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Implementing an Autonomy-Supportive Intervention to Develop Mental Toughness in Adolescent Rowers

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**Abstract**

It was hypothesized that autonomy-supportive coaching behaviors, psychological needs satisfaction, and mental toughness would increase, and controlling coaching behaviors and psychological needs thwarting would decrease following a coach-directed autonomy-supportive intervention. Data related to these hypotheses were collected with coaches (N = 18) and adolescent rowers (N = 61) prior to and following an 8-week intervention, and 8-weeks following the intervention. Coaches were interviewed following data collection about their involvement in the intervention. Results did not support the hypotheses. Qualitative analyses revealed that autonomy-supportive behaviors might not have been adopted due to contextual pressures on the coaches.

**Keywords**

Self-Determination Theory; Resilience; Mixed Methods; Basic Psychological Needs; Motivational Climates



68 notion of optimal human functioning forms the conceptual bridge that joins understandings of  
69 mental toughness development and SDT principles.

70         Within the context of SDT (for a review see, Deci & Ryan, 2000), the optimization of  
71 human functioning is predicated by the satisfaction of three fundamental psychological needs,  
72 namely autonomy (i.e., the perception that one's actions are self-directed and volitional),  
73 competence (i.e., the perception that one has the ability to bring about desired outcomes), and  
74 relatedness (i.e., the belief that one is valued by and connected to wide social networks).  
75 Indeed, researchers have demonstrated strong associations between psychological needs  
76 satisfaction and indicators of optimal human functioning (Deci & Ryan, 2000; Ng et al., 2012).  
77 These associations provide further support for the link between SDT and mental toughness, as  
78 these indicators of human functioning are consistent with conceptualizations of mental  
79 toughness (for a review see, Mahoney, Ntoumanis, et al., 2014). Scholars have also  
80 demonstrated that psychological needs satisfaction is contingent on the provision of particular  
81 psychosocial conditions, as well as the absence or restriction of others (Bartholomew,  
82 Ntoumanis, & Thøgersen-Ntoumani, 2009; Deci & Ryan, 2000). Researchers have contested  
83 that, within sport, coaches are the primary social agent who determine the degree to which  
84 athletes' psychological needs are satisfied or thwarted. Mageau and Vallerand (2003)  
85 suggested that certain coach behaviors promote psychological needs satisfaction in athletes  
86 (e.g., offering choices, providing rationales for tasks and limits, providing structure and  
87 involvement). These coaching behaviors, although suggested to nurture all three psychological  
88 needs (Ntoumanis, 2012), are collectively referred to as autonomy-supportive coaching  
89 behaviors.

90         Bartholomew et al. (2009) suggested that coaches not only need to display autonomy-  
91 supportive behaviors, but also avoid or minimize the use of controlling behaviors. These  
92 researchers identified that coaches could thwart psychological needs by using rewards to  
93 control behaviors, displaying negative conditional regard, intimidating athletes, and enforcing

94 excessive personal control (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010).  
95 Researchers from mental toughness (Gucciardi, Gordon, Dimmock, et al., 2009) have echoed  
96 the above arguments, reporting that coaches can support mental toughness development by  
97 displaying behaviors similar to autonomy-supportive behaviors (e.g., prioritizing athlete  
98 development, continuously challenging athletes, establishing and maintaining positive  
99 relationships), as well as avoiding or restricting actions similar to controlling behaviors (e.g.,  
100 prioritizing success, focusing on athlete weaknesses, creating unchallenging training  
101 environments). In light of the aforementioned evidence, there are reasonable grounds to  
102 suggest that coaching environments that are autonomy-supportive (while also non-controlling)  
103 promote mental toughness development through the satisfaction of psychological needs.

104         Recently, Mahoney, Gucciardi et al. (2014) provided preliminary evidence connecting  
105 SDT principles and mental toughness development. In a group of 220 adolescent cross-country  
106 athletes, they found that athletes' perceptions of autonomy-supportive coach behaviors were  
107 indirectly related to mental toughness through psychological needs satisfaction (in a positive  
108 direction) and psychological needs thwarting (in a negative direction). These authors also  
109 reported that controlling coach behaviors were related with mental toughness indirectly  
110 through psychological needs satisfaction (in a negative direction) and psychological needs  
111 thwarting (in a positive direction). In line with SDT, these authors argued that mental  
112 toughness was enhanced through the energizing effects of psychological needs satisfaction  
113 (and inhibited through the de-energizing effects of psychological needs thwarting). That is,  
114 individuals are more likely to sustain their efforts and persist on tasks – characteristics of  
115 mental toughness – when their psychological needs are satisfied because they perceive their  
116 actions as emanating from a sustainable internal source (e.g., interests, values), as opposed to  
117 uncontrollable external forces and sanctions (e.g., coercion, rewards). Unfortunately, because  
118 of the cross-sectional nature of their study, it is not possible to infer causality from Mahoney,  
119 Gucciardi et al.'s findings. However, when considered alongside the theoretical links between

120 SDT and mental toughness mentioned above, Mahoney, Gucciardi et al.'s study highlights the  
121 need for experimental research into the effectiveness of a coach intervention aimed at  
122 supporting athletes' psychological needs with the intention of promoting mental toughness  
123 development.

