Original Article

The effects of Mindful Sport Performance Enhancement (MSPE) training on mindfulness, and flow in national competitive swimmers

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ABSTRACT

There are limited studies examining the effects of a mindfulness intervention for a specific sport population group. The aim of this applied study was to investigate the effects of a mindful sport performance enhancement (MSPE) program on the mindfulness and flow of adolescent swimmers. Sixteen competitive adolescent swimmers were split into MSPE (n = 9) and relaxation training (RT) (n = 7) groups for eight weeks. Participants completed measures of trait and state flow mindfulness pre and post intervention. Paired t test results revealed that the MSPE group improved trait flow characteristics and global trait flow. ANCOVA analysis also revealed significantly higher effects on global trait flow and the action-awareness merging and clear goals subscales for the MSPE group compared to the RT group. These results suggested that sport orientated mindfulness interventions can psychologically benefit competitive youth swimmers. The study indicates that further research could consider applied designs to investigate in more detail the experiences this population has with specific mindfulness exercises.
Keywords: Sport Performance; Adolescents; Interventions.

Cite this article as:
Chen, M.A., & Meggs, J. (2020). The effects of Mindful Sport Performance Enhancement (MSPE) training on mindfulness, and flow in national competitive swimmers. *Journal of Human Sport and Exercise*, *in press*. doi:https://doi.org/10.14198/jhse.2021.163.04

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E-mail: m.chen@tees.ac.uk
Submitted for publication February 03, 2020
Accepted for publication April 03, 2020
Published *in press* April 24, 2020
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2021.163.04

INTRODUCTION

There has been growing interest in mindfulness interventions for sports performance enhancement as reflected in a recent systematic review (Sappington &Longshore, 2015). One definition of mindfulness is " *paying attention in a particular way: on purpose – in the present moment and non-judgementally*." (Kabat-Zinn, 1994). Mindfulness training aims to develop the athletes awareness of both negative and positive emotions, thoughts and physical sensations through processes of emotional and attentional regulation. Emotion regulation is the "internal and external processes responsible for experiencing, expressing and modulating one's emotions in the service of goal achievement" (Moore & Gardner, 2011, p.249). In practice, the mindful approach to emotional regulation aims to (1) help athletes develop tolerance of their cognitions and view them as naturally occurring and time limited without labelling them and (2) help athletes develop a decentred approach to their cognitions that sees them as internal events of the mind which are merely hypothesis. Focusing on experience in the present, develops attention skills such as focusing on the breadth, and receptive attention where attention is maintained in the present without limitation or direction (Jha, Krompinger & Baine, 2007; Jha, Stanley, Kiyonaga, Wong & Gelfand, 2010). Evidence has shown that these attention practices help adaptive emotional regulation by promoting the experience of unwanted emotions in a non-judgemental manner thus assisting goal-regulated behaviour (Marks, 2008).Those who practice mindfulness experience trait-like differences in their ability to regulate attention in response to stress-inducing stimuli (Davidson, 2002). For example, Slagter, Lutz, Greischar, Francis, Nieuwenhuis, and David et al (2007) found that 3 months of regular meditation led to an increased efficiency of allocating attentional resources.

The primary practice of concentrative and receptive attention that is developed by mindfulness training is a facet of the flow state (Jackson, 2016). Recent empirical and practical work using the MSPE model has identified links between mindfulness and flow (Kaufmann et al, 2009; Swann, Keegan, Piggot & Crust, 2012). Jackson (2016) defines flow as complete involvement in the task at hand for the sake of the absorbing experience itself. Flow can be viewed as an optimal performance state, characterized by fluid, autonomous movement, cognitive clarity and positive affect (Swann et al, 2012; Csikszentmihalyi, 2002).

There are nine dimensions of the flow experience (Csikszentmihalyi, 2002).; *challenge-skill balance, action-awareness merging, clear goals*, are thought to allow for the optimal 'flow' conditions to occur (Nakamura &Csikszentmihalyi, 2002). The remaining six dimensions; *unambiguous feedback, concentration on task, sense of control, loss of self-consciousness*, *time transformation* and *autotelic experience* are proposed to be experiential aspects of flow. It is proposed that the experiential aspects of flow, with a strong emphasis on concentration and focus are interrelated and consistent with the aims and practices of mindfulness training (Jackson, 2016).

