DOCTORAL THESIS

The construct of mental toughness: The development and validation of a new conceptualisation and measure

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The construct of mental toughness:

The development and validation of a new conceptualisation and measure

by

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Dedication

To my parents, to my family, to my friends,

without whom none of this would have been possible

Declaration

I declare that the thesis I have submitted has not previously been submitted for another award and this is my own work.

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Abstract

This thesis examined issues pertaining to the conceptualisation of mental toughness in sport and its measurement through four central studies. Study 1 systematically identified and examined the mental toughness literature and revealed knowledge appeared limited in that popular definitions were predominantly outcome focused, characteristics were largely descriptive, and currently no psychometrically sound objective measure of mental toughness was available. Given the lack of published evidence supporting the psychometric properties of the most widely used, yet unsubstantiated measure of mental toughness, an examination of the factorial validity of the MTQ48 was advocated. As a result, Study 2 evaluated the psychometric properties of the MTQ48 using a construct validity approach. Overall results could not provide support for the hypothesised factor structures of the MTQ48, supporting concerns over the psychometric reliability and validity of the measure. In pursuit of a new definition and conceptualisation of mental toughness, a meta-interpretation approach was adopted in Study 3 designed to systematically analyse and synthesize the current mental toughness literature. A new definition of mental toughness was presented alongside eight conceptually distinct components of mental toughness. In an attempt to move beyond description towards a more theoretical conceptualisation, a multidimensional model of mental toughness was also proposed that reflected the complexity of the concept. In order to operationalise the new conceptualisation, Study 4 developed a new measure of mental toughness – the Sport Mental Toughness Profiler (SMTP). Specifically, two qualitative approaches and two quantitative approaches involving within-network and between-network examinations were conducted. Separate sample CFA's confirmed the factor structure with further support provided by convergent and divergent examinations alongside follow-up internal-reliability analysis, test-retest and multisource ratings. The influence of age, gender, sport-type (individual vs team) and playing level (elite vs sub-elite) on mental toughness was also examined. Whilst replication and extension was advocated, the results of this study served to provide preliminary support for the SMTP as a valid measure of mental toughness for use within a sport context across levels of competition. The thesis concludes with a summary of key findings, an overview of current findings to align the thesis with contemporary research, an overview of the strengths and limitations of the thesis, and a discussion of the implications for theory, practice and future research.

Chapter I

Introduction

Introduction

What separates those who thrive on competition from those who disintegrate under pressure? Why is it that some are able to succeed in the face of adversity while others cannot? What is it that enables some to rebound after defeat, setbacks or personal failure? The answers to these questions have proved much sought after in a world where we seemingly place increased importance on, and have become increasingly obsessed with, the notion of success and the desire and drive to excel. Sport, be it at the recreational or through to the elite level, is no exception and with it athletes, coaches and applied sport psychology practitioners alike acknowledge that winning goes far beyond just technique and physical prowess.

The field of sport has the potential to be a very stressful environment in which to operate and the pursuit and attainment of success or excellence in the face of competition, does not come without its pressures, challenges and adversities. Not only is the pursuit of success arduous, but when reaching or performing in ones defining moment (e.g., a major cup final or last round performance), an individual needs to be able to perform to the best of his/her abilities despite the added demands of the situation. For some nevertheless, this is not always possible or achieved.

That being said, if one can accept that pressure, stress and adversity are unavoidable factors in competition and the pursuit of achievement, coupled with the understanding that success requires adversities as much as it requires triumph over adversity, then it could be argued that it is the varying capacity for one to endure such obstacles that separates the victor or champion from the rest. The phenomenon of *mental toughness* is one that has attracted much attention in academic as well as applied domains and may play an important role in determining ones endeavours for competitive success and/or pursuit of excellence. The reason for this notion is because the characteristics regularly assumed to underpin mental toughness have been associated with resistance against pressure and stress, strength and resilience in the face of adversity, and most importantly, increased performance.

The central purpose of this thesis was to examine issues pertaining to the conceptualisation of mental toughness in sport and its measurement. The specific aims of the thesis were fourfold. Firstly, to provide a summary of the previous findings and advances in the

research area of mental toughness up to the start of this thesis (November 2010), specifically in relation to operational definition, theoretical development frameworks, measurement methodologies and insights into practical application. Secondly, it aimed to provide insight into the psychometric properties of the Mental Toughness Questionnaire-48 (MTQ48; Clough, Earle & Sewell, 2002) in an attempt to inform the research area on the status of a currently well utilised, yet unsubstantiated mental toughness measure. A third endeavour was to develop and propose a new conceptualisation and definition of mental toughness with stronger theoretical underpinning based on the current mental toughness literature. The final aim was to use this conceptualisation to inform the development and preliminary validation, of a new sport-general measure of mental toughness – the Sport Mental Toughness Profiler. Each of the chapters within this thesis addressed a particular aspect of this research programme. Given the time frame imposed on the first investigation in order to allow the research programme to proceed, a follow-up summary of recent advances (December 2010 – January 2014) is also provided in the Discussion (Chapter VI) to align the current findings from this thesis with contemporary research.

Aligned with the central purpose of this thesis, the aim of this chapter is to provide a critical overview of the literature examining the conceptualisation and measurement of mental toughness and outline the direction of this programme of research. The chapter begins with a brief overview of current literature on mental toughness highlighting current knowledge and understanding of the construct in relation to its definition and conceptualisation. Given that a central component of this thesis relates to the evaluation and validation of psychometric measures, an overview of current issues in construct development, measurement and validation in relation to the field of mental toughness is then presented. A summary and recommendations for future research are then provided, after which the chapter concludes by setting out the aims of the current programme of research and outlines the overarching structure of the thesis. The chapter is organised into four sections: (a) conceptualisation of mental toughness, (b) measurement of mental toughness, (c) overall summary and recommendations for future research; and (d) design and structure of the thesis.

Conceptualisation of mental toughness

The term 'mental toughness' is possibly one of the most used and yet least understood in the domain of sport. Its frequent use by athletes, coaches, the media and sport psychologists alike clearly indicates the importance attached to the concept, possibly because of its potential relationship with successful performance (Crust, 2007). Despite its recognition, uncertainty still surrounds the exact definition of mental toughness and its conceptualisation.

Despite the coaching and scientific communities widely acknowledging the importance of mental toughness for achieving performance excellence, overcoming setbacks and bouncing back from adversity, only since the turn of the millennium have researchers allocated empirical attention to this attractive and yet often elusive phenomenon. The first academic reference to the concept of mental toughness was by Cattell, Blewett and Beloff (1955) who suggested 'tough-mindedness' was a culturally or environmentally determined personality trait seen as fundamental for success. Purported to being one of sixteen primary source traits that described personality, Cattell (1957) viewed tough-minded individuals as self-reliant, realistic and responsible, and contrasted this with emotional sensitivity. This position was supported by suggestions that "the athlete who is mentally tough is somewhat insensitive to the feelings and problems of others" (Tutko & Richards, 1971, p. 46), and that "being able to handle pressure off the field can help you be mentally tough on it" (Tapp, 1991, p.45). Whilst others supported the notion that mental toughness was a personality trait (Kroll, 1967, Werner & Gottheil, 1966), others have challenged this (Dennis 1978), with some purporting that the construct is simply a state of mind (Gibson, 1998) or even just a set of psychological characteristics (Bull, Albinson & Shambrook, 1996).

Alderman (1974) suggested that successful athletes were not only physically tough, but mentally tough as well, and that mental toughness was one of the most important psychological qualities that coaches looked for in their players and athletes (Watts, 1978). Luszki (1982) proposed that mental toughness was one of four fundamental principles (physical well-being, skill, experience and mental toughness) necessary for success at the highest level of competition, and that mental toughness was responsible for the acquisition of the other three. Equally, Tunney (1987) identified self-discipline, self-sacrifice, mental toughness and teamwork as being crucial for success in teams. The extensive work of Loehr (1982, 1986, 1995) advocated that mental

toughness is what separates the few who achieve ultimate success from the thousands who do not, and proposed that mentally tough performers are so, because they consistently respond to problems, pressure, making mistakes and competition with the right attitude. According to Loehr (1986), mentally tough performers are disciplined thinkers who respond to pressure in ways which enables them to remain feeling relaxed, calm and energised simply because of an ability to sustain positive energy flow despite adversity.

Just as mental toughness has been associated with competitive success, a lack of mental toughness has been associated with competitive failure and poor performance under pressure, and a lack of ability to cope with challenge and adversity (Pankey, 1993). Williams (1998) highlighted fear and insecurity as being pivotal to performance failure and offered the notion that mentally weaker players are more readily attributed to these factors of losing. Conversely, Goldberg (1998) associated non-mentally tough performers with a lack of control compared to their mentally tough counterparts, and Pankey (1993) identified the less mentally tough as those who react to stressors in a disorganised fashion which in turn results in ineffective coping, helplessness and even depression. Collectively, whilst these views presented are a series of anecdotal and experientially based opinions, not the results of empirical investigations and research programs, the consistent themes only reinforce the associations held between the characteristics of being mentally tough with enhanced performance and future success.

