

1 Mental Toughness and Athletes' use of Psychological Strategies

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13 Keywords: Commitment, confidence, emotional control, psychological skills

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Abstract

This study tested the relationship between mental toughness and athletes' use of psychological performance strategies. A sample of 67 male (M age = 22.55 years, SD = 4.96) and 40 female athletes (M age = 21.08 years, SD = 2.81) acted as participants, and ranged from club / university to national level in a variety of sports. Participants completed the MTQ48 (Clough et al., 2002) to measure mental toughness, and the Test of Performance Strategies (TOPS; Thomas et al., 1999) to measure the use of psychological strategies in practice and competition. Results of Pearson correlations and linear regression analyses revealed that self-talk, emotional control and relaxation strategies were significantly and positively ($r = 0.26$ to 0.37 , $P < 0.01$) related to mental toughness in both practice and competition. Of the MTQ48 subscales, commitment was found to most frequently load against performance strategies and as such it is possible that the results of this study reflect highly committed performers seeking out performance enhancement strategies. Consistent with theoretical predictions, athletes of county standard and above reported significantly higher levels of mental toughness than club / university athletes ($t_{105} = -2.25$, $P = 0.03$).

1 Introduction

2 The concept of mental toughness has recently attracted significant attention from sport
3 psychology researchers attempting to understand how psychological factors can underpin success
4 in sport (Bull, Shambrook, James, & Brooks, 2005; Gucciardi, Gordon, & Dimmock, 2008;
5 Jones, Hanton, & Connaughton, 2007). From the emerging knowledge base, mental toughness is
6 considered to be multi-dimensional (comprising of cognitive, affective and behavioural
7 components) and an important psychological construct that is related to successful sport
8 performance (Bull et al., 2005; Crust & Clough, 2005; Clough, Earle, & Sewell, 2002;
9 Connaughton, Wadey, Hanton, & Jones, 2008; Jones et al., 2007). Unfortunately however,
10 different perspectives on the construct are still apparent. For example, while some researchers
11 suggest that mental toughness can explain how physically talented athletes become great athletes
12 (Gucciardi et al., 2008), others have cautioned against over-emphasising the importance of
13 psychological constructs when success in sports is most likely down to deliberate practice
14 (Ericsson, 1996) and athletes possessing the appropriate blend of physiological, anatomical and
15 psychological attributes (Crust, 2008).

16 Since Jones, Hanton, and Connaughton (2002) lamented the lack of conceptual clarity that
17 has surrounded mental toughness, there appears to have been significant progress and some
18 agreement concerning the key characteristics of this construct (Crust, 2007). Despite different
19 approaches to research involving both qualitative and quantitative methods, a number of key
20 components are consistently reported, and include self-belief, commitment, self-motivation,
21 thriving on competition and challenges, retaining psychological control under pressure,
22 resilience, perseverance, and focus or concentration (Crust, 2007; Gucciardi et al. 2008). Jones et
23 al. (2007) claimed that mentally tough athletes were 'better' at psychologically coping with

1 demanding circumstances, but this is problematic given that these researchers made no
2 comparisons with less tough or less successful athletes. Although it seems reasonable to assume
3 that mentally tough athletes are better at coping with demanding circumstances, it is clear that the
4 descriptive nature of most mental toughness research to date has not allowed this proposition to
5 be satisfactorily tested.

6 Recent qualitative studies (Connaughton et al., 2008; Jones et al., 2007; Gucciardi et al.,
7 2008) have attempted to develop the knowledge base in an emerging area, but this work has
8 essentially replicated previous findings (cf. Fourie & Potgeiter, 2001; Jones et al., 2002). Also,
9 an over-emphasis on studying the elite and assuming that the super-elite (i.e. gold medallists) are
10 somehow more mentally tough than a silver medallist appears to be questionable when
11 consideration is given to multiple other factors that determine success. In short, most of the
12 research concerning mental toughness has not objectively evaluated relationships with
13 performance, cognitions or cognitive strategies, behavioural tendencies or affective states. On
14 this basis, the assumption of mental toughness being a key determinant of success, or the
15 difference between good and great athletes remains speculative. However, if more objective,
16 comparative studies are to emerge, as recently recommended (Crust, 2008; Gucciardi et al., 2008)
17 researchers need to have confidence in psychometric properties of measurement instruments.