124 To date, only two groups of researchers have evaluated mental toughness interventions.  
125 Gucciardi, Gordon, and Dimmock (2009) evaluated the effectiveness of an athlete-centered  
126 psychological skills mental toughness intervention that was informed by their previous  
127 conceptual work (Gucciardi et al., 2008). Bell, Hardy, and Beattie (2013) evaluated a mental  
128 toughness intervention informed by literature on stress, in particular, stress-inoculation  
129 training. Both research groups garnered support for their respective interventions. Our  
130 approach differs from these two studies because it focuses on mental toughness development  
131 through the provision of optimal motivational coaching environments, thereby adding to the  
132 limited body of literature on mental toughness intervention, while also attending to the need for  
133 more experimental research in sport informed by SDT principles.

134 Meta-analytic data has supported the effectiveness of autonomy-supportive  
135 interventions implemented across a variety of contexts including healthcare, education and  
136 workplace settings ( $k = 20$ ;  $N = 916$ ;  $d = .63$ ; Su & Reeve, 2011). Findings from these studies  
137 and others (Ng et al., 2012) demonstrate that autonomy-supportive interventions are effective  
138 for enhancing individuals' satisfaction of their psychological needs as well as outcome  
139 variables that are consistent with mental toughness conceptualizations (for a discussion see,  
140 Mahoney, Ntoumanis, et al., 2014). Su and Reeve found that autonomy-supportive  
141 interventions were most effective when delivered to relatively inexperienced individuals in  
142 teaching roles (compared to professionals, parents, and workplace managers). Further,  
143 interventions were more effective if they included various forms of media (e.g., reading  
144 materials, electronic media), both knowledge- and skill-based content, an instructional period,  
145 and were between 1–3 hours in duration.

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### **The Current Study**

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This study advances previous work in three important ways. First, it is the first SDT-based intervention with mental toughness as an outcome variable, hence, it makes a unique contribution to both SDT and mental toughness literatures. Second, we experimentally test previous arguments and correlational evidence that have indicated that coaching environments might promote mental toughness development through psychological needs satisfaction (Mahoney, Gucciardi, et al., 2014; Mahoney, Ntoumanis, et al., 2014). Third, this study provides both quantitative and qualitative evaluations of the effectiveness of the intervention and identifies barriers and solutions for future intervention work in this area.

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We hypothesized that coaches would display more autonomy-supportive behaviors and less controlling behaviors following exposure to an autonomy-supportive intervention. Additionally, we predicted that athletes' perceptions of autonomy-supportive coach behaviors, psychological needs satisfaction, and mental toughness would increase after coaches had undergone the intervention. In contrast, we expected that athletes' perceptions of controlling coach behaviors and psychological needs thwarting would decrease following the intervention. We expected that these changes would be sustained eight weeks after the end of the intervention. As this study represented one of the very few controlled experiments designed to assess the effectiveness of an autonomy-supportive intervention with coaches, we also interviewed coaches to gather their thoughts on the strengths and weaknesses of the intervention. The aim of these interviews was to gather information that could help strengthen future efforts in this area of research and practice.

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### **Method**

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#### **Participants**

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Adolescent athletes ( $n = 113$ ) and their respective coaches ( $n = 18$ ) were recruited from four rowing clubs in the UK. Rowing was selected because it is a sport with year-round competition, making data collection possible over the course of the study. All four clubs

172 competed in locally and nationally coordinated rowing events. Within each club, coaches were  
173 not designated to one or more particular groups of rowers. Instead, coaches took a collective  
174 approach to training and shared coaching responsibilities across athlete cohorts. All coaches  
175 had been awarded their primary coaching certificates in the past year. As such, the recruitment  
176 of coaches complimented Su and Reeve's (2011) recommendations regarding the  
177 implementation of autonomy-supportive interventions with individuals in early-career  
178 'teaching' roles. A quasi-experimental design was employed with each club assigned to  
179 either a treatment or delayed treatment condition using a computer program.

180 **Group 1: Treatment condition.** The treatment condition comprised 10 male coaches  
181 ( $M_{\text{age}} = 53.88$ ;  $SD = 7.51$ ) from two of the four clubs, along with their respective rowers ( $n = 53$ ;  
182 17 male, 36 female;  $M_{\text{age}} = 15.33$ ,  $SD = 1.31$ ). Rowers in this group had, on average, competed  
183 for 1.65 years ( $SD = 1.51$ ) and trained 6.00 hours/week ( $SD = 3.13$ ).

184 **Group 2: Delayed treatment condition.** The delayed treatment condition comprised 8  
185 coaches ( $M_{\text{age}} = 47.80$ ;  $SD = 5.26$ ; 1 female coach) from the remaining two clubs. Participants  
186 in this group also included rowers from these clubs ( $n = 60$ ; 18 male, 42 female,  $M_{\text{age}} = 14.77$ ,  
187  $SD = 1.68$ ) who had, on average, competed for 2.35 years ( $SD = 1.58$ ) and trained 7.18  
188 hours/week ( $SD = 2.65$ ).

## 189 **Measures**

190 A number of self-report measures and qualitative interviews were employed to address  
191 the aims and hypotheses of the study.

### 192 **Established questionnaires.**

193 **Demographics.** Rowers were asked to respond to single-item questions pertaining to  
194 demographic information including age, gender, years rowing, and hours per week rowing.  
195 Coaches were asked to respond to single-item questions pertaining to their age, gender, and  
196 highest coaching qualification achieved.

197           ***Sport Climate Questionnaire – Short Form (SCQ-SF)***. The SCQ-SF (Hagger et al.,  
198           2007) is a 6-item questionnaire that assesses individuals perceptions of autonomy support (e.g.,  
199           “I feel that my coach provides me with choices and options”) on a scale ranging from 1  
200           (*strongly disagree*) to 7 (*strongly agree*). Adapted from Williams and Deci’s (1996) Learning  
201           Climate Questionnaire, researchers have demonstrated strong internal reliability for the SCQ-  
202           SF with sport samples (e.g., Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003).

