

The Effects of Psychological Skills Training on Mental Toughness and Psychological Well-Being of Student-Athletes

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Abstract

This study examined the effects of a psychological skills intervention (PST) designed to enhance the mental toughness and psychological well-being of student-athlete rowers (N = 16). Within this context, PWB was conceptualized by an amalgamation of the following psychological constructs; self-esteem, perceived self-efficacy, positive affect and dispositional optimism. Progress was examined at three times evenly dispersed over the course of the six-month intervention, pre-, mid- and post-intervention. The intervention was solution-focused and informed by Dweck's (2009) theory of a growth mindset and Goldberg's (1998) psychological strategies to develop mental toughness. The study design was a 2 (group) × 3 (time) two-way MANOVA with repeated measures on one factor (time). Various measures of mental toughness and positive psychological constructs were utilised. Over the course of the intervention, MT significantly improved, in addition to perceived self-efficacy, self-esteem and positive affect. Positive significant relationships were observed between components of MT and each of the positive measures; which lends support to the conceptualization of MT as a positive psychological construct which fosters positive psychological states (Clough & Strycharczyk, 2012). Further research is warranted to examine the development of MT on negative psychological constructs.

Keywords

Mental Toughness, Psychological Well-Being, Positive Psychology, Psychological Skills Training

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1. Introduction

1.1. The Concept of Mental Toughness

The concept of mental toughness (MT) originated from the literature on hardiness (Maddi, 2002). Hardiness is defined by three characteristics; commitment (an involvement in life regardless of stress), control (made evident by a belief that the individual has the power to influence outcomes) and challenge (viewing it as a positive opportunity to develop and grow; Kobasa, 1979; Maddi, 2006). With these constructs in common (Golby & Sheard, 2004; Sheard, 2009), both hardiness and mental toughness possess the propensity to enhance performance, whilst evoking a buffering effect against psychological distress (Gerber et al., 2013; Sheard, 2012). Clough and colleagues (2002) drew attention to a prominent discrepancy, arguing that hardiness failed to capture the “unique nature of the physical and mental demands of competitive sport” (Sheard, 2012: p. 61), whereas mental toughness could better account for this with the inclusion of confidence as a dominant construct. An “unshakeable belief in ones abilities” is a pertinent feature of MT and widely supported to be key to athletic success (Lane, 2014). Definitional consensus of MT is yet to be established (Gucciardi et al., 2015) however the four key attributes alluded to within this paper are supported throughout the extant literature (Bull et al., 2005; Clough et al., 2002; Gucciardi et al., 2008), in addition to other qualities such as positive cognition, the ability to visualize success and constancy when in the pursuit of goals (Golby, Sheard, & van Wersch, 2007; Sheard, Golby, & van Wersch, 2009).

1.2. Mental Toughness as a Proponent of Positive Psychology

Whilst researchers have been examining the defining of mental toughness, many have also explored suitable paradigms. Extensive research supports the application of MT to the paradigm of Positive Psychology (PP) especially within the context of sport. Positive psychology closely examines orientations of psychological well-being (PWB; Lambert, Passmore, & Holder, 2015) and generates knowledge which endeavors to increase human flourishing and thriving (Hefferon, 2013: p. 2). MT appears to imitate these effects amongst athletic populations. Research to support this alludes to the promotion of markers of psychological health as a result of self-reported MT (Rusk & Waters, 2013). Stamp et al. (2015) noted a close association between MT and constructs closely associated to psychological well-being, such as positive affect (Mahoney et al., 2014) and dispositional flow (Crust & Swann, 2013).

When examining PWB, the literature advises the use of both hedonic (assessment of positive emotions and sensations) and eudemonic (measuring constructs which enhance a great sense of life satisfaction; Russel, 2007) related measures (Henderson & Knight, 2012; Huta & Ryan, 2010). Dispositional optimism and positive affect are categorised as hedonic. However they differ in the sense that positive affect is derived from a bottom-up theory of PSW which suggests that it is the accumulation of positive affective experiences which dictate the overall sense of wellness. Alternatively, dispositional optimism encompasses a top-down approach as it assesses PWB as an innate propensity to view the world in a certain way (Lambert, Passmore, & Holder, 2015). Perceived self-efficacy and self-esteem are more closely related to eudemonic strands; self-efficacy beliefs are intrinsically linked to autonomy and a greater sense of control outlined by the Self-Determination (Ryan & Deci, 2000); whereas self-esteem relates to self-acceptance which is highlighted in Ryff’s theory of psychological well-being (Ryff, 1989). Both positive constructs represent cognitions which may prove useful to individuals looking to bolster their psychological health and create a more satisfactory life. Thus, the inclusion of each of the four measures within the present study provided a comprehensive view of the participant’s state of psychological well-being.