18 Some researchers have studied mental toughness using quantitative methods. For
19 example, Golby and colleagues (Golby, Sheard, & Lavalley, 2003; Golby & Sheard, 2004;
20 Sheard & Golby, 2006) used the Psychological Performance Inventory (PPI: Loehr, 1986) as a
21 measure of mental toughness. However, Middleton et al. (2004) found little support for the
22 psychometric properties of the PPI, while the conceptual and theoretical basis of the inventory
23 appears weak. Despite a recent revision (cf. Golby, Sheard & Van Wersch, 2007) which resulted

1 in improved psychometric properties, the revised inventory did not include a measure of control,
2 one of the most recurrent themes of mental toughness literature.

3 A more rigorous approach to studying mental toughness is evident in the work of Clough
4 et al. (2002). These researchers conceptualised mental toughness as a personality trait, and
5 grounded their work in the foundations of existing psychological theory. Specifically, Clough et
6 al. developed a conceptualisation of mental toughness that proceeded from the similar yet distinct
7 construct of hardiness, which has been the focus of much research in health psychology.
8 Existential psychologists (Kobasa, 1979; Kobasa, Maddi, & Khan, 1982) found that some
9 individuals, who possessed hardy personalities, were more resilient and able to remain healthy
10 when faced with high levels of stress, than were others who faced similar stressors but lacked
11 hardiness. Kobasa (1979) proposed that hardiness was characterised by the three inter-related
12 components of control, commitment and challenge. Initial qualitative work by Clough et al.
13 involved athletes, coaches and sport psychologists, and resulted in confidence being added to the
14 three original components of hardiness to more fully represent the sport specific construct of
15 mental toughness. According to Clough et al. (2002):

16 Mentally tough individuals tend to be sociable and outgoing; as they are able to remain
17 calm and relaxed, they are competitive in many situations and have lower anxiety levels
18 than others. With a high sense of self-belief and an unshakeable faith that they can control
19 their own destiny, these individuals can remain relatively unaffected by competition or
20 adversity (p. 38).

21 Clough and colleagues (Clough et al., 2002; Crust & Clough, 2005; Levy, Polman,
22 Clough, Marchant & Earle, 2006) have used their own MTQ48 (Clough et al., 2002) as a measure
23 of mental toughness. There appears to be good evidence to support the construct validity (with

1 significant relations reported with constructs such as self-efficacy), criterion-validity
2 (relationships with performance variables) and a test-retest coefficient of 0.9. Horsburgh,
3 Schermer, Veselka, and Vernon (2009) have recently conducted both exploratory and
4 confirmatory factor analysis on the MTQ48. This work revealed adequate psychometric
5 properties and supported a factor structure that includes challenge, commitment, emotional
6 control, life control, confidence in abilities and interpersonal confidence. Horsburgh et al. (2009)
7 evaluated mental toughness in 219 pairs of adult monozygotic and dizygotic twins and found
8 evidence that individual differences in mental toughness were largely attributable to genetic and
9 non-shared environmental factors. These researchers also found the MTQ48 to be significantly
10 correlated with the big five factors of personality, and supported the view that mental toughness
11 is a trait construct. High scores on the inventory have been found to be related to lower rating of
12 exertion during a demanding cycle task and the ability to bounce back after negative feedback
13 (Clough et al., 2002) as well as increased pain tolerance (Crust and Clough, 2005), rehabilitation
14 from injury (Levy et al., 2006) greater use of problem or approach coping strategies, and less use
15 of avoidance coping strategies (Nicholls, Polman, Levy, & Backhouse, 2008). The results from
16 Nicholls et al. (2008) provide further support for a trait view of mental toughness given the small
17 to moderate relations reported with coping strategies. Given that coping is usually conceptualised
18 as a dynamic process (changes from situation to situation), personality traits are considered to
19 have a relatively small effect on coping strategies used.

