

Mind Over Matter, The Development of The Mental Toughness Scale (MTS)

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Abstract:

Mental Toughness (MT), which refers to an inner focus and commitment to rise above challenges when facing adversity, is viewed as one of the most important psychological attributes in determining success in sport. However, there is little consensus on key components of MT, and existing measures vary greatly while focusing on elite athletes. The purpose of this research was to develop a measure of MT for use with college athletes. Collegiate and noncollegiate athletes ($N = 271$) completed the original 54-item Mental Toughness Scale (MTS) in study 1. Factor analysis (PCA) results reduced the scale to an 11-item scale, with good reliability and validity as demonstrated by its positive correlations with self-esteem and flow. A second study of college basketball players ($N = 143$) was conducted to establish the psychometric properties of the MTS. Study 2 demonstrated convergent, divergent and criterion validity through correlations with related measures, and a CFA provided moderate support for the MTS as a one-dimensional measure of mental toughness in sport.

Keywords: Sports psychology | Athletics | Mental Toughness | College Athletes

Article:

Each year, millions of Americans tune-in to watch elite athletes compete in International and National championships, and Olympic Games. Audiences around the globe are mesmerized by the ability of these elite athletes to channel the pressure of competition and focus on their performance. Mental Toughness (MT) is a characteristic many believe to be important for success in sport; many coaches view MT as a quality that must be considered in the recruitment of athletes (Weinberg, Butt, & Culp, 2011). In fact, some view it as the most important psychological attribute in determining success (Gould et al., 1987). Coaches reason that those who possess a high degree of MT perform better because they are more focused on the task at hand, rather than obsessing about failure and defeat. MT has been defined broadly as the ability to be more consistent and perform better than one's opponent by remaining determined, focused, confident, and in control when under pressure (Jones, Hanton, & Connaughton, 2002). However, to date there is no consensus regarding the key elements of a definition, how it should be

measured, or the best manner in which to strengthen it, especially in the case of collegiate athletes.

Researchers have attempted to assess MT through a variety of scales including the Psychological Performance Inventory (PPI), the Mental Toughness Questionnaire (MTQ-48), and others (Clough, Earle, & Sewell, 2002; Golby & vanWersch, 2009; Gucciardi, Gordon, & Dimmock, 2009), but there is no standard for MT assessment. Methodological concerns include little consistency regarding the factors that make up MT, varied sampling methods used in developing MT measures, and a lack of clarity regarding the intended target population, although most appear to be targeted to elite athletes. Scales developed using elite athletes may reflect a limited view of mental toughness. Although social scientists have attempted to define this complex construct, interpretations of mental toughness may differ depending on the context and demands of the sport. For example, elite athletes will likely have higher demands placed on them and face different critical situations than college athletes. Mental toughness is reflected in the ability to meet the demands of the specific sport or situation; thus, because differences may exist among sport levels, measures developed for elite athletes may not be the most appropriate for college-level athletes. Measures of mental toughness at the collegiate level should be developed and validated with the target population of collegiate athletes.

In the current research, two studies were conducted to develop and assess a measure of MT specifically designed for use with college athletes. Although MT, as conceptualized and measured here may well apply to younger or more elite athletes, we are limiting our scope to ensure that the measure is relevant for the target population of college athletes. At the heart of the current study is the question, what are the characteristics of a mentally tough college athlete?

Defining Mental Toughness

Mental toughness is difficult to describe, and scholarly literature does not provide a clear, unambiguous definition of the construct. Early attempts to define MT were based on personal opinion or anecdotal evidence rather than empirical studies, resulting in definitions that were varied and inconsistent (Goldberg, 1998; Loehr, 1986/1994; Tutko & Richards, 1971). Taking an alternative approach, Jones et al. (2002) interviewed elite international athletes (those that performed in the Olympics or Commonwealth games), soliciting their thoughts on what they believed constituted mental toughness. Based on their findings, Jones et al. (2002) defined MT as “the natural or developed psychological edge that enables you to generally cope better than your opponents with the many demands that sport places on a performer. Specifically, be more consistent and better than your opponents in remaining determined, focused, confident, and in control under pressure” (Jones et al., 2002, p.209). Jones views MT as a defining trait in which “people who become champions aren’t necessarily more gifted than others; they’re just masters at managing pressure, tackling goals, and driving themselves to stay ahead of the competition” (Jones, 2008, p.123). Thus, the existing literature reveals varied concepts of MT, drawing from social science, practical experience, anecdotal evidence, and interviews with elite athletes (Bull et al., 2005; Crust & Clough, 2005; Jones et al., 2002).

Despite these variations, similar core attributes of MT emerge with the components of control, confidence, commitment, motivation being central to most models of MT (e.g., PPI, MTQ-48). It

is clear that researchers developed their MT scales to measure somewhat different components of MT. For instance, control is a core component of MT for both Clough, Earle, and Sewell (2002) and Loehr (1986), but Clough et al. (2002) emphasizes control of emotion and life whereas Loehr (1986) stresses visual/imagery, attention, and attitude control. Although more research is needed to establish greater conceptual clarity, the findings from interviews of Jones et al. (2007) provide a conceptual base from which to begin.

It is clear that to properly assess MT a psychometrically sound and valid measure with a clear definition and conceptual framework is needed. Jones, Hanton, and Connaughton (2007) developed such a framework by surveying elite performers who had either won a gold medal or a world championship, as well as Olympic coaches, and sport psychologists. Participants generated a list of mentally tough attributes, and then worked in a group to rank 32 attributes, thereby developing a framework of mental toughness. The 32 attributes were clustered into four separate dimensions: attitude/mindset (belief, focus), training (using long-term goals as the source of motivation, controlling the environment, pushing yourself to the limit), competition (handling pressure, belief, regulating performance, staying focused, awareness and control of thoughts and feelings, controlling the environment), and post competition (handling failure, handling success). Although this was an important step in conceptualizing MT, no research has used this framework to develop a MT measure using the attributes generated from this study.