1.3. Implications of Psychological Skills Training for Student-Athlete’s Psychological Health

Protection and promotion of psychological well-being is of the utmost importance to student-athletes; unlike other athletic groups, student-athletes have the challenging task of balancing athletic, social, as well as academic commitments (Surujlal, Van Zyl, & Nolan, 2013). Unique stressors this population face include the demands of a regimented schedule (Carodine, Almond & Gretto, 2001) and the experience of mental as well as physical fatigue (Van Zyl, Surujlal, & Singh, 2009). In addition common athlete stressors such as seclusion from social encounters (Martens et al., 2006) and lack of security due to the persistent prospect of being eliminated from the

squad (Ford, 2007). Additionally, the age of the average student-athlete population coincides with the age of onset for many common psychological disorders (e.g., depression and anxiety) (UK Royal College of Psychiatrists, 2011). Enhanced psychological well-being has been found to coincide with a reduction in negative emotional and physical states, which helps athletes create the optimum training environment, to foster performance (Hardy et al., 1996). Coaches and practitioners are now recognizing the importance of psychological, as well as physical health (e.g., Mahoney et al., 2014) and despite psychological well-being being identified as important by practitioners from the Institute of Sport, pragmatic interventions to protect and promote psychological well-being are rarely documented; recently, they urged fellow practitioners “to evolve to meet this demand” (Marshall & Harrison, 2015).

An earlier study found psychological skills training increased mental toughness, promoted psychological development, and aided the performance of adolescent swimmers (Sheard & Golby, 2006). The present study built upon this research by employing equivalent strategies and positive measures amongst an arguably more vulnerable athletic sample to assess the psychological implications. One key discriminating factor was the implicit application of Dweck’s theory of a growth mindset (2012). This theory defines two binary mindsets and their association to performance, namely fixed and growth. Within the context of sport, a fixed mindset attributes superior performance to natural ability, therefore hours of practise are redundant and avoidance of failure is a top priority. Alternatively, an athlete with a growth mindset believes reaching one’s potential is a result of consistent effort and practise, supporting the view that failure should be embraced as an opportunity to identify and develop weaknesses (Dweck, 2009).

Interventions designed to foster a growth-mindset include subtle strategies such as modifying feedback, avoiding statements which attribute success to innate qualities and instead praising effort and practise (Ratten et al., 2015). Within this study the analysis of past performance was also encouraged so weaknesses could be identified and targeted, instilling the belief that consistent practise is the key to success, in turn promoting a growth mindset and healthier attitude towards failure (Dweck, 2009). Encouraging a growth mindset has been found to foster psychologically safe learning environments (Spitzer & Aronson, 2015). The utilisation of the simplistic strategies mentioned has generated significant improvements in motivation and performance; despite not being the panacea for poor performance, they appeared to prime individuals to perceive and respond to situations in a more efficient manner (Dweck, 2012; Rattan et al., 2015; Yeager et al., 2016). Beyond anecdotal evidence, studies have reported neurological differences, those allocated to the growth mindset condition demonstrated greater error-related attention allocation, whereas the fixed mindset group attended to adaptive post-error performance to a greater extent. This highlights how a growth mindset increases awareness of weaknesses/mistakes (Schroder et al., 2014). The notion of a growth mindset is supported by newly emerging research on the neuroplasticity of mature brains (Yamaguchi et al., 2016) which demonstrate how adult brains form new neural pathways and develop in response to practise (Ericsson, Krampe, & Tesch-Romer, 1993).