20 There is still much debate concerning whether mental toughness is more stable and trait-
21 like, or a set of context specific cognitive skills that can be manipulated through training (cf.
22 Crust, 2008). The suggestion that mental toughness may be ‘natural or developed’ (Jones et al.,
23 2007, p. 247) appears to correspond with more recent understanding of the importance of both

1 nature and nurture (cf. Golby & Sheard, 2006). In this regard, researchers have recently turned
2 their attention to how mental toughness might develop. This would appear to be a question of
3 paramount importance to applied sport psychologists who are working with athletes to enhance
4 performance.

5 Evidence from two qualitative studies using elite athletes (Bull et al., 2005; Connaughton
6 et al., 2008) implicates the crucial role of environmental influences such as motivational climate,
7 parental influence, upbringing, and exposure to tough environments (competitive) in the
8 development of mental toughness. However, while Bull et al. reported little evidence to support
9 the importance of psychological skills training in the development of mental toughness, results
10 from the Connaughton et al. investigation did suggest that psychological skills training had a
11 salient role. Specifically, retrospective interviews of elite (mentally tough) athletes revealed that
12 goal-setting, self-talk, and imagery were important strategies that were employed to cope with
13 competitive anxiety and in helping to prepare for competition.

14 The role of mental skills training in the development of mental toughness has received
15 some support through the work of Sheard and Golby (2006). These researchers found that a 7-
16 week mental skills training programme (inc. goal-setting, visualisation, relaxation, concentration
17 and thought stopping skills) led to significant increases in both the performance and self-rated
18 mental toughness of high performing adolescent swimmers. However, it is not possible to
19 determine the importance of individual skills such as goal-setting, with the use of a generic
20 mental skills training programme. Also, the use of the Psychological Performance Inventory
21 (PPI; Loehr, 1986) as a measure of mental toughness is questionable given that previous
22 researchers have shown this instrument to have inadequate psychometric properties (Middleton et
23 al., 2004).

1 While investigating the relationship between mental toughness and coping, Nicholls et al.
2 (2008) found significant correlations between self-reported mental toughness (using the MTQ48)
3 and the use of strategies which included thought control, relaxation and mental imagery.
4 However, the Coping Inventory for Competitive Sports (Gaudreau & Blondin, 2002) which was
5 used by Nicholls et al. does not measure a number of other common psychological strategies used
6 by athletes such as goal-setting and self-talk, and does not differentiate between use in practice
7 and competition. This is important following the work of Jones et al. (2007) whose mental
8 toughness framework clearly identifies characteristics that were specific to training, competition
9 and post-competition. Information concerning the use of such strategies by mentally tough
10 athletes may provide important clues to how mental toughness develops, and the potential role of
11 mental skills training in facilitating mental toughness.

12 One particular psychological inventory has attracted significant support in relation to
13 assessing athletes' use of psychological strategies in both practice and competition. A number of
14 researchers have recommended the Test of Performance Strategies (TOPS; Thomas, Murphy &
15 Hardy, 1999) as an appropriate instrument for assessing use of psychological skills (Jackson,
16 Thomas, Marsh, & Smethurst, 2000; Fletcher & Hanton, 2001; Gould, Dieffenbach, & Moffatt,
17 2002; Williams, Hardy & Mutrie, 2008). This instrument measures some of the most commonly
18 used psychological strategies such as goal-setting, self-talk, imagery and relaxation. While TOPS
19 appears to receive good support from sports psychologists, there is some evidence that the
20 inventory might not be appropriate for use with adolescents, and that the factorial validity
21 requires further development (Lane, Harwood, Terry, & Karageorghis, 2004).

22 This study aimed to evaluate the relationship between mental toughness and the use of
23 psychological strategies in both practice and competition environments. On the basis of existing

1 evidence of a relationship between mental toughness and performance (cf. Crust, 2008), mental
2 skills and performance (Gould et al., 2002) and evidence to suggest psychological skills training
3 can lead to increases in self-reported mental toughness (Sheard & Golby, 2006), a positive
4 relationship between mental toughness and use of psychological strategies in both practice and
5 competition was hypothesised. The strength of relations between mental toughness and
6 psychological strategies within the present research will enable further understanding of whether
7 mental toughness is primarily a trait-like construct, or more of a developed set of psychological
8 skills. Small to moderate relationships were predicted between mental toughness and use of
9 psychological skills in line with the view of mental toughness as a personality trait (Clough et al.,
10 2002).