Despite the intuitively appealing nature of the early perspectives of mental toughness, the conceptual strength and validity of these definitions and conceptualisations appear somewhat limited as they are founded solely on anecdotal evidence, personal beliefs and experiences of the authors, as opposed to being grounded in empirical research (Connaughton & Hanton, 2009). This has led to much confusion and conceptual contradiction surrounding the exact composition of mental toughness and its definition. Despite the existence of a number of recurring themes surrounding the early mental toughness literature (e.g., this ability to cope with adversity, rebounding from setbacks and thriving on pressure), the plethora of definitions and the vast array of attitudes, behaviours, personal characteristics and skills that have been associated with mental toughness have done little to uncover a more scientific definition and conceptualisation of the construct.

At the turn of the new millennium, a significant move away from applied texts and experienced based references emerged, with the more scientific methodologies being undertaken contributing greatly to the conceptual evolution of the mental toughness phenomenon. Overall, several definitions and various attributes of mental toughness have been found by a number of independent groups of researchers. Much of these studies have derived from qualitative investigations exploring the perceptions of mental toughness of various key stakeholders (e.g., athletes, coaches, sport psychologists). These definitions have been shown to vary across sports with a plethora of attributes identified from both sport-general (i.e., sample participants from a variety of sports) and sport-specific investigations (i.e., sample participants from one sport; e.g., cricket).

Despite the advances in scientific enquiry into the phenomenon of mental toughness, differences of opinion still exist on the precise definition and composition of its key constituents. The first to offer a conceptualisation and definition of mental toughness in sport was Jones, Hanton and Connaughton (2002). Based on the insight from 10 elite international athletes, they defined mental toughness as:

> *"having the natural or developed psychological edge that enables you to: 1) Generally, cope better than your opponents with the many demands (competition, training, lifestyle) that sport places on a performer; and 2) Specifically, be more consistent and better than your opponents in remaining determined, focused, confident and in control under pressure"* (p.209).

As a result of an inductive thematic content analysis, twelve key attributes of mental toughness (see Table 1.1) were also identified. These related to performance and lifestyle-related focus, self-belief, desire and motivation and how a mentally tough performer deals with the pressure (external), anxiety (internal) and the hardship associated with top level performance (i.e., physical and emotional pain). Subsequently, participants were asked to rank these in order of importance (see Table. 1.1).

Table 1.1 *Jones et al.'s (2002) Mental toughness attributes and importance ranking*

Rank	*Attribute*
1	Having an unshakable self-belief in your ability to achieve your competition goals
2	Bouncing back from performance setbacks as a result of increased determination to succeed
3	Having an unshakable self-belief that you possess unique qualities and abilities
=4	Having an insatiable desire and internalised motives to succeed
=4	Remaining fully-focused on the task at hand in the face of competition specific distractions
6	Regaining psychological control following unexpected, uncontrollable events (competition-specific)
7	Pushing back the boundaries of physical and emotional pain, while still maintaining technique and effort under distress (in training and competition)
8	Accepting that competition anxiety is inevitable and knowing that you can cope with it
=9	Thriving on the pressure of competition
=9	Not being adversely affected by others' good and bad performances
11	Remaining fully-focused in the face of personal life distractions
12	Switching a sport focus on and off as required

Support for the proposed definition was later offered by Bull, Shambrook, James and Brooks (2005) with a sample of elite English cricketers and by Thelwell, Weston and Greenlees (2005) with a sample of male professional soccer players, all with international experience. Regarding the latter study, when asked to compare their soccer-specific definition and understanding of mental toughness with that proposed by Jones et al. (2002), minor differences were identified. The soccer sample viewed mental toughness as enabling players to "*always"* cope better than their opponents rather than "*generally"* cope better, likewise they identified only ten attributes as opposed to Jones et al.'s (2002) twelve. Adopting similar investigative techniques, Jones, Hanton and Connaughton (2007) conducted a follow-up study using a sample of super-elite sports performers (i.e., Olympic/World Champions) to expand the mental toughness knowledge base, and broadened the scope by including the perceptions of coaches and sport psychologists who had coached and consulted at that level. Results verified their earlier definition of mental toughness, and in doing so, also extended the list of attributes considered essential to the make-up of mental toughness to 30. These were subsequently categorised into 13 sub-components of mental toughness, which were then organised into a framework of mental toughness comprising four dimensions; a general *Attitude/mindset* dimension, and three time-specific dimensions, *Training*, *Competition*, and *Post-competition* (see Figure 1.1).

The construction of Jones et al.'s (2007) framework represented a significant development in the area of mental toughness as it offered a number of practical implications for coaches, athletes and researchers alike. Specifically, the framework provided a clear description of what this multifaceted construct is, it offered insight into what settings these attributes, skills and strategies are necessary for, as well as possessed the potential to uncover how and under what conditions each specific component of mental toughness can be developed. Nevertheless, it is yet unclear as to which order these components are developed, that is, whether performers must acquire this mentally tough attitude/mindset in order to become mentally tough in situations such as training, competition or post-competition, or whether they need to develop mental toughness in these time-specific dimensions before they can develop the mental toughness attitude/mindset. Despite this conundrum, the framework offered a valuable medium to disseminate this research area.

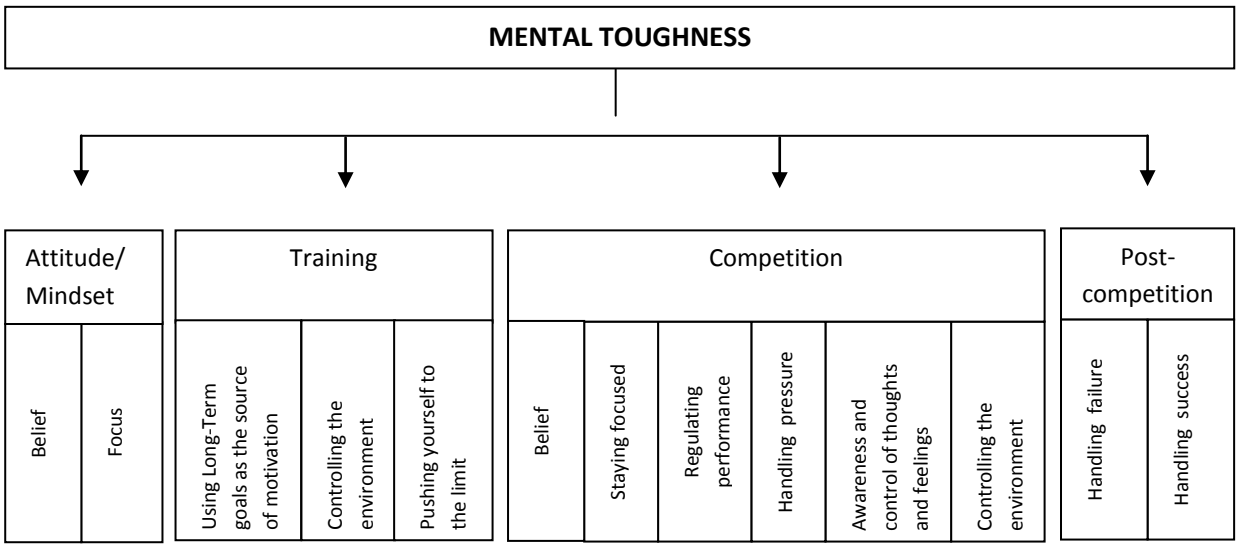

Figure 1.1 *Jones et al.'s (2007) Mental toughness framework*

Concurrently, Clough, et al. (2002) proposed a separate definition of mental toughness postulating mental toughness to be a trait-like quality that determines, in some part, how individuals perform when exposed to stressors, pressure and challenge. Clough et al., (2002) proposed the following definition;

> *"Mentally tough individuals tend to be sociable and outgoing; as they are able to remain calm and relaxed, they are competitive in many situations and have lower anxiety levels than others. With a high sense of self-belief and an unshakeable faith that they can control*

> *their own destiny, these individuals remain relatively unaffected by competition or adversity*" (p. 38).

In an attempt to bridge the gap between theoretical research and applied practice, Clough et al. (2002) proposed their 4C's conceptualisation designed to incorporate ecologically valid views and experiences of athletes and coaches with underlining theories drawn from the existing construct of hardiness (Kobasa, 1979), and one prominent study on physiological adaptation to stress (Dienstbier, 1989). Psychological hardiness (Kobasa, 1979), is conceptualised as a constellation of attitudes, beliefs and behavioural tendencies consisting of Control, Commitment and Challenge, that provides an individual with resistance to negative life experiences such as stress and anxiety (Maddi, 2006). Similarities were acknowledged in that both hardiness and mental toughness are characterised by resiliency, perseverance, effectively coping with pressure or adversity, motives to achieve success (predominantly intrinsic) and a deep sense of purpose and thus involvement in activities and personal encounters. This coupled with Fourier and Potgieter (2001) reporting hardiness to be a sub-component of mental toughness, it is understandable how Clough et al. (2002) drew such close associations between the two constructs.

