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Title: Comparing two measures of Mental Toughness

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Abstract

This paper tested relations between two measures of mental toughness. A sample of 110 male athletes (M age = 20.81 years; SD = 2.76), derived from University sports teams and local sports clubs, gave informed consent before completing two questionnaires to assess mental toughness. It was hypothesized that scales and subscales from the two different instruments, which purported to measure the same or substantially overlapping scales, would be strongly correlated. Predictions concerning the expected relations were made *a priori*. Pearson correlations revealed a significant and positive relationship between higher order mental toughness scores ($r = .75$; $p < .001$). Correlations between similar mental toughness subscales were found to be positive and significant but somewhat lower than expected ($r = .49$ to $.62$). Results suggest instrument subscales with similar labels are not measuring the same components of mental toughness.

Introduction

There appears to be general consensus amongst researchers and sport psychologists that mental toughness (MT) is an important multidimensional construct related to successful performance and outcomes in sport (Crust, 2008; Jones, Hanton, & Connaughton, 2007; Sheard, 2010). Attributes most often reported to represent MT include having unshakeable self-belief, coping effectively with pressure and adversity, being resilient, thriving on pressure, being committed, and having superior concentration skills (Connaughton, Hanton, & Jones, 2010; Crust, 2008; Sheard, 2010). As such, MT represents a constellation of positive psychological variables that help to buffer the harmful effects of stress and allow individuals to perform consistently well regardless of situational factors (Clough, Earle, & Sewell, 2002). However, recent researchers have suggested that MT is more than a resistance resource that operates in times of adversity, and that MT also enables appropriate focus and motivation when things are going well (Gucciardi, Gordon, & Dimmock, 2008). There is still debate concerning whether MT is more stable and trait-like, or a mind-set that can be manipulated through training and experience (cf. Crust, 2008; Sheard, 2010). With describing MT as a psychological edge that may be “natural or developed”, Jones et al. (2007, p. 247) implicate the importance of both nature and nurture. Recent research suggests that the development of MT is a long-term and complex process that is influenced by personal qualities, environmental conditions, and critical incidents (Connaughton et al., 2010).

Clough, et al. (2002) proposed the 4C's model of MT¹ that is represented by: (1) challenge, the extent to which individuals see problems as opportunities for self-development; (2) commitment, as opposed to alienation, which reflects deep involvement with whatever one is doing; (3) emotional control concerns keeping anxieties in check; (4) life control reflects a tendency to feel and act as if one is influential; (5) confidence in abilities involves a high

¹*Six components of the 4C's model are presented because control and confidence each have two sub-components.*

sense of self belief and less dependency on external validation; and (6) interpersonal confidence reflects being assertive when interacting with others.

Much early MT research was qualitative and aimed at establishing a clear conceptualization of the construct (cf. Sheard, 2010). While qualitative research helped to identify some of the key attributes of mentally tough athletes, much less attention was given to issues of measurement (Crust, 2008; Sheard, Golby, & van Wersch, 2009). However, Clough et al. (2002) produced an instrument that has since been used in numerous studies (i.e., Crust & Clough, 2005; Kaiseler, Polman, & Nicholls; 2009; Nicholls, Polman, Levy & Backhouse, 2008). Despite much published research using the Mental Toughness Questionnaire 48 (MTQ48; Clough et al.), some researchers (i.e., Sheard et al., 2009) have been critical of the measure on two counts: First, the conceptualization that underpins the MTQ48; and second, the lack of independent scrutiny of the factor structure.

Initial work by Clough et al. (2002) involved interviews with professional athletes, coaches, and sport psychologists. The resultant conceptualization of MT bore a close resemblance to psychological hardiness, although Clough et al. proposed that MT and hardiness were related yet distinct constructs. Furthermore, the factor structure that emerged from this research appears consistent with the key attributes of MT that have since been identified in numerous qualitative studies. For example, confidence or self-belief, aspects of control and thriving on challenges have all been consistently reported as key components of MT (Crust, 2008; Jones et al., 2007; Sheard, 2010). Furthermore, recent research aimed at establishing psychological characteristics that facilitate a pathway to elite sport performance, included factors that either explicitly (i.e., self-belief, commitment) or implicitly (i.e., competitiveness, coping under pressure) correspond to the 4C's model (Macnamara, Button, & Collins, 2010).