11

12 Method

13 Participants

14 Participants were 107 athletes who all regularly participated in a variety of team and individual
15 sports (e.g., football, rugby, netball, tennis, athletics etc.) in the north of England. The sample
16 consisted of 67 men (M age = 22.55 years, SD = 4.96) and 40 women (M age = 21.08 years, SD =
17 2.81). Of the participants, 36 were club / university athletes while the remaining 71 participants
18 were competing at county standard or higher (5 participants were competing at national level).
19 All participants completed an informed consent form prior to data collection. Ethical clearance
20 for this research was achieved through the research ethics committee of _____ University.

21

22 Instruments

1 The Test of Performance Strategies (TOPS; Thomas et al., 1999) was used to assess the
2 psychological skills and strategies used by athletes in competition and during practice. This 64-
3 item measure was designed to assess the 'psychological processes thought to underlie successful
4 athletic performance as delineated by contemporary theory' (Thomas et al., 1999, p. 699). Each
5 item on the TOPS inventory describes a specific situation that athletes may encounter in training
6 or competition such as, 'During practice I visualise successful past performances'. Respondents
7 are required to assess the frequency of such events on a five-point scale ranging from (1) never,
8 to (5) always. Exploratory factor analysis revealed eight dimensions of psychological skills and
9 strategies (Thomas et al., 1999). Seven of the subscales are measured across both practice and
10 competition contexts, and include activation, automaticity, emotional control, goal-setting,
11 imagery, relaxation and self-talk. Thomas et al. (1999) found that attentional control, which is
12 measured in practice contexts, was not an appropriate solution in competition and as such was
13 replaced by the negative thinking subscale. The internal consistency of the TOPS subscales was
14 reported to range between 0.66 and 0.81 (Thomas et al., 1999). With regard to discriminant
15 validity, Thomas et al. (1999) reported significant differences in psychological skills and
16 strategies when subgroups were defined by age, sex and current level of performance in sport.
17 When examining the factorial validity of the TOPS with adolescent athletes using confirmatory
18 factor analysis, Lane et al. (2004) found partial support for the overall measurement model for
19 competition items, but minimal support for training items. As such, the use of the TOPS
20 inventory with adolescent athletes remains questionable, although the inventory retains good
21 support as the instrument of choice in assessing athlete's psychological skills (Jackson et al.,
22 2000; Fletcher & Hanton, 2001; Gould et al., 2002; Williams, Hardy & Mutrie, 2008).
23

1 Mental Toughness

2 The MTQ48 (Clough et al., 2002), was used to measure mental toughness. Responses are made
3 to the 48-items on a 5-point Likert scale ranging from (1) strongly disagree, to (5) strongly agree,
4 with an average completion time between 10 and 15 minutes (Crust & Clough, 2005). The
5 MTQ48 has an overall test-retest coefficient of 0.9, and previous studies have found high alpha
6 coefficients for the MTQ48 (Nicholls et al., 2008). The psychometric development of the MTQ48
7 (cf. Earle, 2006) involved principal components analysis with varimax rotation. The most
8 satisfactory solution was found to be a six-factor structure (challenge, commitment, emotional
9 control, life control, confidence in abilities and interpersonal confidence). Clough et al. (2002)
10 provided evidence for the construct validity of the MTQ48 with significant relationships reported
11 with optimism ($r = 0.48$), self-image ($r = 0.42$), life satisfaction ($r = 0.56$), self-efficacy ($r = 0.68$),
12 and trait anxiety ($r = 0.57$). In respect of criterion validity, Clough et al. found participants with
13 self-reported high, as opposed to low mental toughness gave lower rating of exertion during a 30-
14 minute physically demanding cycling task. The MTQ48 has been found to correlate with pain
15 tolerance (Crust & Clough, 2005) and a short-form version of the questionnaire has been shown
16 to relate to injury rehabilitation (Levy et al., 2006).

