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Towards construct validity: Investigating the structure of the mental toughness in Sport Questionnaire (MTSQ-32)

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Abstract

In effort to gather construct validity evidence for a new measure of mental toughness, the Mental Toughness in Sport Questionnaire (MTSQ-32), confirmatory factor analyses were performed to examine the plausibility of competing theoretical models. This was done in accordance with Benson's (1998) strong program of construct validity. Four primary models were tested: a unidimensional model, a five-factor model based upon social-cognitive personality theory, a five-factor model based upon the commonly identified attributes of mental toughness, and a 10-factor multidimensional model combining the two five-factor models. Further models were tested that expanded upon the four former by including a reverse coding method effect factor. Complete data on the 32-item questionnaire was collected from 536 high school athletes. Although the unidimensional, unidimensional with the method effect factor, and five-factor attribute models converged to admissible solutions, ultimately none of the hypothesized models were able to provide adequate fit to the data. However, upon the exploratory removal of item 25, the five-factor attribute model provided preliminary support for fitting the data. Implications of this study were discussed, as well as implications for future research.

Keywords: mental toughness, construct validity, confirmatory factor analysis

Chapter I

Introduction

There is an overwhelmingly widespread belief throughout the sporting community that mental toughness is positively related to successful performance in sport. This relationship, which is supported by a wealth of anecdotal evidence, ensures mental toughness' place as a concept of great importance in the field of sport. As members of a community in which one's value is determined by his or her performance, it is only natural for athletes, coaches, and others with ties to sport to be keenly interested in the construct of mental toughness- and more specifically, in assessing it.

Being labeled as a mentally tough performer has been considered "one of the most prized compliments an athlete (or person) can receive" (Smith, 2006, p. 12). Although the label of being mentally tough is coveted throughout the sporting community, a clear understanding of mental toughness itself remains sullied by the lack of a unified concept of the construct. The term is thrown around with such frequency and ease that it may be surprising to discover that there is hardly a consensus in the sport literature as to what mental toughness actually is. In the words of Jones, Hanton, and Connaughton (2002), "mental toughness is probably one of the most used but least understood terms used in applied sport psychology" (p. 205).

Jones et al. (2002) are credited as kick-starting a group of subsequent research efforts aimed at developing an understanding of this thing called mental toughness (Crust, 2008; Harmison, 2011b). Following this new surge in published research on mental toughness, a number of systematic reviews of the state of research findings surrounding the topic of mental toughness were compiled (e.g. Crust, 2007; Crust 2008;

Connaughton, Hanton, Jones, & Wadey, 2008; Connaughton & Hanton, 2009). These reviews serve to summarize the current state of researchers' understanding of mental toughness in the literature. There are a number of common themes that arise among the reviews, including aspects of mental toughness that researchers appear to agree on and, importantly, aspects where a clear consensus has yet to be reached. According to reviews of the mental toughness literature, the two primary themes upon which mental toughness researchers have yet to present a unified stance are (a) defining mental toughness and (b) measuring mental toughness.

Defining Mental Toughness

Definitions of mental toughness are generally traced back to one of two sources: Raymond Cattell (1955) or Jim Loehr (1986). Cattell (1955) often is given credit for providing an early perspective of mental toughness through his inclusion of 'tough-mindedness' (as opposed to 'tender-mindedness') as one of the 16 primary personality source traits he proposed. Loehr (1986) gave a more focused attention to mental toughness; based upon his experiences with elite athletes he generated both an early definition of the construct as well as a measure. In the time between Loehr's (1986) work and present day, there have been numerous attempts to define the construct of mental toughness; Connaughton and Hanton (2009) list 11 different definitions in circulation. The many proposed definitions of mental toughness fall into two major camps: (a) those that define what mental toughness is and (b) those that define what mental toughness allows an athlete to do.

Definitions describing what mental toughness *is* have conceptualized mental toughness as a state of mind (Gibson, 1998), a personality trait (Kroll, 1967; Cattell,

1955; Tutko & Richards, 1972), a personality dimension (Clough, Earle, & Sewell, 2002), and a social-cognitive personality construct (Smith, 2006; Harmison, 2011b). Additionally, Connaughton and Hanton (2009) include the classification of a group of mental toughness use as that of a 'title heading', referring to the use of the label of mental toughness without regard or mention of any sort of explanation or definition. Definitions describing what mental toughness allows athletes to do often capitalize on a set of proposed attributes of mental toughness, such as remaining positive in the face of adversity, persisting through setbacks, performing at a consistent level, or performing well in the face of pressure (Smith, 2006). Jones et al. (2002) posit, "virtually any desirable positive psychological characteristic associated with sporting success has been labeled as mental toughness at one time or another" (p. 206).

In addition to the categorical differences with which mental toughness is described, differences also lie in the conceptualization of mental toughness in terms of a theoretical framework. Although the majority of mental toughness definitions have been derived atheoretically, Clough et al. (2002) attempted to align mental toughness with existing theory, specifically, hardiness theory from the domain of health psychology. Unfortunately, this attempt has been criticized as working in a post-hoc fashion and moreover as adding further conceptual confusion to the construct (Connaughton & Hanton, 2009). Aside from contention in regard to defining mental toughness in terms of what it is vs. what it allows an athlete to do and a theoretical framework for mental toughness, there are further definitional discrepancies of note. For example, not all researchers agree whether mental toughness should be defined on the general or sport-specific level (depending if it is conceptualized in the same manner across

athletes/sports), or whether mental toughness should be defined in absolute or relative terms.

Although there is no clear, consistently accepted definition of mental toughness (Connaughton & Hanton, 2009; Crust, 2007), there is some common ground of note. Most researchers agree that mental toughness is a multidimensional construct, at least partially influenced by one's environment, and related to successful performance in sport (Crust, 2007; Crust, 2008; Connaughton & Hanton, 2009). Further, it seems fair to assume that there is agreement among mental toughness researchers that the achievement of a clearer, deeper understanding of the construct is desired.

For the purposes of this study, mental toughness will be defined according to the following definition from the work of Coulter, Mallett, and Gucciardi (2010):

> Mental toughness is the presence of some or the entire collection of experientially developed and inherent values, attitudes, emotions, cognitions, and behaviours that influence the way in which an individual approaches, responds to, and appraises both negatively and positively construed pressures, challenges, and adversities to consistently achieve his or her goals. (p. 715)

Measuring Mental Toughness

In addition to a clear unified definition, mental toughness researchers are also in need of agreement in regard to a measure of mental toughness. There are currently over 10 measures that have been created with the intent to measure mental toughness. These measures are primarily based on self-report information and have been subject to psychometric criticism, including that of being atheoretical in nature. Ultimately, there is no measure that boasts psychometric properties acceptable enough to be considered a

sound measure of mental toughness (Middleton et al., 2004b; Crust, 2007; Connaughton, Hanton, Jones, Wadey, 2008).

Perhaps one of the most critical issues with existing measures of mental toughness is a lack of transparency in regard to instrument development. As outlined by Gucciardi, Mallett, Hanrahan, and Gordon (2011), three of the most commonly used measures of mental toughness fail to provide detail in regard to vital aspects of the test development process. The Psychological Performance Inventory (PPI; Loehr, 1986) describes neither the theoretical basis upon which it is laid nor the item development process. The Mental Toughness Questionnaire 48 (MTQ48; Clough et al., 2002) falls short of adequately rationalizing the link between hardiness theory (from health psychology) and mental toughness in sport. The Sport Mental Toughness Questionnaire (SMTQ; Sheard, Golby, & van Wersch, 2009) was constructed in an exploratory fashion, without prior specification of a theoretical basis. These issues, along with others such as construct underrepresentation, are discussed further in the review of literature.

In moving forward, Gucciardi and colleagues (2011) call attention to six issues in need of address before the measurement of mental toughness can progress. First, that the process through which a measure gains validity support is just that, a *process*. It is important for this process to begin with the examination of within-network validity. Gucciardi et al. (2011) suggest researchers investigate the factor structure of a measure as one method for providing within-network validity evidence. The second issue in need of address, according to Gucciardi et al. (2011), is in regard to the multidimensional nature of the construct. Before the measurement of mental toughness can move forward, a core set of components must be identified. This will help to clarify both the level of

representation of the construct in a measure and the conceptualization of mental toughness in the literature. Another issue for future research to note and address is that of construct invariance. The fourth issue noted by Gucciardi et al. (2011) is the need for between-network validity evidence for the scores from a measure. Note that addressing this issue is contingent upon the acquisition of within-network validity evidence. Between-network validity evidence can be gathered by examining hypothesized relationships between the scores of the measure and the scores of a measure of a related construct. Gucciardi et al. (2011) further suggest that the progression of the measurement of mental toughness would be advanced by the development of measures outside the boundaries of self-report style. This ties in to the final issue noted by the authors, which is the proposition that using methods outside of self-report can expand measurement of the construct from explicit methods to implicit methods.

In light of these six issues, it is worthy of note here that the primary purpose of this study is to attempt to gain within-network validity evidence for a new measure of mental toughness, which was created based upon a set of core common attributes of mental toughness as identified by the literature. Thus, both of the first two issues identified above will be addressed here. Specifically, these issues will be addressed in accordance with Benson's (1998) strong program of construct validation.

A Strong Program of Construct Validation

With the various conceptualizations and measures of mental toughness in circulation it is difficult to progress the field through empirical research. Carrying out mental toughness research using existing quantitative measures presents a dilemma. Information garnered is thought to be progressing the field, yet this is questionable if the

measures are not backed by psychometric support. Before forward progress can be made, it is necessary to step back and address these concerns. In examining the reviews of mental toughness research it is apparent that two major holes exist in the literature: one surrounding the lack of conceptual clarity, and another surrounding the lack of a viable method for measuring mental toughness. Overall, this thesis serves as an attempt to address these two holes by providing construct validity evidence for a new measure of mental toughness, the Mental Toughness in Sport Questionnaire (MTSQ), which is grounded within a theoretical framework.

As with any measure, and especially with new a measure, gathering and providing psychometric evidence is of utmost importance. Considering the philosophy of science, theories gain support in the event that attempts to falsify them are unsuccessful. Thus in effort to support theory-based psychological measures, attempts should be made to falsify a link between theory and the scores from a measure. This generally includes examining a measure's psychometric properties, such as the evidence for validity.

In relation to the test development process, validation is considered to be the most critical process; it is how the scores from a measure take on meaning (Benson, 1998). Validity refers to the *inferences* derived from test scores (e.g., Sireci & Parker, 2006). According to the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 1999), validity is the "degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of tests" (p. 9).

Construct validity, one of many types of validity, is concerned with the link between the intended construct and the measure's scores. With regard to the MTSQ, construct validity attempts to address the question, 'To what extent do the MTSQ scores

represent the construct of mental toughness in sport competition?' As suggested above in the provided description of validity, gathering evidence in support of construct validity requires both theory and empirical evidence. A construct validation program that emphasizes both aspects, but especially theory, constitutes a 'strong' program (Benson, 1998). Benson (1998) published an example of a strong program of construct validation for those in pursuit of construct validity evidence. This strong program consists of three components: a substantive stage, a structural stage, and an external stage.

Substantive stage. The substantive stage addresses the theoretical foundation upon which a measure is constructed. When involved in this stage, researchers should map out the underlying theory as well as the operational definition of the construct. Benson (1998) notes two cautions raised by Messick (1989) in regard to defining the theoretical and empirical substance of a construct: construct underrepresentation and construct irrelevancy. In terms of the MTSQ, as suggested by Smith (2006) and applied by Harmison (2011b), a social-cognitive personality framework was used to conceptualize mental toughness – specifically, Mischel and Shoda's (1995) Cognitive-Affective Processing System (CAPS) model. Using this framework, mental toughness is defined as a social-cognitive personality construct, and is observed through a set of common attributes. The common attributes associated with mental toughness will be presented later in this document.

Structural stage. Once the substance of the construct, as defined by its theoretical foundation, is laid out, it is then necessary to examine the internal structural make-up of the construct. Recall that this (i.e., providing within-network validity evidence) was identified by Gucciardi and colleagues (2011) as one of the issues in need

of address in order to advance the measurement of mental toughness. The structural stage involves examining the relationships among the observed variables of the measure. Although there are multiple ways to proceed, one of the most popular methods is via factor analysis (Benson, 1998). Factor analysis provides information as to the compositional dimensionality of a construct, as defined by theory (Benson, 1998). In the case of the MTSQ, it is hypothesized that mental toughness is comprised of five related dimensions or factors. If the hypothesized five-factor model arises from a factor analysis as anticipated, support is given for the link between the construct's theory and the measurement of the construct.

External stage. Once evidence is provided for structural, or internal, consistency, it is also important to gather external consistency evidence. The external stage involves the examination of the relationships between the scores on the measure and other external variables. This might entail examining predicted group differences, or perhaps examining predicted correlations between the scores from the measure of interest and those from another. For the MTSQ, if competition level was thought to be related to mental toughness, differences in scores between elite and non-elite athletes might be examined. Further, if mental toughness was thought to be negatively related to cognitive anxiety, the scores from the MTSQ could be correlated with those from a measure of cognitive anxiety.

Together these three components (substantive, structural, and external) combine to form a strong program of construct validation. It is important to note that fulfilling this strong program of construct validation, as laid out by Benson (1998), is contingent upon addressing all three of these stages in the order they appear, as each one supplements the

next. Although all three stages need not be addressed at the same time, it is important that each stage be completed over time in order to provide strong construct validity evidence.