Other studies on MT have also looked at themes or components that make up MT. Weinberg et al. (2011) surveyed NCAA head coaches to capture their perspective on what components make up the essential element. Three themes emerged: Psychological Skills (i.e., focus, confidence, knowledge and mental planning), Motivation to Succeed (i.e., motivation to work hard, persistence), and Resilience (i.e., rebound from setbacks, handling and performing under pressure). Collectively, all of the scales discussed address the key themes of focus, confidence, motivation and resilience; these factors appear to be the common core elements of MT. Thus, the current research focuses on the development of a MT measure based upon the assumption that mental toughness is the ability to be more consistent and better than one's opponent by remaining determined, focused, confident, and in control when under pressure. Given this definition of the construct, evaluations of existing MT measures can be made.

Assessing MT

Although some MT scales have been published, few have established their psychometric properties. Research with these measures focuses primarily on other factors (e.g., performance enhancement, physical endurance and pain tolerance) rather than the psychometrics of MT itself (Crust & Clough, 2005; Sheard & Golby, 2006). Existing MT scales include the Psychological Performance Inventory (Loehr, 1986), the Psychological Performance Inventory-A (Golby, Sheard, & vanWersch, 2007), the Mental Toughness Questionnaire (Clough et al., 2002), and two more recently published measures, the Sports Mental Toughness Questionnaire (SMTQ; Sheard, Golby, & Wersch, 2009) and the Mental, Emotional, and Bodily Toughness Inventory (Mack & Ragan, 2008). All are still in developmental stages, have limited psychometric support, and lack evidence of construct validity. The variation and inconsistency among measures illustrates that MT is multidimensional and complex, and challenging to assess.

The Psychological Performance Inventory (PPI) created by Loehr (1986) assesses MT domains of self-confidence, negative energy, attention control, visual and imagery control, motivation, positive energy, and attitude control. Although this 42-item survey is conceptually logical as a measure of an athlete's mental toughness, the PPI has been criticized for not providing solid evidence of construct validity. Subsequent work on the PPI by Middleton et al. (2004) failed to provide evidence that it was a valid and reliable measure, prompting further work to create a mental toughness scale. Golby, Sheard and Wersch (2007) reevaluated the PPI by examining its factor structure. Based on the results, a new model was identified (PPI-A), comprised of four factors: Determination, Self-belief, Positive Cognition, and Visualization. Consequently, the PPI-A is psychometrically stronger than the original PPI and shorter (14 items); however additional investigations are needed to establish validity and its relevance for collegiate athletes. Despite limited follow up with psychometric properties of the PPI or PPI-A, both scales have been used in research on mental toughness in a variety of sports (Golby & Sheard, 2004, 2006; Golby, Sheard, & Lavalley, 2003; Sheard, 2009; Sheard & Golby, 2006).

Other researchers have attempted to create a more psychometrically sound measure of MT using hardiness as a theoretical basis for development. Clough and colleagues (2002) developed the Mental Toughness Questionnaire (MTQ48), a 48-item measure of an individual's level of control, challenge, commitment, and confidence, for use with professional athletes. While possessing moderate psychometric qualities, the MTQ48 has not been widely accepted as an adequate assessment of MT due, in part, to its similarity to hardiness (Crust & Clough, 2005). Although hardiness is a separate and unique construct, common elements exist such as resiliency, perseverance, effectively coping with pressure and motives to achieve success (cf. Crust, 2007). Additional work is needed to clarify the distinct properties that differentiate MT from hardiness. More recently, Sheard, Golby and van Wersch (2009) developed the Sports Mental Toughness Questionnaire (SMTQ), a 14-item global measure of MT consisting of the three subscales of confidence, constancy, and control; however no follow up work has been conducted using the scale. Other researchers have attempted to create MT sport-specific scales (e.g., cricket, Australian football), however these measures are clearly targeted for those designated sports (Gucciardi & Gordon, 2009; Gucciardi, Gordon & Dimmock, 2009). In contrast, most researchers have argued that core elements of MT are common and used across sports (Jones et al., 2007).

With no consensus on an appropriate measure of mental toughness, Mack and Ragan (2008) attempted to create a new scale using Loehr's (1994) definition of MT as "the ability to perform consistently toward the upper range of one's talent and skill, regardless of competitive circumstance (p.5)." In addition, Loehr viewed toughness to involve physical and emotional as well as mental components. Using Loehr's (1994) suggested constructs of mental, emotional and bodily toughness (self-confidence, negative energy, attention control, visual and imagery control, motivation, positive energy, attitude control, emotional and physical), Mack and Ragan (2008) generated items for each, resulting in the Mental, Emotional, and Bodily Toughness Inventory (MeBTough), a 43-item measure. Results of a Rasch analysis showed that the scale demonstrated a good model-data fit with an item separation reliability of 0.98; thus, items were consistent, showed good variability, and an adequate degree of difficulty (Mack & Ragan, 2008). Although the MeBTough showed potential for assessing MT, the sampling methods raise questions about

the intended target population. The MeBTough was developed using undergraduate students, the majority of which were nonathletes. Further work is needed to determine its relevance for athletes of different levels, gender, and sports. Due to the limited work done on the scale and lack of a conceptual framework, the MeBTough does not provide a solid assessment of mental toughness for college athletes.

Other sport-specific psychological measures assess coping skills that are related to MT, such as the Athletic Coping Skills Inventory-28 (ACSI-28) and the Psychological Skills Inventory for Sport (PSIS-5). The ACSI (Smith, Schutz, Smoll, & Ptacek, 1995) measures coping with adversity, peaking under pressure, goal setting/mental preparation, concentration, freedom from worry, confidence and achievement motivation, and the ability to be coached. The PSIS-5 (Mahoney, Gabriel & Perkins, 1987) is a 45-item measure that assesses anxiety control, concentration, confidence, mental preparation, motivation and team focus. These scales have assessed areas that are important to the coping process in sport and may be related to MT, but they do not assess mental toughness per se.

Elite Versus College Athletes

Most of the literature on mental toughness focuses on athletes at the elite level (e.g., Professional, Olympic or National level), and existing measures have been developed based on studies with elite athletes (Golby et al., 2003). Little work has been done specifically focused on college athletes. It may well be that MT standards and measures for elite athletes are appropriate for college athletes. Indeed, those standards provide a logical starting point. However, college athletes are more diverse, not all are elite, and criteria for MT may be different. For example, with elite athletes, there is more at stake with every competition, whereas college athletes may experience similar high-intensity competition only a few times (postseason play-offs, championships). College athletes may differ from elite athletes in MT because of the differences in type, intensity, and frequency of stressful experiences. With the greater variation at collegiate levels, it seems appropriate to develop a scale based on college athletes to be used with college athletes. Although college athletes may differ from elite athletes in MT components, the research and measures developed with elite athletes still provide a base for developing a measure of MT for college athletes.