In assessing the knowledge base of mental toughness, Gucciardi, Gordon and Dimmock (2009a) employed Personal Construct Psychology (PCP; Kelly, 1955/1991) as a theoretical framework to construct the following definition;

> *"Mental toughness is a collection of experientially developed and inherent sport-specific and sport-general values, attitudes, behaviours, and emotions 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. 278).

Whilst Gucciardi and colleagues did not offer a definitive perspective on the key values, attitudes, cognitions and emotions, investigations into the sport-specific components of mental toughness related to Australian rules football (Gucciardi, Gordon & Dimmock, 2008), cricket (Gucciardi & Gordon, 2009) and soccer (Coulter, Mallett & Gucciardi, 2010) highlight the emergence of a core group of key mental toughness facets that do not vary significantly by sport (e.g., self-belief, self-motive, attention control, resilience).

With consideration for this definition, two important distinctions become apparent compared to those aforementioned (Clough et al., 2002; Jones et al., 2002, Gucciardi et al., 2009a). Firstly, because this definition avoids limiting mental toughness to specific components of various characteristics and instead explicitly states that mental toughness encapsulates a combination of several different human characteristics (i.e., values, attitudes, behaviours and emotions), it is not limited to various characteristics at the expense of others. Likewise, previous definitions have defined mental toughness only in the presence of, or response to, adversity (Clough et al., 2002), whereas this definition highlights the importance of mental toughness across all situations including both positively and negatively construed pressures and challenges. Defined in such a way enables mental toughness to be conceived as a buffer to adversity, but also opens the concept to act as a protective and enabling factor that can promote or maintain adaptation to other positive situations.

Whilst the empirical and conceptual foundations of mental toughness is developing, the emergence of differing conceptualisations (Jones et al., 2007; Gucciardi et al., 2008), some between-sports (Jones et al., 2002, 2007) and some within-sports such as cricket (Bull et al., 2005; Gucciardi & Gordon, 2009), only further cloud the already murky conceptual waters. Despite advances, common limitations have been inherent, in part due to simplistic exploratory methodologies and dominant early perspectives which have been anecdotal rather than scientifically rigorous in nature (i.e., Loehr, 1892, 1985, 1995). The overriding reliance on experiential, anecdotal opinion has merely added conceptual ambiguity to the research area and has resulted in practically every positive psychological trait, characteristic and attribute associated with elite performance being at one time or another erroneously labelled as mental toughness (Jones et al., 2002). What is paramount is that researchers work to agree a common definition and conceptualisation of mental toughness and clearly define the relations between the multidimensional construct and its dimensions. In doing so, it will provide support for mental toughness as a construct and not just a collection of related variables, whilst also assisting the development of practical implications of how to operationalize the construct.

Measurement of Mental Toughness

Whilst the clarification of a theoretically sound definition and conceptualisation of mental toughness is vital, so too is the development of a psychometrically sound measure to assess mental toughness as it offers significant potential to inform the advancement of mental toughness research. Doing so would prove fruitful as it would assist in the design and implementation of experimental designs and development interventions. Researchers have attempted to assess mental toughness in athletes using various scales from a sport-general perspective, including the Mental Toughness Questionnaire (MTQ48; Clough et al., 2002), the Psychological Performance Inventory (PPI; Loehr, 1986), the Alternative-Psychological Performance Inventory (PPI-A; Golby, Sheard & van Wersch, 2007), the Sport Mental Toughness Questionnaire (SMTQ; Sheard, Golby & van Wersch, 2009) and the Mental, Emotional, and Bodily Toughness Inventory (MeBTough; Mack & Ragan, 2008), as well as a sport-specific perspective such as; the Australian football Mental Toughness Inventory (AfMTI; Gucciardi, Gordon & Dimmock, 2009b) and the Cricket Mental Toughness Inventory (CMTI; Gucciardi & Gordon, 2009). Whilst the development of measures to operationalize the different conceptualisations of mental toughness has received much attention, a recent review by Gucciardi, Mallett, Hanrahan and Gordon (2011) concluded that at present, despite those currently available, no comprehensively sound measure currently exists.

Although each of the scales offers many strengths and merits, several limitations exist relating to either their conceptual underpinning or the statistical procedures employed to develop and validate such tools or both. Whilst the development of a measure to assess mental toughness is an important avenue with significant potential to inform the advancement of mental toughness research, it is important to highlight a range of common psychometric issues inherent in their development and use. Three key psychometric issues are paramount in psychometric scale development research and should be considered in the design and implementation of this research project; conceptual and theoretical, item development, and analytical and statistical. An overview of each is now presented.

Conceptual and Theoretical issues

When assessing any psychosocial-related phenomenon, it is fundamentally important to ascertain what is being assessed and to develop intimate knowledge and understanding of how it relates to other associated constructs. As outlined by MacKenzie, Podsakoff and Podsakoff (2011), defining the conceptual domain of the construct not only relates to the identification of what the construct is, what it represents and what it captures, but also requires a discussion of what it is not, and how the construct differs from other related constructs (i.e., mental toughness from resilience and hardiness). As highlighted earlier, there has been much debate about how to best define and conceptualise mental toughness (Clough et al., 2002; Jones et al., 2002, 2007; Gucciardi et al., 2008) with concerns raised around the lack of scientific rigor used in the development of theories and the apparent lack of rationale for the use of other psychological constructs to provide a basis of mental toughness theory construction (Anderson, 2010; Connaughton & Hanton, 2009).

Whilst Loehr's (1986) operationalization of mental toughness via the PPI appears conceptually logical, the measure has received criticism for failing to provide solid evidence of construct validity. Despite being used widely as a measure of mental toughness (e.g., Golby & Sheard, 2004, 2006; Golby, Sheard & Lavallee, 2003; Kuan & Roy, 2007), no information on the conceptual underpinnings of the seven-factor model (e.g., construct definition) is available. Similarly, whilst possessing moderate psychometric qualities, the MTQ48, developed to operationalize Clough et al.'s (2002) 4C's conceptualisation of mental toughness, has received much criticism due in part to its similarity to hardiness (Crust & Clough, 2005). In addition to the three components of hardiness (Control, Commitment and Challenge), the MTQ48 includes the fourth facet of Confidence, which is said to transpose the hardiness construct into the sport domain. Although the conceptual foundation represents a key strength of the MTQ48, the lack of rationale for the theoretical basis of the conceptualisation as well as the insufficient work differentiating mental toughness from hardiness appears problematic. With no consensus on an appropriate sport-general measure of mental toughness, Mack and Ragan (2008) attempted to evolve Loehr's (1994) definition and suggested constructs of mental, emotional and bodily toughness. Despite the potential demonstrated through the psychometric procedures adhered to in the construction of the MeBTough, the lack of conceptual framework and the lack of empirical

foundation of the underpinning theory (i.e., Loehr, 1982, 1986,1995) does not support the use of the MeBTough as a sound assessment of mental toughness.

Using qualitative investigations as a foundation, Gucciardi and colleagues attempted to advance mental toughness measurement by developing empirically driven scales that could adequately capture context-specific components of mental toughness that reflected the shared knowledge within a sport's culture (Gucciardi & Gordon, 2009). The grounded theory approach to developing the theoretical foundation for the development of the measures that was adopted is a major strength of the development of the two sport-specific measures, the AfMTI and CMTI. So too is the evidence offered to support that mental toughness is conceptually related but yet distinct from other construct such as resilience, hardiness and flow (Gucciardi & Gordon, 2009; Gucciardi et al., 2009b), something which has alluded the measure aforementioned. Whilst the properties of these sport-specific measures are encouraging, there are limitations to their practical application beyond their respective Australian football and cricket contexts and as such it is apparent that there is still no psychometrically sound sport-general measure of mental toughness widely available.

Item Development Issues

Another prevalent issue in psychometric scale development relates to the development and selection of items (questions) utilised in such scales. Once the focal construct has been conceptually defined, the next step is to turn attention to the development of items that the instrument will consist of that fully represents the conceptual domain of the construct. Important issues to consider include distinguishing between different aspects of the construct while minimising the extent to which items tap into concepts outside the domain of the focal construct (MacKenzie et al, 2011). A large number of items should be created that fully represents all facets of the concept, yet researchers must pay careful attention to the quality, more specifically the wording and phraseology of the items. Items should be short, simple and unambiguous. Double-barrelled items should be split into two single-idea statements with complicated syntax simplified and made more specific and concise (DeVellis, 1991, 2003; Peterson, 2000). In addition, negatively worded items that represent low levels or the absence of the construct of interest should be included. In doing so, an inventory enables respondents to positively or negatively endorse

items and as a result reduces susceptibility to response bias and acquiescence effects (Nederhof, 1985).