Given the importance and high regard with which the construct of mental toughness is held in the sporting community, it is important that measures aiming to capture the construct are rigorously scrutinized. As the MTSQ goes through the test development process, it is imperative that construct validity evidence be accumulated. As previously mentioned, this crucial process entails following a strong program of construct validation. The substantive stage of this program will be addressed in the review of literature by applying both theory (CAPS framework) and existing conceptual research to the construct of mental toughness. Following this, the structural component of the program will be addressed. Thus, following Benson's (1998) strong program of construct validation, the present study will examine the structural composition of a 32-item version of the MTSQ, as defined by a social-cognitive framework and a set of common observed attributes of mental toughness.

Chapter II

Review of Literature

The following chapter serves to review the literature surrounding mental toughness that impacted and influenced the development of the MTSQ-32. First, the common psychological attributes of mental toughness will be presented and described. Then, previous attempts to develop measures of mental toughness will be reviewed, specifically the Psychological Performance Inventory (PPI), the Mental Toughness Questionaire-48 (MTQ-48), and the Sport Mental Toughness Questionnaire (SMTQ) will be examined. Following this the development of the MTSQ-32 will be discussed. This discussion will include the theoretical framework underlying the measure, item development, and previous factor analytic work on the instrument. Finally, the purpose of the present study will be presented.

Psychological Attributes of Mental Toughness

In effort to better understand a construct it is often most effective to first conduct qualitative research. Data from exploratory qualitative research offers rich, detailed information- arguably more so than that from quantitative research. This descriptive information is especially useful when trying to define or understand a construct that is lacking a solid, unified, theoretical base, such as mental toughness. Hagger and Chatzisarantis (2011b) defended and encouraged the use of qualitative research to inform theory and to aid psychometric instrument development in sport and exercise contexts.

Many research teams have conducted qualitative research in effort to better understand the characteristics of a mentally tough player (e.g., Fourie & Potgieter, 2001; Jones et al., 2002; Middleton, Marsh, Martin, Richards, & Perry, 2004a). Across these

studies, researchers interviewed elite athletes, coaches, sport psychologists (Jones, Hanton, & Connaughton, 2007) and parents of athletes (Coulter, Mallett, & Gucciardi, 2010), indicating that these subjects were thought to have the most experience with mental toughness in sport. The common approach across studies was to ask participants for their perceptions of what characteristics make up mental toughness or a mentally tough player, and to rank these characteristics in terms of perceived importance (e.g., Fourie & Potgieter, 2001; Jones et al., 2002; Thelwell & Weston, 2005). Although each study generated its own list of characteristics, several common attributes emerged across research findings (supporting the multidimensional nature of the construct). The following section serves to review the common characteristics of mental toughness as identified by Harmison (2011b) and championed by 11 research studies. In reviewing these common attributes a clearer picture of mental toughness will be portrayed, and the nomological net surrounding the construct will begin to take shape. These seven common attributes include (1) being confident, (2) summoning motivation and desire, (3) managing pressure, anxiety, and emotions, (4) staying focused, (5) dealing with adversity and failure, (6) overcoming pain and hardship, and (7) finding balance and keeping perspective.

Being confident. Of the seven common characteristics, confidence was perhaps most prominently identified throughout the literature and was often ranked as the most important characteristic of mental toughness or of a mentally tough player (e.g., Jones et al., 2002; Thelwell et al., 2005; Gucciardi, Gordon, and Dimmock, 2008). Research in sport has consistently supported a positive relationship between confidence and performance in sport (e.g., Hays, Thomas, Maynard, & Bawden, 2009). Vealey (1986)

defined sport-confidence as, “the belief or degree of certainty individuals possess about their ability to be successful in sport” (p. 222). Although Koehn and Morris (2011) credit Vealey’s work as “the most concerted attempt to develop a sport-specific theoretical framework that will help us understand the role of self-confidence in sport” (p. 160), they note that sport-confidence is only one of the three main approaches to self-confidence in the sport and exercise psychology literature; the others being self-efficacy and state self-confidence. The use of different approaches is evident when examining the slightly varying ways in which different researchers have described self-confidence as a characteristic of mental toughness. ‘Self-efficacy’ arose from Middleton et al.’s (2004a) work, compared to ‘self-belief’ from Coulter et al. (2010), Gucciardi et al. (2008), Thelwell et al. (2005), Jones et al. (2007), and Jones et al. (2002), ‘self-confidence’ from Loehr (1986), and Bull, Shambrook, James, and Brooks (2005), simply ‘confidence’ from Weinberg, Butt, and Culp (2011), and Clough et al. (2002), and finally, ‘confidence maintenance’ from Fourie and Potgieter’s (2001) work. These labels were often the higher order themes that resulted from the interviews with athletes and coaches. For Jones et al. (2002), specific phrasing from one of the elite athletes interviewed directly influenced the way their definition of mental toughness was constructed, resulting in the description of mentally tough players as having an ‘unshakeable’ self-belief, a phrase that commonly recurs in the literature (e.g., Mack & Ragan, 2008; Clough et al., 2002).

Summoning motivation and desire. Although confidence was one of the most consistently named and highly ranked characteristics of mental toughness throughout the literature, the elite athletes and expert coaches from Fourie and Potgieter’s (2001) study instead named motivation level as most important. These participants both mentioned

motivation level most frequently and ranked perseverance (an aspect of motivation, according to their definition) as most important to mental toughness out of all of the characteristics. Hagger and Chatzisarantis (2011a) defined motivation, based on the work of Kleinginna and Kleinginna (1981), as an internal state that arouses, activates, energizes, or drives action or behavior and determines its intensity, direction, and persistence. Motivation is often dichotomized into intrinsic and extrinsic categories, meaning that we are motivated either by internal factors (e.g., enjoyment of sport) or external factors (e.g., money, awards). Self-determination theory argues that athletes are often motivated by both types of factors, but places special emphasis on intrinsic motivation (Ryan & Deci, 2007). Intrinsic motivation is critical to the longevity of sport participation (Ryan & Deci, 2007), and does not necessarily decline when external motivators become more abundant (i.e. when athletes reach elite levels; Mallett & Hanrahan, 2004). Instead it is thought that external motivators, such as money or awards, increase elite athletes' sense of competence, which in turn influences their self-determined motivation (Mallett & Hanrahan, 2004). As a characteristic of mental toughness, motivation emerged in the literature in terms of 'motivation level' (Loehr, 1986; Fourie & Potgieter, 2001), 'insatiable desire and internalized motives to succeed' (Jones et al., 2002), 'internal motivation to pursue personal bests' (Middleton et al., 2004a), 'using long-term goals as motivation' (Jones et al., 2007), and 'motivation to work hard' (Weinberg et al., 2011), as examples.

Managing pressure, anxiety, and emotions. The third common attribute of mental toughness to have been identified in each of the eleven works reviewed is that of managing pressure, anxiety, and emotions. Mentally tough players are characterized as

being able to successfully manage the various pressures, anxieties, and emotions associated with competition by "accepting competitive anxiety and knowing that one can cope with it; enjoying and thriving on the pressure of competition; accurately understanding one's emotions; channeling negative emotions and using them to one's advantage" (Harmison, 2011b, p. 49). As demonstrated in Harmison's (2011b) sporting example of this attribute, it is not that mentally tough athletes do not experience anxiety or negative emotions, but that they are able to effectively manage them so that they do not inhibit the athlete's pursuit of their goals. According to the Individual Zone of Optimal Functioning (IZOF) model the relationship between emotion and sport performance takes the shape of an inverted 'U', with too little or too much emotion being detrimental to performance (Hanin, 2000). Furthermore, the IZOF model notes that the specific level of emotionality necessary for optimal performance is unique to each athlete (Hanin, 2000). As an attribute of mentally tough athletes, managing pressure, anxiety, and emotions is manifested in the literature as 'accept and cope with anxiety' (Jones et al., 2002), 'stress minimization' (Middleton et al., 2004a), 'controlling emotions' (Thelwell et al., 2005), 'handling pressure' (Jones et al., 2007; Gucciardi et al., 2008; Weinberg et al., 2011), and 'coping under pressure' (Coulter et al., 2010), as examples.

Staying focused. In addition to being confident, summoning motivation and desire, and successfully managing their emotions, pressures, and anxieties, mentally tough athletes are characterized as having the ability to stay focused. Summers and Moran (2011) describe three dimensions of attention: direction (internal-external), width (broad-narrow), and selectivity (attending to relevant features of the environment). Selectivity, being able to ignore distractions and attend to what is most important, is

especially vital to successful sport performance (Moran, 2009). According to Moran (2009), there are five theoretical principles of effective concentration in sport. The first is that athletes must decide to concentrate; concentration will not occur accidentally. Mentally tough athletes choose to concentrate on the important aspects of their competitive environment. The second principle states that athletes can only focus on one thought at any given time. This does not imply that athletes cannot perform multiple tasks at one time, only that additional tasks must be learned to the point of automation (thus requiring no concentration). Interestingly, focusing on automatic processes is often detrimental to sport performance (Moran, 2009). The third principle, athletes' minds are focused when they are doing what they are thinking, speaks to the equivalence between one's thoughts and one's actions that is necessary for effective concentration. The final two principles state that athletes "lose" their concentration when they focus on factors outside of their control, and that athletes should focus outwards when they become anxious. The term 'lose' is used with the caveat that athletes do not ever lose concentration, per se, it merely becomes misdirected. According to the mental toughness literature, mentally tough athletes are characterized as 'remaining fully-focused in the face of personal life distractions' (Jones et al., 2002), having 'task-specific attention' (Middleton et al., 2004a), 'having the ability to ignore distractions and remain focused' (Thelwell et al., 2005), having 'concentration and focus' (Coulter et al., 2010), and having 'attention control' (Loehr, 1986).

Dealing with adversity and failure. Although mental toughness is associated with successful sport performance (e.g., Kuan & Roy, 2007; Weissensteiner, Abernathy, Farrow, & Gross, 2012; Crust & Clough, 2005), mentally tough athletes are not immune

to adversity or failure in sport. What is characteristic of mentally tough athletes is their ability to effectively deal with such adversity and failure as to not let it hinder subsequent performances. This includes, "bouncing back from set-backs with a greater determination to succeed; persevering in the face of obstacles; remaining positive in response to difficult situations; [and] learning from failure and being more determined as a result" (Harmison, 2011b, p. 49). Remaining positive is present in the themes of 'having the ability to react to situations positively' from Thelwell et al. (2005), 'positivity' from Middleton et al. (2004a), and 'view negative experiences as a challenge and catalyst for growth' (Clough et al., 2002). Other relevant themes from the literature include 'perseverance' (Middleton et al., 2004a), '"never say die" mindset' (Bull et al., 2005), 'bounce back from set-backs as a result of determination to succeed' (Jones et al., 2002), 'persistence' (Weinberg et al., 2011), and 'resilience' (Gucciardi et al., 2008; Coulter et al., 2010).

Overcoming pain and hardship. Going hand-in-hand with dealing with adversity and failure is the next attribute of mentally tough players, overcoming pain and hardship. The pain referred to here encompasses both physical and emotional pain. Mentally tough players are thought to challenge their physical and emotional limits in sport (Harmison, 2011b). Based on the work of O'Leary and Ickovics (1994), Carver (1998) described four ways in which an individual can respond to hardship: by succumbing, surviving with impairment, recovering (being resilient), or thriving. A resilient response is one in which the athlete ultimately returns to their pre-hardship level of function. To thrive following hardship is to come out the other side with a higher level of functioning. Mentally tough players are resilient at minimum, and often thrive

following pain and hardship. The attribute of overcoming pain and hardship emerges in the literature in the following ways: ‘push back boundaries of physical and emotional pain’ (Jones et al., 2002), ‘pushing self to the limit’ (Jones et al., 2007), and ‘physical toughness’ (Gucciardi et al., 2008; Coulter et al., 2010).

Finding balance and keeping perspective. The seventh and final commonly identified characteristic of mentally tough athletes, finding balance and perspective, spans the dual roles of athletes: on and off the field. In interviewing elite athletes, Amirault and Orlick (1999) found that balance referred to either having one goal and being mindful of this goal in all of their decisions or actions, or alternatively, balance was “enjoying and respecting different major parts of their life (e.g. sport, family, and leisure time) and not being too reliant on one component for a sense of worth” (p. 50). Harmison’s (2011b) sporting example of a mentally tough athlete finding balance and perspective describes Jeff, who balances out the completion of an intense training period with time away from sport with his family and non-sport interests. Entwined in the concept of balance and perspective is the notion of identity. Eccles (2009) describes a person’s identity as related to both their unique set of skills, characteristics, and competencies, and their unique set of values and goals. Being “an athlete” may reflect the former set, while how athletes balance and spend their non-sport time and thought may reflect the latter. Support for finding balance and perspective as an attribute of mental toughness comes from the themes of ‘independence’ (Bull et al., 2005), ‘switch sport focus on and off as required’ (Jones et al., 2002), ‘self-reflection’ (Bull et al., 2005), ‘have everything outside of the game in control’ (Thelwell et al., 2005), and ‘personal values’ (Gucciardi et al., 2008; Coulter et al., 2010), as examples.

In sum, the combined qualitative work of various research efforts characterizes mentally tough athletes as confident, motivated, focused players who effectively deal with adversity and failure, successfully manage pressure, anxiety, and emotions, are able to overcome physical and emotional pain and hardship, and who find balance and keep perspective. It is worth reiterating that other characteristics outside of the seven discussed have also been identified as attributes of mental toughness. Examples of such characteristics include 'having a presence that affects opponents' (Thelwell et al., 2005), 'team unity' (Fourie & Potgieter, 2001), 'knowledge and mental planning' (Weinberg et al., 2011), and 'sport intelligence' (Gucciardi et al., 2008; Coulter et al., 2010). The seven characteristics of mental toughness discussed here, though, reflect the set of those commonly found in the literature. Perhaps these seven represent the "constellation of core psychological characteristics" of mental toughness to which Coulter et al. (2010, p. 699) referred.

