

A TRIPARTITE MEASURE OF COACH INTERPERSONAL BEHAVIORS

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Conceptualizing and Testing a New Tripartite Measure of Coach Interpersonal Behaviors

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Behaviors

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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 coaching
18 environment that actively thwarts (vs. is indifferent to) athletes' needs. In this three-study
19 paper, we outline the conceptual rationale for, the development of, and initial validity evidence
20 for a tripartite (need supportive, thwarting, and indifferent) measure of interpersonal behaviors
21 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 standardized
30 factor loadings, factor correlations in the expected directions, and acceptable estimates of
31 internal consistency. This model was replicated in Study 3. Tests of nomological networks
32 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 predictor
34 of irrelevant thoughts. Unexpectedly however, need indifference, when compared to need

35 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, Regan, & Wellborn, 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, Curran, & Rouse, 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 Supplementary File 1). Items of these
315 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

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 χ^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 (ρ ; 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 items¹. 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; Sánchez-Oliva, Pulido-González, Leo,
567 González-Ponce, & García-Calvo, 2017), we expected that sport dedication would be best
568 predicted by need support. Exhaustion is a negative outcome that should be best predicted by
569 need thwarting as it is an intensely adverse (“darker”) outcome. Irrelevant thoughts is also a
570 negative outcome but not as strongly adverse as exhaustion, and would be best predicted by
571 need indifference. We used outcomes that have commonly been used before (e.g., dedication,
572 exhaustion), but also measures that haven’t been examined in the SDT literature (e.g.,
573 irrelevant thoughts).

574 **Method**

575 **Participants**

576 The sample ($N = 352$) consisted of 169 female and 183 male competitive athletes,
577 with an average age of 20.02 years ($SD = 5.88$). Athletes represented individual ($n = 76$) and
578 team ($n = 276$) sports such as athletics, cycling, AFL, and netball. Most of the athletes were
579 Australian ($n = 280$), and the remainder ($n = 72$) reported their ethnicities as European, South
580 African, British, etc. Athletes were competitive at the club ($n = 159$), state ($n = 98$), national
581 ($n = 62$), or international ($n = 33$) level. They had been competing in their respective sports
582 for an average of 8.74 years ($SD = 4.81$), and had been training with their respective main
583 coaches for an average of 2.31 years ($SD = 2.26$) on an average of 3.08 times per week ($SD =$
584 1.75).

585 **Procedure**

586 We recruited athletes using a procedure similar to that in Studies 1 and 2.
587 Additionally, the questionnaire was made available online on the Qualtrics platform and was
588 advertised through social media. All participating athletes were eligible to go in to a prize
589 draw to win shopping vouchers. Undergraduate student-athletes ($n = 5$) at the School of
590 Psychology at the first author's university were offered course credit for participation.

591 **Measures**

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

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

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

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

616 **Positive and Negative Athlete Outcomes.** The dedication subscale of the Athlete
617 Engagement Questionnaire (Lonsdale, Hodge, & Jackson, 2007) was employed as a positive
618 athlete outcome. The subscale consists of four items, to which participants responded using a
619 5-point rating scale (1 = *almost never*, 5 = *almost always*). An example item is “I am
620 determined to achieve my goals in sport”. Fit for the single-factor CFA model was excellent
621 [$\chi^2(2) = 4.650, p < .001, CFI = .99, TLI = .99, RMSEA = .06$ (90% CI .00 - .14), SRMR =
622 .06]. Raykov’s composite reliability coefficient for the subscale was .95.

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

630 Finally, the five-item irrelevant thoughts subscale of the Thought Occurrence
631 Questionnaire for Sport (TOQS; Hatzigeorgiadis & Biddle, 2000) was used to assess
632 cognitive interference (a “less dark” negative outcome). Participants responded to
633 experiencing sport irrelevant thoughts about, for example, “Friends”, “Personal worries (e.g.,

634 school, work, relations)", etc. using a 7-point response format (1 = *never*, 7 = *very often*). Fit
635 for the single-factor CFA model was excellent [$\chi^2(5) = 21.449, p < .001, CFI = .97, TLI =$
636 $.95, RMSEA = .08$ (90% CI .06 - .14), SRMR = .03]. Raykov's composite reliability
637 coefficient for the subscale was .92.

638 **Data Analyses**

639 **Scale structure, reliability, and discriminant validity evidence.** The three factor
640 ESEM model was re-tested² to assess the degree to which the factorial structure held when
641 examined with a new sample of athletes. Similar to Study 2, model-to-data fit was determined
642 using a multi-faceted approach. Raykov's composite reliability coefficient was used as an
643 estimate of internal consistency. An examination of the factor correlations between the three
644 subscales served as evidence for discriminant validity.

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

658

Results and Discussion

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

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

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

676 <Insert Table 6 here>

677 **SEM**

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

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

688 <Insert Table 7 here>

689 <Insert Figure 1 here>

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

695 <Insert Figure 2 here>

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

704 **General Discussion**

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

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

711 **Factorial Validity Evidence**

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

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

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

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

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

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

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

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

766 **Evidence for Nomological Network**

767 In terms of the relations between interpersonal behaviors and athlete outcomes,
768 athletes who perceived that their coaches used a high level of need supportive strategies were
769 more likely to report dedication to their sport. Athletes will potentially want to devote more
770 time and energy to pursue their sport-relevant objectives if they perceive their coaches are
771 able to provide them with personally relevant choices, genuinely appreciate the effort and
772 hard work they put into training, and accept them in an unconditional manner. Dedication has
773 previously been examined as a part of athlete engagement (Lonsdale, Hodge, & Jackson,
774 2007); perceived coach interpersonal behaviors have been found to correlate with athlete
775 engagement (Curran, Hill, Hall, & Jowett, 2014; Curran, Hill, Ntoumanis, Hall, & Jowett,
776 2016).

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

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

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

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

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

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

818 **Limitations, Future Directions, and Conclusions**

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

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

847 References

- 848 Adie, J., Duda, J. L., & Ntoumanis, N. (2008). Autonomy support, basic need satisfaction and
849 the optimal functioning of adult male and female sport participants: A test of basic
850 needs theory. *Motivation and Emotion, 32*, 189-199. doi:
851 0.1016/j.psychsport.2011.07.008
- 852 Adie, J., Duda, J. L., & Ntoumanis, N. (2012). Perceived coach autonomy support, basic need
853 satisfaction and the well- and ill-being of elite youth soccer players: A longitudinal
854 investigation. *Psychology of Sport and Exercise, 13*, 51-59. doi:
855 10.1016/j.psychsport.2011.07.008
- 856 Aelterman, N., Vansteenkiste, M., Soenens, B., Fontaine, J., Haerens, L., & Reeve, J. (2018).
857 Towards a fine-grained understanding of need-supportive and need-thwarting
858 teaching: The merits of a gradual approach. *Journal of Educational Psychology*.
859 Advance online publication. doi: 10.1037/edu0000293
- 860 American Educational Research Association (AERA), American Psychological Association
861 (APA), & National Council on Measurement in Education (NCME). (2014).
862 *Standards for educational and psychological testing*. Washington, DC: American
863 Educational Research Association.
- 864 Amorose, A. J., & Anderson-Butcher, D. (2007). Autonomy-supportive coaching and self-
865 determined motivation in high school and college athletes: A test of self-
866 determination theory. *Psychology of Sport and Exercise, 8*, 654-670.
867 doi:10.1016/j.psychsport.2006.11.003
- 868 Amoura, C., Berjot, S., Gillet, N., Caruana, S., & Finez, L. (2015). Effects of autonomy-
869 supportive and controlling styles on situational self-determined motivation: Some
870 unexpected results of the commitment procedure. *Psychological Reports, 116*, 33-59.
871 doi: 10.2466/14.PR0.116k10w7

- 872 Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural*
873 *Equation Modeling: A Multidisciplinary Journal*, *16*, 397-438. doi:
874 10.1080/10705510903008204
- 875 Balaguer, I., González, L., Fabra, P., Castillo, I., Mercé, J., & Duda, J. L. (2012). Coaches'
876 interpersonal style, basic psychological needs and the well- and ill-being of young
877 soccer players: A longitudinal analysis. *Journal of Sports Sciences*, *30*, 1619-1629.
878 doi: 10.1080/02640414.2012.731517
- 879 Barcza-Renner, K., Eklund, R. C., Morin, A. J., & Habeeb, C. M. (2016). Controlling
880 coaching behaviors and athlete burnout: Investigating the mediating roles of
881 perfectionism and motivation. *Journal of sport & exercise psychology*, *38*, 30-44. doi:
882 10.1123/jsep.2015-0059
- 883 Barnes, J., Cote, J., Cudeck, R., & Malthouse, E. (2001). Checking assumptions of normality
884 before conducting factor analyses. *Journal of Consumer Psychology*, *10*, 79-81. doi:
885 10.2307/1480486
- 886 Bartholomew, K. J., Ntoumanis, N., & Thøgersen-Ntoumani, C. (2009). A review of
887 controlling motivational strategies from a self-determination theory perspective:
888 Implications for sports coaches. *International Review of Sport and Exercise*
889 *Psychology*, *2*, 215-233. doi: 10.1080/17509840903235330
- 890 Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C.
891 (2011). Self-determination theory and diminished functioning: the role of
892 interpersonal control and psychological need thwarting. *Personality and Social*
893 *Psychology Bulletin*, *37*, 1459-1473. doi: 10.1123/jsep.32.2.193
- 894 Bartholomew, K. J., Ntoumanis, N., Thøgersen-Ntoumani, C. (2010). The controlling
895 interpersonal Style in a coaching context: Development and initial validation of a

- 896 psychometric scale. *Journal of Sport and Exercise Psychology*, 32, 193-216. doi:
897 10.1177/0146167211413125
- 898 Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal
899 attachments as a fundamental human motivation. *Psychological Bulletin*, 117, 497-
900 529. doi: 10.1037/0033-2909.117.3.497
- 901 Brown, T. A. (2015). *Methodology in the social sciences. Confirmatory factor analysis for*
902 *applied research (2nd ed.)*. New York, NY, US: Guilford Press.
- 903 Browne, M. (2001). An overview of analytic rotation in exploratory factor analysis.
904 *Multivariate Behavioral Research*, 36, 111–150. doi:
905 10.1207/S15327906MBR3601_05
- 906 Cain, M. K., Zhang, Z., Yuan, K.-H. (2017). Univariate and multivariate skewness and
907 kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior*
908 *Research Methods*, 49, 1716-1735. doi:10.3758/s13428-016-0814-1
- 909 Chen, F. F., Hayes, A., Carver, C. S., Laurenceau, J. P., & Zhang, Z. (2012). Modeling
910 general and specific variance in multifaceted constructs: A comparison of the bifactor
911 model to other approaches. *Journal of Personality*, 80, 219-251. doi: 10.1111/j.1467-
912 6494.2011.00739.x
- 913 Chen, B., Mouratidis, A., Ryan, R. M., Sheldon, K.M., Soenens, B., Van Petegem, S. &
914 Verstuyf, J., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-
915 Deeder, J., Duriez, B., Lens, W., & Matos, L. (2015). Basic psychological need
916 satisfaction, need frustration, and need strength across four cultures. *Motivation and*
917 *Emotion*, 39, 216-236. doi: 10.1007/s11031-014-9450-1
- 918 Cheon, S. H., Reeve, J., Lee, J., & Lee, Y. (2015). Giving and receiving autonomy support in
919 a high-stakes sport context: A field-based experiment during the 2012 London