203           ***Controlling Coach Behavior Scale (CCBS)***. The CCBS (Bartholomew et al., 2010) is a  
204           multidimensional self-report measure that assesses athletes’ perceptions of their coaches’  
205           controlling interpersonal styles. The measure comprises four factors: controlling use of rewards  
206           (e.g., “my coach only rewards/praises me to make me train harder”), negative conditional  
207           regard (e.g., “my coach pays me less attention if I have displeased him/her”), intimidation (e.g.,  
208           “my coach threatens to punish me to keep me in line during training”), and excessive personal  
209           control (e.g., “my coach tries to control what I do during my free time”), and is rated on a 7-  
210           point scale (1 = *strongly disagree*; 7 = *strongly agree*). Initial investigation into the  
211           psychometric properties of this measure revealed sound content and factorial validity, as well  
212           as internal consistency and invariance across gender and sport type (Bartholomew et al., 2010).

213           ***Basic Needs Satisfaction in Sport Scale (BNSSS)***. The BNSSS (Ng, Lonsdale, &  
214           Hodge, 2011) measures the degree to which athletes perceive their psychological needs as  
215           being satisfied. The 20-item measure contains three factors: competence (e.g., “I am skilled at  
216           my sport”), relatedness (e.g., “I show concern for others in my sport”), and autonomy, of which  
217           autonomy is further separated into volition (e.g., “I feel I participate in my sport willingly”),  
218           choice (e.g., “In my sport, I get opportunities to make choices”), and internal perceived locus  
219           of causality (e.g., “In my sport, I feel I am pursuing goals that are my own”). Participants are  
220           required to respond to a 7-point scale ranging from 1 (*not at all true*) to 7 (*very true*). Initial  
221           investigations have revealed sound internal consistency scores and model fit indices for the

222 measure, as well as evidence for nomological validity and test-retest reliability (Ng et al.,  
223 2011).

224 ***Psychological Needs Thwarting Scale (PNTS)***. The PNTS (Bartholomew, Ntoumanis,  
225 Ryan, & Thøgersen-Ntoumani, 2011) is a 12-item measure that requires participants to respond  
226 using a seven-point scale (1 = *strongly disagree* and 7 = *strongly agree*). The measure assesses  
227 athletes' experiences of their needs being thwarted, namely those for autonomy (e.g., "I feel  
228 pushed to behave in certain ways"), competence (e.g., "There are situations where I am made  
229 to feel inadequate"), and relatedness (e.g., "I feel rejected by those around me"). Researchers  
230 have demonstrated support for this three-factor model, as well as high internal consistency for  
231 the measure (Bartholomew et al., 2011).

232 ***Mental Toughness Index (MTI)***. The MTI is an eight-item measure of mental  
233 toughness (e.g., "I am able to regulate my focus when performing tasks") that requires  
234 participants to respond to each item on a 7-point scale (1 = *false, 100% of the time* and 7 *true,*  
235 *100% of the time*). Initial investigations by Gucciardi et al. (2015) with individuals across  
236 performance contexts (e.g., education, sport, workforce) supported the psychometric properties  
237 of this measure, as well as links with theoretically connected concepts such as performance,  
238 stress, and psychological health.

239 **Observations**. An adaptation of the observational rating scale for teacher and student  
240 behavior employed by Tessier, Sarrazin, and Ntoumanis (2010) was used to assess coaches'  
241 behaviors. This checklist requires trained observers to score coaches' behaviors on a 7-point  
242 scale across three broad categories: autonomy support (comprising organizational instructions,  
243 rationales, coach guidance), interpersonal involvement (comprising coach-athlete interaction),  
244 and structure (comprising introduction, leadership, workload, scaffolding, and debrief). Higher  
245 scores are reflective of a greater prevalence of autonomy supportive/need supportive behaviors  
246 and the measure has been shown to have adequate intra- and inter-rater reliability (Tessier et  
247 al., 2010). Audio-recordings ranged from 37-113 minutes in duration.

248           **Coach interviews.** Garnered through 1-1 semi-structured interviews, coaches were  
249 asked about their impressions of the intervention (e.g., “what did you like/dislike about the  
250 workshops?”), as well as their recommendations for future interventions (e.g., “what, if  
251 anything, could have been done differently, and how could it have been done?”). These  
252 questions predominately reflected a social validity approach in that they sought to understand  
253 the significance, appropriateness, and effect of the intervention (Wolf, 1978). Readers can  
254 obtain a copy of the full interview guide from the corresponding author upon request.

### 255 **Procedure**

256           Participant recruitment occurred following institutional ethical approval and coincided  
257 with the mid-stage of the summer rowing season, with final data collection occurred during the  
258 mid-stage of the winter season. In the UK, rowing is a year-round sport that is traditionally  
259 separated into two seasons: summer (water-based training) and winter (land-based training).  
260 Following recruitment and written consent, the rowers completed their respective  
261 questionnaire packs. The questionnaire packs took approximately 20 minutes to complete and  
262 the order of the questionnaires was counterbalanced. Due to limited resources, it was not  
263 feasible to collect observational data with all 18 coaches. As such, coach behavior data were  
264 collected from a randomly selected subsample of coaches ( $n = 6$ , that is, three coaches per  
265 condition) by audio-recording one training session per coach using a lapel microphone attached  
266 to an Olympus VN-712PC recorder.