17

18 Procedures

19 Participants were solicited through advertisements at a number of local sports facilities where
20 sports clubs and teams were known to regularly train. Brief information concerning the nature of
21 the study was given in the advertisements along with requests for athletes who regularly
22 competed in competitive sports and were over the age of 16 years, to complete two
23 questionnaires. Respondents who expressed an interest in taking part in the study were provided

1 with further, more detailed information via an online web address, while the second named
2 author answered any additional questions prospective participants had. All participants were
3 assured of confidentiality and informed of their right to withdraw consent. Questionnaires were
4 completed in isolation and were administered via the second named author. Completion of the
5 questionnaires occurred in a variety of settings that were convenient, comfortable and non-
6 threatening for respondents.

7

8 Data Analysis

9 Descriptive statistics (means, standard deviations) were calculated for all measures. Data
10 screening was used to ensure all dependent variables met the assumptions necessary for the use of
11 parametric statistics prior to data analysis. Pearson Product Moment Correlations were also
12 computed between all of the TOPS subscales, total mental toughness and the subscales of the
13 MTQ48. Linear regression analysis was used to determine the relationship between athletes' use
14 of psychological skills and strategies, and mental toughness. Each subscale of the TOPS
15 inventory acted as a dependent variable, with each of the six subscales of the MTQ48 acting as
16 independent variables. In addition, two independent t-tests were used to test for differences in
17 total mental toughness between club / university athletes and athletes currently competing at
18 county standard or above, and between men and women.

19

20 Results

21 Descriptive data for responses to the MTQ48 and TOPS questionnaires can be viewed in table 1
22 and table 2. Measures of skewness and kurtosis found the data to be normally distributed and as
23 such use of parametric statistics was deemed appropriate. Results of the correlation analyses are

1 presented in table 3, whereas table 4 provides information concerning the regression analyses.
2 Three of the performance strategies from the TOPS questionnaire were found to significantly and
3 positively correlate with mental toughness in both practice and competition settings (self-talk,
4 emotional control and relaxation). Additionally, automaticity was found to significantly correlate
5 with mental toughness in practice, while in competition, activation and goal-setting were found to
6 positively correlate with mental toughness. The largest correlation found in the analyses was a
7 significant negative correlation with negative thinking in competition ($r = -0.47, P < 0.01$).
8 When relationships between the subscales of the MTQ48 and the TOPS subscales were analysed
9 via linear regression and Pearson correlations, it became evident that commitment was most often
10 associated with the use of performance strategies in practice and competition. Significant Pearson
11 correlations were found between commitment and 13 of the 16 subscales of the TOPS inventory
12 ranging from 0.19 (imagery and attentional control in practice) to 0.40 (imagery in competition).
13 Results of the linear regression analyses showed a number of the MTQ48 subscales were
14 found to significantly predict use of psychological strategies in both practice and competition.
15 The R^2 values reported, reflect that the independent variables (mental toughness subscales)
16 accounted for between 4 and 20% of the variance in use of psychological strategies. Cohen and
17 Cohen (1983) describe procedures for estimating effect size in regression analyses which
18 involved the transformation of R^2 values into an f^2 equation. According to the estimates provided
19 by Cohen and Cohen, the amount of variance accounted for with respect to emotional control,
20 imagery, and negative thinking in competition, and self-talk in practice was moderate. All
21 remaining R^2 values are considered small, and where less than 10% of the variance is accounted
22 for, the meaningfulness of these relationships should be viewed with caution.

1 An independent *t*-test found significant differences in total mental toughness between
2 club / university athletes and county standard athletes and above ($t_{105} = -2.25, P = 0.03, d = 0.45$).
3 Athletes of county standard and above were found to report significantly higher levels of mental
4 toughness ($M = 178.75, SD = 15.08$) than club / university athletes ($M = 171.53, SD = 16.83$).
5 Further analysis using the mental toughness subscales revealed this difference to be primarily due
6 to differences in commitment. Men and women were not found to report significant differences in
7 mental toughness ($P > 0.05$).