The existing measures, AfMTI, MeBTough, SMTQ, MTI, MTQ48, PPI, and PPI-A, are all valuable measures of MT, but they vary greatly in factors, characteristics, and all are lengthy and time-consuming. Moreover, the various scales have largely been constructed with elite/professional athletes in mind. According to “The Center for Kids in Sport” 30–40 million kids play organized sport each year. A portion of these kids will go on to pursue their sport in college. Very few will go on to become professionals, but thousands of athletes participate each year in NCAA and NAIA. Given the large revenue generated by college sports, it is critical that coaches determine what will bring their organizations a winning team. It would be useful to have at their disposal a sound instrument that can tap MT characteristics in a short time-frame. Because there is agreement that MT is a multifaceted construct, but little agreement on the specific facets, it seems appropriate to focus on the common core definition of MT and develop a shorter, more focused measure.

Gender and Mental Toughness

In addition to focusing on college athletes, gender is also considered as an exploratory factor in the current research. Few studies of mental toughness have considered gender, but some research suggests possible gender differences. Nicholls, Polman, Levy and Backhouse (2009) examined differences in mental toughness among athletes based on gender, achievement level, age, and sporting experience. They found that male athletes had a higher total score on mental toughness and a higher score on the confidence subscale than female athletes. In a study on sports-confidence and competitive orientation, Vealey (1988) found high school and college male athletes to be more confident than female high school and college athletes. In a sample of adolescent elite soccer players, Findlay and Bowker (2009) found that boys had higher competitive, goal and win orientation than girls. The combination of male's greater confidence, competitiveness, and desire to win may provide them with a greater level of mental toughness than females.

The Present Study

If empirical investigations of MT are to continue, a psychometrically and theoretically sound measure of MT must be developed. Jones et al. (2007) have set up a path for developing such a measure. Mental toughness is a construct with four dimensions: attitude/mindset, training, competition and post competition (Jones et al., 2007). It is this 4-dimensional construct that is likely to impact athletic performance. The purpose of this research is to develop a new shorter, focused MT measure for college athletes that is reliable and valid, and that specifically taps into these MT dimensions.

To this end, two studies were conducted. Using college athletes and noncollege athletes, Study 1 focused on the development of a MT scale based on work conducted by Jones et al. (2007). Study 2 focused on the reliability and validity of the scale with current college athletes to further examine the psychometric properties of the new scale.

The first study was designed to identify items to assess mental toughness, examine the internal consistency and test-retest reliability, and preliminary validity by examining relationships of the MTS with other measures. Self-esteem and flow were chosen because studies have found they are related to positive psychological characteristics of MT, including confidence, resilience, self-belief and desire to achieve (Gucciardi & Gordon, 2009; Jackson & Marsh, 1996). Flow is a positive experiential state which is similar to the constructs linked with MT (i.e., positive cognition, positive energy). Similarly, self-esteem has been linked to the MT constructs of confidence and motivation (Aktop & Erman, 2006). It was predicted that the MTS would be positively related to self-esteem and flow, while being negatively related to social desirability and shyness.

Study 1

Method

Participants. Two hundred and seventy-one NAIA, college athletes and noncollege athletes (87 male; 184 female) from several college sports teams, Kinesiology classes and the Psychology Department Human Participants Pool at one university completed the survey. The noncollege athletes were required to have participated on a team sport in the past 10 years. Thus, those not currently on a college team (75%) still had experience on athletic teams. The university in this study was in the initial stages of developing a breadth of athletic teams (i.e., teams in the study were in their third year of being established). Due to the youth of the collegiate sport establishment, college athletes as well as noncollege athletes seemed appropriate for this study (See Table 1).

Measures. The Mental Toughness Scale (MTS). The MTS was developed based on Jones, Hanton, & Connaughton’s (2007) framework of MT. Thirty-two items were generated directly from the attributes listed under the dimensions of attitude/mindset (7 attributes), training (7 attributes), competition (12 attributes) and post competition (6 attributes). Four college athletes and assistant softball coaches reviewed the items, reformatting phrases and separating ambivalent items. This process created an additional 22 items that were broken down from some of the extensive attributes that Jones et al. (2007) found. The final outcome consisted of 54 items meant to assess the four dimensions proposed by Jones et al. (2007): attitude/mindset (21 items; “Having an inner arrogance that makes you believe that you can achieve anything you set your mind to”), training (12 items; “I use all aspects of a very difficult training environment to my advantage”), competition (14 items; “I love the pressure of competition”), and post competition (7 items; “I know when to celebrate success but also know when to stop and focus on the next challenge”). Participants responded on a five-point likert scale (1= strongly disagree; 5 =, strongly agree). Nine items were reverse-scored to reduce unwanted response sets.

Table 1 Demographic Information

Demographics	Percent %
<i>Age</i>	
18–21	53.00
22–25	15.90
26–29	4.00
30–35	0.80
<i>Sex</i>	
Male	22.50
Female	51.30
<i>Ethnicity</i>	
Caucasian	38.70
Hispanic/Latino	10.70
African-American	2.20
Asian-Pacific Islander	3.70
Multiethnic	14.00
Other	3.00
<i>Class Standing</i>	
Freshman	17.00
Sophomore	18.10
Junior	26.60

Senior	11.80
Graduate	0.40
<i>Athlete Type</i>	
College Athlete	18.80
Noncollege Athlete	55.40
<i>Non Collegiate Athlete Sports</i>	
Basketball	26.70
Baseball	24.70
Soccer	16.70
Other	31.90
<i>Years of Experience</i>	<i>Mean (SD)</i>
College Athletes	7.38 (5.30)
Noncollege Athletes	4.89 (4.11)

The Rosenberg Self-Esteem Scale. The 10-item Rosenberg (1965) Self-Esteem Scale is used to measure global feelings of self-worth or self-acceptance. Respondents indicate their answers on a four-point response format scale (1= strongly disagree; 4 =, strongly agree). The mean item score was 1.94, with higher scores representing higher self-esteem.