There is evidence that mental toughness can be developed in a number of ways (Bull et al., 2005), however there is no research to date identifying the superiority of any method (Clough & Strycharczyk, 2012). Psychological skills training remains one of the most utilized procedures which has been demonstrated simultaneously to foster positive psychological development (Beauchemin, 2014; Williams & Krane, 2001). This makes it a favourable approach for the vulnerable athletic populations (e.g., Olympic athletes, student-athletes). PST was developed to enhance performance by providing athletes with an enhanced sense of control over effective movement coordination during training and competition (Martens, 1987; Rushall, 1992) and is underpinned by cognitive-behavioural techniques (e.g., Meichenbaum, 1977). The present study adopted a collaborative, adaptive approach, whereby assessments of the psychometric measures of mental toughness were used to assess and identify weakness from the onset and throughout the intervention, to inform the content of subsequent PST sessions. This approach made better use of the restricted time and enhanced the individualisation of the psychological skills training session

1.4. Purpose

This study was designed to examine the effects of PST on MT and psychological well-being amongst a sample of female student-rowers over the course of the competitive season. More specifically, to assess whether PST improved MT in addition to constructs closely associated to psychological well-being. Furthermore, the purpose of secondary analysis was to examine the relationship between MT and PWB.

2. Method

2.1. Procedure

Informed consent was received and participants were reassured of their right to withdraw at any time in accordance with the BPS Code of Ethics (BPS, 2009). Due to training and academic commitments, allocated session time was limited to four sessions of approximately one and a half hours duration; thus replicating real-world conditions. In conjunction with group-based sessions, each participant received one-to-one support via e-mail. There was approximately three months between each group session which attenuated any potential learning effects.

The initial session included an introduction from the researchers and discussion around the concept of mental toughness and positive psychological well-being, applied to their chosen sport. Prior to this, the first measurements were conducted online; similar methods have been utilised within the nascent literature (Gucciardi et al., 2016). The software package SurveyMonkey (SurveyMonkey Inc., 1999-2016) was used to administer the measures of MT and PWB electronically via the coach to the participant's personal e-mail. There were 96 questions in total. Pilot testing ($N = 5$) reported an average completion time of 20 minutes. Each participant was informed of the importance of completing the questionnaire independently, in an open and honest manner, whilst being reassured of the confidentiality of their data. The participants were asked to complete the survey in their own time prior to the following session. To ensure subsequent sessions catered for the requirements of the squad, the survey results informed their focus. The data indicated very low levels of confidence, the researchers then collaborated with the coaches to confirm this and then dedicated time to constructing the following session. The work of Goldberg (1998) informed the structure and content of the session (Sheard & Golby, 2006).

Three months later, the squad were invited to attend the subsequent session designed to enhance the facet of MT in which performed least well, self-confidence. Each rower was granted permission to take notes throughout. Upon completion of the session they were advised to practise the skills they had learnt during the following weeks, and to log their progress in a journal. A journal was advised to promote self-reflection, however to promote confidentiality there was no measures in place to assess journal completion, or content. Immediately after the session, each participant was sent the link to the second questionnaire, which they were asked to complete in their own time. The questionnaire was a replication of the first however questions were randomised to reduce the effects of familiarity (Martin, 2008). The same method of analysis and collaboration was employed to formulate the following session. Based on previous findings the penultimate session was designed to continue to build confidence and promote positive cognitions (with a particular focus on reducing negative thoughts regarding their ability to perform at their important upcoming race). Participants were advised to practise and reflect on the skills discussed in the sessions. Immediately after, the surveys were distributed in the same manner.

Two months later the final session was held whereby participants were fully debriefed and questions or queries were addressed in this session (see **Table 1** for session content and rationale).

2.2. Participants

Access to the sample of rowers was granted on the terms that each rower received one-to-one psychological support over the course of the competitive season. The female rowers ($N = 16$) including regional and national level performers, voluntarily participated (ages ranged from 18 - 31 years, $M = 21.42$, $SD = 3.75$). From an initial intake of $N = 31$, $N = 16$ completed in all three assessments and psychological skills training sessions.

2.3. Measures

2.3.1. Mental Toughness

The Sports-related Mental Toughness Questionnaire (SMTQ; Sheard, Golby & van Wersch, 2009) is a 12-item tool and one of the first psychometrically-sound tools to measure sports-related MT. The sub-categories originated from themes and definitions of qualitative data (see Clough et al., 2002; Jones et al., 2002; Thelwell et al., 2005 for details). The measure includes dimensions of confidence, constancy and control. This was used in conjunction with The Psychological Performance Inventory - Alternative (PPI-A; Golby, Sheard & van Wersch, 2007), which is a 14-item measure adapted from the Psychological Performance Inventory (Loehr, 1986) which calculates a total measure of mental toughness, as well as four independent sub-components (namely self-belief and determination, in addition to psychological skills such as positive cognitive and visualisation). Adequate

Table 1. Session content and rationale for use of specific strategies and techniques.