- 920 Paralympic Games. *Psychology of Sport and Exercise*, 19, 1-11. doi:
921 10.1016/j.psychsport.2015.02.007
- 922 Cheon, S. H., Reeve, J., Lee, Y., Ntoumanis, N., Gillet, N., Kim, B. R., & Song, Y.-G.
923 (2019). Expanding autonomy psychological need states from two (satisfaction,
924 frustration) to three (dissatisfaction): a classroom-based intervention study. *Journal of*
925 *Educational Psychology*, 11, 685-702. doi: 10.1037/edu0000306
- 926 Clark, L. A., & Watson, D. (2019). Constructing validity: New developments in creating
927 objective measuring instruments. *Psychological Assessment*. Advance online
928 publication. doi: 10.1037/pas0000626
- 929 Comrey, A. L., & Lee, H. B. (1992). A first course in factor analysis. Hillsdale, NJ: Erlbaum.
- 930 Conroy, D. E., & Coatsworth, J. D. (2007). Assessing autonomy-supportive coaching
931 strategies in youth sport. *Psychology of Sport and Exercise*, 8, 671-684.
932 doi: 10.1016/j.psychsport.2006.12.001
- 933 Courvoisier, D., & Etter, J.-F. (2008). Using item response theory to study the convergent
934 and discriminant validity of three questionnaires measuring cigarette dependence.
935 *Psychology of Addictive Behaviors*, 22, 391-401. doi: 10.1037/0893-164X.22.3.391
- 936 Curran, T., Hill, A. P., Hall, H. K., & Jowett, G. E. (2014). Perceived coach behaviors and
937 athletes' engagement and disaffection in youth sport: The mediating role of the
938 psychological needs. *International Journal of Sport Psychology*, 45, 559-580. doi:
939 10.7352/IJSP2014.45.559
- 940 Curran T., Hill A. P., & Niemiec C. P. (2013). A conditional process model of children's
941 behavioral engagement and behavioral disaffection in sport based on self-
942 determination theory. *Journal of Sport and Exercise Psychology*, 35, 30-43. doi:
943 10.1123/jsep.35.1.30

- 944 Curran, T, Hill, A. P., Ntoumanis, N., Hall, H. K., & Jowett, G. E. (2016). A three-wave
945 longitudinal test of self-determination theory's mediation model of engagement and
946 disaffection in youth sport. *Journal of Sport and Exercise Psychology*, 38, 15-29. doi:
947 10.1123/jsep.2015-0016
- 948 deCharms, R. (1968). *Personal causation: The internal affective determinants of behavior*.
949 New York: Academic Press.
- 950 Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-determination theory in work
951 organizations: The state of a science. *Annual Review of Organizational Psychology*
952 *and Organizational Behavior*, 4, 19-43. doi: 10.1146/annurev-orgpsych-032516-
953 113108
- 954 Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human*
955 *behavior*. New York: Plenum Press.
- 956 Deci, E. L., Schwartz, A. J., Sheinman, L., Ryan, R. M. (1981). An instrument to assess
957 adults' orientations toward control versus autonomy with children: Reflections on
958 intrinsic motivation and perceived competence. *Journal of Educational Psychology*,
959 73, 642-50. doi: 10.1037/0022-0663.73.5.642
- 960 Delrue, J., Reynders, B., Vande Broek, G., Aelterman, N., De Backer, M., Decroos, S., De
961 Muynck, G.-J., Fontaine, J., Fransen, K., van Puyenbroeck, S., Haerens, L., &
962 Vansteenkiste, M. (2019). Adopting a helicopter-perspective towards motivating and
963 demotivating coaching: A circumplex approach, *Psychology of Sport and Exercise*,
964 40, 110-126. doi: 10.1016/j.psychsport.2018.08.008
- 965 DeVellis, R.F. (2012). *Scale development: Theory and applications* (3rd ed.). Thousand
966 Oaks, CA: SAGE.

- 967 Gaudreau, P., Amiot, C. E., Vallerand, R. J. (2009). Trajectories of affective states in
968 Adolescent hockey players: Turning point and motivational antecedents.
969 *Developmental Psychology, 45*, 307-319. doi: 10.1037/a0014134
- 970 González L., García-Merita M., Castillo I., Balaguer I. (2016). Young athletes' perceptions of
971 coach behaviors and their implications on their well- and ill-being over time. *Journal*
972 *of Strength and Conditioning Research, 30*, 1147–1154. doi:
973 10.1519/JSC.0000000000001170
- 974 Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-
975 regulation and competence: A social contextual perspective. *Journal of Educational*
976 *Psychology, 81*, 143-154. doi: 10.1037/0022-0663.81.2.143
- 977 Gucciardi, D.F., Weixian, J. C., Gibson, W., Ntoumanis, N., & Ng, L. (in press).
978 Motivational climate in the classroom: Factorial and convergent validity evidence of
979 the Need Support Behaviors Scale with health science students. *European Journal of*
980 *Psychological Assessment*.
- 981 Gustafsson, H., Kenttä, G., & Hassmén, P. (2011). Athlete burnout: An integrated model and
982 future research directions. *International Review of Sport and Exercise Psychology, 4*,
983 3–24. doi: 10.1080/1750984X.2010.541927
- 984 Haerens, L., Vansteenkiste, M., De Meester, A., Delrue, J., Tallir, I., Vande Broek, G., Goris,
985 W., & Aelterman, N. (2018). Different combinations of perceived autonomy support
986 and control: identifying the most optimal motivating style. *Physical Education and*
987 *Sport Pedagogy, 23*, 16–36. doi: 10.1080/17408989.2017.1346070
- 988 Hagger, M. S., Chatzisarantis, N., Hein, V., Pihu, M., Soos, I., & Karsai, I. (2007). The
989 perceived autonomy support scale for exercise settings (PASSSES): Development,
990 validity, and cross-cultural invariance in young people. *Psychology of Sport and*
991 *Exercise, 8*, 632-653. doi: 10.1016/j.psychsport.2006.09.001

- 992 Hancox, J. E., Quested, E., Thøgersen-Ntoumani, C., & Ntoumanis, N. (2015). An
 993 intervention to train group exercise class instructors to adopt a motivationally
 994 adaptive communication style: a quasi-experimental study protocol. *Health*
 995 *Psychology and Behavioral Medicine*, 3, 190-203. doi:
 996 10.1080/21642850.2015.1074075
- 997 Hodge, K., Lonsdale, C. and Jackson, S. A. (2009). Athlete engagement in elite sport: An
 998 exploratory investigation of antecedents and consequences. *The Sport Psychologist*,
 999 23, 186-202. doi: 10.1123/tsp.23.2.186
- 1000 Holzinger, K. J., & Swineford, S. (1937). The bifactor method. *Psychometrika*, 2, 41–54. doi:
 1001 10.1123/tsp.23.2.186
- 1002 Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling:
 1003 Guidelines for determining model fit. *The Electronic Journal of Business Research*
 1004 *Methods*, 6, 53 – 60.
- 1005 Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure
 1006 analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*,
 1007 6, 1-55. doi: 10.1080/10705519909540118
- 1008 Hurley, A., Scandura, T., Schriesheim, C., Brannick, M., Seers, A., Vandenberg, R., &
 1009 Williams, L. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues,
 1010 and alternatives. *Journal of Organizational Behaviour*, 18, 667-683. doi:
 1011 10.1002/(SICI)1099-1379(199711)18:6<667::AID-JOB874>3.0.CO;2-T
- 1012 Huysamen, G. K. (2006). Coefficient alpha: unnecessarily ambiguous, unduly ubiquitous.
 1013 *South-African Journal of Industrial Psychology*, 32, 34-40. doi:
 1014 10.4102/sajip.v32i4.242
- 1015 Isoard-Gauthier, S., Guillet-Descas, E., & Lemyre, P.-N. (2012). A prospective study of the
 1016 influence of perceived coaching style on burnout propensity in high level young

- 1017 athletes: Using a self-determination theory perspective. *The Sport Psychologist*, 26,
1018 282-298. doi: 10.1123/tsp.26.2.282
- 1019 John, O., & Benet-Martínez, V. (2000). Measurement: reliability, construct validation, and
1020 scale construction. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods*
1021 *in social and personality psychology* (pp. 339-369): Cambridge University Press.
- 1022 Katz, I., & Assor, A. (2007). When choice motivates and when it does not. *Educational*
1023 *Psychology Review*, 19, 429-442. doi: 10.1007/s10648-006-9027-y
- 1024 Kinnafick, F. E., Thøgersen-Ntoumani, C., & Duda, J. (2016). The effect of need supportive
1025 text messages on motivation and physical activity behaviour. *Journal of Behaviour*
1026 *Medicine*, 39, 574-586. doi: 10.1007/s10865-016-9722-1
- 1027 Lonsdale, C., Hodge, K., & Jackson, S. (2007). Athlete engagement: II. Development and
1028 initial validation of the Athlete Engagement Questionnaire. *International Journal of*
1029 *Sport Psychology*, 38, 471-492. doi: 10.1037/t50268-000
- 1030 Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*,
1031 35, 382-385.
- 1032 Mageau, G. A., & Vallerand, R. J. (2003). The coach–athlete relationship: a motivational
1033 model. *Journal of Sports Sciences*, 21, 883-904. doi: 10.1080/0264041031000140374
- 1034 Markland, D., Tobin, V. J. (2010). Need support and behavioural regulations for exercise
1035 among exercise referral scheme clients: The mediating role of psychological need
1036 satisfaction. *Psychology of Sport and Exercise*, 11, 91-99. doi:
1037 10.1016/j.psychsport.2009.07.001
- 1038 Marsh, H. W., Hau, K.-T., & Grayson, D. (2005). Goodness of fit evaluation in structural
1039 equation modeling. In A. Maydeu-Olivares & J. McArdle (Eds.), *Psychometrics. A*
1040 *Festschrift for Roderick P. McDonald* (pp. 275-340). Hillsdale, NJ: Erlbaum.

- 1041 Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In search of golden rules: Comment on
1042 hypothesis-testing approaches to cutoff values for fit indexes and dangers in
1043 overgeneralizing Hu & Bentler (1999). *Structural Equation Modeling, 11*, 320-341.
1044 doi: 10.1207/s15328007sem1103_2
- 1045 Masser, M., & Creed, L., (1976). The greatest love of all [Recorded by Whitney Houston].
1046 On *Whitney Houston* [CD]. USA: Arista.
- 1047 Matosic, D., Ntoumanis, N., & Quested, E. (2016). Antecedents of need supportive and
1048 controlling interpersonal styles from a self-determination theory perspective: A
1049 review and implications for sport psychology research. In M. Raab, P. Wylleman, R.
1050 Seiler, A. M. Elbe, & A. Hatzigeorgiadis (Eds.), *Sport and exercise psychology*
1051 *research: From theory to practice* (pp. 145-180). San Diego, CA, US: Elsevier
1052 Academic Press. doi: 10.1016/B978-0-12-803634-1.00007-8
- 1053 Morin, A. J. S., Arens, A. K., & Marsh, H. W. (2016). A bifactor exploratory structural
1054 equation modeling framework for the identification of distinct sources of construct-
1055 relevant psychometric multidimensionality. *Structural Equation Modeling, 23*, 116-
1056 129. doi: 10.1080/10705511.2014.961800
- 1057 Muthén, L. & Muthén, B. (1998-2017). *Mplus user's guide* (8th ed.). Los Angeles, CA:
1058 Muthén & Muthén.
- 1059 Niemiec, C., Lynch, M., Vansteenkiste, M., Bernstein, J., Deci, E., & Ryan, R. (2006). The
1060 antecedents and consequences of autonomous self-regulation for college: a self-
1061 determination theory perspective on socialization. *Journal of Adolescence, 29*, 761-
1062 775. doi: 10.1016/j.adolescence.2005.11.009
- 1063 Ntoumanis, N. (2012). A self-determination theory perspective on motivation in sport and
1064 physical education: Current trends and possible future research directions. In G.C.