There is evidence to support the validity and reliability of the MTQ48. Clough et al. (2002) found differences in cognitive performance following negative feedback and in ratings

of exertion during a strenuous physical task, between participants with high and low levels of MT (using the MTQ48). Work by Crust and Clough (2005) supported construct validity of the MTQ48 with significant relations found between MTQ48 scores and pain tolerance. Research has also found significant relations between MTQ48 scores, optimism and coping skills (Nicholls et al., 2008). In terms of reliability, the overall internal consistency of the MTQ48 has generally been reported at 0.9 or above (i.e., Kaiseler et al., 2009). Despite such evidence, critics have highlighted the need for further psychometric testing. Independent researchers recently tested the factor structure of the MTQ48 using confirmatory factor analysis (CFA). Horsburgh, Schermer, Veselka, and Vernon (2009) reported support for the factor structure of the MTQ48 and significant relations between MT and other personality factors. Unfortunately, Horsburgh et al. did not provide a full report of the CFA data such as fit indices. However, Horsburgh et al. did find that MT behaves, “in the same manner as virtually every personality trait that has ever been investigated in behavioral genetic study.” (p. 104).

Recently, Sheard et al. (2009) developed a multidimensional measure of MT called the Sports Mental Toughness Questionnaire (SMTQ). These researchers developed items for the SMTQ by using raw data themes and quotes from previous qualitative studies of MT. Two studies, including 1142 participants supported a three-factor model for the SMTQ plus a higher order factor using both exploratory and CFA. The SMTQ measures global MT and three subscales (i.e., confidence, constancy, and control). According to Sheard (2010), the confidence subscale measures athletes’ belief in their own abilities to achieve goals and be better than their opponents. Constancy reflects determination, personal responsibility, an unyielding attitude, and ability to concentrate. Finally, control in the SMTQ is concerned with the perception that one is personally influential and can bring about desired outcomes with particular reference to controlling emotions.

Sheard et al. (2009) provide evidence that the SMTQ possesses satisfactory psychometric properties, with adequate reliability, divergent validity, and discriminative power. The internal consistency of factors was found to be good, with all alpha coefficients above 0.7. Low to moderate correlations between related, yet distinct concepts (e.g., hardiness, optimism) provide support for discriminant validity, while evidence for differences in MT relating to age, gender and competitive standard were also found. However, Sheard et al. recommended further testing of the construct validity of the SMTQ.

In developing instruments to test constructs within sport domains, researchers have emphasized the importance of a multitrait-multimethod (MTMM) approach to test the convergent and discriminant validity of measurement instruments (see Marsh, 2007). This approach involves instruments purporting to measure the same or substantially overlapping scales to be administered to the same participants. A systematic evaluation of correlations between scales from different instruments is conducted, which includes matching (i.e., similar or identical content) and non-matching comparisons. Large correlations between matching scales provides support for convergent validity. When correlations in matched scales are higher than in non-matched scales, support for discriminant validity is provided. Marsh details how this approach has been used to establish construct validity in physical self-concept.

Marsh (2007) suggests that MTMM analyses can help to reveal problems based upon the labels given to scales. While instruments such as those posited to measure MT, contain similar or even identical labels for scales, it can not be assumed that these are measuring the same construct. For example, the jingle fallacy concerns two measures that are given the same label, but are inappropriately assumed to measure the same construct (when in fact they are measuring different constructs). In contrast, the jangle fallacy occurs when different labels are inappropriately assumed to measure different constructs (when in fact they are measuring the same construct). Thus, only through testing such relations can researchers interpret whether measures of MT are measuring the same, or different factors.

Given that both the MTQ48 and the SMTQ have been used to measure MT in the extant literature, it is necessary to understand how these measures relate to each other. However, it is important to acknowledge that other instruments have been developed to measure MT. For example, the Mental Toughness Inventory (MTI; Middleton, Marsh, Martin, Richards, & Perry, 2004a) is a 67-item instrument that measures 12 components of MT. While the MTI was developed via a construct validation approach, the instrument appears somewhat limited given that validation was restricted to 12-19 year old participants. The MTI has not been fully tested or frequently employed within the extant literature (Sheard, 2010). Gucciardi and colleagues have developed measures that are specific to particular sports such as Australian football (Gucciardi, Gordon, & Dimmock, 2009) and cricket (Gucciardi & Gordon, 2009). While these instruments appear to have developed through rigorous psychometric procedures, they are for sole use in designated sports. In contrast, most researchers contend that core components of MT exist, and will be required across sports (Jones et al., 2007; Sheard, 2010).