8

9 Discussion

10 The aim of this research was to evaluate the relationship between mental toughness and the use of
11 psychological strategies. Results suggest that mental toughness was significantly related to the
12 use of a number of performance strategies in both practice and competition. Although previous
13 studies have highlighted low to moderate relationships between mental toughness and coping
14 (Nicholls et al., 2008) the present study considered the strategies used by athletes in planning and
15 preparing for competition. This is important given that recent researchers have highlighted the
16 restrictive nature of much mental toughness research that has primarily conceptualised the
17 construct in terms of how individuals cope, or react in adversity (Gucciardi et al., 2008). A
18 further strength of the present research is the use of an inventory (TOPS) that has been frequently
19 employed in previous research (Gould et al., 2002) and as such allows comparisons to be made to
20 existing findings.

21 With respect to the use of performance strategies in competition, low to moderate
22 significant positive correlations were found between total mental toughness and five of the eight
23 strategies measured by the TOPS inventory: namely; activation, relaxation, self-talk, emotional

1 control, and goal-setting. These strategies are broadly consistent with those that Williams and
2 Krane (2001) reported more successful athletes used to achieve peak performances. Of the
3 positive relationships found between mental toughness and use of performance strategies in
4 competition, the strongest were self-talk ($r = 0.37, P < 0.01$), emotional control ($r = 0.36, P$
5 < 0.01) and relaxation ($r = 0.29, P < 0.01$). Overall, the strongest correlation found was the
6 negative relationship between mental toughness and negative thinking ($r = -0.47, P < 0.01$) which
7 is consistent with theoretical and empirical research that emphasise mental toughness as a
8 positive psychological construct associated with optimism and self-belief (Crust, 2008; Jones et
9 al., 2007; Nicholls et al., 2008).

10 When the data was analysed with respect to practice contexts, significant positive
11 correlations were found between mental toughness and automaticity, the use of relaxation
12 strategies, self-talk and emotional control. Thus, the latter three performance strategies previously
13 highlighted are the only ones that showed significant and positive correlations with mental
14 toughness in both practice and competition settings. Importantly, both qualitative and quantitative
15 studies have previously reported the importance of self-talk and relaxation strategies in regards to
16 mental toughness. Elite athletes emphasised self-talk, as well as goal-setting and imagery as
17 important strategies that were used to cope with competitive anxiety and in helping to prepare for
18 competition (Connaughton et al., 2008). In research outside of sports contexts, psychologists
19 have found the use of relaxation strategies associated with psychological resilience (Wolin &
20 Wolin, 1993). Furthermore, Nicholls et al. (2008) previously reported significant correlations
21 between mental toughness and the use of relaxation, thought control and mental imagery.

22 When the data was considered with respect to the subscales of the MTQ48, it became
23 apparent that the component of mental toughness most consistently correlated with the use of

1 psychological performance strategies was commitment. It is possible that being committed, and
2 thus deeply involved in ones chosen sport, would lead mentally tough performers to seek out
3 alternative ways of enhancing their performances. Of the sixteen subscales of the TOPS
4 inventory, commitment was found to correlate with thirteen of these, and most significantly with
5 the use of imagery in both practice and competition. Confidence in ones abilities was found to
6 correlate with seven performance strategies, most notably with self-talk in practice ($r = 0.42, P <$
7 0.01), while consistent with theoretical predictions, emotional control on the MTQ48 was
8 significantly related to the use of emotional control strategies in competition ($r = 0.42, P < 0.01$)
9 and practice ($r = 0.30, P < 0.01$). In recent research concerning mental toughness in Australian
10 Football, elite coaches with significant playing experience highlighted the importance of
11 managing emotions to enhance performance (Gucciardi et al., 2008). Interestingly, research
12 concerning the related construct of psychological resilience has shown that resilient individuals
13 tend to use positive emotions to bounce back from negative emotional experiences (Tugade &
14 Fredrickson, 2004). These researchers showed that resilient individuals found positive meaning
15 in stressful encounters and that efficient emotional regulation was achieved, in part, by
16 experiencing positive emotions.