267           Following baseline data collection, coaches in Group 1 participated in the 8-week  
268 intervention (see below). This duration was informed by previous intervention studies  
269 exploring SDT principles (Su & Reeve, 2011). Shorter time periods may not have been  
270 sufficient to change coach behavior, whereas longer interventions may have jeopardized  
271 compliance. Upon completion of the intervention, athletes from both groups again completed  
272 the aforementioned questionnaire package. These activities formed the post-intervention and  
273 second baseline data collection points for Group 1 and Group 2, respectively. Coaches in

274 Group 2 then participated in the 8-week intervention, before athletes completed the  
275 questionnaire package for a third time. At this data collection point, coaches' behaviors were  
276 again recorded as before, and a randomly selected sub-sample of coaches ( $n = 5$ ; three coaches  
277 from the autonomy-supportive intervention without delay) participated in the semi-structured  
278 interviews. These activities formed the follow-up and post-intervention data collection points  
279 for Group 1 and Group 2, respectively (see Table 1 for an illustration of the data collection  
280 points for the study). The collection of follow-up data 8-weeks following the completion of the  
281 intervention was deemed necessary to explore any maintenance effects of the intervention.

282 **Intervention.** Consistent with Su and Reeve's (2011) recommendations, coaches  
283 attended two 2-hour workshops. The last author, who was knowledgeable about SDT  
284 principles and experienced in the delivery of workshops, but who was unaware of the aims and  
285 hypotheses of the study (to avoid placing unnecessary emphasis on mental toughness  
286 development) and not involved in data collection, delivered these workshops.

287 The first workshop included both knowledge-based and skill-based activities and was  
288 divided into four broad sections. Firstly, coaches were presented with an overview of the  
289 theoretical underpinnings of SDT. During this presentation, emphasis was placed on the  
290 associated outcomes (e.g., benefits associated with task persistence and engagement, goal  
291 achievement, psychological well-being, as well as enhanced creativity, problem-solving skills,  
292 and coping abilities) of individuals who perceived psychological needs satisfaction compared  
293 to psychological needs thwarting. Secondly, coaching behaviors that have been demonstrated  
294 to enhance perceptions of psychological needs satisfaction were detailed (Mageau &  
295 Vallerand, 2003). Controlling coach behaviors were also discussed during this time and  
296 coaches were encouraged to avoid or minimize the use of such behaviors (Bartholomew et al.,  
297 2010). Following this stage of the workshop, a number of worked examples and small group  
298 activities were used to offer coaches the opportunity to demonstrate their knowledge of the  
299 information presented. Coaches were presented with workshop booklets that included a

300 number of quizzes pertaining to SDT principles, unfinished practical examples to complete,  
301 and questions about autonomy-supportive and controlling coaching scenarios. The first  
302 workshop concluded with coaches preparing a training session informed by autonomy-  
303 supportive practices. As part of this activity, coaches were asked to action their plans prior to  
304 the second workshop.

305         The second workshop, delivered 1 week after the first, was designed for coaches to  
306 discuss their experiences when implementing their training plans. During this workshop, the  
307 presenter facilitated discussions, but predominately encouraged coaches to use their knowledge  
308 and experiences from the first workshop to identify learning points, as well as help each other  
309 troubleshoot difficulties implementing autonomy-supportive behaviors. The second workshop  
310 concluded with a summary led by the presenter who reiterated the value and importance of  
311 employing coaching behaviors that support athletes' psychological needs.

312         In the 6 weeks following the second workshop, coaches were emailed supplementary  
313 information that related to SDT principles and autonomy-supportive behaviors. These materials  
314 included brief educational videos, media articles, and illustrated handouts. Again, the  
315 dissemination of these supplementary materials were consistent with Su and Reeve's (2011)  
316 recommendations.

### 317 **Coding and Analysis of Interviews**

318         Interviews ranged from 35-42 minutes in duration. Content analysis protocols were  
319 employed to interpret data from these interviews. Content analysis is an established data  
320 analysis method used for describing and quantifying phenomena and comprises three phases:  
321 preparation, organizing, and reporting (Elo & Kyngäs, 2007). In the first of these phases  
322 (preparation), transcripts are read and re-read as a way for researchers to immerse themselves  
323 in the data. Data are not analyzed during this phase per se; analysis is typically reserved for the  
324 second phase. During the second phase (organizing), researchers read the transcripts and  
325 journal comments next to interesting or significant statements, labeling these comments using

326 terms and short phrases. Employing a higher level of abstraction, these terms and short phrases  
327 are then categorized into a small number of higher order themes. In the final phase (reporting),  
328 researchers develop a table that synthesized the organizing phrase. The table includes  
329 superordinate and subordinate themes, as well as identifiers that the researchers can use to  
330 locate representative quotes. This phase also involves researchers interpreting the results,  
331 paying particular attention to translating the themes in light of contextual factors by providing  
332 descriptions and examples of each.

333 Two third-party researchers, trained in qualitative methods, but unaware of the aims  
334 and hypotheses of the study, conducted the analysis. The first researcher completed the content  
335 analyses first before presenting the second researcher with a deconstructed results table  
336 (including uncategorized raw data, subordinate themes, and superordinate themes) for the  
337 second researcher to reconstruct. The second researcher's reconstruction was 86% consistent  
338 with the first researcher's initial table. The lead author then met with both researchers to  
339 discuss disagreements until a consensus was formed about the hierarchical structure of the  
340 analysis. Finally, a detailed overview of the results was presented to the participants following  
341 analysis. Participants were asked to reflect on and verify the accuracy of the analysts'  
342 interpretations; participants voiced no disagreements.