The two instruments used in this study were both general measures of MT (rather than measures specific to individual sports), with the MTQ48 being the most frequently employed measure of MT in published academic research to date, while the SMTQ is a newer instrument, but with seemingly impressive psychometric properties (Sheard, 2010). While the conceptualization and development of these two instruments has been somewhat different, there appears to be some similarity (i.e., confidence, control) in terms of the reported scales. However, there is a danger that if researchers are comparing findings between these instruments, they are not aware of differences that exist between scales. The aim of this study was to take a MTMM approach to further test the construct validity of the MTQ48 and SMTQ.

Method

Participants

Participants were 110 male club and University athletes (M age = 20.81 years, SD = 2.76). All participants had at least one year of experience in their chosen sport (M experience = 9.34 years, SD = 5.43). The sample consisted of athletes who were mostly team sport players (i.e., soccer, rugby union etc.) and represented 10 sports.

Instruments

Participants provided demographic information and were given a booklet that included two measures of MT. The MTQ48 (Clough et al., 2002) is a 48-item inventory that requires responses to statements on a 5-point Likert scale ranging from (1) *strongly disagree*, to (5) *strongly agree*. The MTQ48 provides a total MT score and measures six subscales of challenge, commitment, emotional control, life control, confidence in abilities and interpersonal confidence. Example items include “Challenges usually bring out the best in me” (challenge); “I don’t usually give up under pressure” (commitment); “I can usually control my nervousness” (emotional control); “I generally feel in control” (life control); “I am generally confident in my own abilities” (confidence in abilities); and “I usually speak my mind when I have something to say” (interpersonal confidence). Independent researchers have provided support for the factor structure of the questionnaire using CFA (Horsburgh et al., 2009). Support for the validity and reliability of the MTQ48 has previously been reported (cf. Clough et al., 2002).

The SMTQ (Sheard et al., 2009) was also used to measure MT. The 14-item SMTQ provides a global measure of MT as well as the three subscales of confidence, constancy, and control. Participants respond to items using a 4-point Likert scale, ranging from (1) *not at all true*, to (4) *very true*. Sample items include “I have unshakeable confidence in my ability” (confidence); “I get distracted easily and lose my concentration” (constancy); and “I get anxious by events I did not expect or cannot control” (control). CFA has provided support for the three subscales and a global measure of MT.

Procedure

Prior to the distribution of questionnaires, comparisons were made between the content of items from the 11 scales (7 MTQ48 and 4 SMTQ). Predictions were made based upon the degree of similarity between scales. The MTQ48 subscale of confidence in abilities closely resembled SMTQ confidence. The MTQ48 subscale of emotional control appeared similar to SMTQ control. Constancy on the SMTQ seemed to be most closely related to commitment from the MTQ48. As such, these relations were predicted to be strong (i.e., $r \geq .70$), as was the relationship between total MT and global MT. The second author then contacted organizers of sports teams to gain permission to distribute questionnaires, after gaining approval by a University Research Ethics Committee. Participants were given assurances of confidentiality and each provided written consent prior to completing the questionnaires. Most questionnaires were completed following training sessions.

Data analysis

Data was visually screened for outliers and checked for normality. Descriptive statistics were calculated on all study variables. The internal consistency of the MTQ48 and SMTQ were calculated and compared to previously published data. Pearson correlations were used to test for relationships between scales and subscales.

Results

Descriptive data from responses to the MTQ48 and the SMTQ can be viewed in Table 1. Pearson correlations between scales from the MTQ48 and the SMTQ, as well as the alpha coefficients can be viewed in Table 2. The overall internal consistency of the MTQ48 and the SMTQ were found to be good (.91 and .81 respectively). However, two subscales from each of the questionnaires were found to have problems with internal consistency ($\alpha < .70$). Both of the MTQ48 control subscales (emotional and life control), and the SMTQ subscales of constancy and control had inadequate internal consistency. Follow-up correlational analyses were conducted in an attempt to highlight any items which appeared to fit poorly within the subscale. With regard to MTQ48 emotional control (lowest internal consistency) item 34, “I

generally hide my emotions from others” was found to be unrelated to the subscale but was significantly and negatively correlated with three other subscale items. While all of the items from the MTQ48 life control subscale, and the SMTQ subscales of constancy and control, were found to be significantly and positively related to the subscale in question, a number of items were found to be unrelated to each other. As predicted, the higher order scores from the questionnaires (total MT and global MT) were found to be significantly correlated ($r = .75$). The scales predicted to be highly (i.e., $r \geq .70$) and significantly related (MTQ48 confidence in abilities and SMTQ confidence; MTQ48 emotional control and SMTQ control; and MTQ48 commitment and SMTQ constancy) were all found to be significantly related but with moderate as opposed to high correlations (.56, .49, and .61 respectively). Overall, the highest correlations between MTQ48 and SMTQ subscales were found to be: MTQ48 challenge and SMTQ confidence ($r = .62$); MTQ48 Commitment and SMTQ constancy ($r = .61$); and MTQ48 commitment and SMTQ confidence ($r = .59$).