Session	Content	Rationale/Advice from Goldberg (1998)
1	Personal Introductions	Lead and supporting researcher introduce themselves to the group, provide a background and focus on building a rapport.
	Purpose of the PST	Highlight the importance of psychological characteristics in rowing, concepts of psychological well-being and mental toughness introduced.
	Logbook	Athletes were asked to record their physical and psychological preparations, progress, general thoughts and concerns in a personal logbook. They were advised to keep this up to date and granted the freedom to complete this however they wished. This practise has been found to increase athlete's sense of self-awareness (Hardy, Roberts & Hardy, 2009), developing an awareness of one's cognitions is a fundamental part of psychological skills training (Gould, 1998).
Assessment 1—Rowers received a link to the online survey (October 14th 2014)		
2	Feedback from the squad's first psychometric assessment	As a squad, from the psychological constructs assessed, confidence was particularly low. This is understandable due to the nascent nature of the squad and lack of success to date. Placing this into context, the Lead Researcher discussed the importance of formulating task-oriented goals, which focus on mastery; rather than ego-oriented goals driven by success, encouraging athletes to aspire to perform better than their previous each time.
	Technique 1: Self-Talk	This session outlined how self-talk is nothing more than internal dialogue/thoughts (Bunker, Williams & Zinnser, 1993). Following this, the lead discussed the implications of negative self-talk on athletic performance, drawing upon real life examples from professional practise and asked athletes to become more aware of their thoughts during practise and performance, whilst monitoring which thoughts hinder and which seem to facilitate their performance.
	Technique 2: Thought-stopping	This is an inhibition strategy whereby athletes use a verbal or nonverbal cue to acknowledge and suspend unhelpful thoughts (Zinnser et al., 2010). The disruption of the thought has been found to increase the athlete's sense of self-awareness - however rowers were made aware of the detrimental effects which may arise when they focus on what "not" to think (i.e., hyper accessibility).
	Technique 3: Thought Control	To avoid "hyper accessibility" (Wegner & Erber, 1992) athletes were informed not to consciously try to diminish the thought, but to demonstrate an awareness and observe it passing through their consciousness. Athletes were advised to incorporate idiosyncratic positive, supportive thoughts, daily (Gould, 1998: p. 29). Such as "I will always strive to do the best I can".
	Technique 4: Concentration Skills & Focus	The rowers were introduced to the "here and now principal", importance of "controlling their eyes and ears" and effective ways to do this (e.g., performance rituals). They were asked to consider what performance rituals they currently engage with to help get "in the zone".
Assessment 2		
3	Feedback from the squad's second psychometric assessment	Confidence had improved but it was still relatively low, visualisation was still quite low at this point too. Feedback and session content was geared towards enhancing confidence in preparation for the rowers upcoming race.
	Building self-confidence - Awareness of "U"	According to Goldstein (1998) confidence is the product of hard work. Psychological skills and a positive outlook must be accompanied by consistent effort and dedication to training. The "no deposit, no return" formula was discussed with the athletes.
	Technique 5: Expect success and Positive imagery	This session touched upon the importance of expecting success after doing all you can to perform to your best and introduced athletes to coping and mastery imagery (including ways in which they can be implemented and the importance of ample practise and individual reflection). Imagery works well for some athletes, and not so well for others, therefore athletes were advised to practise different techniques at different times (days before a race versus just before the race), to decipher "what works best".
Individual sessions to reiterate the information covered and address personal issues and concerns		
Assessment 3		
4	Psychometric scores	The athletes received the squads results over the three assessments, the findings were interpreted by the lead researcher.
	Debrief of the session	Athletes were fully debriefed of the nature of the research and questions were welcomed.

psychometric properties have been reported for both measures (Golby et al., 2007; Sheard et al., 2009) and the approach of applying both has been applied within the extant literature (Chen & Cheesman, 2013; Wieser & Thiel, 2014).