- 1065 Roberts and D.C. Treasure (Eds), *Motivation in sport and exercise* (pp. 91-128).
1066 Champaign, IL: Human Kinetics. doi: 10.1177/1477878509104324
- 1067 Ntoumanis, N., & Mallett, C. (2014). Motivation in sport: A self-determination theory
1068 perspective. In A. Papaioannou, & D. Hackfort (Eds.), *Routledge companion to sport
1069 and exercise psychology: Global perspectives and fundamental concepts* (pp. 67-82).
1070 Taylor and Francis.
- 1071 Ntoumanis, N., Quested, E., Reeve, J., Cheon, S.H. (2018). Need supportive communication:
1072 Implications for motivation in sport, exercise, and physical activity. In B. Jackson, J.
1073 A. Dimmock, & J. Compton (Eds.), *Persuasion and communication in sport, exercise,
1074 and physical activity* (pp.155-169). Abigdon, UK: Routledge.
- 1075 Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York, NY: McGraw-Hill.
- 1076 Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Brière, N. M. (2001). Associations among
1077 perceived autonomy support, forms of self-regulation, and persistence: A prospective
1078 study. *Motivation and Emotion*, 25, 279-306. doi: 10.1023/A:1014805132406
- 1079 Polit, E. F., Beck, T. T., & Owen, S.V. (2007). Is the CVI an acceptable indicator of content
1080 validity? Appraisal and recommendations. *Research in Nursing & Health*, 30, 459-
1081 467. doi: 10.1002/nur.20199
- 1082 Pulido, J. J., Sánchez-Oliva, D., Leo, F. M., Sánchez-Cano, J., & García-Calvo, T. (2018).
1083 Development and validation of coaches' interpersonal style questionnaire.
1084 *Measurement in Physical Education and Exercise Science*, 22, 25-37. doi:
1085 10.1080/1091367X.2017.1369982
- 1086 Quested, E., Bosch, J. A., Burns, V. E., Cumming, J., Ntoumanis, N., & Duda, J. L. (2011).
1087 Basic psychological need satisfaction, stress-related appraisals, and dancers' cortisol
1088 and anxiety responses. *Journal of Sport and Exercise Psychology*, 33, 828–846. doi:
1089 10.1123/jsep.33.6.828

- 1090 Qusted, E., Ntoumanis, N., Stenling, A., Thøgersen-Ntoumani, C., & Hancox, J. E. (2018).
1091 The Need-Relevant Instructor Behaviours Scale (NIBS): Development and initial
1092 validation. *Journal of Sport and Exercise Psychology, 40*, 259-268. doi:
1093 10.1123/jsep.2018-0043
- 1094 Raedeke, T.D., & Smith, A.L. (2001). Development and preliminary validation of an athlete
1095 burnout measure. *Journal of Sport and Exercise Psychology, 23*, 281-306. doi:
1096 10.1123/jsep.23.4.281
- 1097 Ramis, Y., Torregrosa, M., Viladrich, C., & Cruz, J. (2017). The effect of coaches'
1098 controlling style on the competitive anxiety of young athletes. *Frontiers in*
1099 *psychology, 8*, 572. doi: 10.3389/fpsyg.2017.00572
- 1100 Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied*
1101 *Psychological Measurement, 21*, 173-184. doi: 10.1177/01466216970212006
- 1102 Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how
1103 they can become more autonomy supportive. *Educational Psychologist, 737, 44*, 159-
1104 175. doi: 10.1080/00461520903028990
- 1105 Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during
1106 a learning activity. *Journal of Educational Psychology, 98*, 209-218. doi:
1107 10.1037/0022-0663.98.1.209
- 1108 Reinboth, M., Duda, J. L., & Ntoumanis, N. (2004). Dimensions of coaching behavior, need
1109 satisfaction, and the psychological and physical welfare of young athletes. *Motivation*
1110 *and Emotion, 28*, 297-313. doi: 10.1023/B:MOEM.0000040156.81924.b8
- 1111 Reise, S. P. (2012). Invited paper: The rediscovery of bifactor measurement models.
1112 *Multivariate Behavioral Research, 47*, 667–696. doi: 10.1080/00273171.2012.715555

- 1113 Rocchi, M., Pelletier, L., & Desmarais, P. (2017). The validity of the Interpersonal
1114 Behaviours Questionnaire (IBQ) in sport. *Measurement in Physical Education and*
1115 *Exercise Science, 21*, 15-25. doi: 10.1080/1091367X.2016.1242488
- 1116 Ryan, R. M. (1991). The nature of the self in autonomy and relatedness. In: J. Strauss & G.R.
1117 Goethals (Eds), *The self: Interdisciplinary approaches* (pp. 208-238). Springer, New
1118 York, NY. doi: 10.1007/978-1-4684-8264-5_11
- 1119 Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal*
1120 *of Personality, 63*, 397-427. doi: 10.1111/j.1467-6494.1995.tb00501.x
- 1121 Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory. Basic psychological needs in*
1122 *motivation, development and wellness*. New York, NY: Guilford Press.
- 1123 Sheldon, K. M., & Filak, V. (2008). Manipulating autonomy, competence and relatedness
1124 support in a game-learning context: New evidence that all three needs matter. *British*
1125 *Journal of Social Psychology, 47*, 267-283. doi: 10.1348/014466607X238797
- 1126 Sheldon, K. M., & Watson, A. (2011). Coach's autonomy support is especially important for
1127 varsity compared to club and recreational athletes. *International Journal of Sports*
1128 *Science & Coaching, 6*, 109-123. doi: 10.1260/1747-9541.6.1.109
- 1129 Sheldon, K. M., Williams, G. C., & Joiner, T. (2003). *Self-determination theory in the clinic:*
1130 *Motivating physical and mental health*. New Haven, CT: Yale University Press.
- 1131 Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's
1132 alpha. *Psychometrika, 74*, 107-120. doi: 10.1007/s11336-008-9101-0
- 1133 Skinner, E., Johnson, S., & Snyder, T. (2005). Six dimensions of parenting: A motivational
1134 model. *Parenting: Science and Practice, 5*, 175-235. doi:
1135 10.1207/s15327922par0502_3
- 1136 Smith, N., Quested, E., Appleton, P. & Duda, J. L. (2016). A review of observational
1137 instruments to assess the motivational environment in sport and physical education

- 1138 settings. *International Review of Sport and Exercise Psychology*, 134-159. doi:
1139 10.1080/1750984X.2015.1132334
- 1140 Soenens, B., & Beyers, W. (2012). The cross-cultural significance of control and autonomy
1141 in parent–adolescent relationships. *Journal of Adolescence*, 35, 243-248. doi:
1142 10.1016/j.adolescence.2012.02.007
- 1143 Soenens, B., Sierens, E., Vansteenkiste, M., Dochy, F., & Goossens, L. (2012).
1144 Psychologically controlling teaching: Examining outcomes, antecedents, and
1145 mediators. *Journal of Educational Psychology*, 104, 108-120. doi: 10.1037/a0025742
- 1146 Standage, M., Curran, T., & Rouse, P. (2019). Self-determination based theories of sport,
1147 exercise, and physical activity motivation. In T. S. Horn & A. L. Smith (Eds.),
1148 *Advances in sport and exercise psychology* (4th ed., pp. 289-311). Champaign, U. S.
1149 A.: Human Kinetics.
- 1150 Stenling, A., Ivarsson, A., Hassmen, P., & Lindwall, M. (2015). Using bifactor exploratory
1151 structural equation modeling to examine global and specific factors in measures of
1152 sports coaches' interpersonal styles. *Frontiers in Psychology*, 6, 1-12. doi: doi:
1153 10.3389/fpsyg.2015.01303
- 1154 Tabachnick, B. G. & Fidell, L. S. (2012). *Using multivariate statistics* (6th ed.). Boston, MA:
1155 Pearson
- 1156 Tafvelin, S. and Stenling, A. (2018). Development and Initial Validation of the Need
1157 Satisfaction and Need Support at Work Scales: A Validity-Focused Approach.
1158 *Scandinavian Journal of Work and Organizational Psychology*, 3, 1–14. doi:
1159 10.16993/sjwop.30
- 1160 Tessier, D., Sarrazin, P., & Ntoumanis, N. (2008). The effect of an experimental program to
1161 support students' autonomy on the overt behaviours of physical education teachers.

- 1162 *European Journal of Psychology of Education*, 23, 239-253. doi:
 1163 10.1007/BF03172998
- 1164 Tucker-Drob, E. M., & Salthouse, T. A. (2009). Confirmatory factor analysis and
 1165 multidimensional scaling for construct validation of cognitive abilities. *International*
 1166 *Journal of Behavioral Development*, 33, 277-285. doi: 10.1177/0165025409104489
- 1167 Van den Berghe, L., Soenens, B., Vansteenkiste, M., Aelterman, N., Cardon, G., Tallir, I. B.,
 1168 & Haerens, L. (2013). Observed need supportive and need thwarting teaching
 1169 behavior in physical education: Do teachers' motivational orientations matter?
 1170 *Psychology of Sport and Exercise*, 14, 650-661. doi:
 1171 10.1016/j.psychsport.2013.04.006
- 1172 Vansteenkiste, M., Niemiec, C. P., & Soenens, B. (2010). The development of the five mini-
 1173 theories of self-determination theory: An historical overview, emerging trends, and
 1174 future directions. In T. C. Urdan & S. A. Karabenick (Eds.), *Advances in motivation*
 1175 *and achievement: The decade ahead* (pp. 105-165). London, England: Emerald Group
 1176 Publishing Limited. doi: 10.1108/S0749-7423(2010)000016A007
- 1177 Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic
 1178 psychological need satisfaction and need frustration as a unifying principle. *Journal of*
 1179 *Psychotherapy Integration*, 23, 263-280. doi: 10.1037/a0032359
- 1180 Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996).
 1181 Motivational predictors of weight loss and weight-loss maintenance. *Journal of*
 1182 *Personality and Social Psychology*, 70, 115-126. doi: 10.1037/0022-3514.70.1.115
- 1183 Wilson, P. M., Gregson, J. P., & Mack, D. E. (2009). The importance of interpersonal style in
 1184 competitive sport: a self-determination theory approach. In C. H. Chang (Ed.),
 1185 *Handbook of sport psychology* (pp. 259-276). Hauppauge, NY; Nova Science.

Footnotes

1186

1187 1. The other 10 models were also re-run with these 22 items. Although the CFA
1188 models with nine-factor solutions reached acceptable fit indices, they were rejected on the
1189 basis of lack of sufficient items per factor. The three-factor CFA also demonstrated good fit,
1190 however, the three-factor ESEM model was preferred as it yielded lower factor correlations.
1191 The rest of the models did not converge or demonstrated poor standard factor loadings or
1192 multiple large unintended cross-loadings.

1193 2. Similar to Study 2, we re-tested all other factor models. Yet again, a model with
1194 acceptable fit for the nine coach interpersonal behaviors (Model 3) was rejected on the basis
1195 of lack of sufficient items per factor. The three-factor CFA (Model 1) demonstrated good
1196 model to data fit, however, factor correlations were higher than those for the three-factor
1197 ESEM model. Most of the other models (e.g., Models 4, 6, 7, 8, 9, 10, 11) did not converge.
1198 Model 12 (bifactor one-G, three-S) also demonstrated good model-to-data fit, however, yet
1199 again, the S-factor for need thwarting was problematic, with only two items that had
1200 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).