It is on this level that current measures of mental toughness appear to present some significant challenges towards psychometric integrity. The lack of information supporting the conceptual underpinnings of Loehr's (1986) seven-factor model, and lack of insight into item development procedures in the construction of the PPI (e.g., expert review) or psychometric data to support its validity and reliability is concerning. Subsequent examinations have questioned the validity of the PPI model with findings from both Middleton et al. (2004) and Golby, et al. (2007) failing to support the hypothesised model. Based on the findings, Globy, et al. (2007) identified a new model comprising four factors which resulted in the construction of the PPI-A. Whilst psychometrically stronger that the original PPI, additional investigations are still needed to establish its validity.

Equally, although researchers have provided evidence for the reliability and validity of the MTQ48 (i.e., test-retest, internal consistency; Crust, 2008), evidence to support the development process is overly brief and Clough et al. (2002) do not provide any detail regarding the methodologies employed to develop the items and associated inventory (i.e., exploratory and confirmatory factor analysis techniques). Conceptual limitations also lie within the content of several items of the MTQ48. For example, the Confidence subscale contains several items with content that is inconsistent with the scale definition. Items such as "I generally feel that I am a worthwhile person" and "At times I feel completely useless" appear to be capturing aspects of self-esteem (i.e., self-evaluation or appraisal of one's own worth, Harter, 1982), not the "high sense of self belief" (Clough et al., 2002) which it is designed. With similar items appearing to be closer related to possessing an optimistic outlook presenting the same issue (Crust & Swann, 2010).

Similarly while Sheard et al. (2009) provide clear criteria for establishing the factor structure of the SMTQ, the logical validity of some of the items is questionable. For example, the item "I can regain my composure if I have momentarily lost it" appears more logically connect to the Control subscale as opposed to the Confidence scale it is designated. Furthermore, the items measuring the subscale Constancy ("an athlete's determination to meet the demands of training and competition, willingness to take responsibility for setting training and completion goals,

possession of unyielding attitude, and an ability to concentrate" Sheard, 2010, p.77) also appear to tap into a wide range of factors from concentration ("I get distracted easily and lose my concentration") to personal responsibility ("I take responsibility for setting myself challenging targets"). As a consequence it is hard to theoretically ascertain how these elements logically fit together. In this instance it appears that through exploratory factor analysis techniques, the SMTQ has combined into single scales, components that other research groups have identified as being distinct components in other models of mental toughness (Jones et al., 2002, 2007). Whilst psychometric testing and refinement is a crucial element of developing inventories, logical validity must also be a high priority (MacKenzie et al, 2011).

Analytical and Statistical Issues

Following measure construction and distribution to a sample population, it is important to consider appropriate analytical procedures and significant testing to ensure the psychometric integrity of the measure. Preceding this is the issue of sampling which has shrouded much of the literature to date. Randomly selecting participants from a general population is often considered optimal in order to infer research findings back to the general population (Thomas, Nelson & Silverman, 2005). Nevertheless, this is not appropriate for researchers looking to assess mental toughness in sport given that it would require all participants to be engaging in recreational or competitive sport. Previous literature has been divided through either focusing solely on the elite samples of professional or world's best athletes (Connaughton et al., 2008; 2010; Golby, et al., 2003; Golby & Sheard, 2004; 2006; Jones et al. 2002, 2007; Thelwell et al., 2005) or drawn heavily on student populations (Crust & Azadi, 2009, 2010; Crust & Keegan, 2010; Mack & Ragan, 2008; Middleton et al., 2004; Nicholls, Polman, Levy & Backhouse, 2008, 2009; Sheard, 2009a, 2009b; Sheard et al., 2009). Non-athlete populations have been used to assess the criterion validity of the MTQ48 in genetic studies (Horsburgh, Schermer, Veselka & Vernon, 2009) and within the domains of business (Marchant, Polman, Clough, Jackson, Levy & Nicholls, 2009) and health (Gerber et al., 2012) however these methods only further challenge the ecological validity of the scales which were intended for the use in the sport domain.

After administration and completion of inventories, the data should be inputted for statistical analysis using one of various statistical programs (i.e., EQS, LISREL, AMOS). Following

entry, the data should be screened for normal distribution by examining the symmetry of the data distribution curve (Field, 2009). Once normal distribution is ascertained, the exploration of factor structures can be undertaken using exploratory factor (or principle component) analysis, followed by clarification through confirmatory factor analysis (CFA) to assess the reliability of the pre-identified model structure. Through model structure analysis, revisions and deletions should be made to the items until an acceptable goodness of fit value is produced. There are various fit indices that can be utilised in a CFA, of which further detail is provided in Chapter III (see Table 3.1).

It is the statistical and analytical level at which the current literature is most challenging with limited evidence reported to support the psychometric integrity of various measures in circulation (i.e., PPI, MTQ48). Whilst widely used within the literature, Loehr (1986) offered no psychometric data to support its reliability and validity with subsequent examinations questioning the factorial validity of the model (Middleton et al., 2004; Golby et al., 2007; Gucciardi, 2012). In relation to the MTQ48 (Clough et al. 2002), whilst researchers have provided evidence for the reliability and validity of the measure (e.g., test-retest, internal consistency; Crust, 2008), several methodological and conceptual concerns in relation to its conceptual distinctiveness from hardiness remain. What is more, Clough et al.'s (2002) account of the psychometric development process is overly brief and does not provide sufficient detail regarding the statistical procedures employed in the development and validation of the proposed model and associated inventory (i.e., EFA, or CFA). Moreover, studies have reported the use of differing factor structures to that of the original described by Clough and colleagues, namely four (e.g., Clough et al., 2002; Veselka, et al., 2009), six (e.g., Crust & Azadi, 2009, 2010; Nicholls et al., 2008, 2009) and nine factor models (e.g., Horsburgh et al., 2009).

Despite several studies that have employed the MTQ48 having samples sizes in excess of 400 (e.g., Kaisler, Polman & Nicholls, 2009; Nicholls et al., 2008, 2009) its factor structure was not examined. The one study that undertook such measures was a genetic study by Horsburgh, et al. (2009) which offers support for the superiority of the correlated, four-factor model when compared with a uni-dimensional model. Nevertheless, they too fail to report any empirical data (i.e., fit indices, parameter estimates) to support their conclusions. As a result, caution in using the MTQ48

is urged until scientifically rigorous, psychometric evidence supporting the factorial validity of the MTQ48 is provided.

Similarly, examinations of the factorial validity of the PPI have failed to support the hypothesized model (Golby et al., 2007; Middleton et al., 2004) and whilst initial psychometric properties of the SMTQ were adequate in the development study, follow up work is required to examine the robustness of its factor structure in other independent samples. In relation to the sport-specific measures, both the AfMTI and CMTI have reported psychometric examinations using both confirmatory and exploratory factor analytical techniques. Although requiring replication and extension, the results provide preliminary support for the factor structure, internal reliability and construct validities of both measures.

Overall summary and recommendations for future research

Consistently, mental toughness is described as one of the most used and most desired characteristics for performance excellence in sport (Gould, Diffenbach & Moffett 2002), yet it remains one of the least understood in the field of Sport and Exercise Psychology (Jones et al., 2002). Discussed openly between those in sport, be it athletes, coaches, researchers and practitioners alike, there remains theoretical ambiguity due to a lack of consensus surrounding its definition and conceptualisation. Whilst there has been significant progress forward since the seminal paper by Jones et al., (2002), a number of limitations in the research area still remain. Specifically, the mental toughness literature has been riddled with conceptual inadequacies, resulting from weak theoretical conceptualisations based predominantly on personal experience and opinion, as opposed to resulting from empirical programmes of research. This has led to research promoting measures with weak psychometric properties and insufficient underlying rationale, which has only exasperated the issue. In the simplest of terms, over 10 years on from Jones et al.'s (2002) study, it is still unclear exactly what mental toughness is and therefore issues relating to its measurement are inherent. Given the recent surge in attempts to progress the research area of mental toughness in relation to conceptualisation, definition, and measurement, this thesis aims to bring this research together into a coherent, unified body of literature.

Design and structure of the thesis

Considered one of the most viable and effective ways of investigating complex social and psychological phenomenon (Brannen, 1992, Creswell, 2003), a multi-method research design was adopted for this research programme. Multi-method research involves the integration of two or more unique ways of collecting and analysing data (e.g., quantitative, qualitative, observational, psycho-physiological) and relating each method within a single research programme (Creswell, Plano Clark, Guttman & Hanson, 2003). The rationale for mixed method approaches is well supported (Brewer & Hunter, 1989; Creswell, 2003; Creswell et al., 2003; Greene, Caracelli & Graham, 1989; Newman, Ridenour, Newman & DeMarco, 2003; Punch, 2005) as it enables the researcher to compliment and elaborate on the results from one method with that of another. By combining results, this approach yields a more complete analysis and facilitates a more comprehensive interpretation and understanding of the phenomenon to emerge.