## 343 **Results**

### 344 **Retention**

345 All 18 coaches participated across the entire duration of the study. However, athlete  
346 retention was comparatively poor. Only 61 of the original 113 rowers completed all data  
347 collection points. This attrition was due largely to athletes terminating their participation in  
348 rowing, and absenteeism during data collection points. With regards to the latter, coaches from  
349 all four clubs speculated that school holidays and examinations were the main causes of  
350 participant absenteeism. This attrition occurred despite attempts to schedule data collection

351 points outside school holidays and examination periods. The attrition rate of athlete  
352 participants across the study is depicted in a CONSORT flow diagram in Figure 1.

### 353 **Quantitative Data Analysis**

354 A series of mixed-design (3 time points x 2 conditions) ANOVAs were conducted to  
355 analyze the study hypotheses. There were no significant main effects for the study variables  
356 across time, except for psychological needs thwarting. Contrasts revealed that psychological  
357 needs thwarting scores were significantly higher at follow-up compared to post-intervention,  
358  $t(60) = -3.22, p < .01, d = -0.37$  CI [-0.56, -0.18] and follow-up compared to baseline,  $t(60) = -$   
359  $2.40, p = .02, d = -0.28$  CI [-0.48, -0.09]. There were no significant main effects for condition,  
360 or any significant time x condition interactions across the study variables (see Table 2 for  
361 descriptive statistics and a summary of results).

### 362 **Observational Data Analysis**

363 Intra-rater reliability analyses were conducted and revealed acceptable consistencies  
364 between the scores of the two raters ( $\hat{\alpha} = .84, 95\%$  CI [0.58, 0.97]). Both raters were blind to  
365 the aims of the study and the experimental condition to which the coaches belonged. A mixed-  
366 design ANOVA revealed no main effects for time or condition, or any significant time x  
367 condition (2x2) interactions (see Table 2 for descriptive statistics and summary of results).

### 368 **Qualitative Data Analysis**

369 Coaches identified a number of benefits and barriers related to the intervention. Implicit  
370 within these comments were recommendations for future interventions. Below we discuss the  
371 themes that emerged from the interviews, providing descriptions and examples of each (see  
372 Table 3 for a summary of the content analysis).

373 **Intervention benefits.** Coaches identified five benefits of the workshops: the  
374 opportunity to share ideas in a group setting, enhanced insight, affirmation of current coach  
375 practices, application of skills beyond rowing, and practical skill use. Coaches expressed the  
376 value of the group-based nature of the workshops and how sharing opinions, ideas, and

377 perspectives helped facilitate learning. Most coaches commented that they rarely met with  
378 fellow coaches to discuss their practices and that the workshops benefitted from encouraging  
379 question asking, discussion, and debate. As an example, one coach stated:

380           You got to hear about other peoples' perspectives. Whether you agreed or disagreed,  
381 they're still coaching in that style, they still have that point of view. That helps you  
382 make better decisions when you're working with your athletes and it helps you  
383 understand your colleagues better when you're coaching with them.

384           Coaches also reported that their insights about their coaching practices were enhanced  
385 through their participation in the workshops. Coaches commented that they typically did not  
386 engage in self-reflection and that the workshops offered a unique opportunity to examine their  
387 practices, why they engaged in particular behaviors, and the athlete outcomes they were  
388 targeting through their coaching. As one coach stated:

389           What was interesting was to take a step back and evaluate how much my coaching fits  
390 into the different styles and ways of coaching. It was good taking a step back and  
391 looking at the research that I could apply to my coaching.

392           Coaches also identified that the workshops affirmed their current coaching practices.  
393 Although such perspectives are supported through athletes' responses to the questionnaires at  
394 baseline (e.g., athletes' perceived their coaches as largely autonomy-supportive), they may also  
395 explain why some coaches did not report adopting new skills following the workshops. That is,  
396 coaches already believed they possessed the skills being discussed in the workshops and, as  
397 such, had little room for improvement in these areas. As an example of coaches' perceptions of  
398 their knowledge, one coach stated, "[the workshops] affirmed some of my beliefs and  
399 approaches. It was a reflection of my value system and what I've been trying to do."

400           Coaches identified that the skills that were presented in the workshops were applicable  
401 to settings outside of sport. Coaches reported using the skills in their home and work lives. "I  
402 liked the content emails where you provided a little snapshot or case study. I've passed them

403 onto my own clients from a business sense.” One coach mentioned that he continued to  
404 practice the behaviors discussed in the workshops at follow-up. This coach stated: “I really  
405 liked the idea about developing autonomy on the water. I was playing with that today actually.”  
406 While this is a benefit of the intervention, the limited reference to the application of workshop  
407 skills by the other coaches raises questions about why autonomy-supportive behaviors were not  
408 more readily adopted (see below for further discussions).

409 **Intervention barriers.** Coaches also identified four barriers to adopting the autonomy-  
410 supportive behaviors discussed in the workshops including, restrictions on time, relapsing into  
411 previous coaching practices, limited understanding of the workshop materials, and a  
412 dissonance between the workshop content and the performance context. Although only noted  
413 by one coach, most coaches (not just those interviewed) appeared to be hindered by time  
414 demands. The majority of coaches ( $n = 17$ ) were employed in fulltime work and/or had family  
415 commitments outside rowing. Further, and in support of this point, during informal discussions  
416 between the lead researcher and the coaches, coaches often stated that their resources were  
417 stretched across large athlete cohorts and that additional coaching staff were needed to  
418 unburden their coaching workload. Coaches also believed that, while they engaged in  
419 autonomy-supportive behaviors immediately following the workshops, they reverted to their  
420 original coaching practices over time. As one coach remarked, “I think I have a default style.  
421 Because work is so busy, you try something new for a few weeks, then you become lazy and  
422 go back to how you were before”.