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.

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

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

Note. χ^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.

Initial and Final Model Fit (Study 2)

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

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
Deliberately ignores me. (R)		.66***		.10	1.59	1.35	2.61	6.11
Makes it clear that I have little to contribute. (C)		.53***		.11	1.65	1.34	2.45	5.65
Tries to control everything I do. (A)		.67***		.08	1.63	1.18	2.31	5.31
Dismisses my opinion. (A)		.65***		.10	1.54	1.18	2.69	7.25
Blames me when things don't go well. (C)		.70***		.10	1.54	1.20	2.50	5.77
Makes it clear that he/she doesn't like me. (R)		.86***		.08	1.27	.90	4.00	16.76
Uses guilt tactics to control what I do. (A)		.88***		.08	1.35	.92	3.31	11.80
Belittles my abilities. (C)		.84***		.07	1.45	1.08	2.91	8.77
Need indifferent behaviors								
Keeps to himself/herself. (R)			.65***	.10	2.17	1.53	1.35	.96
Is unresponsive to my opinions. (A) (M)			.55***	.11	2.02	1.36	1.32	1.15
Sets activities that aren't challenging enough. (C) (M)			.64***	.12	2.33	1.51	1.08	.39
Is indifferent to how I feel. (R) (M)			.69***	.11	2.20	1.39	1.14	.78
Sets activities that lack variety. (A)			.65***	.10	2.45	1.60	1.06	.35

Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
Can be disorganized. (C)			.61***	.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	.66**			.09	5.49	1.20	-.97	.96
Ensures that tasks are suited to my skill level	.74**			.07	5.70	1.29	-1.22	1.53
Takes interest in my welfare	.79**			.08	5.82	1.23	-1.35	2.35
Encourages me to take my own initiative	.65**			.10	5.91	1.12	-1.42	2.66
Recognizes my efforts and accomplishments	.79**			.09	5.92	1.17	-1.42	2.57
Accepts me	.69**			.09	6.31	1.00	-1.86	4.19
Explains the reasons when he/she asks me to do something	.49**			.08	5.75	1.32	-1.39	1.71
Shows care and concern	.69**			.08	6.01	1.18	-1.38	1.88
Tries to control everything I do		.50**		.13	2.18	1.48	1.27	.69
Makes it clear that I have little to contribute		.49**		.10	1.75	1.39	2.21	4.29

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Items	Factor loadings			SE	Means	SD	Skewness	Kurtosis
	NS	NT	NI					
<i>STEM: My coach...</i>								
Deliberately ignores me		.77**		.09	1.45	1.14	3.25	10.65
Dismisses my opinion		.65**		.09	1.59	1.18	2.39	5.58
Blames me when things don't go well		.67**		.08	1.73	1.34	2.14	3.99
Makes it clear that he/she doesn't like me		.94**		.07	1.29	.92	4.04	17.72
Uses guilt tactics to control what I do		.80**		.09	1.47	1.06	2.84	8.20
Belittles my abilities		.72**		.08	1.54	1.19	2.66	6.99
Is unresponsive to my opinions		.24*	.40**	.08	2.17	1.39	1.24	.87
Sets activities that aren't challenging enough			.75**	.08	2.52	1.53	1.01	.27
Keeps to himself/herself			.61**	.09	2.23	1.45	1.23	.86
Sets activities that lack variety			.71**	.07	2.52	1.55	.96	.04
Can be disorganized			.58**	.08	2.30	1.50	1.20	.66
Is indifferent to how I feel			.52**	.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).

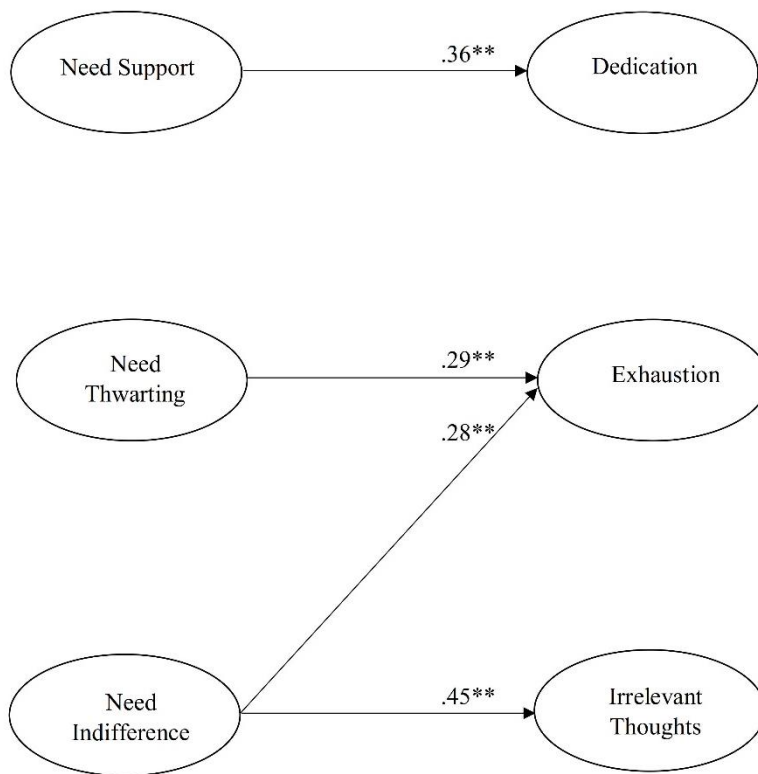


Figure 1. SEM with need supportive, thwarting, and indifferent interpersonal behaviors, and dedication, exhaustion, and irrelevant thoughts.

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

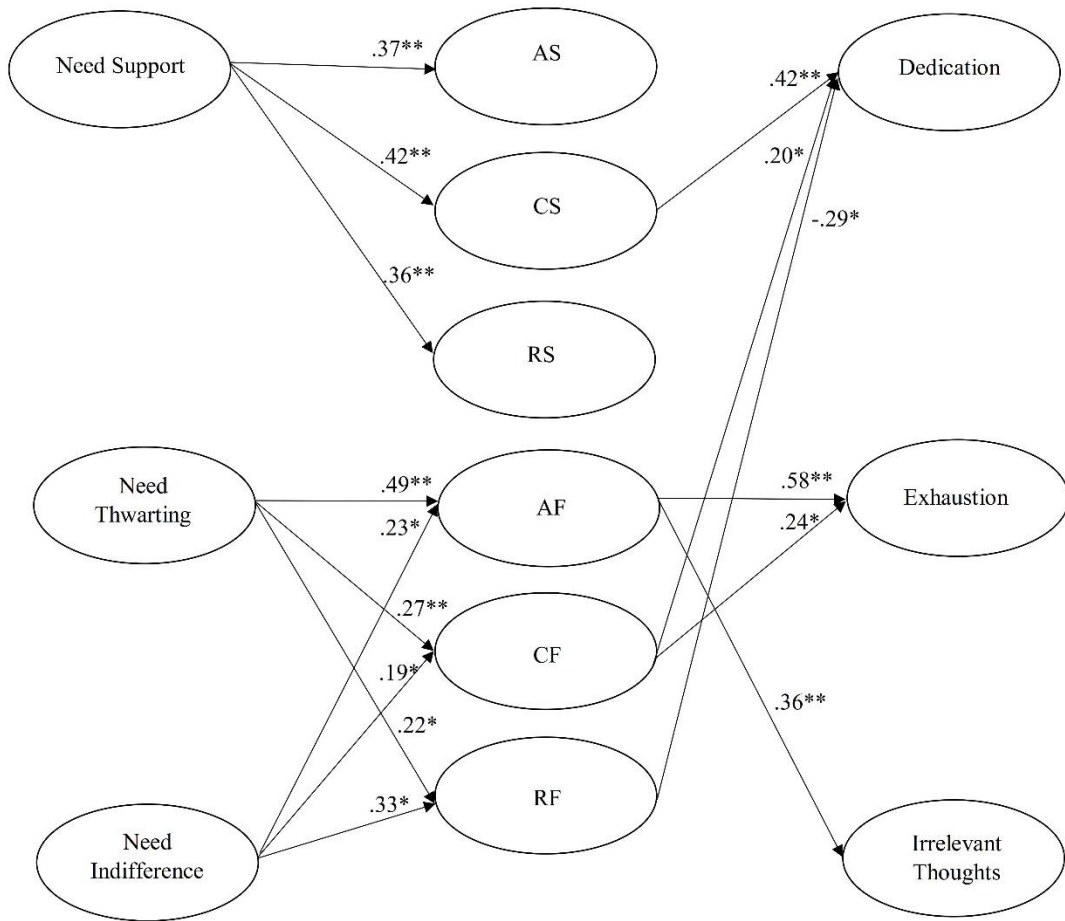


Figure 2. SEM with need supportive, thwarting, and indifferent interpersonal behaviors, six dimensions of the need states, dedication, exhaustion, and irrelevant thoughts

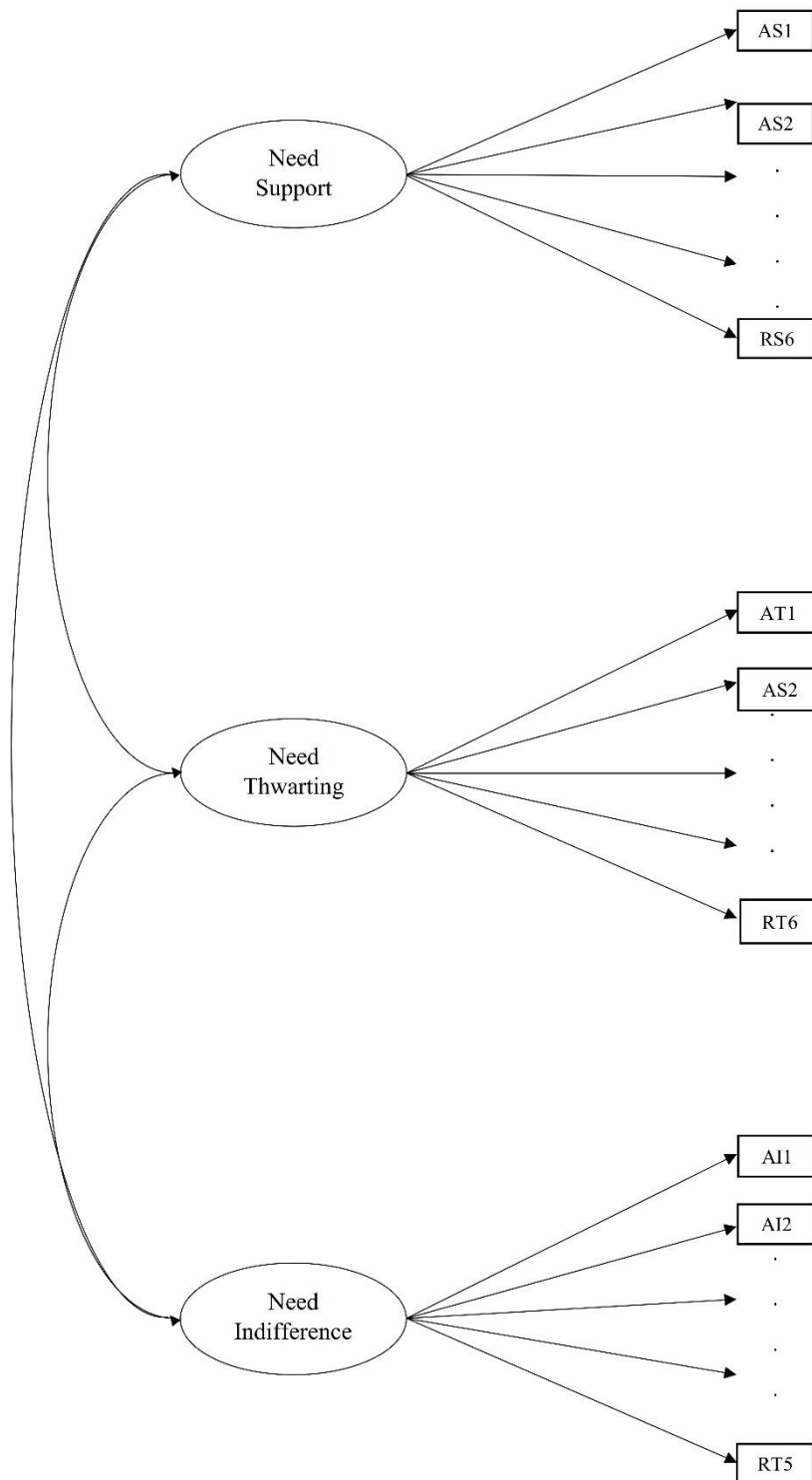
Note. ** $p < .01$, * $p < .05$. AS = autonomy satisfaction; CS = competence satisfaction; RS = relatedness satisfaction; AF = autonomy frustration; CF = competence frustration; RF = relatedness frustration. Only significant structural paths are reported for simplicity purposes.

