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

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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.

With an increased understanding of mental toughness and its key components (Gucciardi & Gordon, 2011), researchers have shifted their attentions and efforts from these foundational topics to exploring key factors associated with mental toughness development (Gucciardi, Gordon, Dimmock, & Mallett, 2009; Weinberg, Butt, & Culp, 2011). In so doing, researchers have attempted to ground understanding of mental toughness development in established theory from broader fields of psychological inquiry. In particular, one group of researchers (Mahoney, Gucciardi, Ntoumanis, & Mallett, 2014; Mahoney, Ntoumanis, Mallett, & Gucciardi, 2014) have argued for and provided preliminary evidence to support the usefulness

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of self-determination theory (SDT; Deci & Ryan, 1985) for understanding mental toughness development. The purpose of the current study was to extend on these recent advances by evaluating the effectiveness of an SDT-informed intervention for developing mental toughness in a sport setting.

AN OVERVIEW OF MENTAL TOUGHNESS AND SDT

A number of definitions of mental toughness have been offered in the past decade (Gucciardi, Gordon, & Dimmock, 2008; Jones, Hanton, & Connaughton, 2007). Despite some differences, these definitions share considerable conceptual space. Gucciardi, Hanton, Gordon, Mallett, and Temby (2015) acknowledged these similarities and defined mental toughness as the capacity to attain and sustain high-performance standards commensurate with subjective (e.g., goal progress) and objective indicators (e.g., race times), especially when faced with challenges, stressors, and adversities. Based on this definition, mental toughness is a concept that broadly references the optimization of human functioning. Like mental toughness, the optimization of human functioning is also a central focus of SDT—in particular, the processes and conditions that foster and forestall such functioning (Deci & Ryan, 2000). As such, the notion of optimal human functioning forms the conceptual bridge that joins understandings of mental toughness development and SDT principles.

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

Bartholomew et al. (2009) suggested that coaches not only need to display autonomy-supportive behaviors but also need to avoid or minimize the use of controlling behaviors. These researchers identified that coaches could thwart psychological needs by using rewards to control behaviors, displaying negative conditional regard, intimidating athletes, and enforcing excessive personal control (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010). Researchers of mental toughness (Gucciardi, Gordon, Dimmock, et al., 2009) have echoed the preceding arguments, reporting that coaches can support mental toughness development by displaying behaviors similar to autonomy-supportive behaviors (e.g., prioritizing athlete development, continuously challenging athletes, establishing and maintaining positive

relationships), as well as avoiding or restricting actions similar to controlling behaviors (e.g., prioritizing success, focusing on athlete weaknesses, creating unchallenging training environments). In light of the aforementioned evidence, there are reasonable grounds to imply that coaching environments that are autonomy supportive (while also noncontrolling) promote mental toughness development through the satisfaction of psychological needs.

Recently, Mahoney, Gucciardi, et al. (2014) provided preliminary evidence connecting SDT principles and mental toughness development. In a group of 220 adolescent cross-country athletes, they found that athletes' perceptions of autonomy-supportive coach behaviors were indirectly related to mental toughness through psychological needs satisfaction (in a positive direction) and psychological needs thwarting (in a negative direction). These authors also reported that controlling coach behaviors were related with mental toughness indirectly through psychological needs satisfaction (in a negative direction) and psychological needs thwarting (in a positive direction). In line with SDT, these authors argued that mental toughness was enhanced through the energizing effects of psychological needs satisfaction (and inhibited through the deenergizing effects of psychological needs thwarting). That is, individuals are more likely to sustain their efforts and persist on tasks—characteristics of mental toughness—when their psychological needs are satisfied because they perceive their actions as emanating from a sustainable internal source (e.g., interests, values), as opposed to uncontrollable external forces and sanctions (e.g., coercion, rewards). Unfortunately, because of the cross-sectional nature of their study, it is not possible to infer causality from Mahoney, Gucciardi, et al.'s findings. However, when considered alongside the theoretical links between SDT and mental toughness just mentioned, Mahoney, Gucciardi, et al.'s study highlights the need for experimental research into the effectiveness of a coach intervention aimed at supporting athletes' psychological needs with the intention of promoting mental toughness development.

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

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

THE CURRENT STUDY

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.

We hypothesized that coaches would display more autonomy-supportive behaviors and less controlling behaviors following exposure to an autonomy-supportive intervention. In addition, 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 8 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.