423 During the interviews, coach also revealed, often unknowingly, that they had  
424 misinterpreted aspects of the workshops. An example of this theme was a coach who believed  
425 that autonomy-supportive coaching meant forfeiting ‘honest’ feedback, when, in reality,  
426 coaches who prescribe to autonomy-supportive coaching practices provide frequent, non-  
427 controlling feedback to foster perceptions of competence and strong coach-athlete

428 relationships. This coach said: “Sometimes I would give controlling feedback. [The athletes]  
429 prefer the honesty rather than me just being polite”.

430 Finally, coaches identified that the workshops did not appear specifically tailored to  
431 rowing, but were instead a generic program designed for any sports. One coach stated, “I  
432 suppose a bit more time to relate examples from a rowing setting would have been useful”.

### 433 **Discussion**

434 The aim of the current study was to evaluate the effectiveness of an autonomy-  
435 supportive intervention in fostering psychological needs satisfaction for the development of  
436 mental toughness in a sample of adolescent rowers. Our hypotheses were not supported.  
437 Athletes’ did not perceive coaches as displaying more autonomy-supportive behaviors and less  
438 controlling behaviors following exposure to the intervention. Additionally, athletes’  
439 perceptions of psychological needs satisfaction and mental toughness did not increase  
440 following the intervention. Further still, athletes’ perceptions of psychological needs thwarting  
441 did not decrease following the intervention. These findings indicated that the intervention was  
442 not successful in altering coach behaviors, hence a lack of support for the other hypotheses in  
443 our study. Indeed, the only significant finding to emerge from the study was an unexpected  
444 increases in athletes’ perceptions of psychological needs thwarting. This change occurred  
445 regardless of experimental condition, suggesting that these findings were not a result of the  
446 intervention and more likely a consequence of extraneous variables not directly examined in  
447 this study. Increases in land-based training (e.g., weights/ergometer training) over the course of  
448 the study may explain this unexpected finding. That is, coaches increased land-based training  
449 as the study progressed because of safety concerns following the commencement of the winter  
450 season. Some researchers have proposed that land-based, compared to water-based training,  
451 undermines the interests and enjoyment of junior rowers (Fraser-Thomas, Côté, & Deakin,  
452 2007), which may explain the increase in perceived psychological needs thwarting amongst  
453 participants.

454           There are various possible reasons why the intervention was unsuccessful in altering  
455 coaches' behaviors. Based on athletes' perceptions of coach behavior (both autonomy-  
456 supportive and controlling), as well as coaches' observed behaviors, it might be suggested that  
457 the coaches may have were already engaging in autonomy-supportive and avoiding controlling  
458 behaviors prior to the intervention (contextual barriers may also be a reason for a lack of  
459 compliance; see discussions below). Hence, future studies need to select coach participants that  
460 would benefit most from an intervention similar to that used in the current study. It is also  
461 worth addressing potential barriers to implementing autonomy-supportive interventions in  
462 sport. Researchers and practitioners could consider the barriers identified by coaches in the  
463 current study. Although autonomy-supportive interventions are suggested to be most effective  
464 when they consist of a theory-based instructional period (Su & Reeve, 2011), the delivery of  
465 such content should be conducted in innovative and appropriate ways (for futher reading, see,  
466 Mahoney, Gucciardi, Gordon, & Ntoumanis, in press). Researchers could devise creative and  
467 innovative approaches for supplementing and facilitating the communication of this complex  
468 knowledge such as replaying recorded coach-athlete interactions that demonstrate autonomy-  
469 supportive or controlling coach behaviors, as well as conducting role-plays and practical  
470 examples during workshops. Such approaches should be specifically tailored for individual  
471 sports (e.g., rowing role-plays for rowing coaches) so as to highlight the relevance and  
472 application of autonomy-supportive behaviors in context. The fidelity of tailoring interventions  
473 to the intended audience could be used to assess coach compliance (Nelson, Cordray,  
474 Hulleman, Darrow, & Sommer, 2012). While meaningful, such approaches are demanding on  
475 resources and, as such, were not able to be implemented within the current study.

#### 476 **Practical Implications**

477           Although some barriers can be addressed by attending to workshop content, other  
478 barriers reflect the contextual complexities of implementing autonomy-supportive  
479 interventions. Based on our qualitative findings, coaches in the current study found time

480 pressures a barrier to implementing the autonomy-supportive behaviors. Controlling coach  
481 behaviors are typically regarded by individuals such as coaches as a time-efficient approach to  
482 communicating information and gaining compliance (Bartholomew et al., 2009). Although  
483 some controlling coach behaviors may be more efficient initially (e.g., “you’ll keep doing this  
484 until you straighten your back” is a more efficient statement than, “if you’re able to keep your  
485 back straight, you may lengthen your stroke and move the boat faster”), they do not promote  
486 sustained learning and may have associated long-term negative consequences (e.g., increased  
487 negative affect).