Thesis Organisation

The thesis comprises six chapters and contains four empirical studies. Following this introduction, four studies which are central to this research programme are presented, with each of the aforementioned aims addressed within individual chapters of this thesis. The purpose of the Chapter II (Study 1) is to provide a systematic review of current mental toughness literature. Specifically, this chapter aims to: provide greater clarity on the definition and conceptualisation of mental toughness, explore the current understanding of underlying developmental processes, as well as illuminate methodological issues relating to assessment, and provide future research directions to support the direction research programme. Overall the results of this study highlighted that despite the considerable volume of research into mental toughness, there is still debate regarding its definition, conceptualisation and its measurement. What is more, concerns were raised in relation to the lack of published evidence supporting the psychometric properties of the most widely used, yet unsubstantiated measure of mental toughness.

The purpose of Chapter III (Study 2) was to offer a psychometric examination of the Mental Toughness Questionniare-48. Volunteer student athletes (N = 615) were drawn across recreational to international performance levels. A construct validity (within-network) approach was conducted

to examine the latent structure of the inventory. As confirmatory factor analysis yielded a poor fit and improper solution for both the 4-factor and 6-factor *a priori* models presented in the literature (Clough et al., 2002; Nicholls et al., 2008), independent analysis of each respective scale as well as exploratory factor analysis was pursued. Overall the results of this study could not provide support to the hypothesised factor structure of the MTQ48, highlighting concerns over the psychometric reliability and validity of the measure of mental toughness.

The purpose of Chapter IV (Study 3) was to develop a new conceptualisation and definition of mental toughness with stronger theoretically underpinning based on the current mental toughness literature. Specifically, a meta-interpretation approach (Weed, 2005, 2006, 2008) was adopted to systematically analyse and synthesis the current qualitative mental toughness literature. Following progressive categorising, analysis and interpretation, a new definition of mental toughness was presented alongside a new conceptualisation encompassing eight conceptually distinct components of mental toughness. A multidimensional model of mental toughness was then proposed that reflects the complexity of the concept.

The purpose of Chapter V (Study 4) was to present the development and validation of a new general measure of mental toughness for sport undertaken within a construct validation framework. Specifically, two qualitative approaches were conducted to generate an inventory with items that represent the key mental toughness components of the new conceptual model of mental toughness, and two quantitative approaches then followed involving within-network and between-network examinations. The preliminary validation approach was conducted in five phases. Phase One involved the generation of a pool of items designed to assess mental toughness behaviours from a between-sport perspective. Phase Two presented evidence for the content validity of the items, with Phase Three explaining the construction of the Sport Mental Toughness Profiler *(*SMTP*).* Phase Four described the evaluation of the 32-item SMTP and a preliminary psychometric evaluation of the inventory using a 3-stage exploratory confirmatory factor analytical approach. Finally, Phase Five described a between-network examination exploring the relationship between the hypothesised factor structure of the proposed SMTP and other constructs hypothesised to have some logical, theoretical relationship with mental toughness. Separate sample CFA's were conducted to confirm the factor structure and follow-up internal-reliability analysis was conducted

using test-retest and multisource rating approaches. In addition, the influence of age, gender, sport-type (individual vs team) and playing level (elite vs sub-elite and amateur) on mental toughness subscale scores and psychometric integrity was also examined. Overall the results of this study provide support to the validity and reliability of the SMTP as a new psychometric measure of mental toughness.

The purpose of the sixth and final chapter was to draw together the main findings of each of the respective studies and present the implications of this programme of research. Specifically, an overview of the aims and findings of each study is presented, followed by a summary of recent advances in mental toughness research in order to align the current findings from this thesis with contemporary research. The strengths and limitations of the thesis are then discussed with the implications of the findings for theory, practice and future research shared. The thesis is then drawn to a close with an overall conclusion of the central tenets of the programme of research.

Overall aims

Overall, this thesis attempts to provide the scope to uncover a greater understanding of mental toughness with the intention of aiding athletes, coaches and practitioners alike to profit from the findings. Proposed objectives of the research include;

1) Conceptual clarity on the construct of mental toughness through the consolidation and synthesis of current literature
2) Evidence clarifying the psychometric properties of the MTQ48
3) A new theoretically driven and conceptually informed definition and conceptual model of mental toughness
4) The development of a valid and reliable measure of mental toughness
5) A preliminary understanding of the difference in mental toughness across gender, sport type and competition levels

As a result, findings arising from the thesis possess a number of implications for interventions and programmes designed to enhance mental toughness.

Chapter II

Study 1 – "What is this thing called Mental Toughness?": A systematic review of mental toughness literature in sport

Summary

In this chapter, a systematic review of mental toughness literature is presented. In previous traditional narrative literature reviews of mental toughness (Connaughton, Hanton, Jones & Wadey, 2008; Connaughton & Hanton, 2009; Crust, 2007, 2008), the authors have converged on a number of key issues believed to be significant in advancing the field but results have lacked analysis or evaluation. The purpose of the current study therefore, was to conduct a systematic review of mental toughness literature which was designed to provide a comprehensive search for relevant studies, to then consolidate findings and identify the most appropriate direction for future research. Specifically, the review aimed to provide a coherent and unified summary of mental toughness definitions, conceptualisations and characteristics that have been identified across the published literature. Current knowledge and understanding of the operational mechanisms underpinning mental toughness and its development was explored, and methods implemented to measure mental toughness were assessed. Following an overview of interventions and strategies recommended for enhancing mental toughness, the chapter concludes with a summary of future research opportunities in an attempt to encourage the pursuit of quality research in the area.

Introduction

The fascination with mental toughness began in the 1950s, with attempts made to explain the concept in a variety of ways that included mental toughness as a personality trait (Cattell et al., 1955; Werner & Gottheil, 1966), a defence mechanism against adversity (Alderman, 1974; Favret & Benzel, 1997) and a decisive factor in determining performance (Luszki, 1982; Pankey, 1993). However, despite efforts to contribute to the research area, prior to 2002, approaches have lacked scientific rigor and the conceptual underpinnings of the proposed definitions have been questionable and resulted in virtually any positive and desirable psychological characteristic that has been associated with success being labelled as mental toughness (Jones et al., 2002). The lack of empirical research has led to a multitude of definitions and conceptualisations which has only created misunderstanding and misinterpretation of mental toughness and led to increased conceptual confusion. Nevertheless, with an increasing number of athletes, coaches and sport psychologists alike, attributing outcomes in sport to mental toughness, or a lack of it, the demand

from players and coaches for interventions and strategies to developed levels of mental toughness has become prevalent (Clough & Strycharczyk, 2012).

Previously, Crust (2007, 2008), Gucciardi et al., (2009a) and several sport psychology textbooks have provided succinct narrative literature reviews on mental toughness in sport (Connaughton & Hanton, 2009). Whilst these review existing publications related to mental toughness in sport and provide implications for future research, as traditional literature reviews, they involve no evaluation and merely present a subjective tour of research that the authors see as relevant with no boundaries or predetermined quality assurance criteria. Furthermore, it is possible that some studies may have been consciously ignored to suit the scope of the review or inadvertently missed in the filtering process. What is more, since their publication, the surge in research activity has meant there are several investigations published which these do not cover (e.g., Crust & Azadi, 2009, 2010; Crust & Keegan, 2010; Crust & Swann, 2010) which warrant further discussion.

In this research programme, a systematic review was adopted in favour of the traditional literature review because it is seen as more objective, replicable, systematic and provides a comprehensive coverage of a target research area (Weed, 2005). Klassen, Jahad and Moher (1998) defined the approach as “a review in which there is a comprehensive search for relevant studies on a specific topic, and those identified are then appraised and synthesised according to a predetermined explicit method” (p. 700). The systematic review has been seen as a logical alternative to the traditional narrative literature review and is favourable given the comprehensive nature of the search to seek all relevant studies whilst the existence of pre-determined exclusion criteria reduces the likelihood of investigator bias and random error during the selection process (Evans & Chang, 2000). The primary objective of the review is to efficiently integrate volumes of information and provide data for rationale decision making. They assist the researcher to establish whether scientific findings are consistent and can be generalised across populations and settings (Mulrow, 1995).

Rarely have reviews been conducted as a primary research activity in its own right, however the systematic review procedure provides a powerful means to establish generalizability of scientific findings across populations and settings whilst also helping to identify key variances

(Mulrow, 1995). For example, whilst there are key attributes which appear to provide sport-specific information, there also seems to be several key characteristics of mental toughness that are common across all sports (i.e., self-belief, self-motivation, ability to handle pressure, resilience). It is therefore important for researchers, coaches and practitioners to have a greater understanding of the similarities and differences that exist in mental toughness across different sports and settings.