The Flow State Scale. The Flow State Scale (Jackson & Marsh, 1996) is used to measure flow (or a positive experiential state) in sports and physical activity settings. The nine dimensions that make up the 36-item instrument are each measured on a 5-point response format scale (1= strongly disagree; 5 = strongly agree). The mean items score for this sample was 4.18 with higher scores representing a higher state of flow. The scale has been shown to have good internal consistency (alpha = .83).

The Marlowe-Crowne 2(10). The Marlowe-Crowne 2(10) is a shortened version of the MCSD designed to measure an avoidance of disapproval, or social desirability. Participants are asked to respond “True” of “False” to 5 items keyed in the true direction and 5 items in the false direction. The mean score in this sample was 1.42 with higher scores representing higher need for approval. The scale has been shown to have moderate internal consistency with alpha coefficients ranging from .59–.70 (Strahan & Gerbash, 1997).

The Revised Shyness Scale. The Revised Shyness scale (Cheek & Buss, 1981) is used to assess an individual’s level of shyness. The Revised Shyness Scale consists of 13 items with 4 items reversed scored. Respondents answer on a five-point scale (1= very uncharacteristic or untrue; 5 = extremely characteristic or true). The mean item score was 3.61 with higher scores representing higher shyness. Cronbach’s alpha for the 13-item scale has been shown to be .86 (Hopko, Stowell, Jones & Armento, 2005).

Procedure

Two-hundred and one individuals completed the survey in group settings in various kinesiology classes and college sport teams. An additional 70 participants from the Human Participants Pool (HPP) completed the survey to assess the test-retest reliability of the scale. Due to computer difficulties, some participants completed the scale twice (30 participants), two days apart, while

others (40 participants) completed the scale at 7-days apart. All participants were required to have history of playing on a competitive athletic team either in the past or currently. The survey took 30 min to complete.

Results

In an attempt to explore the scale's structure, the 54 items from the MTS were factor analyzed using principal components extraction (allowing extractions of factors with Eigenvalues greater than 1) with an orthogonal rotation using SPSS v 14.0. Following suggestions from Tabachnick and Fidell (2007) that 300 cases would be suitable for running a factor analysis, we approached this guide with 271 cases. The assumption of normality was first tested using the Kolmogorov-Smirnov test, and the assumption was met. The principal components extraction was used to create eigenvalues that maximize the amount of shared variability among the variables (Tabachnick & Fidell, 2007). There were 13 factors extracted accounting for 62.11% of the variance. However, the scale failed to rotate based on more than 25 iterations, suggesting that 13 factors were unnecessary (Tabachnick & Fidell, 2007). Based on the scree plot and factor loadings the analysis was rerun forcing 2, 3 and 4 factors, all yielding the same result that factor loadings were strongest on a single factor. In the unrotated solution, items loaded strongest on a single factor providing evidence for a general factor of mental toughness. A listing of factor loadings when forcing 4 factors is found in Table 1. According to Tabachnick and Fidell (2007) a factor loading of .60 is an acceptable criterion for retaining items. Using Factor 1, items were retained if they had a factor loading of .550 or above. This criterion resulted in 11 items remaining in the final MTS scale, accounting for 47.23% of the explained variance. Analyses revealed that the items had moderate communalities ranging from .314–.524. The mean item score was 3.78 with higher scores representing greater mental toughness.

Reliability of the MTS was assessed in two ways: Cronbach's alpha and test-rest reliability. The 11-item MTS showed good internal consistency (Cronbach's alpha = .86), with item-total correlations ranging from .43 to .63. Test-retest reliability at two days showed the scale to perform consistently ($r = .68, p < .001$); and reliability was higher at one week apart ($r = .90, p < .001$).

Validity of the MTS was examined by looking at correlations with other measures. Convergent validity was found through a positive correlation of the MTS with flow ($r = .62, p < .05$). Divergent validity was demonstrated through low correlations of the MTS with shyness ($r = .26, p < .05$), and social desirability ($r = -.29, p < .05$).

Discussion

In Jones et al.'s (2007) framework of mental toughness, four dimensions emerged: attitude/mindset, training, competition, and postcompetition. The initial 54-item scale tapped into each of these dimensions. However, the 11-item resulting MTS (see Table 2) captured the specific elements of training and competition. Training is essential to mental toughness, in that most athletes spend more time training for their sport than actually competing in it. Competition is an important element of mental toughness because that is the domain in which all the preparation, hours spent in practice and time improving in sport are tested. More work was deemed necessary to further assess the validity of the scale with current athletes. This reduced

11-item scale was used in study 2.

Study 2

To ensure the MTS worked with the target population of collegiate athletes, the primary purpose of study 2 was to use the 11-item scale developed in study 1 with current college athletes and establish validity by demonstrating that mental toughness, as measured by the MTS, is related to constructs typically possessed by mentally tough individuals: high levels of flow, self-efficacy, self-esteem. To provide further validity support for the MTS, the Sport Orientation Questionnaire (Gill & Deeter, 1986), a Self-Efficacy Scale (Sherer, Maddux, Mercandante, Prentice-Dunn, Jacobs, & Rogers, 1982) and a previously published mental toughness measure were added to Study 2. Study 2 also reevaluated the internal consistency of the MTS with a new sample and provided additional tests of concurrent validity.

Method

Participants.

One-hundred and forty-three current college basketball athletes (74 male; 69 female) were recruited from 12 college basketball teams throughout Southern California. The majority of athletes ranged in ages 18–24 with a mean age of 19.98. The majority of the sample consisted of freshman (38.5%) and sophomores (25.2%); their ethnic composition was predominantly white (33.6%) and African American (30.1%).

Procedure.

Participants were selected from university basketball teams that have individual online statistics. Most athletes averaged 10 years of experience playing basketball and spent about 18 hr a week in practice. A list of basketball teams in San Diego, California was generated based on accessible individual statistics online. Using a snowball technique, coaches on the list were contacted and additional teams were identified based on references from other coaches. Letters of introduction were emailed to coaches and were followed up with a phone call. Coaches who agreed to allow 30 min of practice time to conduct the study were identified. The principal investigator then traveled to each university to distribute and collect the questionnaires from athletes on each team. Athletes completed questionnaires in the gym, classroom, conference room or locker room. To obtain evaluations of the MT of the players from another source, the head or assistant coach was asked to make an assessment of each player's level of MT. The coach was provided with the study's definition of MT (the natural or developed psychological edge that enables one to be more focused, determined, confident and in control under pressure than one's opponent). Then coaches ranked their players in order from highest mentally tough to lowest mentally tough and rated each athlete on a scale of 1–10 for individual level of MT.