Supplementary File 1*Measures and Items used to Inform the Creation of the TMIB-C*

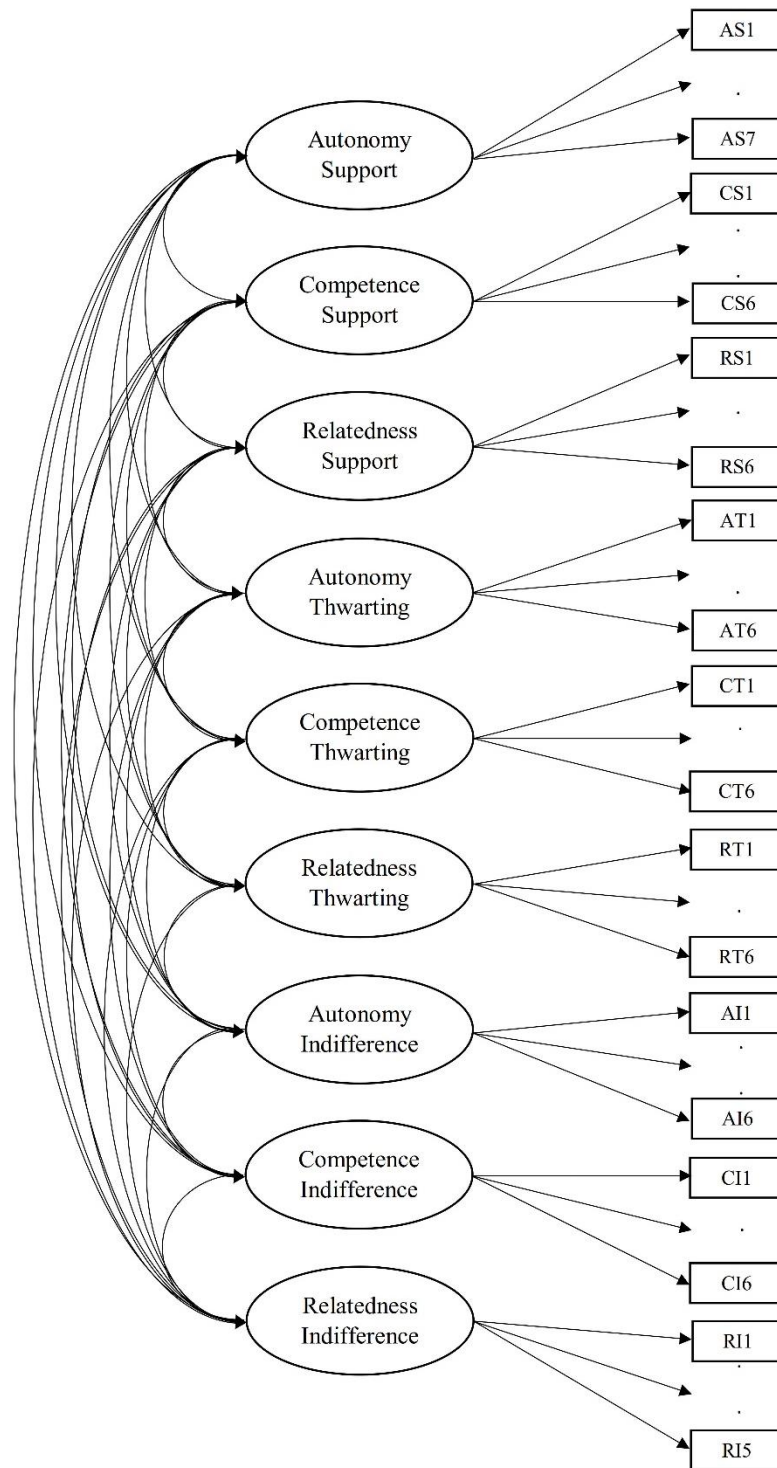
Measures and items found by searching databases	Authors
Controlling Coaching Behavior Scale (CCBS)	Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010
Teacher as Social Context Questionnaire (TASCQ)	Belmont, Skinner, Wellborn, & Connell, 1988
Perceived Autonomy Support Scale for Exercise Settings (PASSES)	Hagger, Chatzisarantis, Hein, Pihu, Soos, & Karsai, 2007
Health Care Climate Questionnaire (HCCQ)	Williams, Grow, Freedman, Ryan, & Deci, 1996
Autonomy-Supportive Coaching Questionnaire (ASCQ),	Conroy & Coatsworth, 2007
Need Support for Exercise Scale (NSE)	Markland & Tobin, 2010
Parent as Social Context Questionnaire (PASCQ)	Skinner, Regan, & Wellborn, 1986
Psychologically Controlling Teaching (PCT)	Soenens, Sierens, Vansteenkiste, Dochy, & Goossens, 2012
System for Observing Need-supportive Interactions in Physical Education (SONIPE)	Haerens et al., 2013
Multidimensional Motivational Climate Observation System (MMCOS)	Smith, et al., 2015

Empowering and Disempowering Motivational Climate Questionnaire (EDMCQ-C)	Appleton, Ntoumanis, Quested, Viladrich, & Duda, 2016
Interpersonal Supportiveness Scale-Coach (ISS-C)	Wilson, Gregson, & Mack, 2009
Caring Climate Scale	Newton et al., 2007
Teacher provided autonomy support and structure items put forth by Yang, Reeve, & Deci, 2010	Yang, Reeve, & Deci, 2010
MPOWER	Webster et al., 2013
Perceived Parental Autonomy Support Scale (P-PASS)	Mageau et al., 2015
Parental Psychological Control	Barber, 1996
Perceptions of Parents Scale (POPS)	Grolnick, Deci, & Ryan, 1997
Social Support Questionnaire (SSQ)	Sarason, Sarason, Sheerin, & Pierce, 1987
Need thwarting teaching behaviors put forth by Van den Berghe et al., (2013)	Van den Berghe et al., 2013
Autonomy supportive and controlling behaviors by Reeve & Jang, 2006	Reeve & Jang, 2006
Learning Climate Questionnaire	Black & Deci, 2000