2.3.2. Psychological Well-Being

Self-esteem: The Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965) was used, the RSES is a 10-item measure which denotes a global feeling of self-worth utilising a four-point Likert scale ranging from “strongly agree” to “strongly disagree” to statements such as “I feel I have a number of good qualities”.

Perceived self-efficacy: Self-efficacy was assessed using The Generalised Self-Efficacy Scale (GSES; Schwarzer & Jerusalem, 1993). The GSES is a 10-item measure based on a Four-point Likert scale whereby agreement is categorised as “not at all true”, progressing through to “extremely true” to statements such as “I am confident I could deal efficiently with unexpected events”.

Dispositional optimism: The Life Orientation Test (LOT; Scheier & Carver, 1985) was administered to examine dispositional optimism. The LOT is contrived of eight items on a Five-point Likert scale. The items denote level of agreement ranging from “I agree a lot” to “I disagree a lot” to statements such as “most days, life is really interesting for me”.

Positive affect: The Positive and Negative Affect Schedule (PA-NAS, Watson, Clark, & Tellegen, 1988) was used to assess experiences of positive affective states. The PANAS is a 20-item measure based on a Five-point Likert scale. Each item requires the participant to retrospectively sum-up the degree to which they feel a certain way (i.e., interested, inspired...). Items range from “not at all to” to “extremely”. Adequate psychometric properties have been reported for each of the four measures (Makikangas & Kinnunen, 2003; Schwarzer & Jerusalem, 1993; Iwanaga et al., 2004; Crocker, 1997).

2.4. Design

A 2 (group) × 3 (time) two-way MANOVA with repeated measures on one factor (time) was implemented. The two levels of the independent group variable of perceived performance was senior boat rowers (N = 4), versus the remaining rowers. The three levels of the repeated time variable were classified as pre-, mid- and post-intervention.

2.5. Statistical Analysis

Analysis was conducted using SPSS 21.0. The data was screened for normality and outliers. Significant correlations were interpreted with Pearson’s moment-correlation (Hinkle, Wiersma, & Jurs, 1998) and a two-way multivariate analysis of variance with repeated measures on one factor (time) was administered followed by post-hoc testing to examine differences. As the success of psychological skills training was dependent not only on the progress of the squad, but each participant’s progress, the reliable change index (RCI; Jacobson and Traux, 1991) was calculated (Zahra, 2010). This warranted a test-retest study on a representative sample of student-athletes (N = 30) over a two-week period. Due to the limited sample size, a two-way random effect inter-class correlation was used to establish a measure of reliability for both measures of MT (SMTQ; ICC(3) = 0.915, $p < 0.001$ and PPI-A; ICC(3) = 0.948, $p < 0.001$) (see Table 2 for reliability statistics).

3. Results

Descriptive statistics suggested a discernible improvement over time in MT, self-efficacy, positive affect, self-esteem and dispositional optimism; however not all improvements were statistically significantly (see Table 3

Table 2. Reliability statistics.

Measure	Alpha	Pearson’s correlation co-efficient	Inter-class correlation co-efficient
PPI-A	0.913	0.840**	0.915**
SMTQ	0.948	0.903**	0.948**

** $p < 0.001$.

for descriptive statistics and **Figure 1** for bar charts).

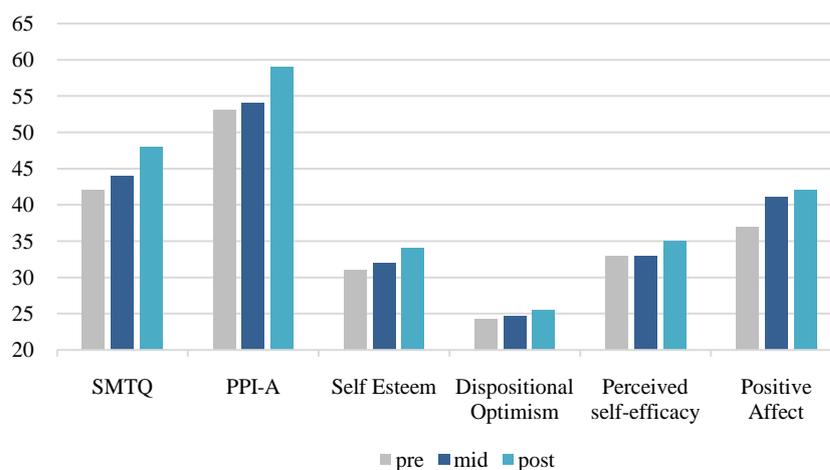
Measures related to psychological well-being were significantly correlated; positive affect and perceived self-efficacy demonstrated the strongest positive relationship ($r.70, p < 0.001$). With regards to MT and PWB, the strongest positive correlations were observed between the SMTQ and positive affect ($r.67, p < 0.001$) and the PPI-A and perceived self-efficacy ($r.64, < 0.001$). Both measures of MT were also significantly related ($r.69, p < 0.001$) (see **Table 4**).