Measures.

The Mental Toughness Scale (MTS). The 11-item MTS developed in study 1 was used in study 2. The item score ranges from 1 to 5, with higher scores indicating a higher degree of mental toughness

The Sport Orientation Questionnaire (SOQ). The 25-item Sport Orientation Questionnaire (Gill & Deeter, 1986; SOQ) was used to measure an individual's competitiveness, win orientation (outcome) and goal orientation (performance). Respondents described reactions to sport situations on a 5-point likert scale (1= agree strongly; 5 = strongly disagree). Gill and Deeter (1986) reported test-retest reliability from .73 to .89 and internal consistency coefficients from .79 to .95 for the three subscales. In this sample, the mean score was 4.52 ($SD = 0.39$) and the scale demonstrated good reliability ($\alpha = .89$).

Table 2 Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4
1. I have an unshakable self-belief in my athletic abilities.	.500	-.121	.239	.318
2. When I (or my team) am losing, I feel like there is no way I (we) can win.	.328	.471	.012	.061
3. I have an inner arrogance that makes me believe I can achieve anything I set my mind to.	.502	-.282	.122	.294
4. I love the pressure of competition.	.454	-.004	.222	.015
5. I know when to celebrate success but also know when to stop and focus on the next challenge.	.595	-.123	.108	.072
6. I recognize the importance of knowing when to switch on and off from my sport.	.294	-.263	-.202	.249
7. I have a killer instinct to capitalize on the moment when I know I can win.	.584	-.138	.051	.232
8. I believe in the phrase, "It's not over until it's over."	.586	-.044	.014	-.094
9. Outside my sport, I am able to make the right decisions under pressure.	.498	-.007	-.174	-.105
10. I know what needs to be done to achieve the level of performance required to win.	.627	-.206	.179	.033
11. I remain in control and not controlled.	.576	.018	-.226	.053
12. I am able to channel anxiety in pressure situations.	.566	.095	-.348	.112
13. I know I can achieve my goals in my sport.	.662	.112	.068	.042
14. I am not swayed by short term goals (financial, performance) that will jeopardize the achievement of my longterm goals.	.439	-.163	-.063	.135
15. During games or competition, I want to get it over with.	.208	.327	.318	.031
16. I am able to bounce back from mistakes or errors.	.528	.098	-.368	.139
17. I wish I could achieve my goals in my sport.	-.170	.182	.040	.411
18. I know I can overcome challenges to reach my personal goals.	.630	.093	-.074	-.025

19. My inner arrogance makes me feel like I stand out above others.	.274	-.299	.249	.498
20. I have the patience and discipline to control my efforts to achieve each goal along the ladder of success.	.687	-.025	-.022	.084
21. After a mistake, I am able to regain composure.	.597	.099	-.412	.160
22. I am in control of the quality of my performance.	.500	.233	-.042	.132
23. My long term goals are never structured or planned.	-.205	-.491	-.264	.094
24. When I make a mistake I start worrying and thinking about failure.	.336	.447	-.151	.451
25. I thrive on opportunities to beat other people in training.	.296	-.456	.421	-.034
26. I can recognize any inappropriate thoughts (i.e., negative thoughts).	.365	.085	-.312	-.377
27. I view difficult environment factors as challenges to overcome in an effort to enhance my performance.	.441	-.061	-.081	.307
28. I can take on and beat the best in the world.	.354	-.357	.327	.367
29. Even though I am tired, I continue to train to achieve my goal.	.656	-.014	.121	-.262
30. I use all aspects of a very difficult training environment to my advantage.	.683	-.052	.085	-.310
31. When a negative thought comes into my head, I quickly switch it to a positive one.	.455	.123	-.339	.008
32. Sometimes I give up when challenges in my sport are too overwhelming.	-.410	-.441	-.061	-.177
33. I believe I can punch through any obstacle people put in my way.	.539	-.149	.069	.218
34. I can find a balance in life between sport, family, friends and social life.	.507	.009	-.276	.101
35. I am not fazed by making mistakes.	.409	-.131	-.334	.338
36. I spend time wishing for the impossible.	.036	.496	-.104	.244
37. I use failure to drive myself to further success.	.338	-.148	.212	-.224
38. I am able to increase my effort if it is required to win.	.568	-.105	.005	-.090
39. I know that a proper balance in life contributes to my success.	.550	.071	-.173	-.220
40. When an obstacle is in my way I find a way to overcome it.	.693	.068	-.208	-.166
41. I believe that my desire will ultimately result in me fulfilling my potential.	.578	-.015	-.117	-.065
42. I accept, embrace, and even welcome the elements of training that are considered painful.	.617	-.079	.301	-.101
43. I need adversity to get stronger.	.493	-.117	-.188	-.067
44. I adapt to any change/distraction/threat under pressure.	.563	-.090	-.178	.065
45. I recognize failure but can learn from it.	.523	.141	-.234	-.285
46. I raise my performance up a gear when it matters	.579	-.089	.043	-.138

most.				
47. My goals are achieved due to luck.	.225	.461	.314	.175
48. I know how to rationally handle success.	.476	-.059	.065	-.044
49. There is nothing I can learn from failure.	.240	.642	.261	-.173
50. I do not think I can realistically achieve my goals in my sport.	.373	.502	.226	.107
51. When training gets tough (physically and mentally) because things are not going my way, I keep myself going by reminding myself of my goals are aspirations.	.600	-.046	.178	-.125
52. I love all aspects of training, even the ones that hurt.	.525	-.076	.349	-.146
53. I don't enjoy being able to give absolutely everything.	.326	.375	.460	-.032
54. I have total commitment to my performance goal until every possible opportunity of success has passed.	.553	-.209	.215	.211

The Self-Efficacy Scale. The Self-Efficacy Scale (Sherer, Maddux, Mercandante, Prentice-Dunn, Jacobs, & Rogers, 1982) was used to measure general levels of belief in one's own competence. The scale consisted of 30 items with respondents indicating their answers on a 5-point likert scale (1 = strongly disagree; 5 = strongly agree). In this sample, the mean score was 4.04 ($SD = 0.52$), with $\alpha = .89$.