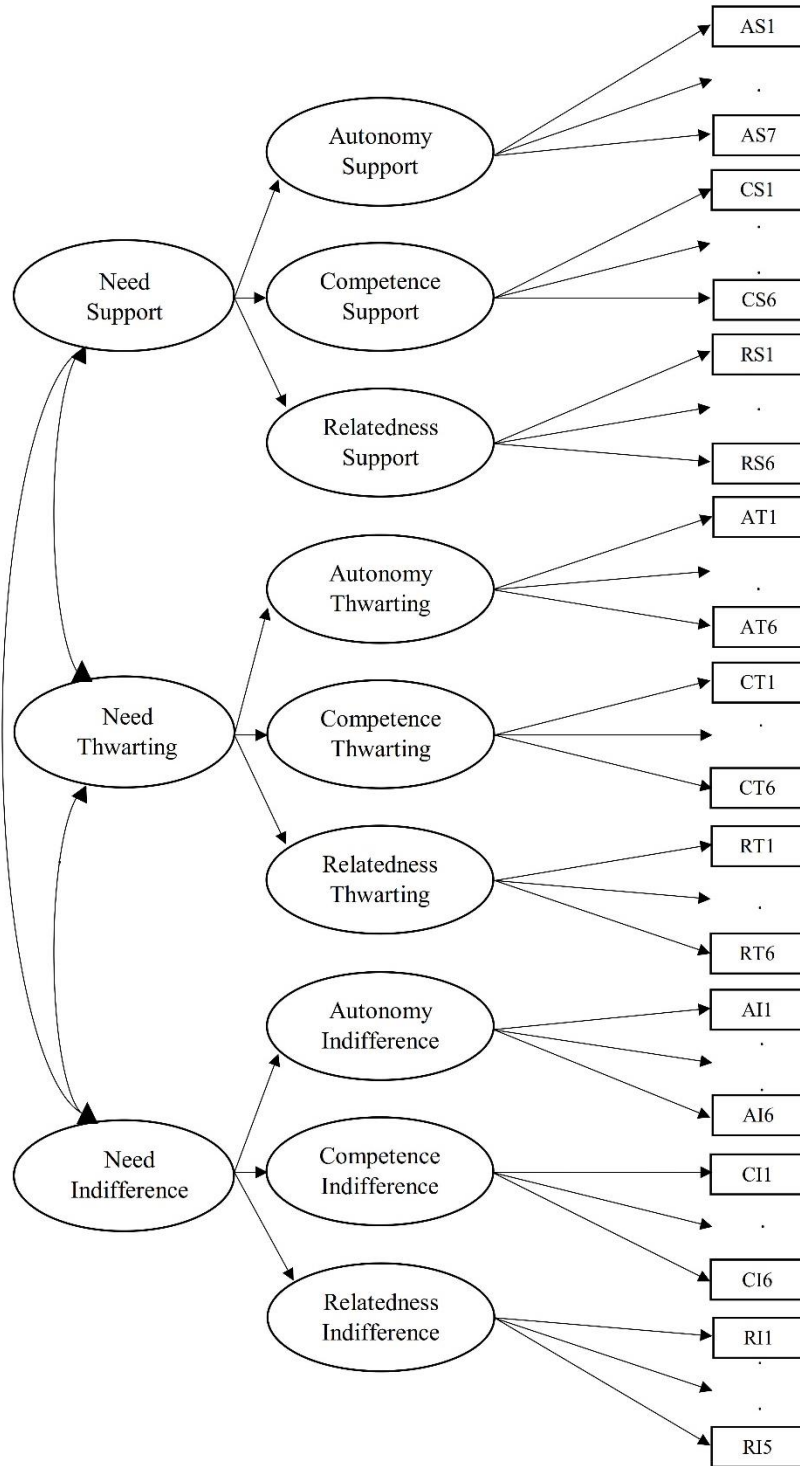
Supplementary File 2



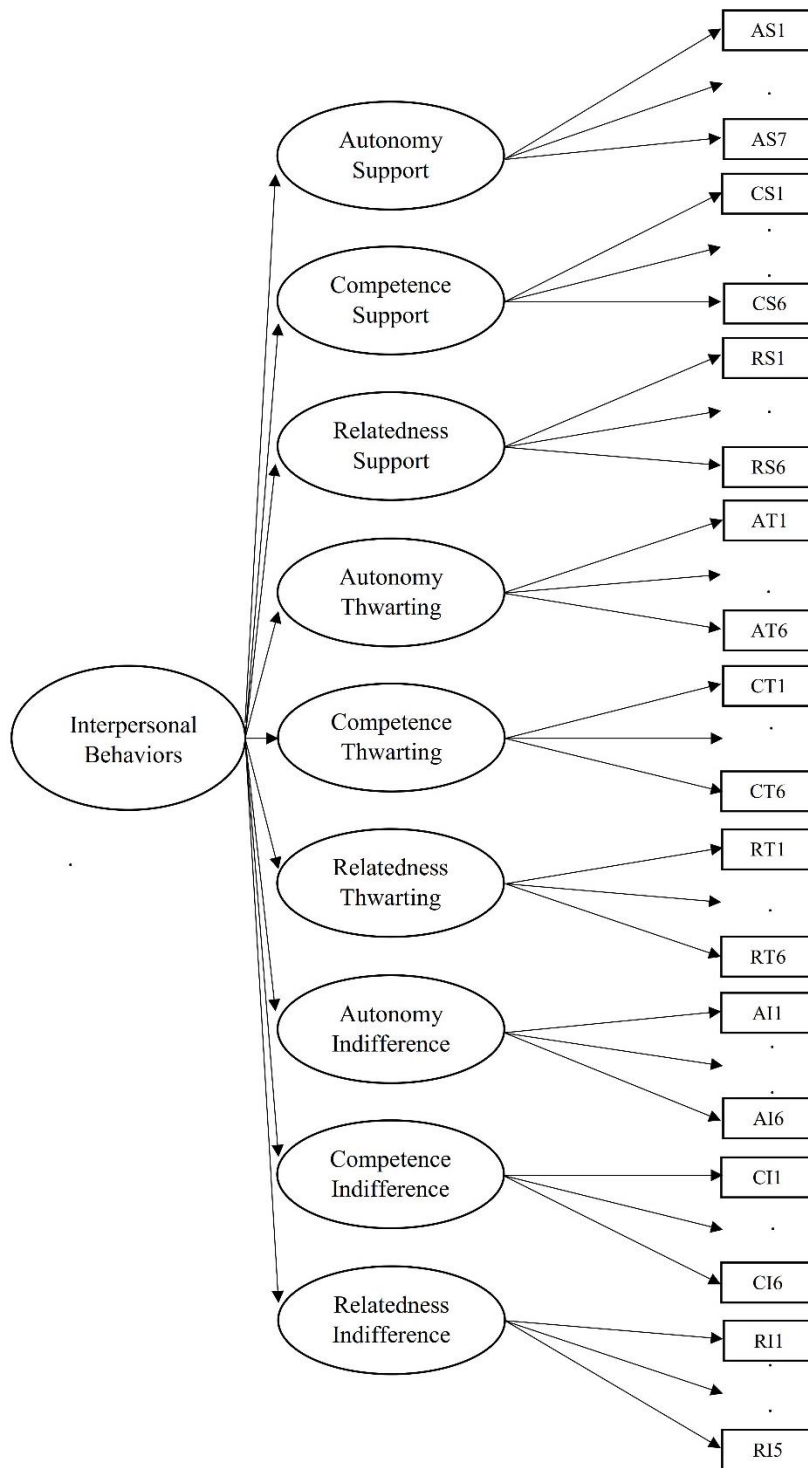
Model 1. Three-factor CFA



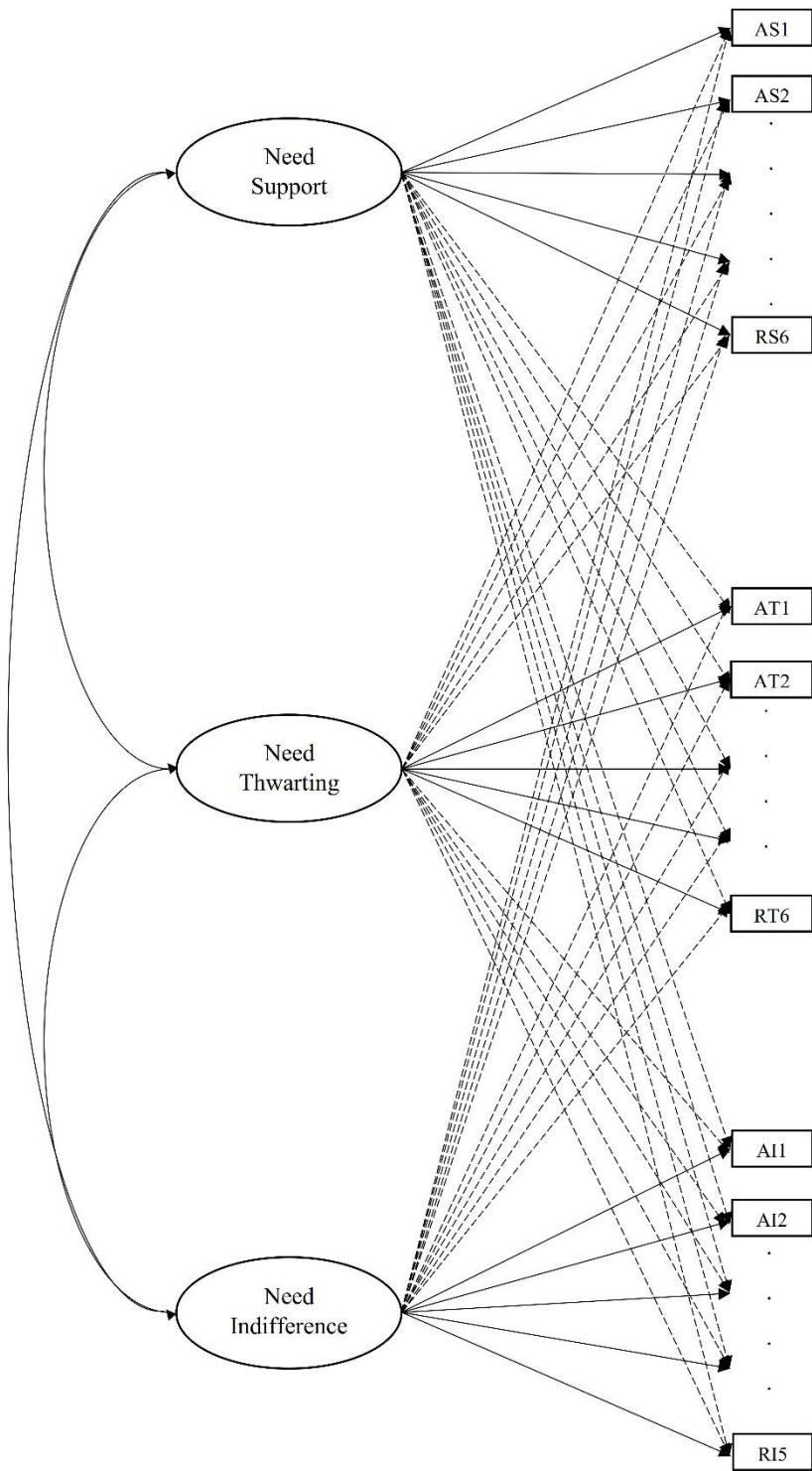
Model 2. Nine-correlated factors CFA



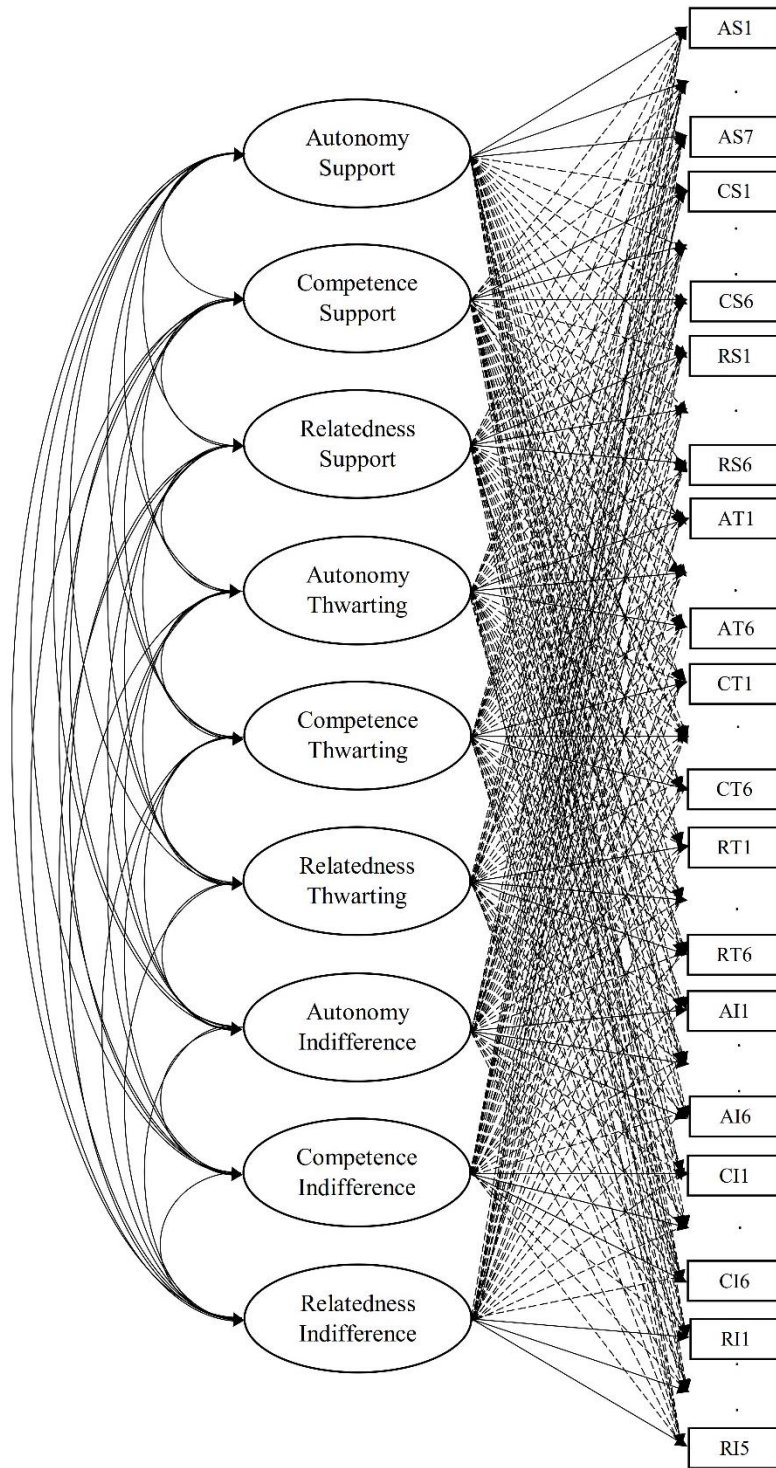
Model 3. H-CFA (three-H, nine-L)