MANOVA denoted a significant difference over time on measures of MT, perceived self-efficacy, self-esteem, positive affect and dispositional optimism, Wilks $\lambda = 0.023, F(12, 50) = 4.208, p < 0.001, \text{partial } \eta^2 = 0.50$, observed power = 0.998. Post-hoc results yielded statistically significant improvements for PPI-A $F(2,30) = 11.98$,

Table 3. Descriptive statistics.

	Pre-intervention	Mid-Intervention	Post-intervention
	Mean (SD)	Mean (SD)	Mean (SD)
SE	31.2 (3.1)	32.0 (4.2)	34.8 (3.2)
DO	24.3 (3.8)	24.7 (3.4)	25.5 (3.3)
PSE	32.9 (3.6)	32.8 (3.7)	34.6 (3.4)
PA	37.3 (5.4)	41.3 (4.9)	42.7 (5.2)
SMTQ	42.0 (5.0)	44.0 (5.0)	48.0 (3.0)
Conf.	17.3 (2.9)	18.1 (3.6)	20.7 (2.1)
Const.	14.3 (1.4)	14.8 (1.0)	14.7 (1.0)
Cont.	10.1 (2.8)	11.4 (2.2)	12.6 (2.0)
PPI-A	53.0 (6.0)	55.0 (7.0)	59.0 (4.0)
D	13.2 (1.5)	13.3 (1.6)	14.0 (1.0)
SB	14.8 (2.8)	15.1 (2.9)	16.4 (2.0)
PC	14.6 (2.5)	15.0 (2.4)	16.5 (1.6)
V	10.7 (2.4)	11.6 (2.8)	12.1 (2.0)

SE = Self-Esteem; DO = Dispositional Optimism; PSE = Perceived Self Efficacy; PA = Positive Affect; SMTQ; Total MT Score of Sports-related Mental Toughness Questionnaire; Conf. = Confidence; Const. = Constancy; Cont. = Control; PPI-A; Total MT Score of Psychological Performance Inventory-Alternative; D = Determination; SB = Self-Belief; PC = Positive Cognition; V = Visualisation.



Colour of pre-intervention included.

Figure 1. Bar chart depicting changes over time.

Table 4. Correlations.

	SI	DO	PSE	PA	SMTQ	Cont.	Const.	Conf.	PPIA	D	SB	PC	V
SI	1.00												
DO	0.384	1.00											
PSE	0.477*	0.490*	1.00										
PA	0.159	0.601**	0.701**	1.00									
SMTQ	0.317	0.204	0.553*	0.665**	1.00								
Cont.	0.430	0.652**	0.202	0.434	0.719**	1.00							
Const.	0.003	0.236	0.229	0.468*	0.670**	0.400	1.00						
Conf.	0.129	0.421	0.662*	0.557*	0.802**	0.237	0.343	1.00					
PPI-A	0.432	0.204	0.641**	0.373	0.689**	0.357	0.324	0.725**	1.00				
D	0.155	-0.037	0.540*	0.407	0.296	-0.148	0.191	0.522*	0.473*	1.00			
SB	0.343	0.241	0.402	0.188	0.507*	0.409	0.192	0.441	0.722**	-0.136	1.00		
PC	0.106	0.298	0.474*	0.411	0.735**	0.606**	0.400	0.572*	0.756**	0.331	0.555*	1.00	
V	0.465*	-0.060	0.286	0.020	0.167	-0.124	0.043	0.357	0.554*	0.342	0.147	-0.020	1.00

SE = Self-Esteem; DO = Dispositional Optimism; PSE = Perceived Self Efficacy; PA = Positive Affect; SMTQ; Total MT Score of Sports-related Mental Toughness Questionnaire; Conf. = Confidence; Const. = Constancy; Cont. = Control; PPI-A; Total MT Score of Psychological Performance Inventory-Alternative; D = Determination; SB = Self-Belief; PC = Positive Cognition; V = Visualisation; * $p < 0.05$; ** $p < 0.001$.