The Rosenberg Self Esteem Scale. The Rosenberg Self-Esteem Scale was used to measure global feelings of self-worth or self-acceptance. In this sample, the mean score was 4.16 ($SD = 0.63$), with $\alpha = .89$.

The Flow State Scale. The Flow State Scale (Jackson & Marsh, 1996) was used to measure flow (or a positive experiential state) in sports and physical activity settings. In this sample, the mean score was 4.20 ($SD = 0.49$), with $\alpha = .86$.

The Mental, Emotional and Bodily Inventory. The MeBTough (Mack & Ragan, 2008) is a 43-item scale that was used to assess overall mental toughness. The scale consists of 3 elements: physical, mental and emotional behavior. Participants respond on a 4-point likert scale how best each item fits (1 = Almost never; 4 = almost always). The scale ranges from 43 to 172, with a high score reflecting a desirable mental toughness attribute. In the current study, the mean score was 1.86 ($SD = 1.27$), with $\alpha = .88$.

Social Commitment Subscale. The Social Responsibility Scale (Greenberger & Sorensen, 1974) was used to measure a person's disposition toward social commitment. This includes feelings of community with others and an investment in long-term social goals. In the current study, the Social Commitment subscale of Greenberger's (1984) Psychosocial Maturity Inventory (Form D, 11th grade version) was used to tap social responsibility. Respondents rated these items using a 4-point likert scale (1 = agree strongly; 4 = disagree strongly). The scale demonstrated high internal consistency (.86 as reported by Greenberger et al., 1974). The author reported adequate evidence of the scale's validity (Greenberger, 1984). In the current study, the mean score was 2.56 ($SD = 0.65$), with $\alpha = .79$.

Grade Point Average. Overall GPA was used as an additional measure for divergent validity. Athletes ranged in GPA from a 2.00–4.00 with a mean GPA of 3.02 ($SD=.57$)

Coaches' Measure. To assess the validity of the MTS coaches completed two tasks. First, the head or assistant coach was given a list with each player's name and asked to rank the players in order from highest to lowest in MT. Second, coaches were asked to rate players individually in their level of MT on a scale of 1–10, with a higher number indicating a higher level of MT. Redshirts (i.e., athletes who are ineligible to play either due to academic or physical reasons) were not included in this study.

Shooting Performance. Statistics of free throws for each player was obtained through online college athletic websites at the end of the season. Free throw percentages were obtained by the total number of shots made in the season divided by the number of shots attempted in the season. Analyses for shooting performance were conducted on only those who started in more than 50% of the games for the entire season. In this sample, starters had an average free throw percentage of 67.61 ($SD = 10.22$).

Results

The results are organized by first interpreting the factor analysis and relationship to underlying dimensions in other MT scales. Next, the potential confounds are reported. The analyses are then described for each hypothesis, first by explaining evidence for convergent validity, divergent validity and criterion validity. The final analyses address the hypotheses of MTS differences by gender.

Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was conducted to examine the factor structure of the 11-item MTS. Using AMOS, the CFA tested a one-factor model after confirming the assumptions of multivariate normality and linearity through SPSS. One case was excluded for missing data. Using Mahalanobis distance, two athletes were multivariate outliers, $p < .001$, and the data from these participants were also deleted. Structural equation modeling (*SEM*) analyses were performed using data from 140 athletes. The one-factor model is consistent with the view of mental toughness as a unidimensional construct ranging from low mental toughness to high mental toughness. In this model, all 11 items are loaded on a single factor. Results are based on maximum likelihood estimates produced from covariance matrices. Analyses indicated that the independence model could not be rejected; however, the model shows a moderate fit ($DF = 44$; $\chi^2 = 67.50$; $CMIN/DF = 1.53$; $CFI=.94$, $RMSEA=.062$, $LO 90=.029$, $HI 90 = 0.090$, $PCLOSE=.239$). The standardized factor weights and the standardized coefficients are presented in Figure 1.