Discussion

As predicted, a significant and positive correlation was found between higher order MT as measured by the MTQ48 and SMTQ respectively. The size of relationship between total, and global MT was large ($r = .75$) but accounts for only 56% of common variance. As such, 44% of variance between the measures remains unexplained. While the MTQ48 and SMTQ are significantly related, it would appear that they are measuring somewhat different components of MT. Marsh (2007) outlined criteria for establishing both convergent and discriminant validity using systematic evaluation of correlations between instruments purporting to measure the same or substantially overlapping scales. Marsh stressed the need for large correlations between matching scales (convergent validity) and larger correlations than non-matching scales (discriminant validity). With respect to the MTQ48 and SMTQ, matched subscales were found to be significantly related, but with moderate, rather than strong relations. Moreover, correlations between non-matched subscales (i.e., MTQ48

challenge and SMTQ confidence) were found to be equally as high as matched subscales.

Thus, while there is evidence for substantial overlap between the higher order factors measured by the MTQ48 and SMTQ, subscales purporting to measure similar components of MT (i.e., confidence, control) are not measuring the same factor (i.e., jingle fallacy). Thus researchers must be aware that these two measures overlap but are not measuring identical components of MT. As such, comparisons between evidence derived from these measures should be interpreted cautiously.

The descriptive data from the MTQ48 was similar to that reported by Kaiseler et al. (2009) while the SMTQ scores were slightly higher than previously reported norms for club or regional athletes (cf. Sheard et al., 2009). While the overall internal consistency of each measure was found to be good, problems with two subscales on each instrument were evident. In particular, the two subscales of control on the MTQ48 (emotional and life control) and the subscales of control and constancy on the SMTQ were found to have inadequate internal consistency ($\alpha < .70$). Previous researchers have reported similar problems with the MTQ48 subscale of emotional control (Kaiseler et al., 2009). One of the seven emotional control subscale items was found to be unrelated to the scale and negatively correlated with other items. The internal consistency of SMTQ control and constancy were found to be lower than previously reported (cf. Sheard et al., 2009). It must be acknowledged that the sample size in the present research is significantly lower than those used in the development of either instrument and this may have contributed to such findings. Nevertheless, there are numerous examples in sport psychology literature where instruments have been refined to improve psychometric properties. Establishing validity and reliability is an ongoing process. In particular, the MTQ48 subscale of emotional control appears to be in need of further refinement.

One possible reason for the moderate, rather than large correlations found between the matched subscales of the instruments is evident in closer examination of subscale items. For

example, while Sheard et al. (2009) provide clear criteria for establishing factor solutions for the SMTQ, in terms of some of the items, the logical validity might be questioned. For example, one item pertaining to measure confidence (I can regain my composure if I have momentarily lost it) seems more logically connected with control. Regaining composure suggests asserting internal control rather than being confident. Another item from the SMTQ confidence scale (I interpret potential threats as positive opportunities) appears to more closely resemble the challenge scale of the MTQ48, which Clough et al. (2002) described as the extent to which individuals see problems as opportunities for self-development. This offers a partial explanation for why SMTQ confidence was more strongly related to MTQ48 challenge (.62) than to MTQ confidence in abilities (.56).

Furthermore, the term committed or commitment is referred to in items from both the constancy and confidence subscales of the SMTQ. The final item of the SMTQ (under pressure, I am able to make decisions with confidence and commitment) appears to tap more than one factor. While a reasonable argument could be forwarded for confidence and commitment to be related, most theorists would agree they are not synonymous (Crust, 2008). The items measuring constancy on the SMTQ also appear to tap a wide range of factors from concentration (I get distracted easily and lose my concentration) to personal responsibility (I take responsibility for setting myself challenging targets); it is difficult to see how these logically fit together within one scale as a loss of concentration appears more akin to lack of attentional control. Indeed, a recently developed MT inventory specific to cricket (Gucciardi & Gordon, 2009) reported a five-factor model that included affective intelligence, attentional control, resilience, self-belief, and desire to achieve. With just three-factors (confidence, constancy, and control) it appears that the SMTQ has combined into single scales, components that other research groups have identified as being independent in models of MT (see Jones et al., 2007; Middleton, Marsh, Martin, Richards, & Perry, 2004b). Although

psychometric testing is a crucial component of developing measurement instruments, logical validity must also be given high priority.