As mindfulness training emphasises the present moment and non-judgemental acceptance of internal and external experiences it seems logical that mindful practice may be helpful in achieving the flow state and thus leading to optimized performance (Bishop, Lau, Shapiro, Carlson, Anderson, Carmondy et al 2004; Kaufmann, et al, 2009).

Recent non-randomized experimental studies have sought to establish if mindfulness training, has an influence on flow and performance (Hasker, 2010; Bernier, Thienor, Codron & Fournier, 2009; Thompson, Kaufmann, De Petrillo, Glass & Arnkoff, 2011; Scott-Hamilton, Schutte, & Brown, 2016). Although, some of these studies have shown that mindfulness-based training improves flow states relative to control groups, methodological limitations (e.g., no details of control group procedures or individual qualitative accounts of

the mindful intervention) prevent clear conclusions about the efficacy of mindfulness interventions for sports performers.

One competitive sport that may elucidate the mindfulness-flow relationship is competitive swimming. Swimming is an intense, rhythmical sport with pacing requirements that may predispose these athletes toward a more frequent flow experience. Cathcart, McGregor and Groundwater (2014) have suggested that athletes in pacing sports may have a higher capacity to observe and notice present moment feelings because optimal pacing involves integration of kinaesthetic information with cognitive and emotional processes to match present perceived exertion with a 'program' of optimal exertion for the required distance (Tucker, 2009). In other consistent findings, Bernier, Thienot, Codron and Fournier (2009) showed, via qualitative analysis, that some elite swimmers reported attending to bodily sensations prior to competition. Therefore, swimmers may be especially receptive to mindful training that develops attentional focus on present moment experience leading to action-awareness merging and the experiential flow dimensions of concentration and control on task.

Therefore, this study will compare the effects of a mindful program on flow against a relaxation training program. Traditional relaxation training differs from mindful training as the former aims to relax participants during practice through specific exercises. Given that deep breathing techniques are often recommended as pre-performance routines for swimmers (e.g. Mesagno & Mullane-Grant, 2010; Whudan, 2014) it is important to compare mindful training with relaxation techniques to help gain evidence for the specific attention and emotional regulation mechanisms of mindfulness training.

Taken together, the aims of this study, were to first, investigate if a MSPE group of swimmers shows improved mindfulness and trait and state flow, and second, to examine the effectiveness of MSPE to improve trait and state flow, and state mindfulness in comparison to a relaxation training group. Therefore, the predictions are as follows: First, the MSPE group will show improved, mindfulness, trait and state flow over the course of the program and second, the MSPE group will show greater improvement in mindfulness, trait and state flow compared to the relaxation training group.

METHOD

Design

A non-randomised experimental control design was used. Participants were placed into one of two groups based on timing and logistical availability. Group 1 received the Mindful sports performance enhancement training programme for adolescents (MSPE) and group 2 received the relaxation training programme (RT). The two intervention groups attended a 30-minute training workshop for 8 weeks with associated home activities and practice logbooks. The MSPE workshops were based on the MSPE approach (Kaufman, Glass, & Arnkoff, 2009). The RT group were given the same behavioural content but with an emphasis on using volition and relaxation techniques to control emotions with no instructions on mindfulness concepts. The outcome variables were global dispositional flow (DSS-2), global state flow (FSS-2), trait mindfulness (MAAS-A), and state mindfulness (TMS). All dependent variables were taken pre and post intervention. In an attempt to capture the change process, state mindfulness (TMS) was measured at weeks 2, 4, 6 and 8 for the MSPE group only.

Participants

Sixteen participants volunteered from a local swimming club to take part in the study. All participants were National Level competitive swimmers (Mage:13.06;SD = 1.57) and Mexperience: 4.53; SD = 1.59) with 9

males and 7 females. The study was approved for ethical procedures by Teesside University prior to data collection.

Measures

Dispositional flow scale -2 (DFS-2)

The DFS-2 (Jackson & Eklund, 2002) is a measure of the tendency to experience flow during a physical activity, with each of the 36 items rated on a scale from 1 (*never*) to 5 (*always*). This scale is theoretically grounded in the concept of flow and contains nine dimensions: challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration on the task at hand, sense of control, loss of self-consciousness, time transformation and autotelic experience. Analysis of the DFS-2 has indicated acceptable reliability and validity (Jackson & Eklund, 2004). Flow can be calculated on a dimensional and global level (i.e., total score) and expressed as either a global sum or an item mean score for each dimension. The dimensions measuring the foundations of the flow experience (i.e., challenge-skill balance, unambiguous feedback and clear goals) were combined to provide a measure of flow conditions. The remaining six conditions were combined to give a composite score of the flow characteristics.