With consideration of other literature synthesis methods, the approach of a meta-analysis of the literature was not deemed appropriate. Eysenck (1995) suggests that "a meta-analysis is only properly applicable if the data summarised are homogenous" (p. 70) and only yields similar quantitative outcomes. Consequently, when there is a lack of homogeneity among theoretical conceptualisations, participant sample sizes, methods of data collection and variables measured, a non-statistical synthesis is preferred. Given the literature on mental toughness has a high level of heterogeneity in terms of study design, theoretical models, and variables, the systematic review approach (Bland, Meurer, & Maldonado, 1995) was determined to have better applicability in this case.

As a result, there were four main purposes to this systematic review of the mental toughness literature in sport:

a) To examine the evidence for both the definition and conceptualisation of mental toughness, as well as the identification of common and unique key attributes and characteristics;
b) To examine the evidence for the underlying mechanisms purported to explain the development and maintenance of mental toughness;
c) To examine the current methodologies employed and instruments developed to assess mental toughness;
d) To highlight the practical implications of the recent investigations in relation to potential intervention programmes to enhance levels of mental toughness.

Method

Procedure

The methodology used for the systematic review was based on the guidelines described by Chalmers and Haynes (1995), Lloyd Jones (2004) and Mulrow (1995). Together they stipulate the need for a specific and clear remit with a clear and transparent search strategy (i.e., databases and key words clearly outlined) to ensure the process is thorough and explicit, and could, if warranted, be replicated independently. Relevant papers are reviewed for quality and relatedness before accepted within the review process.

In this study, an exhaustive search of literature to locate all the published studies on mental toughness up to November 2010 was conducted. The search strategy used the following main sources to locate published studies of mental toughness in the sports domain: (a) electronic searches of computerised databases (SPORTDiscus, PscyhINFO, Web of Knowledge and Science Direct); (b) manual searches of citations in papers identified by the electronic searches; (c) searches of extensive personal files of key researchers in the field (N = 5), and (d) hand searching of journals (*European Journal of Sport Science*, *International Journal of Sport & Exercise Psychology*, *International Review of Sport & Exercise Psychology*, *Journal of Applied Sport Psychology*, *Journal of Sport Behavior*, *Journal of Sports Sciences*, *Journal of Sport & Exercise Psychology*, *Psychology of Sport & Exercise*, *Personality and Individual Differences*, *Perceptual and Motor Skills* and *The Sport Psychologist)*. Key words used in the electronic search were: mental toughness, mentally tough, psychologically tough, toughness and tough-mindedness. Inclusion criteria were that articles must provide quantitative or qualitative data on mental toughness and have been published as full papers in peer-reviewed journals in the English language. Unpublished articles, conference papers, dissertations, theses and studies in languages other than English were excluded. Whilst this approach represents a publication bias (Egger & Smith, 2001), given the limited amount of information provided in published abstracts of conference proceedings, it is unlikely these can be evaluated with sufficient rigour to be included in the review. In addition, it is impractical and expensive to obtain copies of unpublished documents and translate foreign written material.

As recommended by Lloyd Jones (2004) and Meade and Richardson (1997), sifting was carried out in three stages (see *Figure 2.1*). Papers were initially reviewed by title, then by abstract, and finally by full text, excluding those at each step that did not meet the inclusion criteria (Lloyd Jones, 2004). The first stage of searches returned 485 references up to the cut off period of November 2010. Three-hundred and seventy-four were removed after reading their title during the first phase of sifting. The abstracts of articles were then read and 65 references were excluded at the second stage of sifting. No further exclusions were made following screening of the papers and as a result, 46 papers were included in the systematic review. Seven dissertations and theses were extracted from the online British Library EThOS (Electronic Thesis Online Service) and the Australian Research Online system. These articles were screened but omitted as they had not been published.

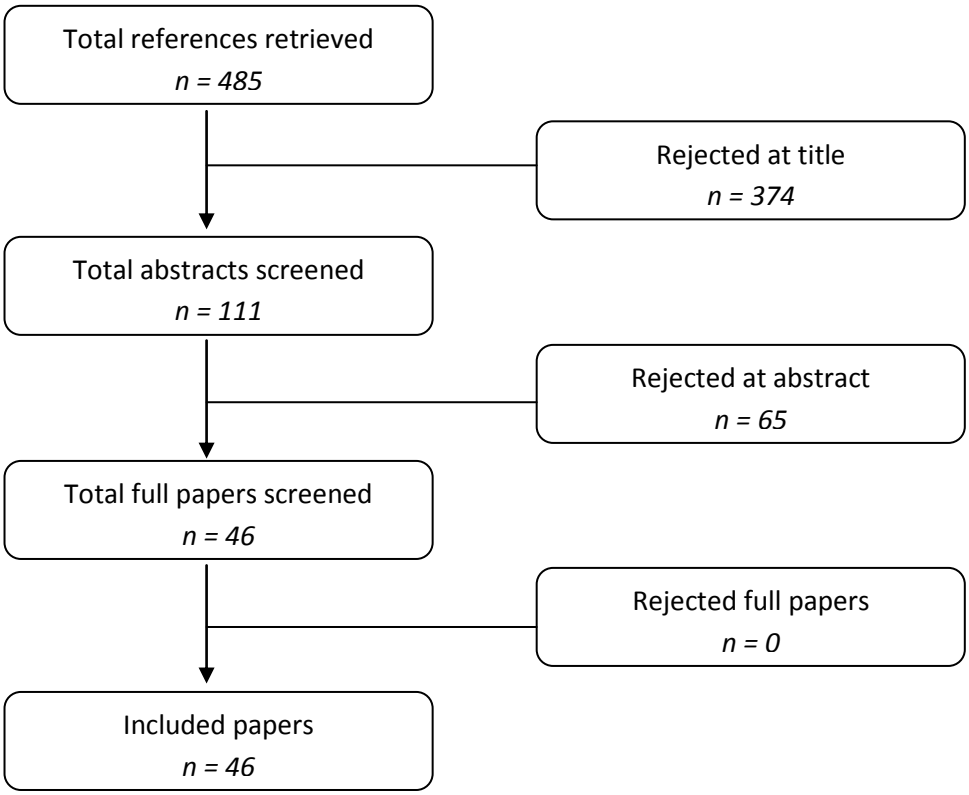

Figure 2.1 Summary of study selection and exclusion

A quantitative procedure was also used to catalogue the design and content of each of the studies reviewed. Themes extracted included: demographics and sample characteristics, methodological design, and the method of assessment administered. Quantified trends of study characteristics were catalogued using frequencies and percentages to identify emerging and fading themes.

Results

A summary of the papers included in the review is provided in Table 3.1 (see Appendix 2.1 for complete references). Of the 46 papers in this systematic review, a clear trend since 2002 was observed with the increased adoption of both qualitative and quantitative methodologies to understand mental toughness and its development (see *Figure 2.2*). Whilst qualitative methodologies have been an initial method of choice (N = 10), an increasing prevalence of quantitative approaches has emerged in line with the emergence of various mental toughness inventories designed to assess mental toughness from both sport-specific and sport-general perspectives (see *Figure 2.3*). Three studies employed a mixed method design, four studies were critical reviews of literature, and one provided a comparison with the Soviet approach of volitional preparation (see *Table 2.2* for a summary of each study).

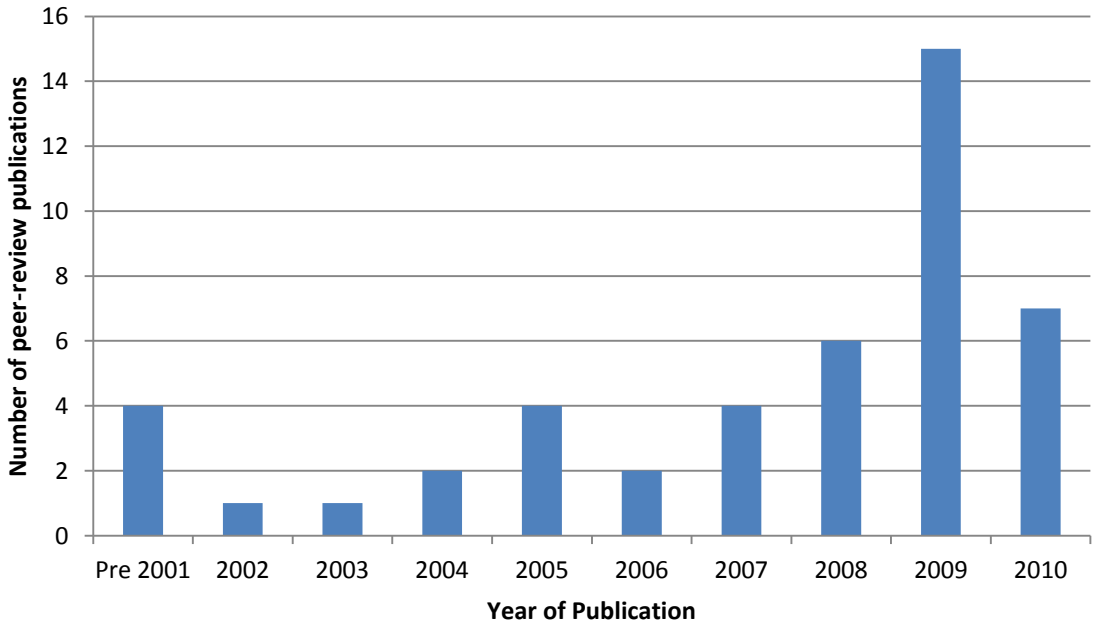

Figure 2.2 Chronological overview of the number of mental toughness papers published in peer-reviewed journals

Across all studies 9383 participants were used, of which 6404 were male (68.25%), 2704 were female (28.82%), with 275 not identified (2.93%). Throughout the studies, 164 coaches, 171 parents and 6 sport psychologists were included. Of the studies reviewed, 18 adopted sport-specific investigations, focusing solely on one individual sport (e.g., soccer, gymnastics, cricket)

whereas 17 investigated mental toughness from a general between-sport perspective across a variety of sports and disciplines.