Previous Attempts to Develop a Measure of Mental Toughness

The qualitative work featured above has often served to inform the construction of measures of mental toughness. Unfortunately, none of these measures are without criticism. As discussed previously, there is still an existing need for a sound measure of mental toughness in sport. The following section serves as a review and critical evaluation of the three most commonly utilized measures in circulation.

The Psychological Performance Inventory (PPI). The PPI was created by Loehr in 1986, based on his personal definition of mental toughness and stemming from his experience with elite athletes (Gucciardi, 2012). Loehr (1986) defined mental toughness in terms of seven key components: self-confidence, attention control, negative

energy, motivation, attitude control, positive energy, and visual and imagery control. These seven components comprise the seven subscales of the PPI. With six questions devoted to each subscale, the PPI contains 42 items. The following is an example of an item from the self-confidence subscale, "I believe in myself as a player", which like the other items is responded to using a five-point Likert-type scale with 1 being 'almost always' and 5 being 'almost never' (as described by Kuan & Roy, 2007). Unfortunately, not much else is known about the PPI from Loehr's (1986) work; according to Gucciardi (2012), "in addition to lacking information on the conceptual underpinnings of his seven-factor model (e.g., construct definition), Loehr offered no information on item development procedures (e.g., expert review) or psychometric data to support its reliability and validity" (p. 395). Fortunately, other researchers have taken up the task of further examining the psychometric properties of the PPI.

The internal consistency reliability of the subscales of the PPI have been examined by various research teams, resulting in a range of Cronbach's alphas (across the studies)- between .55 and .80 for each of the seven scales (Middleton et al., 2004b; Kuan & Roy, 2007; Gucciardi, 2012). Ultimately, Gucciardi (2012) only found the scores from three of the seven subscales to be adequately reliable, defining 'adequate' as over .69. The evidence provided by these studies for the reliability of the PPI scores is not wholly impressive in terms of magnitude. Even with a larger number of items (42-items), which positively affects Cronbach's alpha values, only once did any of the scales' reliability values hit .80. From the reports above, the case for the PPI scores as reliable measures of mental toughness is not strong.

Given that reliability is a necessary (but not sufficient) prerequisite for validity, the validity of the PPI is already a half step behind due to the less-than-ideal reliability evidence. Factor analytic studies were conducted on the PPI by Middleton et al. (2004b), Golby et al. (2007), and Gucciardi (2012). Middleton et al. (2004b) set out to be the first to subject the PPI to rigorous psychometric evaluation, and ran a confirmatory factor analysis (CFA). A CFA tests *a priori* hypotheses about the factor structure of responses to a measure. In this case, it was hypothesized that the responses to the PPI would follow a seven-factor model, with each factor corresponding to one of the seven subscales. The CFA resulted in poor model fit and had factor correlations greater than one, which is indicative of an improper solution. Even after deleting troubling items, the seven-factor model still remained improper. The authors credit the PPI for having face validity, but ultimately concluded that the PPI responses did not support a seven-factor model of mental toughness as set forth by Loehr (1986).

Golby et al. (2007) also examined the factor structure of the PPI, but not by employing a CFA. The authors instead used principal components analysis (PCA), applying an oblique rotation (allowing for correlation between subscales) to assess the factor structure of the PPI. Note that the authors here did not have an *a priori* hypothesis mandated upon the analyses. Results of the PCA supported the two factors of visualization and imagery control, and motivation. The remaining items grouped together to form four factors, resulting in a six-factor model overall. After problematic items were deleted, a total of four factors remained. These results do not provide support for the initial seven-subscale model set forth by Loehr (1986).

Gucciardi's (2012) construct validity assessment of the PPI was conducted using CFA. The results of this CFA were similar to Middleton et al.'s (2004b) in that the model did not have good fit, nor did it provide a proper solution (factor correlations greater than 1). Gucciardi (2012) also attempted to provide convergent validity evidence for the PPI, but the PPI scores did not consistently correlate with the achievement goal measure as hypothesized.

Although construct validation is an ongoing process, the results above do not provide support for construct validity of the inferences based upon PPI scores. As mentioned previously, the need for validity evidence for a measure is crucial. As stated by Gucciardi (2012), "the PPI should not be employed as a measure of mental toughness in future investigations or applied practice" (p. 401).

The Mental Toughness Questionnaire-48 (MTQ48). The MTQ48 was created by Clough, Earle, and Sewell (2002) and is credited as the first measure of mental toughness generated out of rigorous scientific processes (Gucciardi et al., 2011). Improving upon the creation of the PPI, the authors of the MTQ48 brought a theoretical backing to the measure of mental toughness - although not from the realm of sport. Clough et al. (2002) linked attributes of mental toughness as described by the sporting community to the construct of hardiness from the field of health psychology; the common link being how individuals handle stress. What is lacking in this attempt is an explanation as to why hardiness theory is appropriate for understanding mental toughness (Connaughton & Hanton, 2009; Connaughton et al., 2008; Crust, 2007; Harmison, 2011b). Connaughton and Hanton (2009) further criticize the unjustified application of

hardiness theory to mental toughness as adding further conceptual confusion to the construct.

According to health psychology literature, hardiness is comprised of three facets: control, commitment, and challenge (Clough et al., 2002). Based on anecdotal and sport intervention evidence, the authors added a fourth 'C', confidence, to the three C's of hardiness. The authors felt that with the addition of confidence to the three C's of hardiness they had comprised a theoretical framework for mental toughness. The four C model (confidence, control, commitment, and challenge), created primarily from the health psychology construct of hardiness, serves as the basis for the MTQ48. In addition to the four main dimensions, control and confidence were further broken up into sub-dimensions: emotional control, life control, confidence in abilities, and interpersonal confidence (Clough, Marchant, & Earle, 2007). Items were written corresponding to the four main dimensions of mental toughness and were tested by athletes for clarifying purposes. The items consist of statements such as 'I can usually adapt myself to challenges that come my way', eliciting responses on a five-point Likert scale from 1 'strongly disagree' to 5 'strongly agree' (Crust & Swann, 2013).

In the technical manual for the MTQ48 (Clough et al., 2007), Cronbach's alpha values are provided for each of the dimensions, sub-dimensions, and the MTQ48 as a whole - which in and of itself creates confusion as to the dimensionality of the scale. These values were based on a sample of 963 responses from a pool of students (n = 619), administrators/managers (n = 136), engineers (n = 42) and athletes (n = 166). The reliability coefficients range from .70 to .91, with the whole scale alpha reliability being .91. The authors conclude that these are all above the minimum acceptable level for

reliability (Clough et al., 2007). In addition to the Cronbach's alphas, an overall test-retest coefficient was reported at .90. Crust and Swann (2013) used the MTQ48 to measure mental toughness in relation to dispositional flow in 135 college athletes. Cronbach's alphas from this study range from .63 to .93 for the four dimensions. The combination of these two research efforts complement one another in providing general support for the MTQ48 scores as reliable.

Due to three-fourths of the theorized dimensions of the MTQ48 coming directly from a similar but distinct construct (i.e., hardiness), it is important to provide construct validity evidence for the MTQ48 as a measure of mental toughness and not simply a measure of hardiness plus confidence. In their review of mental toughness measures, Gucciardi et al. (2011) state this nicely in claiming that "further conceptual justification and empirical work is required to delineate the usefulness of integrating hardiness with confidence as being mental toughness in sport" (p. 115). Although not appropriate for construct validation purposes, the measure's technical manual reports that a PCA was performed to assess the factor structure of the MTQ48, using the same sample as was used for the reliability analysis (N = 963; Clough et al., 2007). This resulted not in a four-factor model, but in a six-factor model, with all factor loadings reported at or above .30. The six factors identified were challenge, commitment, emotional control, life control, confidence in abilities, and interpersonal confidence. Upon being subjected to an *a priori* method of validation (i.e., CFA), Gucciardi, Hanton, and Mallett (2012) did not find support for the hypothesized four-factor structure of the MTQ48.

Other forms of validity evidence have also been investigated for the MTQ48. Convergent validity was assessed by Clough et al. (2007). The authors hypothesized that

mental toughness would theoretically be related to certain personality dimensions measured using the PREVUE personality scale (e.g. submissive - assertive, self-sufficient - group oriented). Significant positive relationships were found between the MTQ48 scores and five of the eight personality dimensions of the PREVUE (Clough et al., 2007). Criterion validity was assessed by Crust and Clough (2005). In their simple experiment, Crust and Clough (2005) had a sample of 41 male undergraduates complete a physical endurance task, along with the MTQ48. In support of criterion validity, scores on the MTQ48 were significantly positively related to performance on the endurance task (Crust & Clough, 2005).

Taking all of the attempts of providing validity evidence discussed above into account, it is not clear that a case for the MTQ48 as a measure of mental toughness in sport can be made. As stated by Harmison (2011a), "it is quite possible that the MTQ48 is a valid and reliable measure of hardiness in sport, but not mental toughness in sport" (p. 4).

The Sport Mental Toughness Questionnaire (SMTQ). The SMTQ was developed by Sheard, Golby, and van Wersch (2009) based on themes and quotes from previously conducted qualitative studies on mental toughness. From the qualitative information gathered, the authors generated items that were piloted to a group of 10 athletes and 10 coaches from various sports. Ultimately 18 items that were applicable to a variety of sports were kept. Responses to these items were made using a four-point Likert scale from 'not at all true' to 'very true' (Sheard et al., 2009). In comparison to the previous two measures the SMTQ has a leg up on brevity, which is an important consideration for one's audience. Additionally, the SMTQ differs from the other two

previous measures (PPI and MTQ48) in the generation of its dimensions. While the dimensions of the PPI and MTQ48 were contrived prior to data analyses, the three dimensions of the SMTQ were created based on the results of Principal Axis Factoring analyses (PAF) (Sheard et al., 2009). The three SMTQ factors are: confidence, constancy, and control.

Using a sample of 1,142 athletes ranging in age from 16 to 63 from a variety of sports, the authors calculated Cronbach's alpha values for each of the subscales of the measure. All internal consistency ratings were above the authors' chosen level of acceptability: confidence (α = .80), constancy (α = .74), and control (α = .71). In slight contrast to these Cronbach's alpha values were those computed in a study by Jones and Parker (2013). Using a sample of 299 British university athletes, Jones and Parker (2013) found two of the three dimensions to have low reliabilities (constancy α = .58, and control α = .57). Perhaps one source of the inconsistency found here is the double-barreled nature of some of the items, as pointed out by Gucciardi et al. (2011), such as 'I am able to make decisions with confidence and commitment.' When an item is double-barreled, its responses do not provide unique pieces of information. The contradictory reliability evidence presented in these two studies leaves something to be desired. More reliability measures are necessary to further evaluate the state of the reliability of SMTQ scores.

Due to the brief nature of both the scale length and theorized dimensions, content related validity is important to consider. The level of representation of a construct in a measure is an important consideration for any measure. Recall the numerous characteristics and definitions mentioned in the introduction of this paper that have been

attributed to mental toughness at one point or another. Although content validity of the SMTQ has not been formally addressed in the literature, researchers have been quick to point out that using three dimensions alone under-represents the breadth of the complex construct of mental toughness (e.g. Gucciardi et al., 2011; Harmison, 2011a).

Sheard et al. (2009) reported construct validity evidence for the SMTQ by way of CFA. The results of the CFA showed good overall model fit and good incremental fit for the hypothesized three-factor model. Although local fit was not reported, the global fit of the three-factor model supplies preliminary construct validity evidence for the SMTQ (Sheard et al., 2009).

Interestingly, Crust and Swann (2011) devoted an entire study to comparing the two measures, SMTQ and MTQ48, in hopes of achieving convergent validity evidence. Using a sample of 110 male college athletes, Crust and Swann (2011) found the total mental toughness scores to be significantly positively related (r = .75), supporting the two measures as being interrelated and perhaps tapping into the same construct. The matching subscales of the two measures however (e.g. MTQ48 control – SMTQ control), did not fare as well with significant moderate, but not strong, relationships present (Crust & Swann, 2011). The authors concluded that although the MTQ48 and SMTQ were statistically significantly related, it is probable that they are measuring slightly different components of mental toughness (Crust & Swann, 2011).

Ultimately, there is brief initial validity evidence towards the support of the SMTQ as a measure of mental toughness, but both the quality and quantity of this evidence does little to offer a convincing argument. The SMTQ is thus one of three commonly used measures of mental toughness that lack a theoretical foundation,

supportive psychometric evidence, or both.

Development of the Mental Toughness in Sport Questionnaire (MTSQ)

The MTSQ was created with the intent of addressing the need for a theoretically grounded measure of mental toughness, and the present study seeks to provide initial psychometric support for this new measure. In addressing both of these crucial aspects, the MTSQ will be set up to make a meaningful contribution to the mental toughness literature.

A social-cognitive theoretical framework. Although the primary goal of this thesis is to address the need for a sound measure of mental toughness, it is important to note that a sound measure of mental toughness cannot exist in the absence of a theoretical framework serving as its foundation. Theoretical frameworks serve to further the understanding of constructs such as mental toughness, both in research and in practice (Harmison, 2011b).

As suggested by Smith (2006) and applied by Harmison (2011b), a social-cognitive framework will be used to conceptualize mental toughness. This cognitive-affective conceptualization of mental toughness focuses on the cognitions, affects, and behaviors underlying the construct. This is in contrast to a host of research that has centered on identifying the attributes of mental toughness. Using the cognitive-affective personality system (CAPS; Mischel & Shoda, 1995) as a model for conceptualizing mental toughness is especially useful for clarifying the definition of the construct in terms of what it *is*, rather than what it allows athletes to *do*. Smith (2006) argues that "using the construct defined by the observed behaviors as a causal explanation for those behaviors in the absence of underlying causal mechanisms amounts to logical error of circular

reasoning" (p. 20). Using the CAPS model allows mental toughness to be defined by its underlying system of cognitions and affects (constituting a bottom-up approach). Further, the CAPS model serves as a framework with which a measure of mental toughness in sport can be developed; a measure that attempts to get at the CAPS units that comprise a mentally tough personality. This is the framework upon which the MTSQ was developed.