METHOD

Participants

Adolescent athletes ($n = 113$) and their respective coaches ($n = 18$) were recruited from four rowing clubs in the United Kingdom. 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 competed in locally and nationally coordinated rowing events. Within each club, coaches were not designated to one or more particular groups of rowers. Instead, coaches took a collective approach to training and shared coaching responsibilities across athlete cohorts. All coaches had been awarded their primary coaching certificates in the past year. As such, the recruitment of coaches complimented Su and Reeve (2011) recommendations regarding the implementation of autonomy-supportive interventions with individuals in early-career "teaching" roles. A quasi-experimental design was employed with each club assigned to either a treatment or delayed treatment condition using a computer program.

Group 1: Treatment Condition

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

Group 2: Delayed Treatment Condition

The delayed treatment condition comprised eight coaches ($M_{\text{age}} = 47.80$, $SD = 5.26$; one female coach) from the remaining two clubs. Participants in this group also included rowers

from these clubs ($n = 60$; 18 male, 42 female; $M_{\text{age}} = 14.77$, $SD = 1.68$) who had, on average, competed for 2.35 years ($SD = 1.58$) and trained 7.18 hr/week ($SD = 2.65$).

Measures

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

Established Questionnaires

Demographics

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

Sport Climate Questionnaire–Short Form (SCQ-SF)

The SCQ-SF (Hagger et al., 2007) is a six-item questionnaire that assesses individuals' perceptions of autonomy support (e.g., "I feel that my coach provides me with choices and options") on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The SCQ-SF was adapted from Williams and Deci's (1996) Learning Climate Questionnaire, and researchers have demonstrated strong internal reliability for the SCQ-SF with sport samples (e.g., Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003).

Controlling Coach Behavior Scale

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

Basic Needs Satisfaction in Sport Scale

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

Psychological Needs Thwarting Scale

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

Mental Toughness Index

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

Observations

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

Coach interviews

Garnered through one-to-one semistructured interviews, coaches were asked about their impressions of the intervention (e.g., "What did you like/dislike about the workshops?"), as well as their recommendations for future interventions (e.g., "What, if anything, could have been done differently, and how could it have been done?"). These questions predominately reflected a social validity approach in that they sought to understand the significance, appropriateness, and effect of the intervention (Wolf, 1978). Readers can obtain a copy of the full interview guide from the corresponding author upon request.

Procedure

Participant recruitment occurred following institutional ethical approval and coincided with the midstage of the summer rowing season, with final data collection occurring during the midstage of the winter season. In the United Kingdom, rowing is a year-round sport that is traditionally separated into two seasons: summer (water-based training) and winter (land-based training). Following recruitment and written consent, the rowers completed their respective questionnaire packs. The questionnaire packs took approximately 20 min to complete, and the order of the questionnaires was counterbalanced. Due to limited resources, it was not feasible to collect observational data with all 18 coaches. As such, coach behavior data were collected

Table 1
Study Timetable for the Treatment and Experimental Groups

Week 1		Week 10		Week 19	
Treatment (baseline)	Delayed (Baseline 1)	Treatment (postintervention)	Delayed (Baseline 2)	Treatment (follow-up)	Delayed (postintervention)
Questionnaire package		Questionnaire package		Questionnaire package	
Demographic questionnaires				Coach interviews	
Coach observations				Coach observations	

from a randomly selected subsample of coaches ($n = 6$, i.e., three coaches per condition) by audio-recording one training session per coach using a lapel microphone attached to an Olympus VN-712PC recorder.

Following baseline data collection, coaches in Group 1 participated in the 8-week intervention (described next). This duration was informed by previous intervention studies exploring SDT principles (Su & Reeve, 2011). Shorter periods may not have been sufficient to change coach behavior, whereas longer interventions may have jeopardized compliance. Upon completion of the intervention, athletes from both groups again completed the aforementioned questionnaire package. These activities formed the post-intervention and second baseline data collection points for Group 1 and Group 2, respectively. Coaches in Group 2 then participated in the 8-week intervention, before athletes completed the questionnaire package for a third time. At this data collection point, coaches' behaviors were again recorded as before, and a randomly selected subsample of coaches ($n = 5$; three coaches from the autonomy-supportive intervention without delay) participated in the semistructured interviews. These activities formed the follow-up and postintervention data collection points for Group 1 and Group 2, respectively (see Table 1 for an illustration of the data collection points for the study). The collection of follow-up data 8 weeks following the completion of the intervention was deemed necessary to explore any maintenance effects of the intervention.