Flow state scale – 2 (FSS-2)

The FSS-2 (Jackson & Eklund, 2002) is designed to assess flow experiences during a recently completed physical activity. The items are identical to those on the DFS-2 but are worded in the past tense, and studies have suggested that it is a reliable and valid measure of the flow construct (Jackson & Eklund, 2004). The Likert scale is identical to the DFS-2. Participants were given the FSS-2 with reference to the most recent pre and post intervention competitive swimming experience. The 36 items were summed to produce a global flow state score. The higher the score, the more intense the flow experiences are believed to be. The state flow dimensions were also summed to give a measure of state flow experience and state flow characteristics as mentioned above.

Mindful attention awareness scale for adolescents (MAAS-A)

The MAAS-A (Brown, West, Loverich, & Biegel, 2011) assesses trait mindfulness with items such as "*I find myself preoccupied with the future or the past*" and "*I find myself doing things without paying attention*." It is a 14-item inventory measured on a 6-point scale of responses, ranging from 1 (*almost always*) to 6 (*almost never*); higher scores reflected higher trait mindfulness. In adult samples, reported internal consistency estimates (Cronbach's alpha) have consistently been above .80 (e.g., Brown & Ryan, 2003). The MAAS-A is a single factor inventory which conceptualises mindfulness only in terms of its attentional aspect. The inventory has shown evidence for high internal consistency and acceptable test-retest-reliability and agreement (Brown et al, 2011).

Toronto mindfulness scale (TMS)

The TMS (Lau, Bishop, Segal, Buis, Anderson, Carlson & Cormody, 2006) assesses state levels of mindfulness immediately following the practice of a mindfulness exercise or workshop (Bishop et al, 2004). Each of the 13 items is rated on a scale ranging from 0 (not at all) to 4 (very much). Analyses by Lau et al (2006) showed that this instrument is a reliable and valid measure of state mindfulness that contains the two subscales, curiosity and de-centring.

Daily Mindfulness log

This log asks participants to keep a daily account of whether they practiced the mindfulness exercises and skills learned in the previous workshop (e.g. diagrammatic breathing; sitting meditation; body scan etc) the length of their practice, as well as any observations they note. The following instructions were from the body

scan logbooks:- "You are required to practice (1) Body scan exercise and (2) use the STOP acronym in self-selected activities. Also use the breath and the letting go process during the STOP daily activity. Make a note of anything that comes up in the practice, so that we can talk about it at the next workshop." Each logbook had columns for each day, description of the activity type / duration of practice and comments. A logbook with identical columns was also given to the RT group every week with instructions regarding relaxation and tension exercises performed during, sitting, standing and walking exercises.

Procedure

The lead researcher conducted a 30-minute talk to the parents of swimmers at Middlesbrough swimming club prior to a normal swimming session. Email addresses were then provided and information sent to all parents concerned providing details of the proposed workshop time, location and aims of the whole program. When the swimmers arrived for the first week, the rationale of the program was explained, and they completed all baseline questionnaires (DFS-2; FSS-2; MAAS-A). In addition, the MSPE group completed the TMS at weeks 2, 4, 6, 8 and post intervention.

The content for each MSPE workshop followed the Mindful sports performance enhancement (MSPE) protocol. The relaxation training (RT) workshop procedures were identical in terms of the exercises administered per workshop, except the instructions emphasised only volition, relaxation and tension (Bernstien, Borkovec & Hazlett-Stevens, 2000). At the end of each workshop, participants were given logbooks and instructions for the individual exercises to be completed and return at the next weekly workshop. One-week post-intervention (i.e., week 8), the swimmers completed the same measures they had at the beginning of workshop 1.