The CAPS model considers personality to be a system of interactions between the psychological features of one's environment and one's cognitive-affective mediating units, supporting the observation that people behave in consistently inconsistent ways (Mischel & Shoda, 1995). The psychologically active features of one's environment consist of the situational factors to which a person attributes meaning. This cognitive processing of situational factors is what contributes to variability in behavior from situation to situation. In addition to the psychological features of a situation, the CAPS model describes five dynamic cognitive-affective processing units that interact with both the situational factors and also with one another as a person selects, interprets, and generates behavior in any given situation (Mischel & Shoda, 1995).

The five CAPS units are encodings, expectancies and beliefs, affects, goals and values, and self-regulation skills (Mischel & Shoda, 1995). Encodings refer to one's constructions of the self, others, events, and the world, existing for both internal and external factors. These constructions are formed when a person assigns meaning to a feature of the situation they attend. Expectancies and beliefs include one's beliefs about the self, the world, and the way one anticipates behavioral outcomes. Expectancies and beliefs include both global and situation specific expectations. Affects refer to psychological and physiological emotions and affective responses to situations. Goals

and values include desired (and/or undesired) outcomes and affective states, both immediate and long-term. Finally, self-regulation skills refer to the psychological and physical strategies and plans a person utilizes in effort to control their internal states (cognitions and affects) and behavior. It is important to note that these five CAPS units are not thought to exist in isolation of one another, but are, according to theory, interconnected in an organized manner (Smith, 2006). The organization, and thus accessibility, of these cognitive-affective processing units varies from individual to individual. In sum, the CAPS model represents "a personality system in which individuals are characterized both in terms of (a) the cognitions and affects that are available and accessible, and (b) the distinctive organization of the interrelations among them and psychological features of situations" (Mischel & Shoda, 1995, p. 254).

In applying social-cognitive theory to the construct of mental toughness, Harmison (2011b) implied threefold: mental toughness is multidimensional, it is partially inherited, and it is partially learned. The first implication, that mental toughness is multidimensional, speaks to both the dynamic nature of the construct and to the many attributes that are associated with it. Harmison points out that an athlete's level of mental toughness is a multidimensional function of their dynamic personality system, not simply the set of how much of each associated attribute they possess. The latter two implications stem from two principles that apply to all personality constructs, namely that they are influenced by both biological (nature) and environmental (nurture) factors. Exactly which aspects of mental toughness are resistant to change and which can be learned is unclear, but Harmison notes that although self-regulation skills are often the focus of traditional

psychological skills training programs, they should not be the only focus for attempting to develop mental toughness.

Further applying the CAPS model to the construct of mental toughness, Harmison conceptualizes mental toughness as an organized network of the interconnected cognitions and affects that make up the five CAPS units. To supplement this, the display of mentally tough behavior in sport is equated to that of a behavioral signature. Ultimately, Harmison argues that, "mental toughness in sport can best be understood as a complex, relatively stable social-cognitive personality construct that can be modified over time if new learning, development, or biochemical changes take place within the athlete" (2011b, p. 47-48).

Item development. The MTSQ was developed as a composite between the CAPS theoretical framework and the common attributes associated with mental toughness as identified in the sport literature. Specifically, Harmison and a team of doctoral student researchers began by generating 60 items, with five items for each of the 12 attributes identified by Jones et al. (2002); creating one item for each CAPS unit and each of the 12 attributes. In this way, the encodings, expectancies and beliefs, affects, goals and values, and self-regulation skills comprising each attribute were covered. In addition, content for the items was generated by reviewing the literature on the theoretical underpinnings behind each of these attributes in conjunction with mental toughness.

Exploratory factor analysis of the MTSQ-60. In effort to investigate the dimensionality and cohesion of the MTSQ-60 items Harmison, Sims, and Virden (2008) conducted an exploratory factor analysis (EFA) on a sample of 310 college-level athletes from a variety of sports. Using principal axis factoring extraction and varimax rotation,

the EFA resulted in a five-factor solution that was determined to be the most interpretable. It was of particular interest to the authors that the items grouped together according to the CAPS model, as this had potential implications for the conceptualization of mental toughness. Specifically, the items grouped together to form the following five dimensions: tough attitudes, tough beliefs, tough emotions, tough values, and tough skills. According to the authors, tough attitudes are comprised of the personal constructs that mentally tough athletes have about themselves, as well as their perceptions of the competitive environment. Tough beliefs are made up of the convictions and expectations that these athletes hold to be true about both themselves and their competitive environment. The feeling states (both psychological and physiological) that athletes experience in reaction to their competitive environment comprise the third dimension, tough emotions. Tough values are the underlying motives, goals, and desired outcomes that mentally tough athletes hold in regard to achievement in the competitive environment. Tough skills are made up of the plans, strategies, and actions mentally tough athletes engage in in order to self-regulate their thoughts, feelings, and behaviors in competitive environments. Based on these results, it was hypothesized that mental toughness was less of a reflection of an athlete's level of any certain attribute(s), and more of a reflection of an athlete's collection of attitudes, beliefs, emotions, values, and skills about the attributes (Harmison, Sims, & Virden, 2008). Further, based on the results of the EFA, a number of items were removed or modified, and several items were created to form a second version of the measure, the MTSQ-50.

Factor analyses of the MTSQ-50. Following the results and revisions of the scale based upon the EFA, the MTSQ-50 was administered to a new sample of 842

athletes from a variety of sports at the high school, college, and international elite levels. Harmison, the present author, and a team of both student and professional researchers, conducted a confirmatory factor analysis on this sample to test the proposed five-factor model mentioned above. The CFA of this five-factor model ultimately resulted in inadequate fit. As is common practice, an EFA was run on the same sample from which the CFA did not fit. The EFA produced four, five, and six factor solutions. Theoretical and qualitative literature on mental toughness was revisited and re-examined to aid in the interpretation of the models produced. After careful consideration by the research team, a new five-factor model was ultimately championed as being supported by both theory and empirical evidence. The five factors that emerged reflected a synthesis of the CAPS model and the common attributes of mental toughness. Specifically, these factors were: having self-belief, summoning motivation and desire, dealing with adversity and failure, managing pressure and negative emotions, and staying focused. Mentally tough athletes that have self-belief believe in their own ability to achieve their goals and reach their potential. Further, mentally tough players who believe in themselves reveal their competence and have the desire to be the player who makes the difference in their competitive environment. Mentally tough players summon motivation and desire by having an internal determination and desire to succeed, a goal-directed orientation, a disciplined and determined work ethic, and by competing with themselves and others. Mentally tough athletes are thought to deal with adversity and failure by regulating their thoughts and feelings following mistakes in competition, remaining positive and persevering through obstacles, learning from difficult situations and failure, and by using previous failures to augment their determination to succeed. The fourth factor, managing

pressure and negative emotions, describes mentally tough athletes who accept and cope with competitive anxiety, thrive on the pressure that comes with competitive environments, and understand and use negative emotions they may experience to their advantage. Finally, mentally tough athletes are thought to stay focused by thinking clearly, remaining in the present, concentrating on the task at hand, and successfully disregarding distracting thoughts and distracting elements of the environment.

In addition to producing an interpretable model supported by theory, the results of the EFA allowed the research team to further reduce and revise the items comprising the measure. Item deletions and modifications were based upon the consideration of, again, both theory and empirical results. Further, several new items were written that resulted in a third version of the measure, the MTSQ-32.

Purpose of the Present Study

The purpose of the present study is to continue the strong program of construct validation of the MTSQ by assessing the structural composition of the MTSQ-32 via confirmatory factor analysis (CFA). In assessing the structure of the MTSQ-32, this study serves to further the understanding of mental toughness in athletes. A theoretically grounded and empirically supported measure of mental toughness would address the current need for a sound measure of mental toughness. Given a sound measure of mental toughness, the sport community would have a tool that could be used to further the understanding of how mental toughness develops in athletes, or to assess the effectiveness of mental toughness interventions, as examples.

Chapter III

Method

Sample

The sample of athletes was recruited from a district of six high schools located in the southwestern region of the United States. The total sample included 599 high school athletes, of which 536 provided complete data. Of these 536, there were 276 males (51.5%) and 260 females (48.5%). The ages of the participants ranged from 14 to 18 years (M = 16.2 years), with the majority of participants being in either 10th or 11th grade (n = 418; 70%). Participants were first asked if they were of Hispanic, Latino, or Spanish origin, to which 13.6% (n = 73) chose 'Yes'. Participants who chose 'No' were asked to further describe how they identify their ethnicity. Of the 476 participants who provided further information regarding their ethnicity, 73.1% identified themselves as Caucasian/White, 10.7% as African American/Black, 7.1% as Asian American, 5% as other, 3.8% as Biracial, and 0.2% as Pacific Islander (one participant). In regard to their primary sport, participants represented the following 14 sports: baseball, tennis, track and field, volleyball, wrestling, basketball, cross country, diving, football, golf, soccer, softball, and swimming. When asked about the level at which they participate in their primary sport, 44.6% of participants reported participating at the varsity team level (n = 239), 48.1% reported participating at both varsity team level and select team level for their primary sport (n = 258), and 2.8% reported participating at only the select team level (n = 15). Participants reported spending an average of 11.7 hours per week practicing their primary sport (SD = 6.4 hours), and an average of 5.1 hours per week formally competing in their primary sport (SD = 4.1 hours).

Measure

The Mental Toughness in Sport Questionnaire-32 (MTSQ-32) contains 32 items intending to measure an athlete's mental toughness in sport. The measure is sport general, but is specific to competition settings. The participants were given the following instructions:

> Below are a set of statements that describe the mental toughness of athletes in their sport. Please read each statement carefully and then circle the number next to each statement that most accurately reflects your thoughts and feelings about yourself in your **MAIN SPORT**. There are no right or wrong answers. Do not spend too much time on any one statement.

The 32 items include statements such as "I possess a firm, unshakable belief that I will be victorious when I compete." The Likert-style response scale ranged from 1-7 with 1 corresponding to 'Strongly Disagree', 4 corresponding to 'Neutral', and 7 corresponding to 'Strongly Agree'. See Appendix A for the complete questionnaire.

Procedure

The data used in the present study were collected as a part of a larger research project that was conducted to examine how coaches, parents, and teammates influence the development of athletes' mental toughness. Approval for the larger study was granted by the Institutional Review Board of the University of North Texas. The head athletic director (AD) of the district of six high schools used in this study was contacted directly by a member of the research team. The purpose of the study as well as proposed data collection plans were described to the AD. The head AD contacted the ADs from each of the six high schools in the district to meet and discuss the data collection process.

Ultimately, it was decided that each individual sport coach would be given the opportunity to administer the questionnaires to their respective team(s).

Coaches received detailed instructions as to how to complete each step of the questionnaire administration process. The instructions included the purpose of the study, athlete eligibility information, a reminder as to the voluntary nature of student participation, a set of informed consent instructions, and a set of questionnaire administration instructions. All of the instructions, both to the coaches and to the participants, were standardized with the intention that each participant would have the same experience.

During a practice session in the spring of 2013, coaches gathered informed consent from athletes who were 18 years of age and from parents of athletes under 18 years of age. Assent was gathered from athletes under 18 years of age. Following the collection of informed consent/assent forms, the coaches administered the questionnaires. The MTSQ-32 was administered to the high school athletes as one measure contained in a packet of questionnaires. The questionnaire packet contained a total of seven measures and took approximately 30 minutes to complete. The order of the presentation of questionnaires did not vary, and the MTSQ-32 was the 7^{th} measure completed by all participants. Demographic information was collected at the end of the packet as to not influence participants' responses according to gender or race effects. All ADs, coaches, and participants were thanked for their participation and a donation was made to the district Athletic Department as a sign of gratitude.

Data Analysis

Software. Preliminary data analyses were performed using SPSS 21.0, and PRELIS 2.80 (Jöreskog & Sörbom, 1999). Confirmatory factor analyses were performed using covariance matrix data read in to LISREL 8.80 (Jöreskog & Sörbom, 2006).

Models. The purpose of this study was to investigate the structural make-up of the MTSQ-32. A total of eight competing models were tested. A unidimensional model was the first model to be tested, with all items loading on a single mental toughness factor. It was not hypothesized that this model would adequately fit the data; the intent for the analysis of this model was to provide evidence in support of the multidimensional nature of the construct. The second model tested was a five-factor model reflecting the common attributes of mental toughness: being confident, summoning motivation and desire, managing pressure, anxiety, and emotions, staying focused, and dealing with adversity and failure (Figure 1). Third, a five-factor model reflecting the CAPS units (tough beliefs, tough attitudes, tough emotions, tough values, and tough skills) was tested (Figure 2). Both the second and third models were supported by previous theoretical and empirical work. The fourth model tested was one in which the items were multidimensional, meaning that they corresponded to more than one set of factors. In this case, each item was hypothesized to load on one attribute factor and one CAPS factor (Figure 3, item numbers included). Support for this model came from a reflection on the item development process, in which items were each written with the intent of covering both an attribute of mental toughness and a CAPS unit. The remaining four models were versions of the previously mentioned models, but with the addition of a method effect factor. This method effect factor was added to account for common variance between the

six items that were written to be reverse coded. Figure 4 shows the five-factor attribute model with the reverse coded method effect factor included (item numbers included).