Table 2.1 Summary of Systematic Review

	N		N
Sample Size		***Country***	
< 15	12	UK	17
16 – 50	7	Australia	8
51 – 100	3	USA	4
101 – 200	9	Other	5
201 – 400	6	Mixed	4
401 – 500	5	Cultural Comparisons	3
> 501	6	***Type of sport***	
Gender		Sport-general	17
Male Only	17	Sport-specific	18
Female Only	2	Team Only	14
Male + Female	24	Individual Only	5
Not identified	2	Other	5
Age (Mean)		***Design***	
< 18	9	Quantitative approach	28
19 – 25	24	- PPI	9
26 – 35	7	- MTQ48	10
36 – 45	4	- SMTQ	2
> 46	1	- Other	9
Not specified	9	Correlation	24
Sample role		Experimental	2
Non-athlete	5	Intervention	2
Athlete	35	Questionnaire development & validation	8
Coach	9	Qualitative approach	13
Psychologist	3	- Interview	12
Family	1	- Focus Group	4
Competition Level		- Mixed Method	5
Recreational only	-	Literature Review	5
Club / University only	8		
County / Regional only	1		
Elite / Professional only	12		
Multiple levels	15		
Not identified	1		

Note: Number of studies review = 46, Papers ranged from 1978 to November 2010

Table 2.2 Studies of mental toughness in sport

Study	Sample Information	Instrumentation / Procedure	Key findings
Dennis (1978) Mental toughness and performance success and failure	238 undergraduate physical education students, those scoring highest and lowest (N = 40 in each) on the mental toughness subscale were selected	MT subscale of Motivation Rating Scale (Tutko & Richards, 1972), Choice reaction time with manipulation on task success/failure feedback	-No significant interaction between MT and success/failure was reported -No difference between MT level and success level was reported -MT as an important personality attribute underlying behaviour in athletics could not be suggested -Reliability and validity of the scale was unknown
Lee, Shin, Han & Lee (1994) Developing the norm of Korean table tennis players' mental toughness	519 students; 182 middle school (MS) students (M = 87, F = 95), 199 high school (HS) students (M = 92, F = 107) and 138 college (CA) students/adults (M = 50, F = 88)	Psychological Performance Inventory, (PPI; Loehr, 1982)	-CA showed higher scores of self-confidence, arousal, control, attention control, visual and image control and attitude control than MS and HS students -Males showed higher scores on self-confidence, arousal control, attention control and positive energy than female -Females showed higher scores on attitude control than male players -Sig diff in self-confidence, positive energy among schools and between gender -Sig diff in arousal control, attention control, visual and imagery control, attitude control among schools but not between gender -no sig diff in motivation level
Shin & Lee (1994) A comparative study of mental toughness between elite and non-elite female athletes	223 female athletes (elite = 107, non-elite = 116) who actively play in volleyball, table tennis, badminton, shooting and archery	Completed the Mental Toughness Test (MTT; Loehr, 1982, also known as the Psychological Performance Inventory, PPI)	-No significant differences found between sports -Elite players generally showed a higher ability in all factors except arousal control -Significant differences in self-confidence between sport events and skill level were found -Female athletes showed a low arousal control and attention control ability
Fourie & Potgieter (2001) The nature of mental toughness in sport	130 elite South African coaches from 30 different sport bodies, 93M and 38F, age ranged from 22-85 years (Mean = 42.7 years) 160 athletes from 31 disciplines, 87M and 73F, age ranged from 14-35years (Mean age = 21 years), from university to international level	Questionnaire requesting to list the characteristics of an athlete who is mentally tough, rank the first three factors in order of importance and rate the extent to which the coach and psychologist could strengthen these characteristics in an athlete Used inductive content analysis to identify emergent themes and patterns in the data and arranged and sorted under key titles	-12 components of MT were identified -Coaches regarded concentrations as the most important characteristic, while the athletes regarded perseverance as the most important -Coaches rated the effectiveness of coaches and sport psychologists in strengthening the characteristics of MT more highly than athletes did
Jones, Hanton & Connaughton (2002) What is thing called mental toughness? An investigation of elite sport performers	10 international sport performers 7M and 3F (Mean age = 31.2 years, s = 5.28) from swimming, sprinting, artistic and rhythmic gymnastics, trampolining, middle-distance running, triathlon, golf, rugby union and netball	Based on the general framework of Personal Construct Psychology (Kelly, 1955); Stage 1 – Focus groups involving 3 sport performers, the session was audio taped and transcribed verbatim Stage 2 – Individual interviews, face-to-face or via telephone with remaining participants, lasting between 60-90 min, all were recorded and transcribed verbatim Stage 3 – Follow-up interview involving rating of agreement of MT definition and rank of attributes in terms of importance	-A conceptual definition of MT emerged from the results which emphasised natural and developed aspects of its development, and general and specific dimension to MT (not just about competition but training and general lifestyle). -Also implied that the true test of MT is achieving success -Participate support for the definition when asked to rate the extent to which they agree with the definition out of 10 resulted in a mean of 8.7 (SD = 1.06) - 12 attributes of MT emerged which related to self-belief, desire/motivation, dealing with pressure and anxiety, focus (performance and lifestyle related), and pain/hardship factors
Golby,Sheard & Lavellee (2003)	70 international rugby league	Assessed mental toughness by questionnaire using	-Significant positive relation between total scores on the PPI and the PVS III-R (*r*

A cognitive-behavioural analysis of mental toughness in national rugby league football teams	footballers, ages 18to 35 years (Mean age = 25.5 years, s = 3.2) form four teams ; Wales (n = 15), France (n = 21), Ireland (n = 13) and England (n = 21).	the PPI (Loehr, 1986) and hardiness using the PVS III-R (Maddi & Khoshaba, 2001)	= .45, p <.01). Both inventories may be measuring related by distinct attributes of mental skill -Hardiness subscale Challenge appeared, generally, not to be related to other subscales -Superior hardiness related to improved performance
Golby & Sheard (2004) Mental toughness and hardiness at different levels of rugby league	115 M professional rugby league players, age range 18-35 years (Mean age = 25.5 years, s = 3.3), from International/Super League/Division 1	PPI (Loehr, 1986), Personal Views Survey III-R (PVS III-R; Maddi & Khoshaba, 2001)	-Performers at the highest playing level scored highest in all three hardiness scales (commitment, control, challenge) and two of seven MT scales (negative energy control, attention control) -A psychological profile that includes high levels of MT and, in particular, hardiness, appeared to distinguish elite-level players -No significant differences in MT and hardiness observed between Super league and Division One players but apparent gulf between these and International players -Hardiness construct had greater explanatory prowess than MT measure -Subscales of Commitment and Challenge most successfully discriminated between the three playing standards -Both PPI and PSV III-R are measuring related but distinct attributes of mental skills, indicating both concurrent and convergent validity"
Middleton, Marsh, Martin, Richards, & Perry (2004) The psychological performance inventory: Is the mental toughness test tough enough?	263 student-athletes (62% M, 38% F) who attended a specialised sports high school. Mean age was 13.8 years (SD = 1.6), respondents drawn from Year 7(19%), Year 8 (22%), Year 9 (22%), Year 10 (20%), Year 11 (10%) and Year 12 (7%)	PPI (Loehr, 1986) Global Mental Toughness Measure (GMTM) Physical Self-Description Questionnaire (PSDQ: Marsh, Richards, Johnson, Roche & Tremayne, 1994) Perceptions of Success Questionnaire (POS: Roberts & Balague, 1991) Elite Athlete Self-Description Questionnaire (EASDQ: Marsh, Hey, Johnson & Perry, 1997) Flow Trait Scale (FLOW: Jackson & Csikszentmihalyi, 1999)	-PPI factors have good face validity but CFA resulted in poor fit to the data and improper solution -numerous factor correlations approached or exceed unit value -neither the PPI or the alternative structure qualified in terms of conceptual (theoretical) bases, within-network properties and between-network properties
Bhambri, Dhillon & Sahni (2005) Effect of psychological interventions in enhancing mental toughness dimensions of sports persons	32 State level table-tennis players (20M, 12F)	PPI (Loehr, 1986) Subjects were divided into 4 groups of 8 participants (3 experimental and 1 control) Each experimental group were provided with different intervention techniques; relaxation, imagery or combination of the two	-All 3 experimental groups showed significant improvement on MT dimensions compared to pre-test scores -Maximum improvement was found in combination group -No improvement was observed for control group
Bull, Shambrook, James & Brookes (2005) Towards an understanding of mental toughness in elite English cricketers	A list of the mentally toughest cricketers was compiled by 101 cricket coaches. 12 of the Top 15 rated players were recruited	Focus group meetings with follow-up semi-structured interviews with each participant	-Presents a systematically constructed framework of MT specific to cricket -Global MT themes were organised under general dimensions of 'Developmental factors,' 'Personal responsibility,' 'Dedication and commitment,' 'Belief,' and 'Coping with pressure.' -Identified the critical role of the payer's environment in influencing 'Tough Character,' 'Tough Attitudes,' and 'Tough Thinking.'
Crust & Clough (2005) Relationship between mental toughness and physical endurance	41 M Undergraduate Sports & Exercise students (Mean age = 21.0, s = 2.7)	MTQ48 (4 factor solution), Isometric endurance time, holding a dumbbell (1.5% of body weight) using the dominant arm at90˚ angle to torso with overhand grip for as long as possible	-Significant correlation between endurance times and overall MT, Control and Confidence but not Challenge or Commitment. -Results support the criterion-related validity of the MTQ48
Thelwell, Weston & Greenlees	43M professional soccer players	Participants requested to rate their level of	-General consensus with the MT definition forward by Jones et al., (2002) with