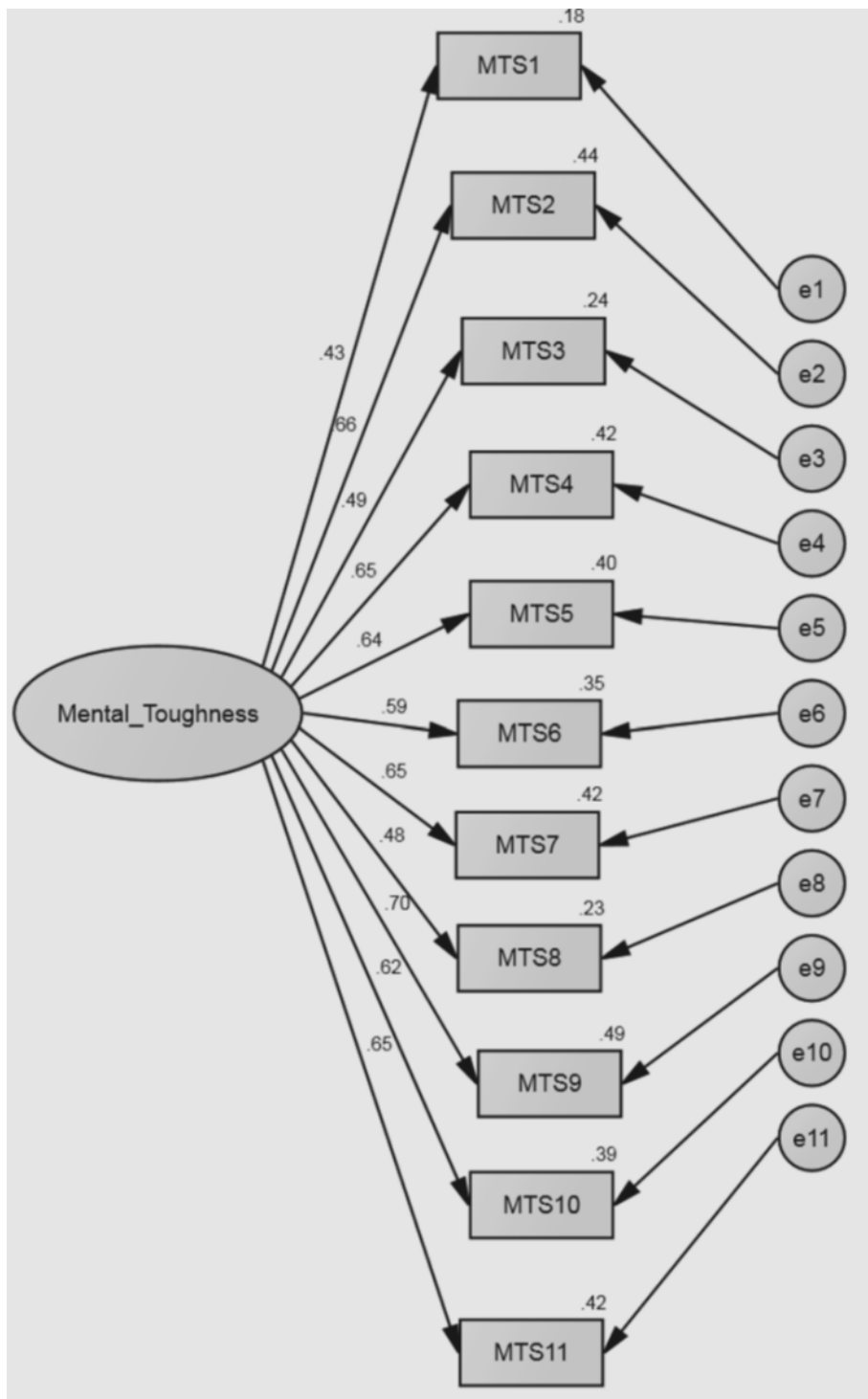


Figure 1. CFA model with standardized coefficients.

Convergent and Divergent Validity. Pearson's correlations were used to examine the first hypothesis regarding evidence for convergent validity. As predicted, higher MT scores were related to a higher degree of flow ($r = .49, p < .05$), self-efficacy ($r = .22, p < .05$), and greater self-esteem ($r = .24, p < .05$). In addition, higher MT scores were related to being more

competitive ($r = .37, p < .05$) and being more goal orientated ($r=.35, p < .05$). Contrary to the prediction no relationship was found between MT scores and having a win orientation, $r = .15, p = .07$ (see Table 3).

Pearson’s correlations were also used to examine the second hypothesis regarding evidence for divergent validity. It was predicted that there would be a no relationship between the MTS and social responsibility or GPA. Results indicated that MT score and GPA, ($r=-.15, p = .10$) and MTS and level of social responsibility ($r = .09, p = .23$) were not significantly related. (see Table 3).

Table 3 Correlations Among Variables

	MTS	Flow	MeB Tough	Self-Esteem	Self-Efficacy	Compet.	Win orientation	Goal orientation	Soc Respons.	GPA	Rank	Rating	Free Throws
MTS	—												
Flow	.49*	—											
MeBTough	.54*	.32*	—										
Self-Esteem	.24*	.38*	.41*	—									
Self-Efficacy	.22*	.11	.44*	.50*	—								
Competitiveness	.37*	.25*	.44*	.22*	.22*	—							
Win Orientation	.15	.24*	.16	.04	.01	.52*	—						
Goal Orientation	.35*	.09	.25*	.01	.13	.56*	.23*	—					
Soc. Respons.	.09	.01	-.23*	-.31*	-.36*	.01	.24*	.16	—				
GPA	-.15	-.04	.01	.03	.06	-.11	-.09	-.21*	-.23*	—			
Coach Ranking	-.18*	-.10	-.28*	-.15	-.18*	-.23*	-.14	-.14	.18*	.15	—		
Coach Rating	.12	.04	.22*	.13	.15	.22*	.06	.07	-.21*	.13	-.84*	—	
Total Free Throws	-.08	-.30*	-.08	-.17	-.21	.07	.22	.06	.04	.17	-.12	.19	—

Criterion Validity. In addition, Pearson correlations were used to assess the criterion validity of the MTS. Higher scores on the MTS were related to the MeBTough, ($r = .54, p < .05$). A Spearman's rank correlation showed that players ranked at the top of the list (that is, a ranking closer to 1) also had a high rating by the coach (Spearman rho = $-.86, p < .05$). Once it was determined that coaches' rankings and ratings of athletes were related, analyses were done comparing athletes' MT scores to coaches' ranking and ratings. Results indicated that higher MT scores were significantly related to rankings by the coach (Spearman rho = $-.20, p < .05$), with higher MT scores associated with higher player rankings. There was no relation between MT score and individual rating by the coach ($r = .12, p = .16$).

MTS and Free Throws. The next set of analyses considered the relationship between a measure of athletes' performance and MT scores. Person's correlations were conducted to assess the fourth hypothesis of the relationship between free throw percentage and MT score. Free throws were assessed from the time data were collected from the team as well as free throws made in the entire season. There was no difference between free throw percentage in the middle of the season and season free throw percentage, so free throws made from the entire season were used to measure athletes' performance. Since number of free throws attempted varied to such a great degree, only players who were starters were used to test this hypothesis. Two teams were dropped from analyses due to no available online statistics, resulting in a total of 44 starters. Although it was predicted that there would be a positive relationship between MTS scores and free throw percentage, no such relationship existed, $r = -.08, p = .40$.

MTS and Gender. Further exploratory analyses examined the relationship between gender and mental toughness. Results from an independent samples *t* test indicated that, contrary to expectations, males ($M = 4.19, SD = .49$) and females ($M = 4.06, SD = .55$) did not differ on mental toughness scores, $t(141) = 1.45, p > .05, d = 0.25$.

General Discussion

This study examined the psychometric properties of the newly-developed Mental Toughness Scale (MTS). The results provide support that the MTS is a reliable and valid measure of MT. The scale was related in the predicted ways to various other measures, providing support for the convergent and divergent validity of the MTS. In addition, criterion support was provided by coaches' rankings of their team in MT. The CFA provided support for the one-factor MTS model having a moderate fit; however, further work is needed with larger sample sizes to develop a better fitting model. Although this study had limitations, such as the assessment of teams at different levels of competition, the MTS appears to be a useful tool in assessing college athlete's MT.

