 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 modeling. 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

Table 3

Subscales	$\chi^2$	<i>df</i>	<i>p</i>	CFI	TLI	SRMR	RMSEA [90% CI]
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*Initial and Final Model Fit (Study 2)*



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 modeling. G-factor = global factor estimated as part of a bifactor model. S-factor = specific factor estimated as part of a bifactor model.

Table 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>								
Need supportive behaviors								
Takes interest in my welfare. (R)	<b>.75***</b>			.09	5.73	1.29	-1.42	2.55
Shows that he/she understands my perspective. (A)	<b>.85***</b>			.07	5.47	1.23	-0.92	1.08
Ensures that tasks are suited to my skill level. (C)	<b>.77***</b>			.09	5.61	1.33	-1.21	1.56
Accepts me. (R)	<b>.48***</b>			.13	6.17	1.07	-1.46	2.16
Encourages me to take my own initiative. (A)	<b>.67***</b>			.10	5.87	1.17	-1.15	1.29
Shows care and concern. (R)	<b>.57***</b>		-.22*	.10	5.94	1.24	-1.37	1.76
Explains the reasons when he/she asks me to do something. (A)	<b>.55***</b>			.11	5.69	1.39	-1.31	1.54
Recognizes my efforts and accomplishments. (C)	<b>.67***</b>			.09	5.80	1.20	-1.18	1.45
Need thwarting behaviors								

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
Deliberately ignores me. (R)		<b>.66***</b>		.10	1.59	1.35	2.61	6.11
Makes it clear that I have little to contribute. (C)		<b>.53***</b>		.11	1.65	1.34	2.45	5.65
Tries to control everything I do. (A)		<b>.67***</b>		.08	1.63	1.18	2.31	5.31
Dismisses my opinion. (A)		<b>.65***</b>		.10	1.54	1.18	2.69	7.25
Blames me when things don't go well. (C)		<b>.70***</b>		.10	1.54	1.20	2.50	5.77
Makes it clear that he/she doesn't like me. (R)		<b>.86***</b>		.08	1.27	.90	4.00	16.76
Uses guilt tactics to control what I do. (A)		<b>.88***</b>		.08	1.35	.92	3.31	11.80
Belittles my abilities. (C)		<b>.84***</b>		.07	1.45	1.08	2.91	8.77
Need indifferent behaviors								
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

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
Can be disorganized. (C)			<b>.61***</b>	.12	2.24	1.52	1.19	.62

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

Table 5

*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. \*\* $p < .001$ .

Table 6

*Factor Loadings, Standard Errors, Means, SDs, Kurtosis and Skewness for the TMIB-C Items (Study3)*

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

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
<i>STEM: My coach...</i>								
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
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 disorganized			<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
Factor Correlations and Internal Consistency	1	2	3					

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
<i>STEM: My coach...</i>								
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 behaviors, NT = need thwarting behaviors, NI = need indifferent behaviors. Raykov's composite reliability coefficients are presented on the diagonal of the correlation matrix.



Table 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 indifference, 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).

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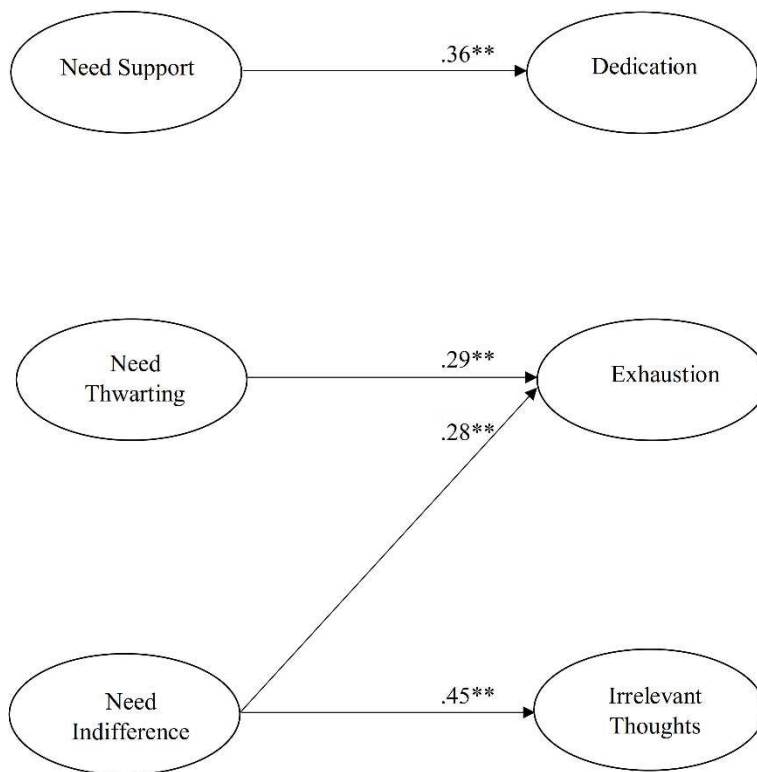


Figure 1. SEM with need supportive, thwarting, and indifferent interpersonal behaviors, and dedication, exhaustion, and irrelevant thoughts.