Intervention

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

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

tivities were used to offer coaches the opportunity to demonstrate their knowledge of the information presented. Coaches were presented with workshop booklets that included a number of quizzes pertaining to SDT principles, unfinished practical examples to complete, and questions about autonomy-supportive and controlling coaching scenarios. The first workshop concluded with coaches preparing a training session informed by autonomy-supportive practices. As part of this activity, coaches were asked to action their plans prior to the second workshop.

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

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

Coding and Analysis of Interviews

Interviews ranged from 35 to 42 min. Content analysis protocols were employed to interpret data from these interviews. Content analysis is an established data analysis method used for describing and quantifying phenomena and comprises three phases: preparation, organizing, and reporting (Elo & Kyngäs, 2007). In the first of these phases (preparation), transcripts are read and reread as a way for researchers to immerse themselves in the data. Data are not analyzed during this phase per se; analysis is typically reserved for the second phase. During the second phase (organizing), researchers read the transcripts and journal comments next to interesting or significant statements, labeling these comments using terms and short phrases. Employing a higher level of abstraction, these terms and short phrases are then categorized into a small number of higher order themes. In the final phase (reporting), researchers develop a table that synthesized the organizing phrase. The table includes superordinate and subordinate themes, as well as identifiers that the researchers can use to locate representative quotes. This phase also involves researchers interpreting the results, paying particular attention to translating the themes in light of contextual factors by providing descriptions and examples of each.

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

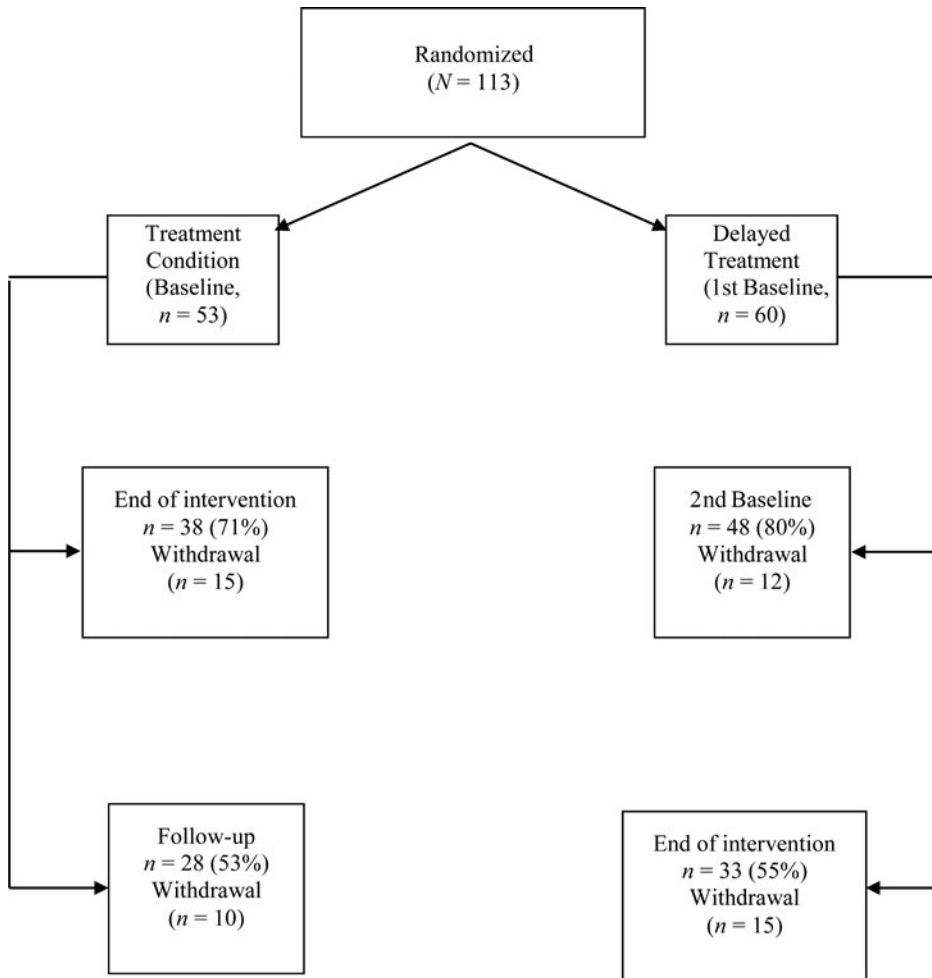


Figure 1. CONSORT flow diagram.