$p < 0.001$, partial $\eta^2 = 0.44$, SMTQ $F(2, 30) = 18.64$, $p < 0.001$, partial $\eta^2 = 0.55$, positive affect $F(2, 30) = 4.49$, $p = 0.020$, partial $\eta^2 = 0.23$, self-esteem $F(2, 30) = 13.98$, $p < 0.001$, partial $\eta^2 = 0.48$ and perceived self-efficacy, $F(2, 30) = 4.69$, $p = 0.017$, partial $\eta^2 = 0.24$ also significantly changed over the course of the intervention. However, no significant change was observed amongst group means for dispositional optimism $F(2, 30) = 1.93$, $p = 0.16$, partial $\eta^2 = 0.11$. Pair-wise comparisons identified that the majority of significant change occurred pre- to post-intervention (SMTQ $p < 0.001$; PPI-A $p = 0.002$; self-esteem $p < 0.001$; positive affect $p = 0.037$) excluding perceived self-efficacy and dispositional optimism; there were no significant differences between group means when analysing pre- to mid-scores (SMTQ $p = 0.08$; PPI-A $p = 0.53$; perceived self-efficacy $p = 1.00$; dispositional optimism $p = 1.00$; self-esteem $p = 0.97$; positive affect $p = 0.09$).

The RCI highlighted the number of individual significant improvements and deteriorations ($p < 0.05$) amongst the squad (refer to **Table 5** for details).

4. Discussion

The objective of the study was to examine the effects of a psychological skills training (PST) intervention incorporating principals of Dweck's (2009) theory of a growth mindset on the MT and psychological well-being, namely self-esteem, perceived self-efficacy, positive affect, and dispositional optimism of a sample of student-athletes, as well as to examine the relationship between MT and both eudemonic and hedonic measures of subjective well-being.

The total MT score (SMTQ; Sheard et al., 2009) was significantly related to perceived self-efficacy, dispositional optimism and positive affect. This supports the claim that characteristics of MT are closely associated to subjective psychological wellness (Mahoney et al., 2014; Sheard, 2012). However, the Adapted Psychological Performance Inventory (PPI-A) measuring the athletes attributes and awareness of mental skills was not significantly related to any of the following positive measures, despite the positive significant relationship between sub-component determinism and perceived self-efficacy. The PPI-A captures unique components of MT, it is also reasonable to argue that the discrepancies observed highlight how some, but not all characteristics of mental toughness align with positive psychological well-being; whilst lending support to nascent research identifying relationships between components of MT and characteristics detrimental to psychological health, such as those

Table 5. Reliable change index for measures of mental toughness. Green signifies a significant increase and red denotes a significant deterioration.

SMTQ				PPI-A			
Participant	Pre-score	Post-score	RCI	Participant	Pre-score	Post-score	RCI
1	41.00	44.00	1.861	1	51.00	59.00	3.234
2	45.00	53.00	4.961	2	55.00	63.00	3.234
3	42.00	47.00	3.101	3	61.00	62.00	0.404
4	43.00	48.00	3.101	4	48.00	60.00	4.851
5	44.00	49.00	3.101	5	56.00	65.00	3.638
6	50.00	53.00	1.861	6	61.00	65.00	1.617
7	45.00	48.00	1.861	7	55.00	55.00	0.000
8	46.00	53.00	4.341	8	62.00	63.00	0.404
9	29.00	46.00	10.543	9	48.00	55.00	2.830
10	36.00	42.00	3.721	10	46.00	57.00	4.446
11	42.00	48.00	3.721	11	52.00	57.00	2.021
12	48.00	48.00	0.000	12	62.00	55.00	-2.830
13	42.00	51.00	5.582	13	47.00	58.00	4.446
14	35.00	49.00	8.682	14	42.00	57.00	6.063
15	43.00	45.00	1.240	15	55.00	57.00	0.808
16	42.00	51.00	5.582	16	48.00	65.00	6.872
17	36.00	45.00	5.582	17	50.00	53.00	1.213
18	42.00	45.00	1.861	18	54.00	57.00	1.213
19	40.00	47.00	4.341	19	59.00	58.00	-0.404