Identification. In order to perform structural equation modeling, models must be identified. While just-identified models can be run, they yield one possible solution - a direct replication of parameters. What is more useful is to examine over-identified models (more observations than estimated parameters), in which multiple solutions are possible. With a total of 528 observations, each of the hypothesized models was theoretically over-identified. For example, the unidimensional model was over-identified with 464 *df*, the five factor models were over-identified with 454 *df* each, and the multidimensional item model was also over-identified with 412 *df*.

Estimation. Model parameters were estimated using Maximum Likelihood (ML) estimation. Although ML, Generalized Least Squares (GLS), and Weighted Least Squares (WLS) produce equivalent estimates under the conditions of normally distributed data and correctly specified models, one or both of these conditions will not be fully met by this study (or the majority of studies)(Olsson, Foss, Troye, & Howell, 2000). It is important to take choice of estimator into account given that these three estimators are differentially affected by sample size, model misspecification, and kurtosis (Olsson et al., 2000). ML estimation produces the least biased parameter estimates when a model is misspecified, and is the most insensitive to sample size and kurtosis (Olsson et al., 2000). For these reasons, ML estimation was employed in this study. Due to multivariate non-normality in the data (discussed further in the results), the Satorra-Bentler (SB) scaling method (Satorra & Bentler, 1994) was used in conjunction with ML estimation to adjust

the chi-square statistic, standard errors, and fit indices produced from ML estimation for kurtosis in the data.

Goodness-of-fit indices. Global goodness of fit between the models and data was examined using four fit indices, namely, the χ^2, the Standardized Root Mean Square Residual (SRMR), the Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI). Overall, these indices were chosen due to their ability to function well in conjunction with ML estimation (Hu & Bentler, 1998; Hu & Bentler, 1999). More specifically, each of these goodness of fit indices were chosen to supplement the others in effort to gain a more complete picture of model-data goodness of fit. The χ^2 was used as a measure of exact fit between the model and data; the SRMR was used as a measure of approximate fit that specializes in identifying misfit among factor covariances (simple model misfit); the RMSEA was used as a measure of approximate fit that specializes in identifying misfit among factor loadings (complex model misfit); and the CFI was used as a measure of incremental fit between the theoretical model and a baseline model in which none of the variables are related (Hu & Bentler, 1998; Hu & Bentler, 1999). The SB scaling method (Satorra & Bentler, 1994) was used to adjust the χ^2, RMSEA, and CFI values for the kurtosis in the data. Approximate fit values were interpreted using the suggested cutoff values provided by Yu and Muthén (2002) based on their work with SB adjusted fit values. With moderately non-normal data, Yu and Muthén (2002) recommended that SRMR values close to or less than .07, RMSEA values at or less than .05, and CFI values at or greater than .95 suggest adequate fit.

In addition to global fit, it is important to examine local fit as global fit indices can mask misfit at a local level. Local fit was evaluated by examining the standardized

covariance residuals as well as correlation residuals. Conceptually, these two sets of residuals represent the discrepancies between the observed data and the model implied data on a specific level. Because large sample sizes can inflate standardized residuals, it is especially important to examine and compare both standardized and correlation residuals. Given that standardized residuals are on a z-score metric, a residual greater than |3| signifies that the model did not reproduce the given relationship well. Given that correlation residuals range from -1 to 1, a residual greater than |.15| signifies that the model did not reproduce the given relationship well.

Chapter IV

Results

Data Screening and Assumptions

Responses to the MTSQ-32 items were screened for missing data, univariate and multivariate outliers, univariate and multivariate normality, multicolinearity, and to determine the extent to which the scale responses could be considered to be continuous in level. Of the total sample of 599 athletes, 536 of these participants (approximately 90%) provided complete data across the 32 items of the MTSQ. The majority of the missingness was attributed to a complication in scale administration in which a portion of athletes were mistakenly given a prior version of the measure that did not include all of the same items as the current version. The data from these athletes, as well as the data from any athlete who did not provide a response to each item, were deleted. Thus, the remainder of the data screening, and all subsequent analyses, were performed using the sample of 536 athletes.

Univariate outliers were screened by examining item data for out of range responses (i.e., responses less than 1 or greater than 7). No univariate outliers were found. Multivariate outliers were screened by examining Mahalanobis distances. No distances were found to be substantially distinct from the others, indicating that there were no multivariate outliers.

Univariate normality was assumed given the acceptable (low) values of skewness and kurtosis for each of the items (Table 1). Multivariate normality was assessed using Mardia's normalized multivariate kurtosis. The large value suggested that the data were multivariate non-normal (Mardia's = 61.8). As discussed previously, the implications of

violating this assumption are simply that the Satorra-Bentler scaling method (Satorra & Bentler, 1994) needed to be used to adjust the chi-square statistic, standard errors, and fit indices produced from ML estimation for kurtosis in the data.

Multicolinearity was assessed at the bivariate level and multivariate levels. No items were found to be bivariately multicolinear as none of the item correlations were exceptionally high. The highest correlation was between items 23 and 24 with $r = 0.57$ (Table 1). Additionally, no items were found to be multivariately multicolinear. This was evidenced by all items' Tolerance levels being above 0.10. The lowest Tolerance level was 0.464 for item 23.

The final assumption, that the data were measured on a continuous scale, is an assumption not for CFA but for the use of ML estimation. Although Likert scales having at least five points can be considered continuous scales, it is important to check that the respondents actually utilized all five points (or at least five points). Because the full seven-point response scale was used across *each* of the 32 items, the responses were considered to be on a continuous scale.

Item Analysis

Upon initial inspection of the relationships among items, the research team was surprised to find that the correlations among items across the entire scale were generally low, with only about 35% of the off-diagonal item correlations beyond |.30| in magnitude (see Table 1). Further inspection of the observed correlation matrix (Table 1) revealed that some of the items had little relation to any of the other items on the scale (e.g., item 32, item 2), and that item 5, written to be reverse coded, was positively related to other non-reverse coded items. When item response frequencies were examined, none of the

items were observed to have large frequencies of 'Neutral' responses, which is often an indicator that an item is confusing.

For foreshadowing purposes, observed correlations also were examined as grouped by the five attribute factors (Table 2). Moderate correlations among items proposed to be on the same factor were observed. Notably, the items for the Managing Pressure and Negative Emotions factor generally had little relation to other items outside those for that factor - aside from item 25. Item 25 had moderate relationships with the items for both the Dealing with Adversity and Failure and Focus factors.

Unidimensional Models

Both the unidimensional model and the unidimensional model with the addition of the reverse coding method effect factor converged onto a solution with no warnings, Heywood cases, or inadmissible values reported. The global fit indices are provided in Table 3 along with a summary of the local fit for both models. The global fit indices do not depart largely from the suggested cutoff values, yet are not quite close enough to instill confidence in either model as fitting the data. Further, when taking local fit into account, there are a number of relationships that were poorly reproduced by the models. Taking both global and local fit into account, there does not seem to be strong evidence that either a unidimensional model or a unidimensional model with a method effect fit the data.

Five-Factor Attribute Models

The five-factor attribute model also converged onto a solution with no warnings, Heywood cases, or inadmissible values reported. Thus, the global fit indices and a summary of the local fit for the model are also provided in Table 3. The CFI and RMSEA

values do not depart largely from the suggested cutoff values, yet the SRMR value is slightly out of range of acceptable fit. In regard to local fit, there are a number of relationships that were poorly reproduced by the model. In particular, item 25 had high standardized and correlation residuals with almost every item outside of its factor (Managing Pressure and Negative Emotions). Although a case could potentially be made that the global fit indices suggest roughly adequate model fit, global fit alone should not be the determinant of fit. Taking *both* global and local fit into account, there does not seem to be strong evidence that the five-factor attribute model fits the data.

When the method effect factor was added to the five-factor attribute model (with item 25 included), the model was unable to converge to a solution after 50 iterations. Upon examination of the results of the last iteration attempted, the matrix of correlations between latent variables was found to be non-positive definite and to contain correlations greater than |1|. Specifically, the correlation reported between managing pressure and negative emotions and dealing with adversity and failure was -1.37, and the correlation between staying focused and managing pressure and anxiety was -1.03. Due to the simultaneous and iterative nature of ML estimation, if any inadmissible values are evident then the remainder of the estimated values throughout the whole model are affected. Ultimately, the solution produced was untrustworthy and the results should not be interpreted.

Five-Factor CAPS Models

The five-factor CAPS model converged onto a solution; however, the matrix housing the correlations among the latent factors was non-positive definite and contained an inadmissible correlation value. The correlation between the tough beliefs and tough

attitudes factors was reported to be 1.01. The five-factor CAPS model with the addition of the method effect factor converged onto a solution, but was also plagued by a non-positive definite latent variable correlation matrix and inadmissible correlations. In this instance, the correlations between beliefs and attitudes, beliefs and emotions, attitudes and emotions, and emotions and values were all reported to be greater than 1.00.

Ten-Factor Multidimensional Models

Neither the 10-factor multidimensional model nor the 10-factor model with the method effect factor included converged onto a solution after 50 iterations. As was the issue with the previous models, the matrix of latent variable correlations was not positive definite and contained a number of correlation values greater than |1| for both 10-factor models. For the 10-factor plus method factor, one of the reported correlations (between tough values and tough attitudes) was as extreme as -8.64. With 10+ factors being modeled, over-factoring of the data may have played a role in the failure of these models to converge.

Post-Hoc Analysis

The tests of the four sets of hypothesized models yielded no model that adequately fit the data. Perhaps the most notable problem for the models that converged to admissible solutions was the number of large residuals (local misfit). The standardized and correlation residuals from each of the models were examined for patterns of misfit. Item 25 was identified as having high residuals with many of the other items for the five-factor attribute model, but not for the one-factor models. In an exploratory fashion, item 25 was removed and the five-factor model was re-tested. The five-factor attribute model with item 25 removed was found to adequately fit the data; global fit indices met or

approached their suggested values, and the local misfit was minimized to the extent that not many of the correlation residuals (7%) would be likely to replicate (see Table 3). Importantly, this analysis was conducted in a post-hoc manner based on the sample and results at hand, and thus it is no surprise that the results indicate greater model fit. Before any concrete conclusions of fit are made, these results will need to be replicated on a new sample.

Chapter V

Discussion

Due to the widespread belief that mental toughness is related to successful performance, and the crucial role of performance in sport, mental toughness has become an important construct in the sporting community. The importance of this construct within the sporting community has generated a wide range of research aimed at measuring mental toughness. Many researchers have designed measures, yet there is none to date that is both theoretically grounded and psychometrically-sound. The purpose of this thesis was to provide psychometric support for a new measure of mental toughness that is grounded in social-cognitive theory. Specifically, the present study investigated the structure of the MTSQ-32 in effort to provide evidence towards construct validity of the scale.

Construct validity evidence of the MTSQ-32 was investigated via confirmatory factor analyses. Four theoretically supported models were tested: a unidimensional model, a five-factor model reflecting the five common attributes of mental toughness (Figure 1), a five-factor model reflecting the five CAPS units (Figure 2), and a ten-factor model with multidimensional items loading on one CAPS factor and one attribute factor each (Figure 3). Additionally, each of these models was tested with a method effect factor added to account for variance between negative items (e.g., Figure 4). The results of the factor analyses performed on these models are discussed next, followed by a discussion of the model misfit that occurred, an acknowledgment of the limitations of this study, and finally, a discussion of implications for future research.

Summary of Results

Of all the hypothesized models that were tested, only three converged to admissible solutions. The one-factor, one-factor plus method effect factor, and five-factor attribute models were then examined for data-model fit. Ultimately, it was concluded that none of the hypothesized models provided adequate fit for the data. Upon inspection of the standardized and correlation residuals from each of the models, one item in particular stood out as having high residuals with many of the other items for the five-factor attribute model. In an exploratory fashion, this item was removed and the five-factor model was re-tested. The five-factor attribute model with item 25 removed was found to adequately fit the data; global fit indices met or approached their suggested values, and the local misfit was minimized to the extent that not many of the correlation residuals (7%) would be likely to replicate. This improvement in fit is to be expected of course, as the model was re-tested on the same sample that was used to indicate that item 25 was problematic. Because this outcome may be the result of capitalizing on the specific sample used, the conclusion that this model fits is not fully warranted. It is crucial that this preliminary finding be replicated on an independent sample. Currently, the five-factor attribute model is not fully supported as, again, the findings here necessitate replication. Thus, the measure in its current state is not fit to be readily used as a measure of mental toughness.

Theoretical Implications of Results

Although the present study did not provide full support for any of the theoretical models, the results provide information about the models and have implications for theoretical conceptualizations of mental toughness. Specifically, the results shed light on

the dimensionality of mental toughness. The theoretical implications stemming from the results of each of the four sets of hypothesized models are discussed next.

Most researchers conceptualize mental toughness as a complex, multidimensional construct (see Crust, 2007; Crust, 2008; Connaughton & Hanton, 2009); however not all do. Some researchers have supported the simplified view of mental toughness as a unidimensional construct (Madrigal, Hamill, & Gill, 2013; Gucciardi, Hanton, Gordon, Mallett, & Temby, in press). Although Madrigal, Hamill, and Gill (2013) and Gucciardi et al. (in press) both presented mental toughness as a complex construct comprised of multiple dimensions, they ultimately supported the measurement of mental toughness as a single dimension. Gucciardi et al. (in press) stated that although mental toughness researchers tend to agree on the multidimensional nature of the construct, there is "little research conducted to directly test this assumption against a unidimensional model" (p. 4). In the present study, a pair of unidimensional models were directly tested against multidimensional models resulting in initial support for one of the multidimensional models, but not the unidimensional models.