The MTS scale exhibited good internal consistency with a Cronbach's alpha of .87 in study 1 and .86 in study 2. Other scales measuring MT such as the PPI-A, MTQ48 and MeBTough reveal Cronbach's alphas ranging from .70 and .90 (Golby et al., 2007; Clough et al., 2002; Mack & Ragan, 2008). Thus, the MTS's consistency is similar to other established scales measuring some element of MT. The results provided good evidence of convergent, divergent, and criterion related validity. Convergent validity was demonstrated in that those individuals who scored higher on the MTS also reported greater flow, self-esteem, self-efficacy,

competitiveness and goal orientation, with the strongest relationship between the MTS and flow. Generally, the pattern of correlations in studies 1 and 2 were similar, even though the studies used samples with different levels and types of athletic participation. In study 1, most participants were not college athletes and they played various sports. In contrast, study 2 consisted only of college basketball players currently participating in their season. The similar results suggest that MT encompasses positive psychological attributes of college athletes such as self-esteem, self-efficacy, flow, competitiveness and goal orientation regardless of the level of competition or particular sports. Although convergent validity was demonstrated, not all predicted relationships were found. Win orientation was not significantly related to MTS, as expected. However, the MTS was related to competitiveness, which has been shown to be more strongly related to athletic level than win orientation (Gill & Dzewaltowski, 1988). Discriminant validity was evaluated using a social commitment scale and grade point average. As expected that MT was not related to social commitment or academic achievement.

Criterion validity was established through examining relationships between the MTS, Mentally Emotionally and Bodily Inventory (MeBTough), and coaches' rankings. Athletes with high MT scores on the MTS also revealed high scores on the MeBTough ($r = .54$), which measures mental, emotional, and bodily toughness (Mack & Ragan, 2008). The moderate relationship between scales suggests commonality; but the relationship was not perfect, suggesting some differences in underlying constructs. The MeBTough focuses on mental, physical, and emotional concepts such as the ability to create an optimal performance state, being well prepared, and strength and resiliency. In contrast, the MTS centers on the elements of training and competition. Thus, the two scales both measure MT, but through different dimensions. To further test the criterion validity of the MTS, coaches provided information on athletes' MT by ranking each athlete on the team on level of MT from high to low. In addition, coaches made individual ratings of MT.

Interestingly, MT was related to coaches' rank orders of their athletes, but not to the individual ratings of level of MT. Athletes who were ranked high by their coach also scored high on the MTS. A coach notices athletes who are committed to their sport and can endure stressful athletic situations without faltering. Coaches' ratings of athletes were not related to level of MT. Factors such as coaching experience or how long the coach had been with their team may have played a role into how well the coaches knew their athletes. Having coaches rank and rate each player on MT (according to the definition provided) was a strength in that another valuable source was used to obtain MT beyond the athlete's own perception of their MT. Davis and Zaichkowsky (1998) also identified observable behaviors that are associated with mentally tough performers by having coaches, scouts, and managers rate player's MT in respect to adversity response, overachievement, effort, enthusiasm and skill.

In our study, season free throw percentage was an additional criterion, but there was no relationship between free throw percentage and MT for starting basketball players. This lack of association may be partially due to the fact that starters had a superior free throw percentage ($M = 67.61$, $SD = 10.21$). Another possible explanation may be that examining the entire season may not be the best way to assess how performance may be influenced by MT. Perhaps other methods of assessing effects of MT in performance should be used rather than using free throw percentages.

Previous studies (Nicholls et al., 2009; Findlay & Bowker, 2009) suggest that males would have higher mental toughness than females. However, no gender differences were found on the MMTS. A primary strength of the study is that it yielded a short scale that is psychometrically sound to assess MT. Existing MT scales have ranged in length from 36 to 54 items, with varying subscales and inconsistent reliability and validity information. In addition, the MTS was developed and used with current athletes in the collegiate level. Other MT scales were developed with nonathletic populations or athletes not currently participating in sport. The use of current athletes was a strength because we were able to tap into one's MT while engaged in athletics, not retrospectively. Another strength dealt with MT criterion validity. By gaining insight from the coaches' perspective as well as the players', assessment of athletes' MT was achieved from multiple viewpoints.

The limitations of this study are related to availability of team statistics, procedural issues, and differences in the schools themselves. Although teams were selected based on availability of online statistics, some teams did not provide online statistics on each game, so analyses were done only looking at the end of the season statistics. Procedural issues included how coaches ranked their athletes and the competitive level of teams. For most teams, the head coach ranked and rated their players; however, in two schools, the assistant coach performed this procedure. Different relationships between the head coach and assistant coach with players may affect ratings of an athlete's MT.

The present study indicates that the MTS is a reliable and valid measure, but more work needs to be done. Results from the pilot study showed the MTS to be consistent over a one-week interval; however, researchers should examine the stability of the MTS over longer periods of time. To determine whether MT differs between collegiate and elite athletes, future studies should compare collegiate athletes (i.e., specifically those not pursuing higher competitive levels after college) to elite athletes (e.g., Olympics, National Competitors, Professionals) using the MTS and other MT measures to determine possible differences. Future studies could look at teams or individuals after success or failure, or a win or loss, to see if the MTS remains stable or fluctuates. Future studies should also include athletes in a wider range of individual and team sports to assess the relationship of MT to optimal performance in different sports (e.g., marathons, triathlons, golf, tennis, boxing). In team sports, teammates provide a source of social support which may strengthen positive psychological attributes, whereas in individual sports, the athlete must push him/herself to persist and achieve success. Strategies for enhancing MT also needs further work. Self-belief and confidence have been found to be important attributes of MT, so providing coaches or athletes with ways to enhance self-beliefs would be beneficial in optimizing MT (Gucciardi et al., 2008; Jones et al., 2007; Weinberg et al., 2011).

MT is the ability to be more consistent and better than your opponent in remaining determined, focused, confident and in control under pressure. The new MTS will be of great interest to persons helping athletes optimize performance and the sport experience. In order for athletes to rise above challenges and pressures of their sport it is imperative that we find ways to assess mental skills such as MT. With relevant, psychometrically sound and quick measures of MT, we can work to build athletes' level of mental toughness to help them face the challenges inherent in striving for optimal performance.

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