associated with the dark triad (specifically narcissism, psychopathy and Machiavellianism; Onley et al., 2013; Sabouri et al., 2016). Alternatively, this result may be due to a reductionist approach adopted to the assessment of psychological well-being. It is also important to be mindful that the measure itself was derived by earlier work of Loehr (1986) and despite the years of practical experience which informed development, the psychometric properties of the earlier measure came under scrutiny (Middleton et al., 2003; Sheard et al., 2009). Despite the improvements made to the psychometric properties of the adapted Psychological Performance Inventory (PPI-A Golby et al., 2007), this may well warrant further psychometric support.

The adaptive PST was found to significantly increase levels of mental toughness according to both psychometric measures. There was also a notable increase in levels of perceived self-efficacy, positive affect and self-esteem reported. Therefore it was concluded that this demonstrated convincing evidence both for the trainability of mental toughness and the development of psychological well-being as a result of adaptive-psychological skills training. Post-hoc analysis denoted that there was no significant change in dispositional optimism; this may have been due to the nature of the measure, since dispositional optimism is seen as a stable construct and present findings support this interpretation.

4.1. Future Research

It is important to give consideration to the other variables which may have influenced the results; for instance, visualisation scores may have been susceptible to athletes imaging ability (Issac, 1992; Rodgers, Hall & Buckholtz, 1991) and boat allocation (which took place mid-way through the intervention) may have had a direct effect on the rower's confidence scores as perceived performance is closely associated to an athlete's self-belief

(Krane & Williams, 2006). It is also important to note the findings are only applicable to female student-athletes and therefore future research should consider the implications amongst a male sample. Another pertinent factor may have been the participant's involvement in a new training regime as the start date of the research coincided with the beginning of the competitive season. There is evidence to suggest that physical training fosters the development of MT as well as closely related constructs such as resilience (Deuster & Silverman, 2013), and plentiful research highlighting the psychological benefits of exercise (e.g., Edwards, 2015). To substantiate findings, further research should consider measures to help to control the variables. Before MT can be firmly placed within the realms of positive psychology, research is warranted to explore other positive constructs associated to psychological wellness, such as flourishing (Diener, 1984), as well as the negative constructs evoking a detrimental effect on psychological health (Sabouri et al., 2016). Researchers may also want to consider ways to gather follow-up qualitative data to further validate their results.

4.2. Implications

This study demonstrates promising short-term effects of psychological skills training utilizing growth mindset principals (Dweck, 2009), not only to enhance the mental toughness of athletes but also enhance their sense their psychological wellness which can also have profound benefits to overall health and performance (Mahoney et al., 2014). The use of RCI enabled an assessment of the individual participant's progress with regards to their MT and identified a greater proportion of participants experiencing a significant improvement in MT over the course of the intervention. This provided a useful, time-saving tool to decipher which athletes are making progress against those who were not, enabling the identification of athletes who may require further support. Due to ease of administration, the use of the RCI is strongly advised for those examining the effectiveness of psychological interventions amongst groups of athletes to enable assessment of individual psychological performance; however one potential limitation is the requirement of a reliability assessment (Zahra & Hedge, 2010).

Overall, this study supports the basic principles of PST and encourages practitioners and coaches to implement and work collaboratively during its implementation. Positive psychology promotes optimal functioning amongst healthy individuals, helping individuals who fall within normal parameters surpass boundaries and flourish (Compton & Huffman, 2013), it is based on the premise of "not just fixing what is broken, but nurturing what is best" (Seligman & Csikszentmihalyi, 2007: p. 7). Within the current study, the participants had not reported signs of psychological distress or required treatment for a psychological problem. Therefore, the sessions were designed to nurture what was there and develop a greater sense of mental toughness and psychological wellness utilizing psychological strategies and encouraging a growth mindset (Dweck, 2006). Within sport, the pressure the athlete's experience, in addition to the focus and determination required to succeed mean it is paramount that the athlete is psychologically equipped (Lawless & Grobbelaar, 2015). These findings support previous claims that mental toughness development is primarily driven by the principals of positive psychology; to enable the athlete to surpass the norm and experience optimum psychological functioning in both sport and everyday life (Sheard, 2012).

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