RESULTS

Retention

All 18 coaches participated across the entire duration of the study. However, athlete retention was comparatively poor. Only 61 of the original 113 rowers completed all data collection points. This attrition was due largely to athletes terminating their participation in rowing and to absenteeism during data collection points. With regards to the latter, coaches from all four clubs speculated that school holidays and examinations were the main causes of participant absenteeism. This attrition occurred despite attempts to schedule data collection points outside school holidays and examination periods. The attrition rate of athlete participants across the study is depicted in a CONSORT flow diagram in Figure 1.

Quantitative Data Analysis

A series of mixed-design (3 time points \times 2 conditions) analyses of variance were conducted to analyze the study hypotheses. There were no significant main effects for the study variables across time, except for psychological needs thwarting. Contrasts revealed that psychological needs thwarting scores were significantly higher at follow-up compared to postintervention, $t(60) = -3.22$, $p = .01$, $d = -0.37$, confidence interval (CI) $[-0.56, -0.18]$, and follow-up compared to baseline, $t(60) = -2.40$, $p = .02$, $d = -0.28$, CI $[-0.48, -0.09]$. There were no significant main effects for condition, or any significant Time \times Condition interactions across the study variables (see Table 2 for descriptive statistics and a summary of results).

Observational Data Analysis

Intrarater reliability analyses were conducted and revealed acceptable consistencies between the scores of the two raters ($\hat{O} = .84$), 95% CI $[0.58, 0.97]$. Both raters were blind to the aims of the study and the experimental condition to which the coaches belonged. A mixed-design analysis of variance revealed no main effects for time or condition, or any significant Time \times Condition (2×2) interactions (see Table 2 for descriptive statistics and summary of results).

Qualitative Data Analysis

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

Intervention Benefits

Coaches identified five benefits of the workshops: the opportunity to share ideas in a group setting, enhanced insight, affirmation of current coach practices, application of skills beyond rowing, and practical skill use. Coaches expressed the value of the group-based nature of the workshops and how sharing opinions, ideas, and perspectives helped facilitate learning. Most coaches commented that they rarely met with fellow coaches to discuss their practices and that the workshops benefitted from encouraging question asking, discussion, and debate. As an example, one coach stated,

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

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

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

Table 2
Descriptive Statistics and Results of the Mixed-Design Analyses of Variance

Variable and group	Time 1		Time 2		Time 3		Time F (η_p^2)	Condition F (η_p^2)	Time \times Condition F (η_p^2)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
	Perceived autonomy-supportive coaching								
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 ^b (0.05)	0.39 ^b (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* (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 ^c (0.01)	0.90 ^c (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)
Treatment	4.33	1.06			4.18	0.57			
Delayed	3.96	0.85			4.78	1.09			

Note. Epsilon corrected *df* values.

^a*df* = 1.81, 106.92. ^b*df* = 1.70, 100.27. ^c*df* = 1.68, 99.17, where not otherwise specified, Time *df* = 2, 118; Condition *df* = 1, 59; Time \times Condition *df* = 2, 118. **p* .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 implied 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 ($N = 6$).

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

Coaches identified that the skills that were presented in the workshops were applicable to settings outside of sport. Coaches reported using the skills in their home and work lives. "I liked the content emails where you provided a little snapshot or case study. I've passed them onto my own clients from a business sense." One coach mentioned that he continued to practice the behaviors discussed in the workshops at follow-up. This coach stated, "I really liked the idea about developing autonomy on the water. I was playing with that today actually." Although this is a benefit of the intervention, the limited reference to the application of workshop skills by the other coaches raises questions about why autonomy-supportive behaviors were not more readily adopted (see the following for further discussions).

Intervention Barriers

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

During the interviews, coach also revealed, often unknowingly, that they had misinterpreted aspects of the workshops. An example of this theme was a coach who believed that autonomy-supportive coaching meant forfeiting "honest" feedback, when, in reality, coaches who prescribe to autonomy-supportive coaching practices provide frequent, noncontrolling feedback to foster perceptions of competence and strong coach-athlete relationships. This coach said, "Sometimes I would give controlling feedback. [The athletes] prefer the honesty rather than me just being polite."