As the five-factor attribute model with item 25 removed was the most promising model examined, preliminary support is garnered for this model as the best fit for the MTSQ-32 data. Replication of the fit of the attribute model would provide empirical support for the theoretical conceptualization of mental toughness as comprised of five related, yet distinct, common attributes, namely having self-belief, summoning motivation and desire, dealing with adversity and failure, managing pressure and negative emotions, and staying focused (Harmison, 2011b). The relatedness, yet distinctness, of these attributes is supported by the qualitative literature gathered from interviews with

elite athletes describing the key attributes of mental toughness (e.g., Fourie & Potgieter, 2001; Jones et al., 2002; Thelwell & Weston, 2005). Further, support for a multidimensional model over a one-factor model would provide support for the complex nature of the mental toughness, as hypothesized by many researchers (see Crust, 2007; Crust, 2008; Connaughton & Hanton, 2009).

Along with the unidimensional models, neither the five-factor CAPS models nor the 10-factor multidimensional item models were supported by the present study. The lack of support for the CAPS model may indicate that although athletes have certain mentally tough attitudes, values, beliefs, emotions, and skills, these are not the underlying dimensions of the construct. Even if the CAPS units are not directly implicated in the structure of the measure, they serve an important role in the conceptualization of mental toughness as a social-cognitive personality construct. As such, the mentally tough attitudes, values, beliefs, emotions, and skills athletes possess may still comprise what mental toughness *is*, but the common attributes of mental toughness may better describe how mental toughness manifests in sport. These theoretical implications aside, if and how the five CAPS units work to supplement the attributes of mental toughness continues to be an important, yet unanswered question.

Discussion of Model Misfit

The deciding factor as to whether a model 'fits' the data lies in the examination of both types of fit: global and local. Although some researchers may only look at the global fit indices, it is important to consider both types as global fit can often mask misfit at a local level. Although there are guidelines available for interpreting the adequacy of global fit indices, the interpretation of adequacy of local fit is less straightforward.

Ideally, no standardized residual would be beyond |3| and no correlation residual would be beyond |0.15|, but this would be a rare occurrence. Instead, it is important to not have many residuals that are large in magnitude, as these are likely to replicate across samples. It also is important to keep in mind that standardized residuals will be affected by large sample sizes, whereas correlation residuals will not.

The examination of residuals is a vital part of diagnosing misfit where found. Because none of the theoretical models were found to fit the data, the residuals for each model were examined for clues as to causes of the misfit. Other than item 25 having a number of high residuals with other items for the attribute model, the correlation residuals for the theoretical models did not paint a clear picture of the cause for misfit. The misfit did not seem to be coming from one factor in particular, nor from any particular subset of items. For the five-factor attribute model in particular, the misfit did not seem to have a clear pattern that corresponded to the factors of the model, which led to the hypothesis that the misfit was caused due to poor item functioning rather than poor theory. Two potential explanations for the misfit among the data are item reading level and participant experience level.

Item reading level. The possibility exists that the reading level of the MSTQ-32 may be above the optimal level for the sample at hand and that this may have contributed to some of the model misfit. The Flesch-Kincaid readability index was used to further divulge the readability of the measure. This index provides reading ease and reading level scores for English text. The scores consider sentence length and number of syllables per word in their calculations (Flesch, 1948). Reading ease scores range from 0-100 with scores under 50 indicating ‘difficult’ and scores under 30 ‘very difficult’ (Flesch, 1948).

Reading level scores correspond to the K-12 grade levels, with a cap at 12.0. It is commonly suggested that a reading level between 7.0 and 8.0 is optimal (e.g., Stockmeyer, 2009).

As a whole, the MTSQ-32 has a reading ease of 53.3 and reading level of 10.0, clearly indicating that the content is beyond the suggested guidelines. At a specific level, only five items had a reading level between 7.0 and 8.0, with 26 items above and one item below this range. Item 16 ("I am capable of being one of the very best athletes at my level in my sport") had the highest reading ease (80) and lowest reading level (6.3). Items 1, 18, 20, 22, 25, 30, and 32 all capped out at a reading level of 12.0, with item 22 ("I am able to stay mentally and physically relaxed when faced with adversity during competition") having the lowest reading ease (28.0). With the highest reading ease and lowest reading level item 22 is thus, by the Flesch-Kincaid standards, the most difficult item to read. The readability issues for this item likely stem from the use of words with many syllables, such as 'mentally,' 'physically,' and 'adversity.' Although the participants may be familiar with these words, a much simpler version of this item may have been more clear. For example, by re-wording item 22 from, "I am able to stay mentally and physically relaxed when faced with adversity during competition," to "I am able to keep my mind and body relaxed when faced with challenges during competition," the reading ease rises from 28.0 to 58.4 and the reading level decreases from 12.0 to 9.0.

Attempts to cross-reference item readability with the number and magnitude of residuals per item did not yield further information. Item readability was also examined in regard to negatively worded items, as well as items from the Managing Pressure and Negative Emotions factor. No relationships were evident. Regardless, the low reading

ease and high reading level of the measure will need to be addressed for the progress of the measure.

Participant experience level. Along with item reading level, model-data misfit may be partially due to the experience level of the participants used in this study. The sample used in this study was entirely comprised of high-school athletes, in contrast to the primarily elite level athletes used during the development of the measure. The items of the MTSQ-32 were written based upon the common attributes of mental toughness as identified by elite athletes (across numerous qualitative studies). Further, the factor analytic work of the original measure, the MTSQ-60, was performed using a sample of college-level athletes. Finally, the factor analytic work of the second version of the measure, the MTSQ-50, was performed using a combined sample of high school, collegiate, and elite athletes. The use of high school athletes in this study may have impacted the ability to reflect the structure of the measure as hypothesized from previous work using collegiate and elite athletes.

Due to experiences garnered over time and across levels of competition, the concept of mental toughness may differ between young athletes and more experienced athletes. Young athletes may not have yet acquired the rich experiences needed to allow them to truly connect with the content elicited by the items. Consider item 27: "When I experience some failure during competition, I respond with optimism and hope." It is easy to imagine that the experiences of failure in high school sports, and their effect on the athlete, may be qualitatively different from those at the collegiate- or Olympic-level. Further, the responses to such failure may be qualitatively different based on the level of experience of the athlete. Less experienced athletes may be more prone to respond to

failure with anger or frustration, and to deal with such feelings by repressing them. Athletes with more experience may have had more opportunities over their sporting career to learn that they can channel their failures into something productive, like optimism or hope.

As mentioned previously, none of the 32 items had moderate-to-large frequencies of 'Neutral' responses, which is often an indicator that an item is confusing. This may suggest that the high school athletes responded to the items with a false sense of understanding of the experiences around which the items were created. Because of this, the distinctions between factors may be less clear at lower levels of experience, as perhaps more experiences are required to fully distinguish the factors.

Study Limitations

As conducted, the present study posed a few limitations. Two key limitations to the present study are of note. The first is in regard to the generalizability of results, and the second is in regard to the method of questionnaire administration.

Generalizability. The sample of athletes used in this study was comprised of high school students from a southwestern region of the United States. The sole use of only high school athletes for the present study limits the generalizability of the results to other populations. Although the measure was developed for use among athletes of various levels of experience, the present results can only be generalized to the high school athlete population. Generalizability to other populations of interest, such as collegiate or elite athletes, would require further analyses involving samples from these populations—especially if the construct of mental toughness may vary across experience levels.

Questionnaire administration. The MTSQ-32 was administered to athletes by individual team coaches within the context of a larger study involving six other questionnaires. Although the packet of questionnaires was only reported to take approximately 30 minutes to complete, athletes' responses to the MTSQ-32 may have been affected by the fact that it was completed as the final measure of the packet for all students. Athletes who may have been tired or unmotivated towards the end of the packet were removed from analyses only if they failed to respond to all 32 of the MTSQ-32 items. This removal does not account for participants who may have completed the measure, albeit somewhat carelessly. Additionally, by having individual team coaches administer the questionnaires to their teams, the athletes may have more likely to respond to the questions in a socially desirable way.

Implications for Future Research

Although the hope for the present study was to provide evidence towards the structural stage of Benson's (1998) strong program of construct validation, it cannot be concluded that this stage has been addressed. Due to the importance of construct validation of the MTSQ as a measure of mental toughness in sport, it is recommended that future research seek to continue Benson's (1998) program. Specifically, future research should seek to revise the MTSQ items, re-examine the structure of the measure via confirmatory factor analyses, and investigate the external consistency of the measure.

With the encouragement of adequate fit of the 31-item five-factor attribute model, the next immediate steps in developing the MTSQ as a measure of mental toughness in sport should be to pursue item revision work. Think aloud techniques may be helpful for re-writing items, as there may be discrepancies between what is intended by the

researchers and what is interpreted by the athletes. In re-writing items, close attention should be paid to the readability of items and to the items written for the Managing Pressure and Negative Emotions factor, as this factor did not relate to the other factors nor did the items associated with it relate to the other items of the measure. As was done for prior versions of the measure, the qualitative literature describing mental toughness should be re-examined to inform item development and revisions.

Once item revisions have taken place, subsequent research should be aimed at addressing the structural stage of Benson's (1998) strong program of construct validation. This would thus require re-administering the measure to a sample of athletes. Due to concerns raised about the use of high school athletes, special consideration should be made to use collegiate or elite athlete samples. At a minimum, the same theoretical models that were tested in the present study should be tested again in future research. Although the five-factor attribute model may have been somewhat supported here, it is always important to make comparisons of model fit to other theoretically supported models.

Ultimately, the hope remains that once evidence is provided for structural consistency, external consistency evidence (Benson's (1998) third stage) can then be sought. This could involve the examination of relationships between the scores on the MTSQ and other external variables theoretically related to mental toughness, as well as the examination of predicted group differences on MTSQ scores. It is important to note that fulfilling the strong program of construct validation, as laid out by Benson (1998), is contingent upon addressing all three of these stages, as each one supplements the next. Upon completion of Benson's (1998) program, future research could use the MTSQ to

further understand the development of mental toughness in athletes, the potential for changing one's level of mental toughness or mental toughness profile, the factors that influence mental toughness, the relationship of mental toughness and performance in sport, the effectiveness of mental toughness interventions, or to investigate the behaviors associated with mental toughness.

Conclusion

The present study investigated the structure of the MTSQ-32 in an effort to provide evidence towards construct validity of the scale. Although none of the 32-item hypothesized models provided acceptable fit for the data, once item 25 was removed, the fit of the five-factor attribute model was adequate. However encouraging this may be, there is still work that is required before this model of mental toughness is championed.

Appendix A

Mental Toughness in Sport Questionnaire-32

Directions: Below are a set of statements that describe the mental toughness of athletes in their sport. Please read each statement carefully and then circle the number next to each statement that most accurately reflects your thoughts and feelings about yourself in your **MAIN SPORT**. There are no right or wrong answers. Do not spend too much time on any one statement.

Statement	Strongly Disagree	Disagree	Moderately Disagree	Neutral	Moderately Agree	Agree	Strongly Agree
1. I expect to consistently outperform my opponents because I possess unique abilities that allow me to be better than them.	1	2	3	4	5	6	7
2. If I do not perform well during a competition, I am able to still feel good about myself as a person.	1	2	3	4	5	6	7
3. I am able to always remain disciplined in the pursuit of my competitive goals.	1	2	3	4	5	6	7
4. Although life's distractions may come my way, my mind is fully fixed on my sport when I compete.	1	2	3	4	5	6	7
5. Due to my strong desire to perform well, I often feel an overpowering amount of pressure being placed upon me to succeed.	1	2	3	4	5	6	7
6. I believe in my ability to achieve my competition goals.	1	2	3	4	5	6	7
7. After making a mistake during competition, I quickly forget about the error and mentally let it go.	1	2	3	4	5	6	7
8. I deeply value and appreciate the fact that performing my best requires great effort and mental preparation on my part.	1	2	3	4	5	6	7
9. During competition my mind wanders at times and interferes with my performance.	1	2	3	4	5	6	7
10. The pressure I feel to meet the expectations of others, such as my coaches or parents or fans, is overwhelming at times.	1	2	3	4	5	6	7
11. I expect myself to thrive on the pressure of competition.	1	2	3	4	5	6	7
12. When faced with adversity during competition I remain calm and do not over think about executing my skills.	1	2	3	4	5	6	7

13. I possess a determined, “go the extra mile” work ethic that allows me to achieve my goals when I compete.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14. I am able to block out personal problems and prevent them from interfering with my performance.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
15. I use negative feelings, such as anger or fear, that I experience during competition to improve my performance.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16. I am capable of being one of the very best athletes at my level in my sport.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
17. When I am feeling overly anxious during a competition, I am able to relax my mind and body.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18. When faced with a physically-demanding competitive situation, I perceive it as a challenge and persevere as a result.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19. When I compete, my thoughts are focused on what is happening in the present moment.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
20. At demanding or painful times in a competition, I usually feel negative emotions, such as pessimism or frustration.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
21. I possess a firm, unshakable belief that I will be victorious when I compete.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
22. I am able to stay mentally and physically relaxed when faced with adversity during competition.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
23. When I compete I never give up due to my determination to be the best I can be.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
24. I expect myself to remain focused on the right thing at the right time during competition.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
25. I control negative feelings I experience during competition so that they do not interfere with my performance.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
26. I have unique strengths that set me apart from everyone else that I compete against.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
27. When I experience some failure during competition, I respond with optimism and hope.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
28. Even though I enjoy winning, I feel a sense of satisfaction when I make improvements in my game.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
29. I perform at my best regardless of whether my personal life circumstances are good or bad.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
30. Mastering a difficult, competitive challenge is critical for my success as it increases my enjoyment and interest in what I am doing.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
31. When I compete, I often feel overly tense or worried regarding how I will perform.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

32. My motivation to succeed when I compete comes primarily from external sources, such as awards, recognition, and praise.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