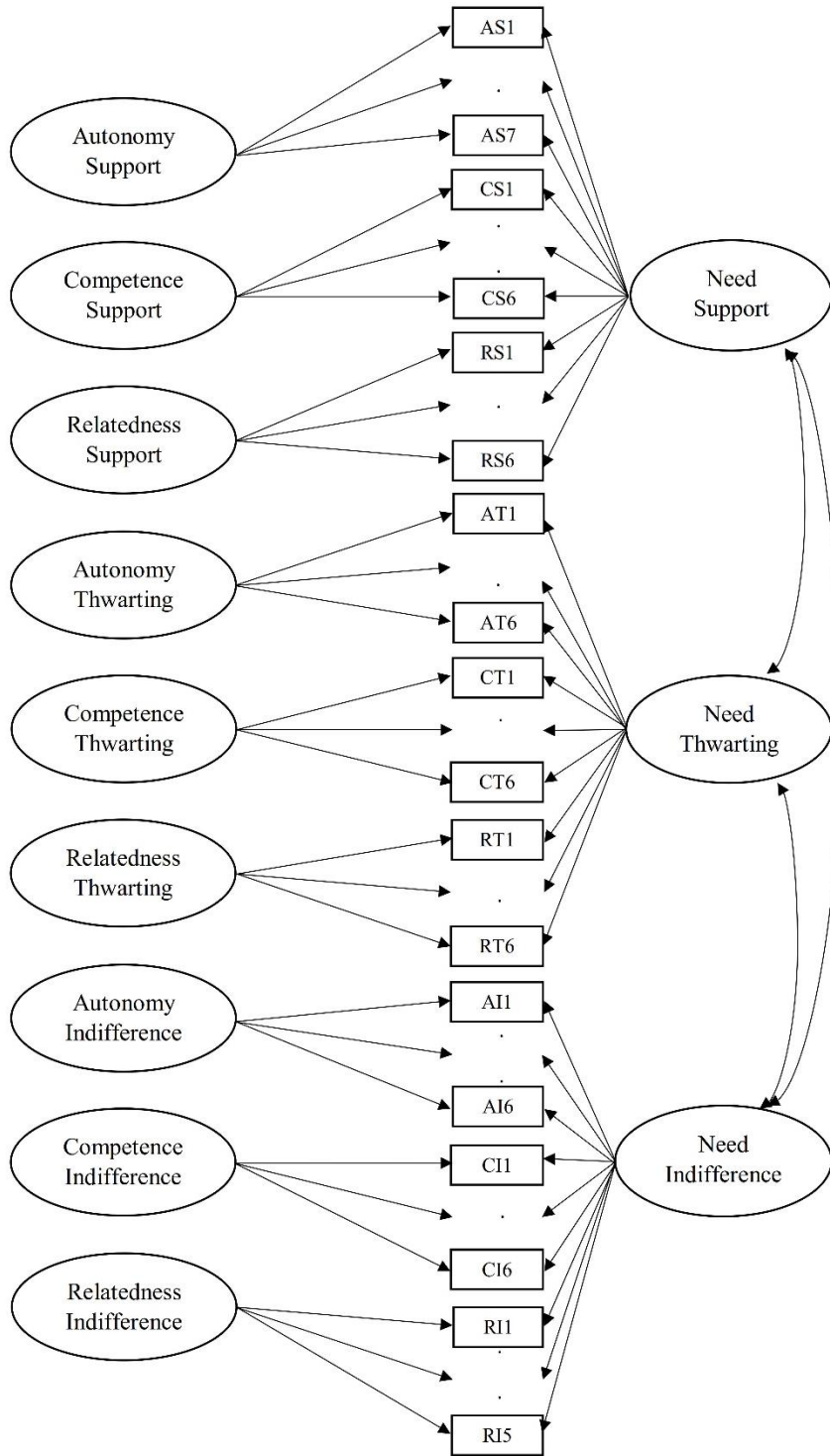
Model 4. H-CFA (one-H, nine-L)