488 In addition to time pressures, coaches also acknowledged that they reverted to previous  
489 coaching styles following the intervention. Researchers have argued that individuals who are  
490 predominately oriented towards being controlled by external directions and sanctions are less  
491 likely to exhibit or, following an intervention, adopt autonomy-supportive behaviors (Reeve et  
492 al., 2014). These orientations have been discussed as a “pressure from within” that inhibits the  
493 adoption of autonomy-supportive behaviors (Reeve, 2009). Coaches’ motivational orientations  
494 were not assessed in the current study, however, their resistance to adopt autonomy-supportive  
495 behaviors may reflect well-learned behaviors that align with controlling orientations. Reeve et  
496 al. (2014) suggested that individuals’ perspectives about the value of autonomy-supportive or  
497 controlling practices is a result of cultural norms. As sport tends to value controlling over  
498 autonomy-supportive coach behaviors (Mageau & Vallerand, 2003), it may be that, before  
499 autonomy-supportive interventions are implemented, researchers need to address the barriers  
500 perpetuated by these culture norms.

### 501 **Theoretical Implications**

502 Altering the cultural value placed on controlling behaviors may take considerable time  
503 and effort. Drawing on conceptual literature (Mageau & Vallerand, 2003; Reeve, 2009),  
504 coaches may feel pressured to employ controlling behaviors because of demands imposed on  
505 them. These pressures may emanate from above (e.g., the inherent power of their social roles

506 as coaches, the belief that coaches are responsible and accountable for athletes' performance)  
507 or below (e.g., responding to passive athlete behavior). Researchers could address pressures on  
508 coaches by developing strategies that help de-emphasize the power differential between  
509 coaches and athletes; working with key stakeholders (e.g., parents, club executives, sport  
510 governing bodies) to loosen the responsibility and accountability of coaches; highlighting and  
511 providing examples of the differences between notions of control and structure;  
512 communicating that while not intended, controlling behaviors further undermine athletes'  
513 interests and engagement; and educating individuals that controlling coaching does not equate  
514 to competent coaching. These recommendations are a meaningful starting point, but  
515 researchers also need to acknowledge that certain pressures (e.g., the cultural value placed on  
516 controlling behaviors) would require considerable effort and time to reduce (Reeve et al.,  
517 2014). Part of this work might entail working with sport governing bodies to educate key  
518 stakeholders, as well as coaches, about the coaching behaviors that are most likely to promote  
519 positive athlete development and growth.

520 As a broader recommendation, autonomy-supportive interventions may be more  
521 effectively implemented and evaluated if greater efforts are made to collaborate with the  
522 recipients of the intervention prior to its commencement. Recently, scholars have suggested  
523 that researchers and key stakeholders (e.g., coaches) need to collaborate prior to the  
524 development and implementation of behavior change interventions (Michie, West, & Spring,  
525 2013). Researchers may even choose to follow current national guidelines for supporting the  
526 involvement of industry and community groups (INVOLVE, 2013). For example, prior to the  
527 commencement of interventions, coaches could be involved in identifying and prioritizing  
528 what aspects they want to change, as well as offered the opportunity to comment on the  
529 intervention material developed. The reason for this bottom-up – as opposed to the traditional  
530 top-down – approach is to attend to the needs and values of individuals who participate in  
531 behavior change interventions. Through collaboration, it is argued that individuals (e.g.,

532 coaches) will engage more in behavior change because their own psychological needs will be  
533 nurtured (McLean & Mallett, 2011).

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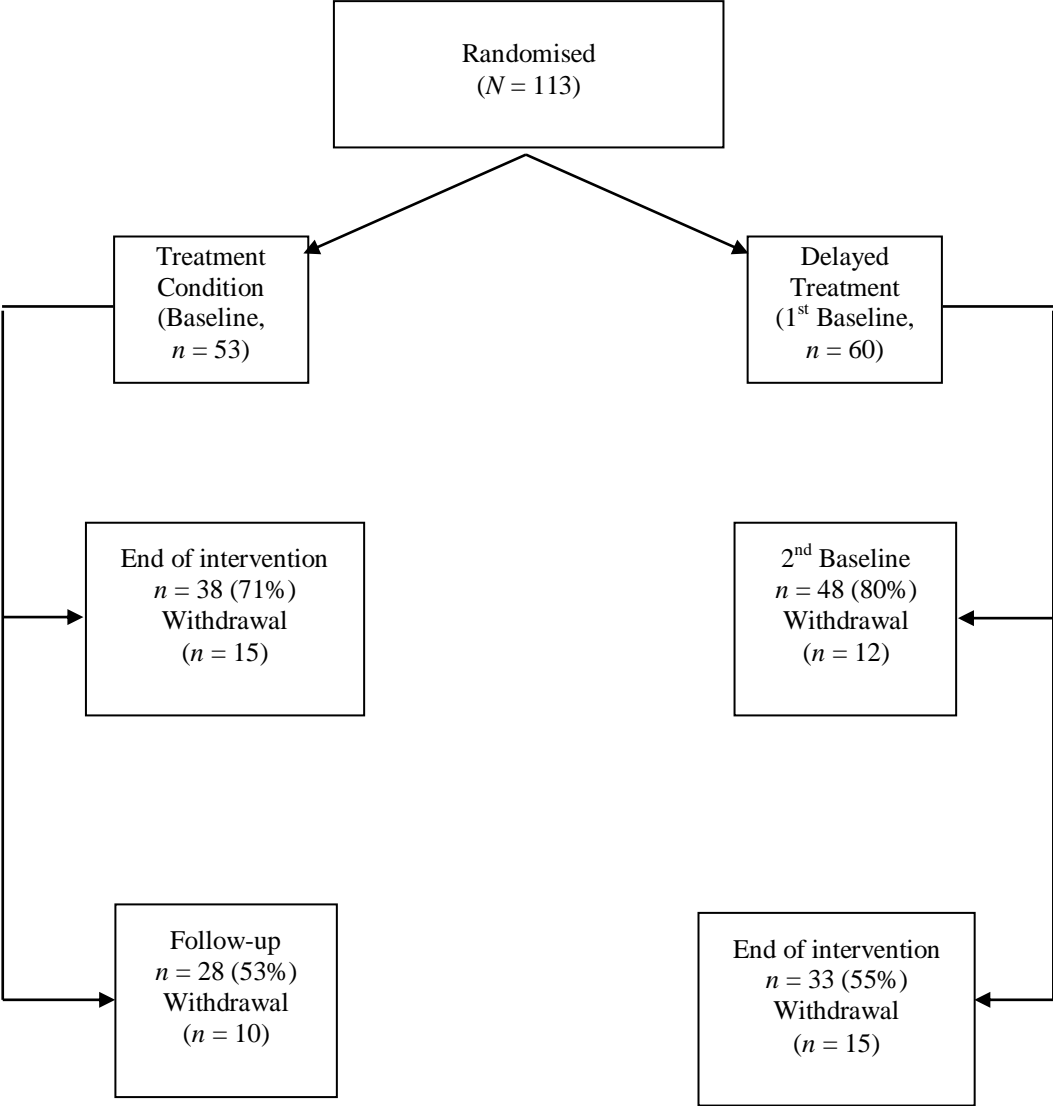