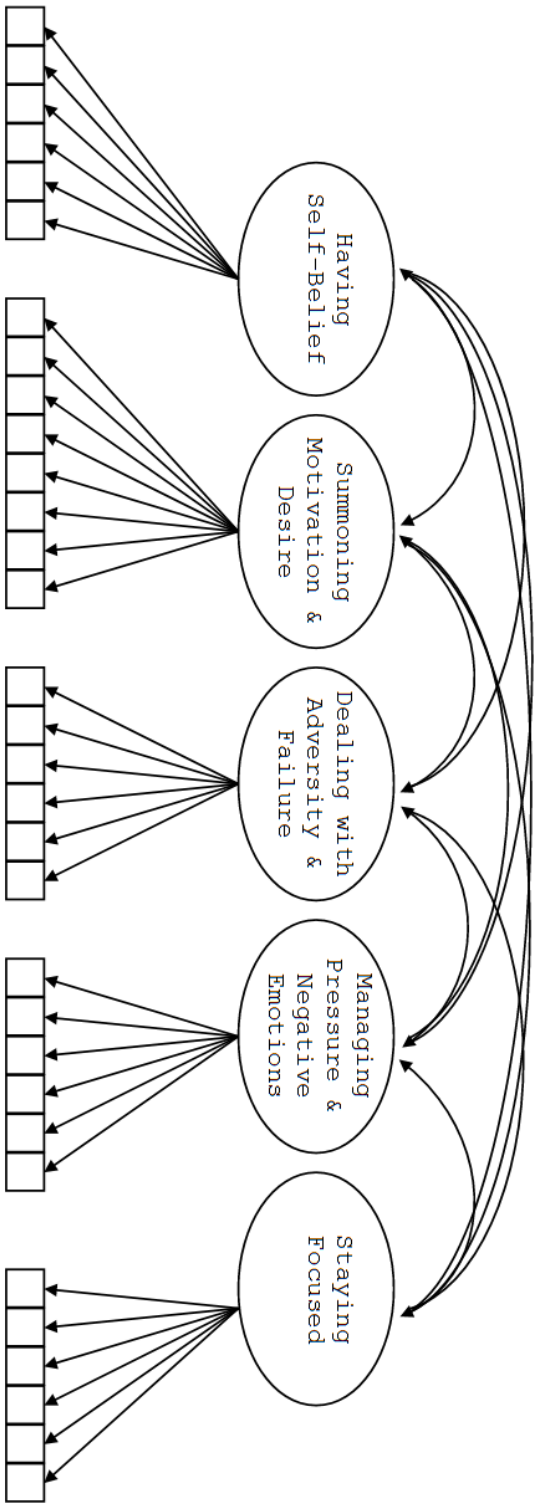

Figure 1. Five-factor attribute model

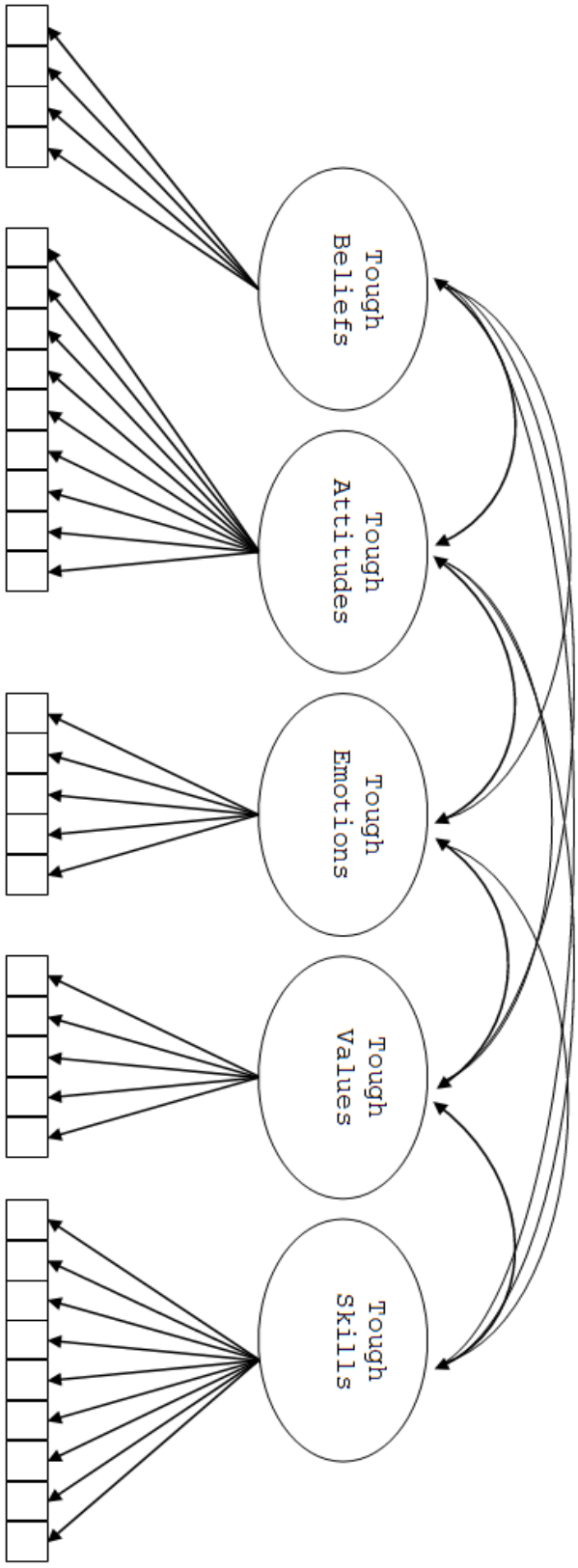

Figure 2. Five-factor CAPS model

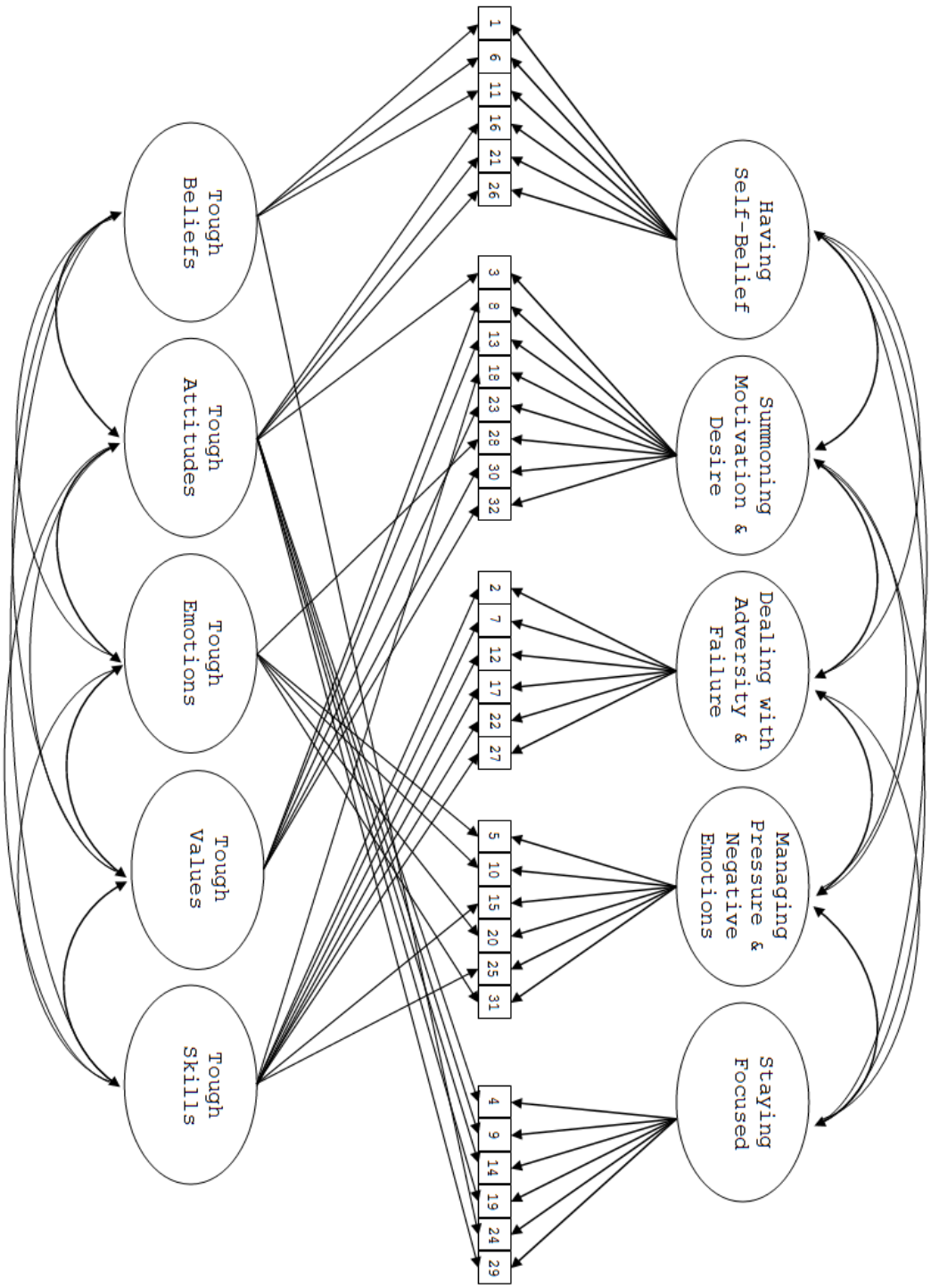

Figure 3. Ten-factor model

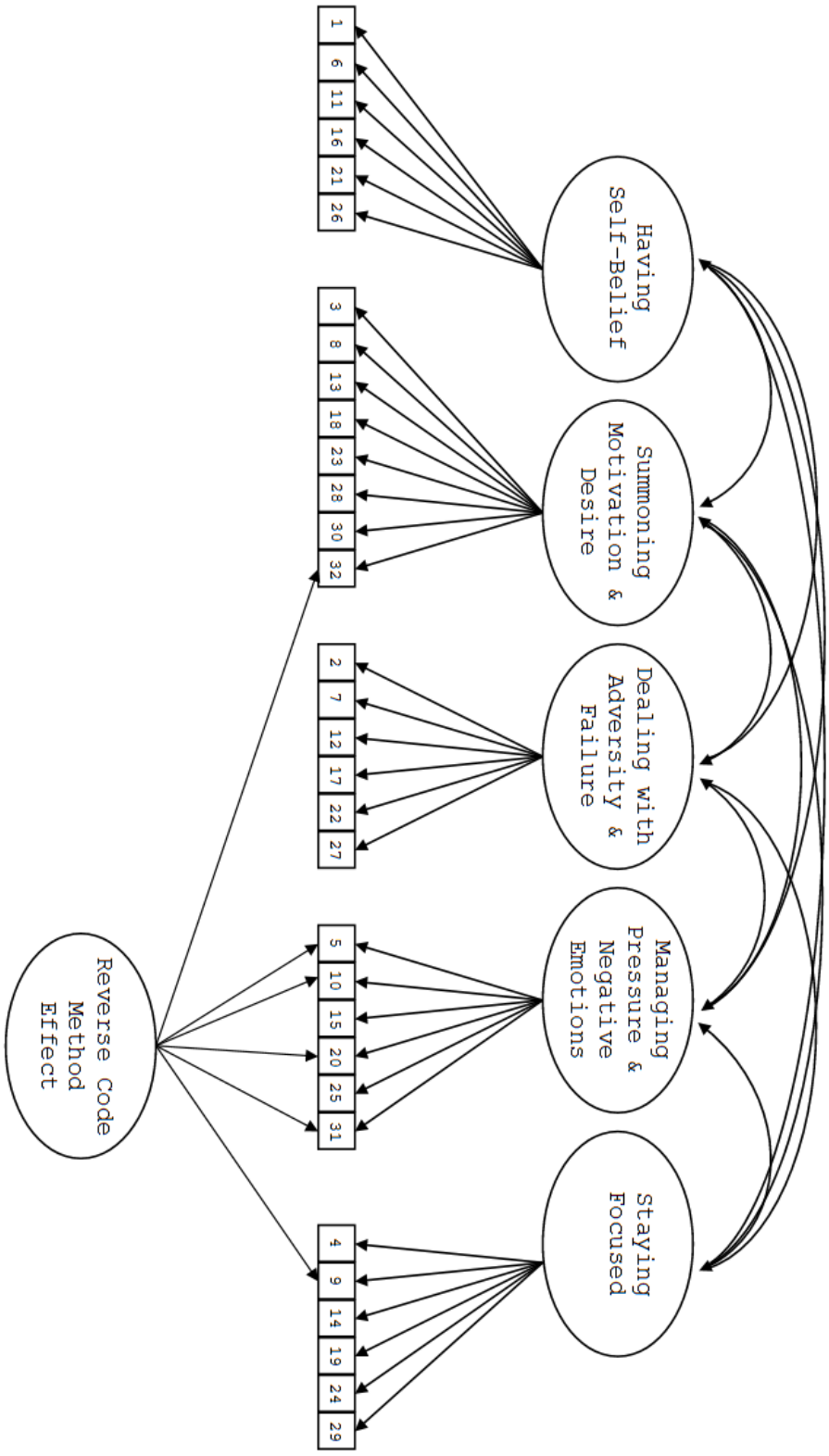

Figure 4. Five-factor attribute model with reverse code method effect

Table 1

Observed Correlations and Descriptive Statistics for the MTSQ-32 Items

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	1.00																															
2	-0.02	1.00																														
3	0.12	0.24	1.00																													
4	0.22	0.12	0.44	1.00																												
5	0.23	-0.14	0.15	0.21	1.00																											
6	0.22	0.10	0.35	0.47	0.16	1.00																										
7	0.11	0.35	0.29	0.24	-0.13	0.24	1.00																									
8	0.12	0.02	0.47	0.43	0.18	0.44	0.23	1.00																								
9	-0.04	0.13	-0.18	-0.32	0.11	-0.22	-0.07	-0.23	1.00																							
10	0.15	-0.17	-0.04	-0.05	0.52	-0.09	-0.13	0.03	0.32	1.00																						
11	0.30	0.01	0.31	0.38	0.15	0.37	0.16	0.34	-0.18	0.02	1.00																					
12	0.28	0.06	0.29	0.31	0.06	0.28	0.31	0.22	-0.15	-0.06	0.42	1.00																				
13	0.21	0.12	0.46	0.40	0.14	0.38	0.18	0.47	-0.22	0.01	0.37	0.31	1.00																			
14	0.17	0.13	0.35	0.48	0.02	0.31	0.23	0.25	-0.28	-0.13	0.26	0.36	0.38	1.00																		
15	0.13	-0.05	0.02	0.05	0.21	0.00	0.01	0.05	0.10	0.17	0.15	0.10	-0.03	0.01	1.00																	
16	0.37	0.02	0.22	0.31	0.20	0.39	0.13	0.19	-0.07	0.00	0.34	0.25	0.31	0.22	0.00	1.00																
17	0.25	0.20	0.31	0.40	-0.01	0.33	0.36	0.24	-0.16	-0.17	0.36	0.51	0.31	0.43	0.07	0.32	1.00															
18	0.28	0.06	0.38	0.39	0.24	0.38	0.18	0.38	-0.17	0.01	0.48	0.39	0.46	0.38	0.09	0.43	0.43	1.00														
19	0.24	0.03	0.38	0.49	0.11	0.38	0.18	0.38	-0.34	-0.04	0.34	0.36	0.40	0.46	0.07	0.29	0.37	0.50	1.00													
20	0.02	-0.10	-0.12	-0.10	0.19	-0.07	-0.11	-0.03	0.32	0.31	-0.02	-0.06	-0.11	-0.15	0.25	0.00	-0.10	-0.09	-0.12	1.00												
21	0.38	0.10	0.26	0.37	0.12	0.40	0.26	0.24	-0.10	0.02	0.42	0.39	0.35	0.27	0.19	0.30	0.42	0.38	0.30	0.04	1.00											
22	0.24	0.17	0.34	0.38	-0.05	0.35	0.38	0.31	-0.23	-0.13	0.37	0.46	0.33	0.40	0.02	0.28	0.56	0.41	0.44	-0.18	0.41	1.00										
23	0.19	0.07	0.42	0.51	0.15	0.38	0.24	0.44	-0.23	-0.03	0.40	0.36	0.49	0.45	0.03	0.28	0.45	0.47	0.48	-0.11	0.37	0.52	1.00									
24	0.24	0.07	0.38	0.49	0.17	0.42	0.22	0.39	-0.26	0.00	0.36	0.37	0.34	0.39	0.02	0.31	0.44	0.46	0.54	-0.10	0.34	0.43	0.57	1.00								
25	0.15	0.19	0.31	0.32	-0.03	0.26	0.40	0.27	-0.18	-0.12	0.21	0.36	0.30	0.37	-0.01	0.20	0.46	0.37	0.37	-0.15	0.30	0.45	0.40	0.37	1.00							
26	0.38	0.06	0.27	0.35	0.19	0.41	0.17	0.27	-0.03	0.05	0.30	0.29	0.41	0.19	0.06	0.57	0.30	0.40	0.33	0.00	0.35	0.34	0.36	0.39	0.25	1.00						
27	0.14	0.33	0.29	0.30	-0.11	0.28	0.46	0.26	-0.05	-0.14	0.23	0.29	0.23	0.29	0.02	0.14	0.36	0.18	0.28	-0.18	0.30	0.43	0.29	0.28	0.41	0.30	1.00					
28	0.03	0.20	0.29	0.29	0.06	0.30	0.12	0.43	-0.09	-0.03	0.19	0.15	0.34	0.16	-0.01	0.18	0.19	0.25	0.28	-0.03	0.14	0.24	0.27	0.38	0.18	0.34	0.29	1.00				
29	0.15	0.17	0.33	0.45	-0.01	0.34	0.27	0.26	-0.27	-0.13	0.29	0.29	0.36	0.49	0.02	0.26	0.42	0.33	0.47	-0.15	0.29	0.44	0.42	0.47	0.40	0.32	0.33	0.30	1.00			
30	0.15	0.06	0.33	0.36	0.18	0.32	0.06	0.42	-0.15	0.02	0.35	0.26	0.40	0.24	0.07	0.31	0.24	0.38	0.39	0.00	0.22	0.26	0.35	0.39	0.23	0.34	0.17	0.49	0.34	1.00		
31	0.04	-0.13	-0.06	-0.07	0.36	-0.14	-0.25	-0.04	0.31	0.45	-0.08	-0.09	-0.02	-0.16	0.24	-0.06	-0.25	-0.01	-0.08	0.36	-0.03	-0.27	-0.10	-0.09	-0.11	0.03	-0.18	0.05	-0.08	0.06	1.00	
32	0.16	0.07	-0.04	0.01	0.18	0.00	0.08	-0.05	0.24	0.20	0.05	-0.03	0.01	-0.03	0.09	0.14	0.02	0.01	-0.04	0.18	0.16	-0.01	-0.03	0.01	-0.02	0.03	0.12	0.05	0.00	0.03	0.26	1.00
Mean	4.60	4.18	5.40	5.46	5.11	5.81	4.46	5.89	3.44	4.50	5.35	4.88	5.39	5.06	4.45	5.23	4.69	5.29	5.53	4.07	4.78	4.86	5.43	5.63	4.83	5.21	4.71	5.72	5.15	5.52	4.39	4.32
SD	1.58	1.80	1.26	1.49	1.51	1.20	1.69	1.13	1.70	1.70	1.35	1.46	1.33	1.53	1.80	1.47	1.40	1.23	1.24	1.63	1.52	1.42	1.36	1.17	1.47	1.37	1.48	1.24	1.45	1.21	1.65	1.69
Skewness	-0.33	-0.12	-0.60	-0.91	-0.64	-1.07	-0.28	-0.96	0.17	-0.35	-0.62	-0.44	-0.71	-0.52	-0.34	-0.58	-0.32	-0.58	-0.62	-0.16	-0.45	-0.46	-0.60	-0.67	-0.44	-0.53	-0.38	-0.93	-0.43	-0.52	-0.26	-0.25