Interventions

Mindful sports performance enhancement

The MSPE protocol for this study adapted the content of Kaufmann, Glass and Pineau (2018) combined with the recommendations from Biegal, Chang, Garrett and Edwards (2014) for teenage clients. The introductory session explained the rationale of the program. Each subsequent workshop contained exercises that are key elements of the MSPE program, including the (1) raisin/polo mint exercise, (2) diaphragmatic breathing, (3) sitting meditation and the STOP acronym, (4 & 5) the body scan, (6) mindful yoga and (7) walking meditation. In addition to these standard MSPE components, the final session (week 8) included a swimming meditation session designed to incorporate all the mindful skills into the swimming pool sessions.

Relaxation training

The RT program used a body awareness-based relaxation intervention. The RT program adapted techniques from autogenic relaxation training using the instructions from Bernstein, Borkovec and Hazlett-Stevens (2000) and integrated these instructions into the same body exercises as the MSPE group. Instructions were given to alternate between tension and relaxation of specific muscles of the body in order to train awareness of different physical states and simple breathing techniques. The first three sessions included exercises specific to systematically teaching relaxation and tension of different muscle groups throughout the whole body (e.g., Bernstein, et. al., 2000, p.35). These instructions were then applied to the same exercises used in the MSPE group (i.e., body scan, yoga and walking) so that participants would learn to appreciate different states of relaxation and tension in those activities.

Data analysis

The means and SD's for each questionnaire total score and subscales were calculated for the MSPE and RT groups. Total scores for each questionnaire were calculated by summing the subscales within each

questionnaire when appropriate. Data was checked for normality prior to conducting repeated t tests and homoscedasticity prior to independent t tests. Prior to one-way analysis of covariance (ANCOVA) multi-collinearity assumptions were examined to check these were satisfied. Regarding inferential tests, first, repeated t tests were conducted to examine pre and post differences on mindfulness, trait and state dispositional flow, trait and state flow subscales, and anxiety for the MSPE group only. Second, ANCOVA analysis was performed with the dependent variable as the pre and post change scores on all variables. The covariate was the subscale pre scores while group was the independent variable. Tabachnick and Fidell (2013) recommended using Analysis of Covariance (ANCOVA) to examine the results of a between-groups design with pre- and post-test measures as this approach takes into account ceiling and floor effects. If hypothesised outcomes are conceptually distinct, as in the present study, alpha inflation stemming from multiple analyses may not be a concern. The univariate significance values and effect sizes are reported. This provided an initial omnibus test of the impact of the intervention on the flow and mindfulness scores. For repeated t tests, Cohen's *d* was calculated for dependent measures designs (Dunlap, Cortina, Vaslow & Burke, 1996). Effect size guidelines (Rosner, 2010) with a small, medium and large effect sizes of 0.2, 0.5 and 0.8 respectively was reported along with the 95% CI of the change score. (Cohen, 1988). For ANCOVA, the partial n^2 effect sizes are interpreted using the following guidelines: .01-.059 (small), .06-.129 (medium) and .13 + (Large) (Cohen, 1988). Given the low sample size, only medium to large effect sizes will be interpreted in the current study. IBM SPSS Statistics (Version 24) was used for all statistics with $\alpha = .05$ for all tests.

RESULTS

Pre and post differences within the MSPE group

Descriptive statistics are shown in Table 1. Paired t-tests were conducted to examine changes in psychological functioning post intervention. Prior to data analysis, assumption checks revealed no missing cases. Shapiro-Wilks tests revealed acceptable normal distribution in the data scores. Flow characteristics did significantly increase post-intervention ($M = 88.44$, $SD = 10.61$) compared to pre-intervention ($M = 80.78$ $SD = 8.82$, $t(8) = 4.43$, $p < .005$, $d = 0.74$. There was also a significant increase in global flow, with post scores ($M = 136.44$, $SD = 13.82$) significantly higher than pre scores ($M = 126.22$, $SD = 10.43$, $t(8) = 4.61$, $p < .005$, $d = 0.73$. The only flow subscale to show a difference was loss of self-consciousness where the post score ($M = 13.44$, $SD = 4.19$) was significantly higher than the pre-intervention score ($M = 9.89$, $SD = 3.66$), $t(8) = 2.53$, $p < .05$, $d = 0.90$. To examine the change in state mindfulness throughout weeks 2, 4, 6 and 8 of the intervention, a repeated measures ANOVA was conducted. For the mindfulness subscale of *curiosity*, there was a significant main effect identified, $F(3,24) = 3.71$, $p < .05$, partial $n^2 = .32$. Pairwise comparisons showed a significant decrease in curiosity from week 4 ($M = 15.11$, $SD = 4.40$) to week 8 ($M = 9.11$, $SD = 4.59$, $F(1,8) = 7.51$, $p < .05$, partial $n^2 = .49$).