17 One of the major limitations of the present research is that the TOPS inventory only
18 assesses the frequency with which participants use psychological performance strategies.
19 Although the current findings highlight relationships between mental toughness and use of such
20 strategies, how effectively such athletes employ these strategies remains unclear. Similarly,
21 although the TOPS inventory allows the general strategies used by performers to be evaluated,
22 more specific details of the types of strategies used would help to provide further clarity. For
23 example, do mentally tough performers tend to employ certain types of self-talk? And in what

1 ways do such athletes achieve emotional control? It is possible that qualitative research
2 employing in-depth interviews with mentally tough performers would help to produce a more
3 'fine grained' understanding.

4 While the present study has used a relatively small sample of athletes, and caution must
5 be urged in interpreting research that employs multiple correlations, the small to moderate
6 relationships found between use of performance strategies and mental toughness appears to be
7 consistent with previous related work that also employed the MTQ48 (Nicholls et al., 2008).
8 Furthermore, the magnitude of these relationships suggests that mental toughness does not simply
9 represent psychological skills usage as measured by TOPS. While this finding alone does not
10 warrant the conclusion that mental toughness is a trait-like construct, it appears reasonable to
11 conclude that mental toughness is more than just a set of context specific psychological
12 strategies. Other recent research suggests mental toughness has a strong genetic component
13 (Horsburgh et al., 2009) and there is evidence that mental toughness does not vary from situation
14 to situation (individual vs team sports; contact vs non-contact sports), and thus is acting like a
15 personality trait (Nicholls, Polman, Levy, & Backhouse, 2009).

16 Further experimental research that builds upon the work of Sheard and Golby (2006) is
17 necessary to evaluate if mental skills training can lead to increases in mental toughness. Some of
18 the relationships that were found in the present study appear to warrant further investigation, and
19 it remains possible that mental skills training has a role to play in the development of mental
20 toughness although inherited qualities, or as Bull et al. (2005) suggest the role of environmental
21 factors might be more significant. Given that the strategies of self-talk, emotional control and
22 relaxation were found to be positively related to mental toughness in both practice and
23 competition, it would seem necessary for future researchers to explore the independent impact of

1 these strategies on mental toughness through the use of intervention studies. With the noted
2 relationships between use of performance strategies and commitment, it remains plausible that
3 the results of this study reflect highly committed, mentally tough athletes being attracted to using
4 psychological strategies that are likely to aid their performances.

5

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1 Table 1 - Means and standard deviations of MTQ48 data

2

Dependent Variables	(N = 107)
MT Total	176.32 ± 15.98
Challenge	31.82 ± 4.13
Commitment	40.97 ± 4.76
Emotional Control	22.82 ± 3.44
Life Control	25.64 ± 3.60
Confidence Ability	31.85 ± 4.77
Confidence Interpersonal	23.22 ± 2.46

3

4 Table 2 – Means and standard deviations of TOPS data

	Club / University (n = 36)		County Standard + (n = 71)		Total Sample (N = 107)	
	Competition	Practice	Competition	Practice	Competition	Practice
Activation	3.67 ± 0.59	3.02 ± 0.62	3.87 ± 0.57	3.28 ± 0.63	3.80 ± 0.56	3.19 ± 0.64
Automaticity	3.13 ± 0.77	3.31 ± 0.65	3.34 ± 0.85	3.51 ± 0.60	3.27 ± 0.83	3.44 ± 0.62
Emotional Cont.	3.40 ± 0.79	3.04 ± 0.71	3.52 ± 0.83	3.19 ± 0.74	3.48 ± 0.82	3.14 ± 0.73
Goal-setting	3.20 ± 0.74	3.22 ± 0.71	3.73 ± 0.76	3.34 ± 0.74	3.55 ± 0.79	3.30 ± 0.73
Imagery	3.06 ± 0.74	3.09 ± 0.59	3.37 ± 0.86	3.38 ± 0.81	3.27 ± 0.83	3.28 ± 0.75
Relaxation	3.31 ± 0.54	2.56 ± 0.82	3.33 ± 0.70	2.61 ± 0.72	3.32 ± 0.66	2.59 ± 0.75
Self-talk	3.15 ± 0.73	3.36 ± 0.74	3.29 ± 0.66	3.41 ± 0.93	3.24 ± 0.86	3.39 ± 0.74
Attentional Cont.	–	3.06 ± 0.38	–	3.08 ± 0.53	–	3.08 ± 0.28
Negative Thinking	2.62 ± 0.65	–	2.29 ± 0.74	–	2.41 ± 0.72	–