Kurtosis	-0.41	-1.06	-0.01	0.35	-0.15	0.99	-0.76	0.61	-1.00	-0.69	0.01	-0.17	0.34	-0.39	-0.80	-0.13	-0.17	0.43	-0.18	-0.71	-0.33	-0.19	-0.14	-0.03	-0.34	0.07	-0.22	0.58	-0.57	-0.08	-0.65	-0.70

Note. $N = 536$.

Table 2

Observed Correlations MTSQ-32 Items Grouped by Attribute

Attribute	Having Self-Belief						Summoning Motivation & Desire								Dealing with Adversity & Failure						Managing Pressure & Neg. Emotions						Staying Focused					
Item	1	6	11	16	21	26	3	8	13	18	23	28	30	32	2	7	12	17	22	27	5	10	15	20	25	31	4	9	14	19	24	29
1	1.00																															
6	0.22	1.00																														
11	0.30	0.37	1.00																													
16	0.37	0.39	0.34	1.00																												
21	0.38	0.40	0.42	0.30	1.00																											
26	0.38	0.41	0.30	0.57	0.35	1.00																										
3	0.12	0.35	0.31	0.22	0.26	0.27	1.00																									
8	0.12	0.44	0.34	0.19	0.24	0.27	0.47	1.00																								
13	0.21	0.38	0.37	0.31	0.35	0.41	0.46	0.47	1.00																							
18	0.28	0.38	0.48	0.43	0.38	0.40	0.38	0.38	0.46	1.00																						
23	0.19	0.38	0.40	0.28	0.37	0.36	0.42	0.44	0.49	0.47	1.00																					
28	0.03	0.30	0.19	0.18	0.14	0.34	0.29	0.43	0.34	0.25	0.27	1.00																				
30	0.15	0.32	0.35	0.31	0.22	0.34	0.33	0.42	0.40	0.38	0.35	0.49	1.00																			
32	0.16	0.00	0.05	0.14	0.16	0.03	-0.04	-0.05	0.01	0.01	-0.03	0.05	0.03	1.00																		
2	-0.02	0.10	0.01	0.02	0.10	0.06	0.24	0.02	0.12	0.06	0.07	0.20	0.06	0.07	1.00																	
7	0.11	0.24	0.16	0.13	0.26	0.17	0.29	0.23	0.18	0.18	0.24	0.12	0.06	0.08	0.35	1.00																
12	0.28	0.28	0.42	0.25	0.39	0.29	0.29	0.22	0.31	0.39	0.36	0.15	0.26	-0.03	0.06	0.31	1.00															
17	0.25	0.33	0.36	0.32	0.42	0.30	0.31	0.24	0.31	0.43	0.45	0.19	0.24	0.02	0.20	0.36	0.51	1.00														
22	0.24	0.35	0.37	0.28	0.41	0.34	0.34	0.31	0.33	0.41	0.52	0.24	0.26	-0.01	0.17	0.38	0.46	0.56	1.00													
27	0.14	0.28	0.23	0.14	0.30	0.30	0.29	0.26	0.23	0.18	0.29	0.29	0.17	0.12	0.33	0.46	0.29	0.36	0.43	1.00												
5	0.23	0.16	0.15	0.20	0.12	0.19	0.15	0.18	0.14	0.24	0.15	0.06	0.18	0.18	-0.14	-0.13	0.06	-0.01	-0.05	-0.11	1.00											
10	0.15	-0.09	0.02	0.00	0.02	0.05	-0.04	0.03	0.01	0.01	-0.03	-0.03	0.02	0.20	-0.17	-0.13	-0.06	-0.17	-0.13	-0.14	0.52	1.00										
15	0.13	0.00	0.15	0.00	0.19	0.06	0.02	0.05	-0.03	0.09	0.03	-0.01	0.07	0.09	-0.05	0.01	0.10	0.07	0.02	0.02	0.21	0.17	1.00									
20	0.02	-0.07	-0.02	0.00	0.04	0.00	-0.12	-0.03	-0.11	-0.09	-0.11	-0.03	0.00	0.18	-0.10	-0.11	-0.06	-0.10	-0.18	-0.18	0.19	0.31	0.25	1.00								
25	0.15	0.26	0.21	0.20	0.30	0.25	0.31	0.27	0.30	0.37	0.40	0.18	0.23	-0.02	0.19	0.40	0.36	0.46	0.45	0.41	-0.03	-0.12	-0.01	-0.15	1.00							
31	0.04	-0.14	-0.08	-0.06	-0.03	0.03	-0.06	-0.04	-0.02	-0.01	-0.10	0.05	0.06	0.26	-0.13	-0.25	-0.09	-0.25	-0.27	-0.18	0.36	0.45	0.24	0.36	-0.11	1.00						
4	0.22	0.47	0.38	0.31	0.37	0.35	0.44	0.43	0.40	0.39	0.51	0.29	0.36	0.01	0.12	0.24	0.31	0.40	0.38	0.30	0.21	-0.05	0.05	-0.10	0.32	-0.07	1.00					
9	-0.04	-0.22	-0.18	-0.07	-0.10	-0.03	-0.18	-0.23	-0.22	-0.17	-0.23	-0.09	-0.15	0.24	0.13	-0.07	-0.15	-0.16	-0.23	-0.05	0.11	0.32	0.10	0.32	-0.18	0.31	-0.32	1.00				
14	0.17	0.31	0.26	0.22	0.27	0.19	0.35	0.25	0.38	0.38	0.45	0.16	0.24	-0.03	0.13	0.23	0.36	0.43	0.40	0.29	0.02	-0.13	0.01	-0.15	0.37	-0.16	0.48	-0.28	1.00			
19	0.24	0.38	0.34	0.29	0.30	0.33	0.38	0.38	0.40	0.50	0.48	0.28	0.39	-0.04	0.03	0.18	0.36	0.37	0.44	0.28	0.11	-0.04	0.07	-0.12	0.37	-0.08	0.49	-0.34	0.46	1.00		
24	0.24	0.42	0.36	0.31	0.34	0.39	0.38	0.39	0.34	0.46	0.57	0.38	0.39	0.01	0.07	0.22	0.37	0.44	0.43	0.28	0.17	0.00	0.02	-0.10	0.37	-0.09	0.49	-0.26	0.39	0.54	1.00	
29	0.15	0.34	0.29	0.26	0.29	0.32	0.33	0.26	0.36	0.33	0.42	0.30	0.34	0.00	0.17	0.27	0.29	0.42	0.44	0.33	-0.01	-0.13	0.02	-0.15	0.40	-0.08	0.45	-0.27	0.49	0.47	0.47	1.00

Note. $N = 536$.

Table 3
Comparison of Exact, Approximate, and Local Fit Across Models

Model	χ^2_{SB}	*df*	*p*-value	RMSEA	SRMR	CFI	# Std. Residuals > |3|	# Corr. Residuals > |.15|	Largest Std. Residual	Largest Corr. Residual
1-factor	1953.62	464	<0.001	0.09	0.09	0.87	95(19%)	44(9%)	10.83	0.54
1-factor + method effect	1538.59	458	<0.001	0.08	0.07	0.91	80(16%)	30(6%)	7.97	0.30
5-factor attribute	1452.63	454	<0.001	0.07	0.10	0.94	100(20%)	57(12%)	8.70	0.41
5-factor attribute (#25 removed)	1249.20	424	<0.001	0.06	0.08	0.94	77(17%)	31(7%)	-7.51	0.31

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