Pre and post-intervention differences between mindfulness and relaxation training groups

ANCOVA findings revealed that the global trait flow, $F(1,13) = 19.38$, $p < .005$, partial $n^2 = .60$, and *merging of action and awareness* subscale, $F(1,13) = 19.80$, $p < .005$, partial $n^2 = .60$ had a significant difference in change scores between the MSPE and RT group. The MSPE group showed a greater increase in *Global trait flow* ($M = 126.22$, $SD = 10.43$ to $M = 136.44$, $SD = 13.82$) compared to the RT group ($M = 121.71$, $SD = 26.14$ to $M = 124.71$, $SD = 18.24$).The MSPE group showed an increase in *merging of action and awareness* ($M = 1.22$, $SD = 3.31$) whereas the RT participants reported a decrease in this sub-scale ($M = -2.0$, $SD = 3.61$). There were no other significant differences between the MSPE and RT groups. In terms of state-flow; ANCOVA revealed that *Clear Goals* showed a significant difference between groups, $F(1,13) = 5.24$, $p <$

.05, partial n^2 = .29, with the MSPE group showing an increase (*M* = 2.11, *SD* = 2.89) compared to RT participants reporting decreases in clear goals (*M* = -1.14, *SD* = 2.67).

Table 1: Means (SD) pre and post trait and state flow scores for the MSPE and RT groups.

	MSPE Group (*n* = 9)				**RT Group (*n* = 7)**			
	Pre		Post		Pre		Post	
Variable	M	SD	M	SD	M	SD	M	SD
Trait Mindfulness	58.44	7.18	53.44	10.74	54.71	16.65	54.71	11.79
Global Trait flow	126.22	10.43	136.44	13.82	121.71	26.14	124.29	18.24
Trait Flow conditions	45.44	5.29	48.00	4.50	41.57	9.86	42.43	5.68
Trait Flow characteristics	80.78	8.82	88.44	10.61	80.14	17.28	81.85	13.59
Challenge-skill balance	14.44	1.13	15.78	1.86	13.57	6.05	15.14	3.39
Action-awareness merging	14.00	2.50	15.22	2.05	11.43	2.44	9.42	2.51
Goals	17.00	2.69	17.00	2.23	16.57	2.76	17.86	3.08
Feedback	14.22	2.82	14.67	2.06	14.86	4.26	13.57	5.06
Concentration	14.11	3.48	14.89	1.76	13.71	5.22	15.57	3.64
Control of task	15.67	2.12	16.67	2.24	14.71	4.79	14.85	3.58
Loss of self-consciousness	9.89	3.66	13.44	4.19	13.57	3.55	13.14	4.98
Time-transformation	11.67	3.61	13.22	4.66	8.00	2.45	8.57	4.58
Autotelic experience	15.22	2.39	15.56	2.51	15.28	4.86	16.14	3.43
Global State flow	129.25	9.95	136.13	17.00	123.57	11.96	122.42	19.41
State Flow conditions	45.13	3.00	48.38	7.19	43.43	2.43	41.57	6.05
State Flow characteristics	84.13	7.72	87.75	10.83	80.14	9.74	80.86	14.15
Challenge-skill balance	17.78	6.90	17.67	7.70	15.57	2.70	15.57	3.51
Action-awareness merging	16.56	7.55	17.44	7.35	9.00	2.65	8.29	3.04
Goals	17.78	7.16	19.89	6.19	18.86	1.95	17.71	2.56
Feedback	15.78	7.77	16.56	7.67	14.57	3.46	15.00	4.32
Concentration	17.11	7.32	18.56	6.95	16.14	4.06	16.00	3.61
Control of task	18.00	7.02	19.11	6.83	15.71	3.90	16.42	3.95
Loss of self-consciousness	16.56	7.72	16.67	7.84	11.00	3.61	11.42	2.99
Time-transformation	14.00	9.43	13.44	9.66	8.00	4.16	7.29	2.63
Autotelic experience	17.33	7.45	17.67	7.37	14.71	3.95	14.71	3.72