5

1 Table 3 – Results of Pearson Product Moment Correlation Analysis between use of Performance Strategies and Mental Toughness

	MT Total		Challenge		Commitment		Emotional Cont.		Life Control		Ability Conf.		Inter. Conf.	
	Pract.	Comp.	Pract.	Comp.	Pract.	Comp.	Pract.	Comp.	Pract.	Comp.	Pract.	Comp.	Pract.	Comp.
Activation	0.07	0.24*	-0.08	0.12	0.19*	0.22*	0.05	0.08	-0.05	0.16	0.11	0.21	-0.02	0.16
Automaticity	0.24*	0.17	0.10	0.11	0.07	0.18	0.15	0.21*	0.17	0.10	0.20*	0.09	0.12	-0.06
Emotional Cont.	0.30**	0.36**	0.19*	0.24*	0.20*	0.25**	0.31**	0.42**	0.29**	0.34**	0.22*	0.15	-0.05	0.02
Goal-setting	0.18	0.28**	0.18	0.15	0.27**	0.26**	0.10	0.10	0.15	0.24*	0.06	0.25*	0.06	0.12
Imagery	0.17	0.14	0.17	0.02	0.31**	0.40**	-0.04	-0.07	0.21*	0.02	0.14	0.09	0.05	0.02
Relaxation	0.26**	0.28**	0.22*	0.12	0.27**	0.17	0.15	0.30**	0.13	0.20*	0.19*	0.18	0.01	0.19*
Self-talk	0.35**	0.37**	0.20*	0.30**	0.29**	0.29**	0.17	0.29**	0.14	0.09	0.42**	0.29**	0.15	0.26**
Attentional Cont.	0.12	-	0.10	-	0.19*	-	0.15	-	0.15	-	-0.15	-	0.09	-
Neg. Thinking	-	-0.47**	-	-0.37**	-	-0.32**	-	-0.34**	-	-0.24*	-	-0.37**	-	-0.25*

2 * $P < .05$; ** $P < .01$

1 Table 4 – Results of the linear regression analysis

Dependent Variable	R ²	ANOVA	Variables Loading Significantly and Beta Value
Activation (p)	0.04	3.99*	Commitment ($\beta = 0.19^*$)
Activation (c)	0.05	5.27*	Commitment ($\beta = 0.22^*$)
Automaticity (p)	0.04	4.55*	Confidence Ability ($\beta = 0.20^*$)
Automaticity (c)	0.04	4.87*	Emotional Control ($\beta = 0.21^*$)
Emotional Control (p)	0.10	11.07**	Emotional Control ($\beta = 0.31^{**}$)
Emotional Control (c)	0.18	22.57**	Emotional Control ($\beta = 0.42^{**}$)
Goal-setting (p)	0.07	7.99**	Commitment ($\beta = 0.27^{**}$)
Goal-setting (c)	0.06	7.38**	Commitment ($\beta = 0.26^{**}$)
Imagery (p)	0.10	11.11**	Commitment ($\beta = 0.31^{**}$)
Imagery (c)	0.20	12.75**	Commitment ($\beta = 0.46^{**}$); Emotional Control ($\beta = -0.21^*$)
Relaxation (p)	0.07	8.32**	Commitment ($\beta = 0.27^{**}$)
Relaxation (c)	0.09	10.58**	Emotional Control ($\beta = 0.30^{**}$)
Self-talk (p)	0.17	21.92**	Confidence Ability ($\beta = 0.42^{**}$)
Self-talk (c)	0.13	7.53**	Challenge ($\beta = 0.22^*$); Commitment ($\beta = 0.21^*$)
Attentional Control (p)	0.13	4.90**	Commitment ($\beta = 0.24^{**}$); Confidence Ability ($\beta = 0.32^{**}$); Emotional Control ($\beta = 0.21^*$)
Negative Thinking (c)	0.19	11.84**	Challenge ($\beta = -0.26^{**}$); Confidence Ability ($\beta = -0.24^{**}$)

2 (p) = practice; (c) = competition; * = $P < .05$, ** = $P < .01$