Figure 1. CONSORT flow diagram.

Table 1

*Study Timetable for the Treatment and Experimental Groups*

Week 1		Week 10		Week 19	
Treatment	Delayed	Treatment	Delayed	Treatment	Delayed
(Baseline)	(Baseline 1)	(Post-intervention)	(Baseline 2)	(Follow-up)	(Post-intervention)
Questionnaire package		Questionnaire package		Questionnaire package	
Demographic questionnaires				Coach interviews	
Coach observations				Coach observations	

Table 2

*Descriptive Statistics and Results of the Mixed-Design ANOVAs*

Variable and group	Time 1		Time 2		Time 3		Time	Condition	Time x Condition
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	$F (\eta_p^2)$	$F (\eta_p^2)$	$F (\eta_p^2)$
Perceived autonomy-supportive coaching							0.04 <sup>a</sup> (0.01)	0.50 <sup>a</sup> (0.01)	0.37 (0.01)
Treatment	5.24	1.14	5.26	0.98	5.14	1.33			
Delayed	5.34	1.21	5.38	1.06	5.45	1.23			
Perceived controlling coaching							2.97 <sup>b</sup> (0.05)	0.39 <sup>b</sup> (0.01)	0.09 (0.01)
Treatment	2.77	1.18	2.60	1.15	2.82	1.23			
Delayed	2.57	0.71	2.47	0.72	2.71	1.02			
Psychological needs satisfaction							0.14 (0.01)	0.23 (0.01)	0.38 (0.01)
Treatment	5.26	0.75	5.36	0.73	5.35	0.74			
Delayed	5.43	0.89	5.36	0.95	5.44	0.77			
Psychological needs thwarting							5.87 <sup>*</sup> (0.10)	0.03 (0.01)	0.61 (0.01)
Treatment	2.58	1.07	2.38	0.97	2.76	1.18			
Delayed	2.47	1.07	2.47	0.99	2.90	1.16			
Mental toughness							0.05 <sup>c</sup> (0.01)	0.90 <sup>c</sup> (0.02)	0.36 (0.01)
Treatment	5.29	0.77	5.35	0.76	5.40	0.99			
Delayed	5.54	0.80	5.52	0.73	5.48	0.88			
Observed Coach behaviors							0.45 (0.01)	0.04 (0.01)	0.94 (0.03)

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Treatment	4.33	1.06	4.18	0.57
Delayed	3.96	0.85	4.78	1.09

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*Note.* Epsilon corrected *df* values, <sup>a</sup>*df* = 1.81, 106.92; <sup>b</sup>*df* = 1.70, 100.27; <sup>c</sup>*df* = 1.68, 99.17; where not otherwise specified, Time *df* = 2, 118, Condition *df* = 1, 59, Time x

Condition *df* = 2, 118; \**p* < 0.01.

Table 3

*Summary of Superordinate and Subordinate Themes, as well as Descriptions, Following Content Analysis*

Superordinate theme and description	Subordinate theme	Description
Intervention benefits – Positive aspects of and reflections about the autonomy-supportive intervention	Group work	Group discussions and activities supported learning and enhanced understanding (4)
	Enhanced insight	Sharing ideas allowed for a deeper understanding of how coaches practiced their trade (3)
	Affirming	Workshops emphasized that current coaching behaviors were supported by research (2)
	Application beyond rowing	Use of skills from workshop outside coaching (2)
	Practical skill use	Use of skills from the workshop in coaching (1)
Intervention barriers – Obstacles that inhibited the adoption of autonomy-supportive behaviors	Limited comprehension	Coaches misinterpreted aspects of the workshops, especially notions of coach control and autonomy-support (3)
	Relevance to rowing	Coaches felt as though the workshop content was unrelated to rowing (3)
	Competing time demands	Coaches were unable to commit to the coaching behaviors suggested in the workshops because of time demands beyond rowing (2)
	Relapse to previous style	Reverted to previous coaching style (2)

*Note.* Number in parentheses denotes number of coaches who referenced the subordinate theme (total  $n = 6$ )