DISCUSSION AND CONCLUSIONS

The first aim of this study was to examine pre and post differences in state mindfulness and trait and state flow within the MSPE group. The prediction that the MSPE group would show improved, mindfulness and trait and state flow over the course of the program showed partial support as there were differences in selected flow variables. The most noted differences were large effect size improvements in the subscales '*loss of self-consciousness*' (*d* = 0.90) and '*challenge-skill balance*' (*d* = 0.84) followed by medium effect size differences in in '*global dispositional flow score'* (*d* = 0.73) and flow characteristics (*d* = 0.74). The second aim the study was to examine if the pre and post differences in state mindfulness and trait and state flow were significantly higher in the MSPE group compared to the RT group. There was some support for this prediction as there were large effects of both trait flow and trait flow characteristics, in the predicted direction. There was also a large effect of the MSPE group significantly improving *action and awareness merging* (partial n^2 = .60) compared to the RT group. This subscale involves a feeling of one and absorption with the activity of swimming and the race. Previous research has found action and awareness to be strongly

associated with the experience of swimming (Bernier et al (2009). These findings suggest that mindfulness attention while swimming brings about an increase in the ability to closely experience one's own action awareness. There was also a large effect of MSPE training on the state flow clear goals subscale (partial n^2 = .29). This implies that the swimmers in the MSPE group became more connected to task relevant cues for performance, which is one of the three conditions thought necessary for flow to occur.

The *loss of self-consciousness* flow subscale is theoretically related to attention regulation which is one of the two key components of mindfulness (Bishop et al, 2004). This component reflects a lack of concern about what others are thinking, reducing the possible negative influence of social evaluation and thus enhancing concentration. As both the trait flow characteristics and total flow variables both showed medium effect size improvements, these findings are broadly consistent with flow theory relating to the ability to sustain attention and remain in the flow state (Csikszentmihalyi, 2002). Brown and Ryan (2003) suggested that mindful individuals are less effected by introjections and experience a loss of self-consciousness more readily (Kee and Wang, 2008). However, the effect of the meditative practices did not appear to have a significant effect on trait-mindfulness unlike other studies (Kaufmann et al, 2009). However, the present study participants had relatively high trait-mindfulness prior to the intervention, perhaps due to the nature of their sport; swimming is rhythmic and requires long periods of prolonged solitary training. In our sample it appeared that the intervention assisted participants in bringing about the characteristics necessary for optimal flow experiences as a result of their existing mindfulness ability and the strategies of application to their swimming practices and competition.

It is important to note that mindfulness skills did not significantly improve in the intervention group and in some cases they significantly decreased. However, the programme did bring about significant improvements in trait and state flow. Swimmers reported a significant decrease in *curiosity* that developed between weeks 4 and 8. They also reported increases in *merging of action and awareness* and *clear goals*. One possible explanation for the reduction in self-reported mindfulness skills could have been related to the age and mindfulness skill level of the swimmers (beginners). The Dunning-Kruger Effect (Johnson, Kerri, Joyce & Kruger, 2003) asserts that as people increase their knowledge, they become less certain of their competence as their minds are opened to a body of new knowledge and experience in essence, how little they know of that area. It is possible that by swimmers increasing awareness of thought content through mindful observation in the workshop practices, they experienced an increase in mindful skill knowledge and therefore an associated initial self-reported decrease in their perceptions of mindfulness skills.

This study has provided support for the use of MSPE interventions for swimmers as a strategy that may improve mindfulness skills, flow state experiences and some aspects of emotional well-being. The findings suggest that practitioners should incorporate diary methods within homebased mindfulness interventions so participants can describe their subjective experience during the exercises. Also, the study suggests that once athletes have done some basic mindfulness exercises, sports specific mindfulness exercises in a meaningful context, should be designed that allow participants to practice basic mindfulness concepts by performing movements that resemble the motor patterns within their sport.

AUTHOR CONTRIBUTIONS

Dr Mark A. Chen, Department of Science, Teesside University, UK - conducted all the workshops. Dr Jennifer Meggs, Department of Sport Science, Lancaster University, UK - assisted with the manuscript write up.

SUPPORTING AGENCIES

No funding agencies were reported by the authors.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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