Low internal consistency for some of the MTQ48 and SMTQ scales could provide an explanation for the lower than expected correlations between MTQ48 and SMTQ scales. For example, it is possible that emotional control from the MTQ48 and control from the SMTQ are more highly correlated, but low scale reliabilities could be adding additional unexplained variance that masks the true relationship. However, this does not explain why the correlations between confidence subscales were lower than expected, because confidence scales on both measures had at least adequate reliability. Knight and Vealey (2002) reported evidence for self-confidence being a multidimensional construct. While both the MTQ48 and SMTQ purport to measure confidence in one's ability, both instruments contain items that appear to extend beyond this narrow focus which has probably contributed to unexplained variance. In the case of the MTQ48, some items appear to resemble self-esteem rather than self-confidence (i.e., feelings of worthiness).

While the MTQ48 and SMTQ both purport to measure MT, and there is a good degree of overlap between items and scales, the present study has found only moderate relations between scales. As Marsh (2007) has previously outlined, the MTMM approach can help to establish discriminant and convergent validity, but it can also highlight problems with the interpretation of scales. Researchers need to be mindful of the present findings when comparing the results of research using these instruments. Both instruments appear to tap the core components of MT but the MTQ48 seemingly provides a more comprehensive measure. While both instruments have been developed using athletic populations, the inclusion of scales measuring components of MT beyond sport (i.e., life control, interpersonal confidence) makes the MTQ48 more applicable for use in other settings (business, education etc.). However, the brevity of the SMTQ is likely to make it a popular instrument in applied sports settings, especially given the reported ability to discriminate between athletes of higher or

lower skill levels. However, the constancy scale of the SMTQ appears to represent a combination of important components of MT (e.g., challenge, commitment, concentration) that might be more appropriately measured through separate scales.

Although there appears to be an emerging consensus concerning the core attributes of MT (Sheard, 2010) with components such as control integral to most models, it is apparent that different research groups are developing instruments that measure somewhat different components of MT. For example, both Clough et al. (2002) and Gucciardi and Gordon (2009) acknowledge control as a core component of MT, but the former emphasize both emotional and life control, while attentional control is proposed by the latter. One of the problems faced by MT researchers attempting to develop measures of the construct is that MT is composed of a number of positive psychological variables that are themselves multidimensional in nature. Until conceptual differences are resolved, scales are likely to be found to be related yet distinct. More research efforts are required to establishing greater conceptual clarity, and in developing and refining psychometric instruments to measure MT.

Table 1

Descriptive Statistics for the MTQ48 and SMTQ (N = 110)

	<i>M</i>	<i>s</i>
Mental toughness (MTQ48)	174.55	19.57
Challenge	30.08	4.02
Commitment	41.22	5.82
Emotional control	22.91	3.15
Life control	24.92	3.21
Confidence in abilities	32.53	5.07
Interpersonal confidence	22.90	3.90
Mental toughness (SMTQ)	41.25	6.06
Confidence	17.21	3.29
Constancy	13.08	1.96
Control	10.96	2.48

Table 2

Pearson Correlations between the MTQ48 and SMTQ (N = 110)

	1	2	3	4	5	6	7	8	9	10	11
1. Mental toughness (MTQ48)	(.90)										
2. Challenge	.83	(.70)									
3. Commitment	.85	.65	(.77)								
4. Emotional control	.65	.52	.45	(.45)							
5. Life control	.74	.52	.54	.40	(.50)						
6. Confidence in abilities	.79	.56	.54	.55	.52	(.75)					
7. Interpersonal confidence	.73	.60	.62	.22*	.53	.40	(.71)				
8. Mental toughness (SMTQ)	.75	.64	.66	.55	.39	.66	.50	(.81)			
9. Confidence	.68	.62	.59	.48	.37	.56	.49	.83	(.81)		
10. Constancy	.52	.38	.61	.29**	.20*	.41	.38	.72	.39	(.56)	
11. Control	.52	.44	.36	.49	.31**	.54	.27**	.77	.40	.45	(.60)

Note. * $p < .05$; ** $p < .01$. All remaining correlations were significant at $p < .001$.

Subscales predicted to be most closely matched are highlighted in bold. Cronbach's alpha shown in parentheses.

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