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

DISCUSSION

The aim of the current study was to evaluate the effectiveness of an autonomy-supportive intervention in fostering psychological needs satisfaction for the development of mental toughness in a sample of adolescent rowers. Our hypotheses were not supported. Athletes did not perceive coaches as displaying more autonomy-supportive behaviors and less controlling behaviors following exposure to the intervention. In addition, athletes' perceptions of psychological needs satisfaction and mental toughness did not increase following the intervention. Furthermore, athletes' perceptions of psychological needs thwarting did not decrease following the intervention. These findings indicated that the intervention was not successful in altering coach behaviors, hence a lack of support for the other hypotheses in our study. Indeed, the only significant finding to emerge from the study was an unexpected increase in athletes' perceptions of psychological needs thwarting. This change occurred regardless of experimental condition, implying that these findings were not a result of the intervention and more likely a consequence of extraneous variables not directly examined in this study. Increases in land-based training (e.g., weights/ergometer training) over the course of the study may explain this unexpected finding. That is, coaches increased land-based training as the study progressed because of safety concerns following the commencement of the winter season. Some researchers have proposed that land-based, compared to water-based, training undermines the interests and enjoyment of junior rowers (Fraser-Thomas, Côté, & Deakin,

2007), which may explain the increase in perceived psychological needs thwarting among participants.

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

Practical Implications

Although some barriers can be addressed by attending to workshop content, other barriers reflect the contextual complexities of implementing autonomy-supportive interventions. Based on our qualitative findings, coaches in the current study found time pressures a barrier to implementing the autonomy-supportive behaviors. Controlling coach behaviors are typically regarded by individuals such as coaches as a time-efficient approach to communicating information and gaining compliance (Bartholomew et al., 2009). Although some controlling coach behaviors may be more efficient initially (e.g., "You'll keep doing this until you straighten your back" is a more efficient statement than "If you're able to keep your back straight, you may lengthen your stroke and move the boat faster"), they do not promote sustained learning and may have associated long-term negative consequences (e.g., increased negative affect).

In addition to time pressures, coaches also acknowledged that they reverted to previous coaching styles following the intervention. Researchers have argued that individuals who are predominately oriented toward being controlled by external directions and sanctions are less likely to exhibit or, following an intervention, adopt autonomy-supportive behaviors (Reeve et al., 2014). These orientations have been discussed as a "pressure from within" that inhibits the adoption of autonomy-supportive behaviors (Reeve, 2009). Coaches' motivational orientations were not assessed in the current study; however, their resistance to adopt autonomy-supportive behaviors may reflect well-learned behaviors that align with controlling orientations. Reeve et al. (2014) suggested that individuals' perspectives about the value of autonomy-supportive or controlling practices is a result of cultural norms. As sport tends to value controlling over autonomy-supportive coach behaviors (Mageau & Vallerand, 2003), it may be that, before

autonomy-supportive interventions are implemented, researchers need to address the barriers perpetuated by these culture norms.

Theoretical Implications

Altering the cultural value placed on controlling behaviors may take considerable time and effort. Drawing on conceptual literature (Mageau & Vallerand, 2003; Reeve, 2009), coaches may feel pressured to employ controlling behaviors because of demands imposed on them. These pressures may emanate from above (e.g., the inherent power of their social roles as coaches, the belief that coaches are responsible and accountable for athletes' performance) or below (e.g., responding to passive athlete behavior). Researchers could address pressures on coaches by developing strategies that help deemphasize the power differential between coaches and athletes; working with key stakeholders (e.g., parents, club executives, sport governing bodies) to loosen the responsibility and accountability of coaches; highlighting and providing examples of the differences between notions of control and structure; communicating that although not intended, controlling behaviors further undermine athletes' interests and engagement; and educating individuals that controlling coaching does not equate to competent coaching. These recommendations are a meaningful starting point, but researchers also need to acknowledge that certain pressures (e.g., the cultural value placed on controlling behaviors) would require considerable effort and time to reduce (Reeve et al., 2014). Part of this work might entail working with sport governing bodies to educate key stakeholders, as well as coaches, about the coaching behaviors that are most likely to promote positive athlete development and growth.

As a broader recommendation, autonomy-supportive interventions may be more effectively implemented and evaluated if greater efforts are made to collaborate with the recipients of the intervention prior to its commencement. Recently, scholars have suggested that researchers and key stakeholders (e.g., coaches) need to collaborate prior to the development and implementation of behavior change interventions (Michie, West, & Spring, 2013). Researchers may even choose to follow current national guidelines for supporting the involvement of industry and community groups (INVOLVE, 2013). For example, prior to the commencement of interventions, coaches could be involved in identifying and prioritizing what aspects they want to change, as well as offered the opportunity to comment on the intervention material developed. The reason for this bottom-up—as opposed to the traditional top-down—approach is to attend to the needs and values of individuals who participate in behavior change interventions. Through collaboration, it is argued that individuals (e.g., coaches) will engage more in behavior change because their own psychological needs will be nurtured (McLean & Mallett, 2011).

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