Note. \*\* $p < .01$ . Only significant structural paths are reported for simplicity purposes.

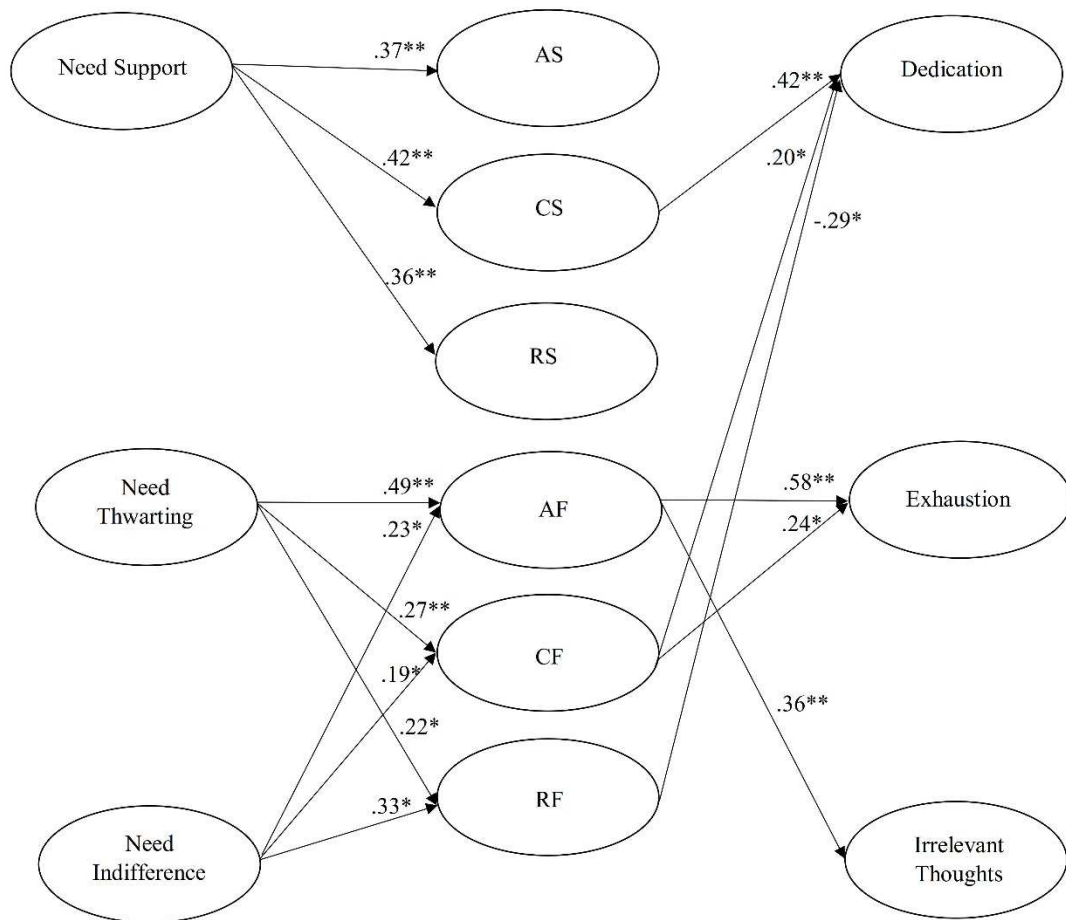


Figure 2. SEM with need supportive, thwarting, and indifferent interpersonal behaviors, six dimensions of the need states, dedication, exhaustion, and irrelevant thoughts

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

**Highlights**

- Interpersonal behaviors were classified as need supportive, thwarting, and indifferent.
- A new tripartite measure of coach interpersonal behaviours was developed.
- A 22-item three-factor ESEM solution provided the best fit to the data.
- Need indifference was operationally distinguished from need support, and need thwarting.
- Distinct predictive value of the three interpersonal behaviours is discussed.

**AUTHOR DECLARATION**

Declarations of interest:

Prof. Nikos Ntoumanis is one of the Editors-in-Chief of PSE. However, he had no involvement in any aspect of the review process for this paper.

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