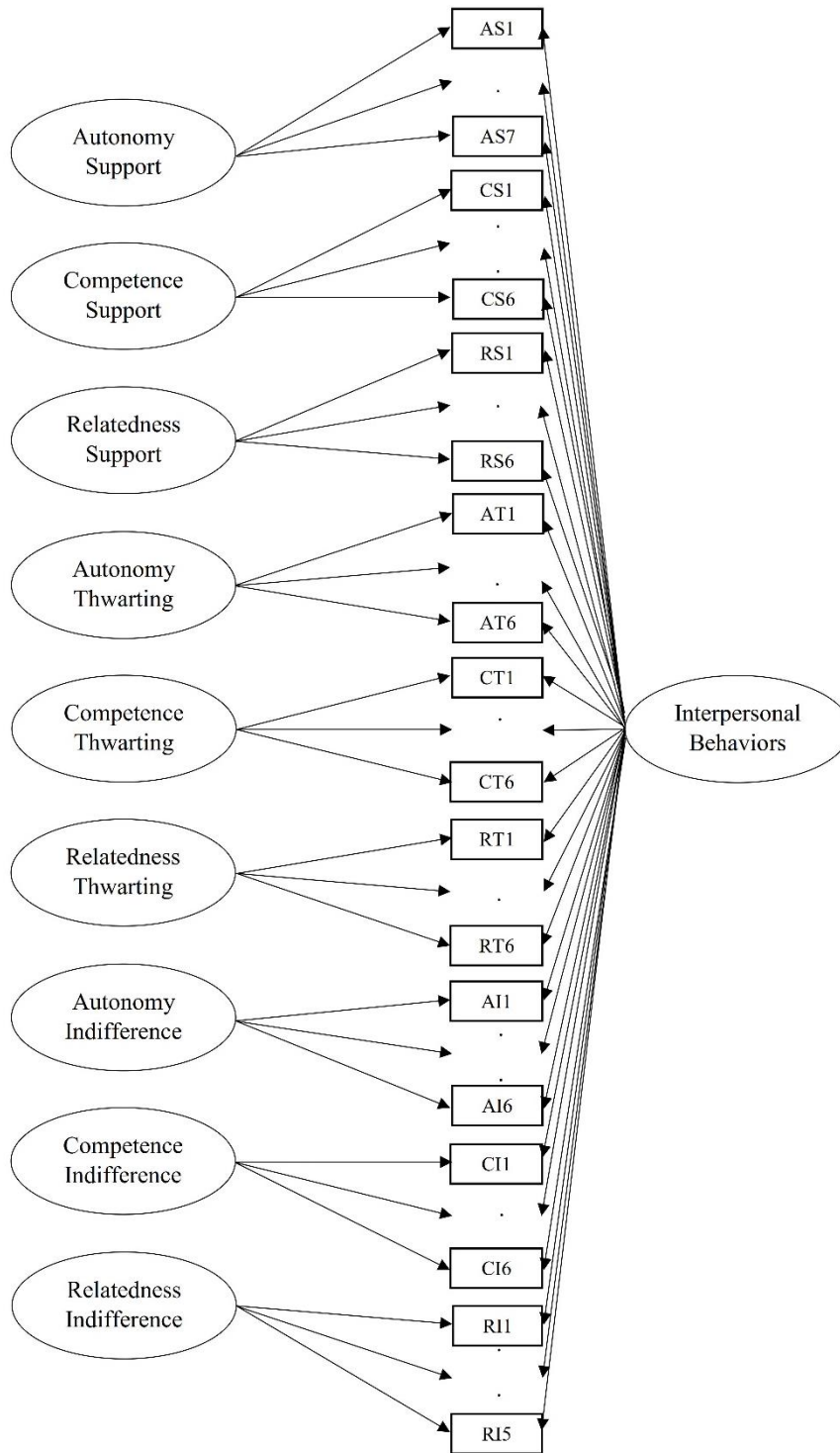
Model 5. Three-factor ESEM



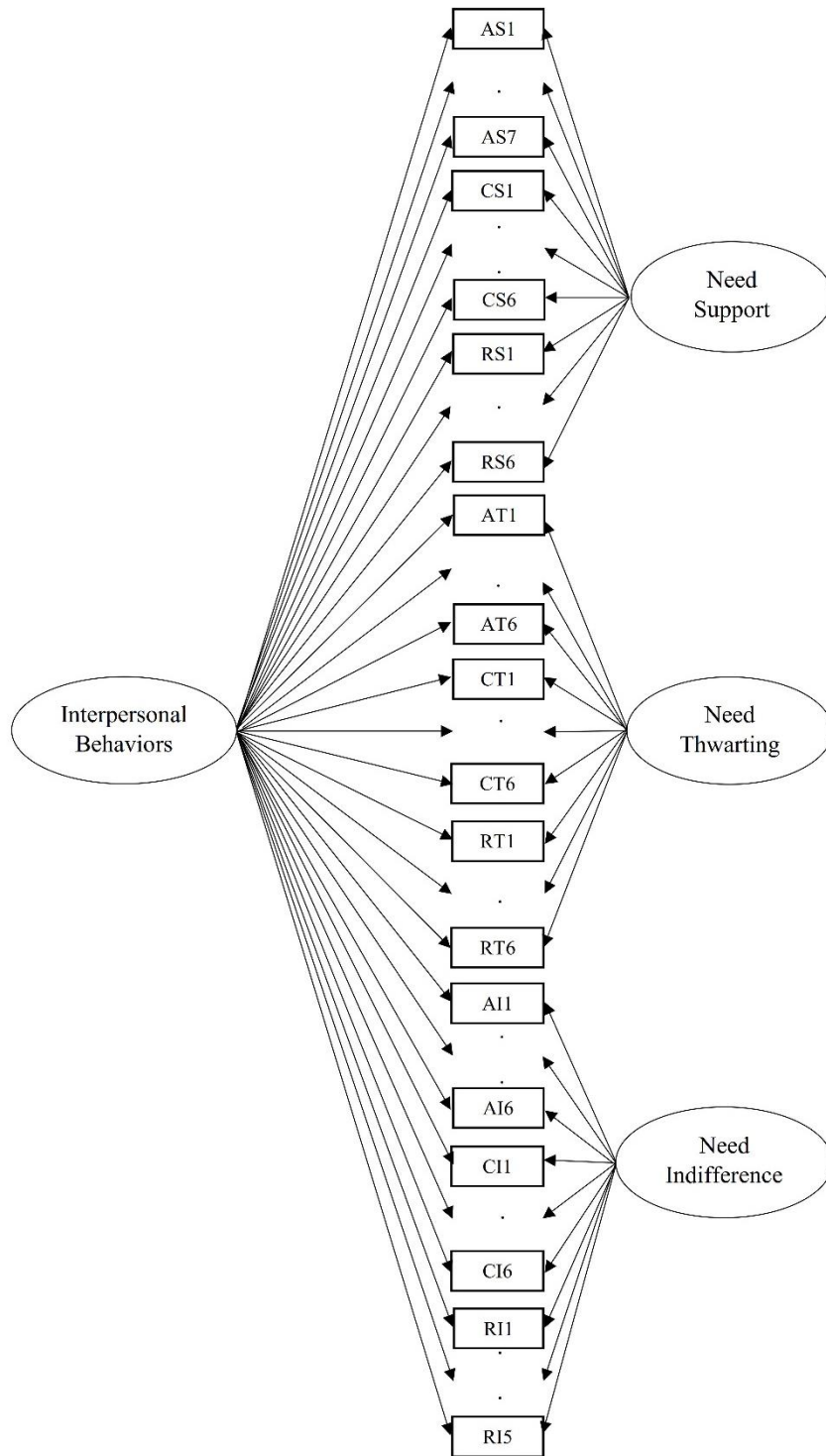
Model 6. Nine-correlated factors ESEM



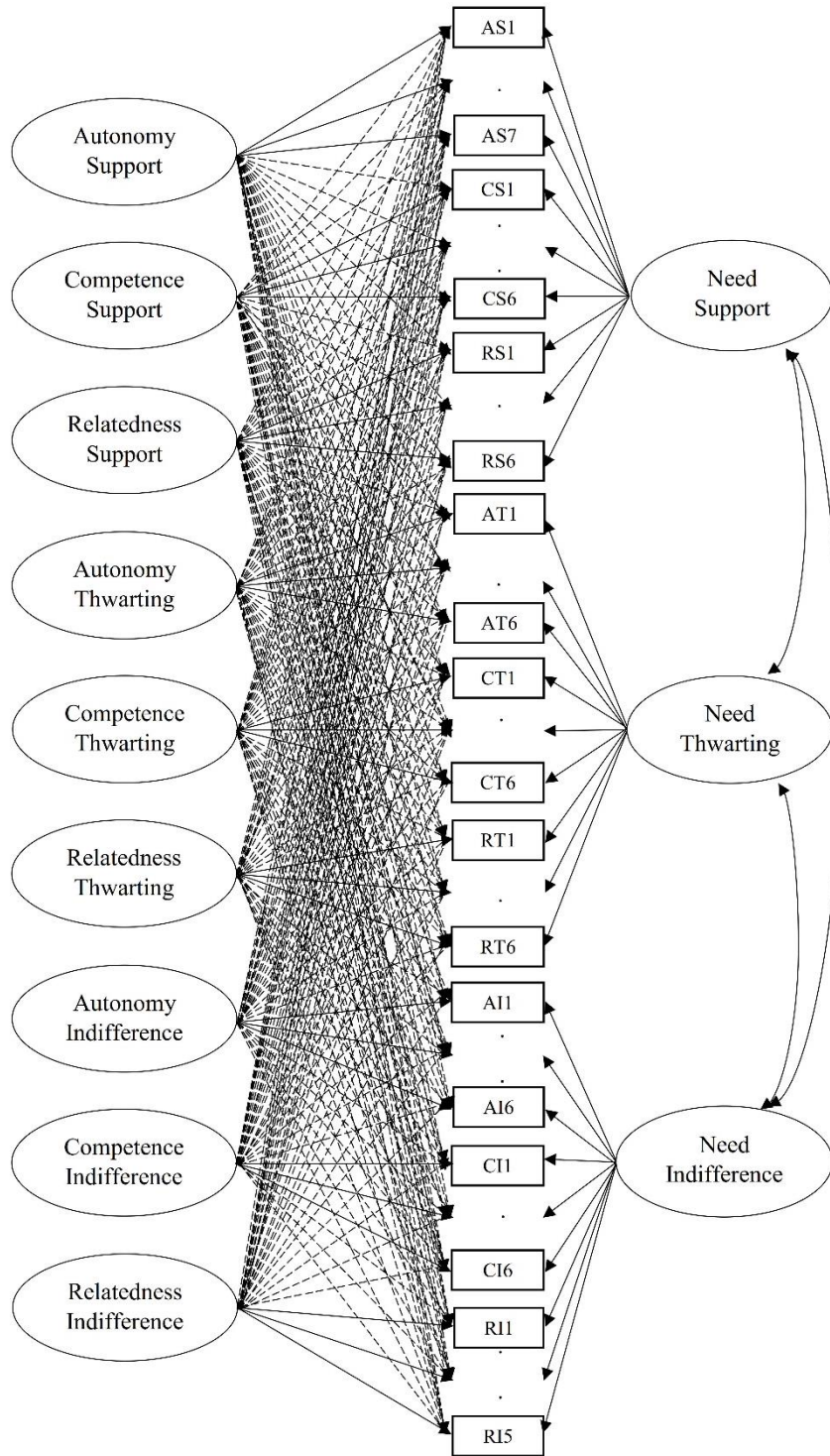
Model 7. Bifactor CFA (correlated three-G, nine-S)



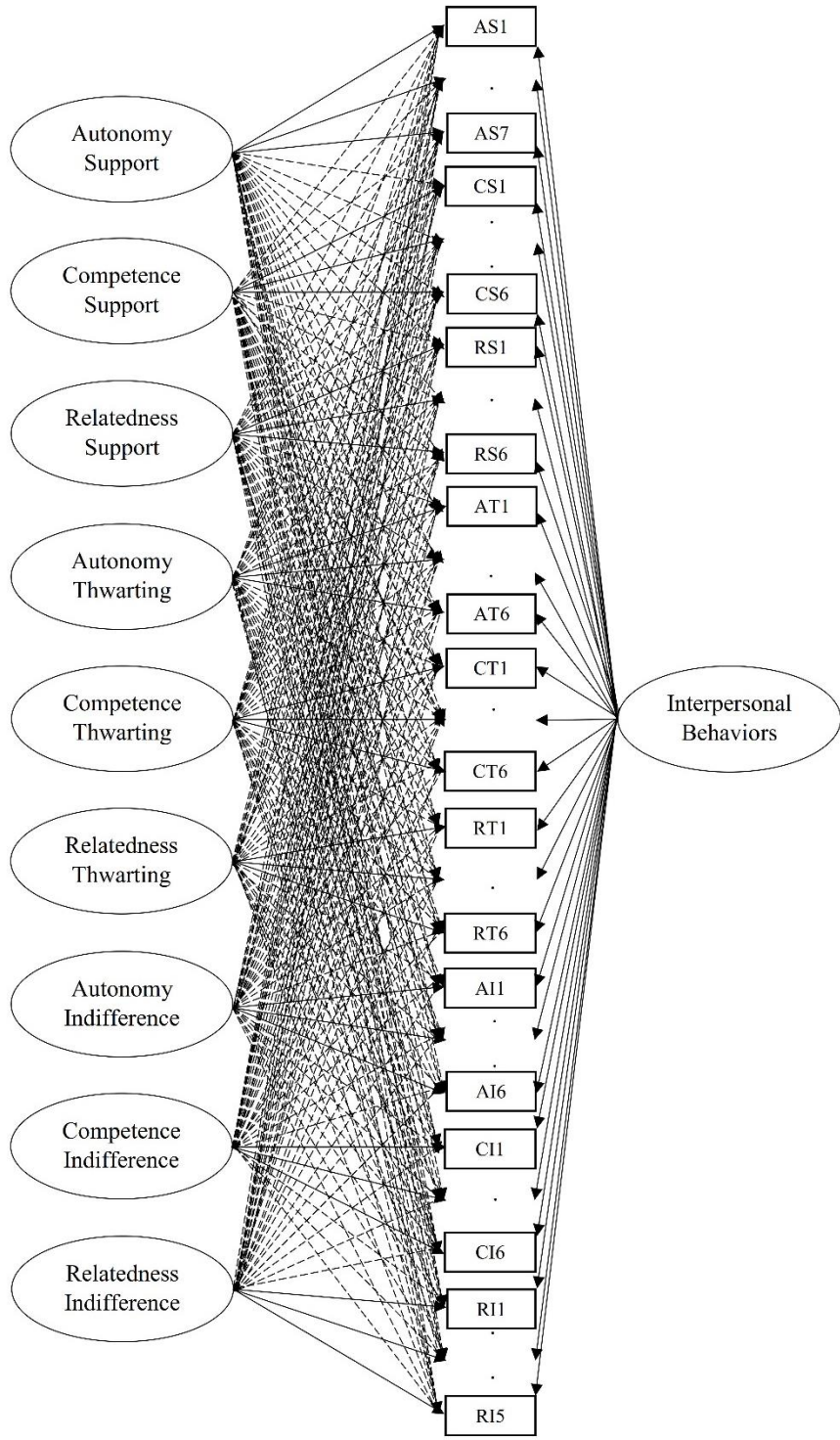
Model 8. Bifactor CFA (one-G, nine-S)



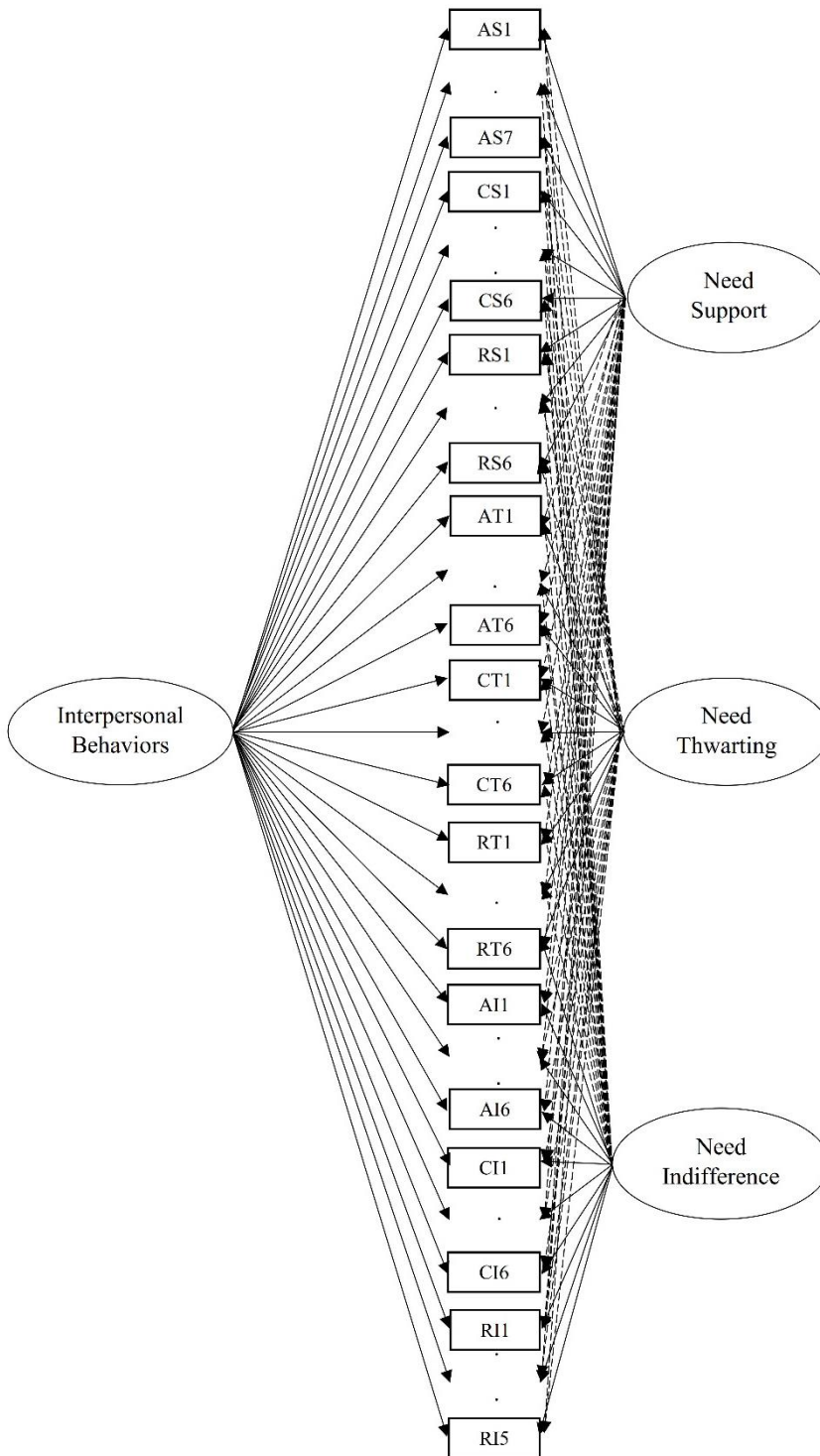
Model 9. Bifactor CFA (one-G, three-S)



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



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



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