(2005) Defining and understanding mental toughness within soccer	(Mean age = 25.2 years, s = 6.2)	agreement with the definition of MT and rank a list of MT attributes in order of importance	the variation that the MT player should 'always' cope better than their opponent -General categories as forwarded by Jones et al. (2002) were supported with self-belief ranking as the most important attribute for MT, slight variations were presented however -Highlighted the role significance of the environment in MT development
Golby & Sheard (2006) The relationship between genotype and positive psychological development in national-level swimmers	31 UK national level swimmers, 13M and 18F, age range 10-24 (Mean age = 13.48, s = 2.93)	PPI (Loehr, 1986) The Self-Perception of Quality of Performance Questionnaire (SPQPQ; Ebbeck & Weiss, 1988), The Personal Views Survey II-R (PVS III-R; Maddi & Khoshaba, 2001), The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) The Generalised Self-Efficacy Scale (GSES; Schwarzer & Jerusalem, 1993), The Life Orientation Test (LOT; Scheier & Carver, 1985) and The Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) DNA samples via buccal swabs	-No significant association between 5-HTT (serotonin transporter) genotype and positive psychological attributes were supported -Revealed a discernible trend of a relationship between LL genotype and high levels of positive psychological development
Levy, Polman, Clough, Marchant & Earle (2006) Mental toughness as a determinant of beliefs, pain and adherence in sport injury rehabilitation	70 patients undertaking a sport injury rehabilitation program, 44M and 26F (Mean age = 32.5 years, s = 10.2), 31% competitive athletes and 69% recreational athletes	MT18 (Short version of MTQ48) Sport Injury Rehabilitation Belief Survey (SIRBS) Sport Inventory for Pain (SIP-15) Sport Injury Rehabilitation Adherence Survey (SIRAS)	-No association between MT and coping appraisals, although high MT displayed more positive threat appraisal (perceived injury to be less threatening/severe) and less susceptible to further injury, and were better able to cope with pain than less MT - Greater rehab attendance displayed by higher MT individuals however more positive constructive behaviour during clinic rehab observed in low MT patients
Crust (2007) Mental toughness in sport: A review		Review of MT literature	-Considers some of the emerging MT definitions and conceptualisations and examines how MT might be developed in performers -Evaluates quantitative and qualitative approaches to MT and developments in MT measurement are discussed
Golby, Sheard & van Wersch (2007) Evaluating the factor structure of the Psychological Performance Inventory	408 UK sport performers, 303M and 104F ranging in age from 12-63 years (Mean age = 24.2, s = 6.7) from roller skating, basketball, canoeing, golf, rugby league, rugby union, soccer and swimming. Ranged from club and regional to international level	PPI (Loehr, 1986) – Test of factorial validity PPI-A – construction of a revised model and CFA of the PPI-A	-Principle components analysis provided minimal support for the factor structure -Exploratory analysis yielded a 4-factor 14item model (PPI-A) and a single factor underlying MT (GMT) was identified with higher-order exploratory analysis -Psychometric analysis of the model using CFA fitter the data well, collectively satisfying absolute and incremental fit index benchmarks with adequate reliability and convergent and discriminant validity
Jones, Hanton & Connaughton (2007) A framework of mental toughness in the world's best performers	8 "super-elite" performers (5M, 3F, age25-48 years), 3 coaches (3M, age 38-60 years) and 4 sport psychologists (4M, age 35-45 years). Sports represented were boxing, swimming, athletics, judo, triathlon, rowing, pentathlon, squash, cricket and rugby union from Australia, England, Canada, and Wales	Stage 1 – Focus groups involving 3 sport performers, the session was audio taped and transcribed verbatim Stage 2 – Individual interviews, face-to-face or via telephone with remaining participants, lasting between 75-95 min, all were recorded and transcribed verbatim Stage 3 – Follow-up interview involving rating of agreement of MT definition, confirmation of MT framework, and rank of attributes in terms of	-Results verified Jones et al.'s (2002) definition of MT -30 MT attributes were identified as essential to being mentally tough -Attributes were clustered under 4 separate dimensions; a general "Attitude/Mindset dimension" and 3-time specific dimensions (Training, Competition and Post-competition) within an overall framework of mental toughness -A question emerged as a result around whether performers must acquire the correct MT attitude/mindset in order to become mentally tough in situations such as training, competition and post-competition or do they need to develop MT in any or all of the three time-specific dimension before they can develop

		importance	the MT attitude/mindset
Kuan & Roy (2007) Goal profiles, mental toughness and its influence on performance outcomes among Wushu athletes	40 Malaysian university Wushu athletes 21M and 19F, (Mean age= 21, s = 1.66)	PPI (Loehr, 1986) Task and Ego Orientation in Sport Questionnaire (TEOSQ; Duda & Nicholls, 1992) Performance measure of winning a medal in the inter-varsity competition was considered a successful performance outcome	-Successful outcome on performance was not found to be a function of goal profile -Significant differences were observed between athletes (medallists and non-medallists) in the MT subscales of self-confidence and negative control
Mack & Ragan (2008) Development of the Mental, Emotional, and Bodily Toughness Inventory in collegiate athletes and non-athletes	261 UG students, 165M and 96F, 29% (n = 75) athletes and 71% (n = 186) non-athletes	Development of the Mental, Emotional and Bodily Toughness Inventory (MeBTough) Mental Toughness Scale – 1-dimensional measure of mental toughness	-Assessed MT in relation to assisting individuals performance in compliance to a rehabilitation program -Developed the MeBTough based on Loehr's definition of MT and delineated the mental, emotional and physical elements of MT into 9 constructs
Connaughton, Hanton, Jones & Wadey (2008) Mental toughness research: Key issues in this area		Review of MT literature	-Reviews the MT literature designed to raise awareness of the key conceptual and methodological issues and stimulate research activity -Highlights the inconsistency and ambiguity in the literature, along with methodological issues with have added to the conceptual confusion
Connaughton, Wadey, Hanton & Jones (2008) The development and maintenance of mental toughness: perceptions of elite performers	7 Elite International athletes (5M, 2W) from artistic and rhythmic gymnastics, swimming, trampolining, triathlon and rugby union (mean age = 33 years, sd = 5.3). Sample from Jones et al. (2002) original sample	Semi-structured face-to-face or telephone interviews. All interviews were recorded in their entirety and transcribed verbatim. Each interview lasted between 100 and 180 min (mean 144 min, sd = 30)	-MT development is a long-term process that encompasses a multitude of underlying mechanisms that operate in a combined fashion -MT was perceived by the participants to develop within Bloom's (1985)three career phases (i.e. early, middle, and later years) -In general, the mechanisms related to features associated with a motivational climate, various significant individuals, experience in and outside of sport, the experience of critical incidents, psychological skills and strategies, and an insatiable desire and internalised motive to succeed -Once developed, a fourth phase was identified in order to maintain MT
Crust (2008) A review and conceptual re-examination of mental toughness: Implications for future researchers		Review of MT literature	-Review of MT research and examines the major conceptual concerns -Comparisons are made with research development in the related concept of hardiness -It is argued that more innovative approaches to research are require to further develop knowledge (i.e. experimental designs, longitudinal studies, psycho-physiological approaches, environmental manipulations)
Gucciardi, Gordon & Dimmock (2008) Towards an understanding of mental toughness in Australian football	11 M elite coaches (Mean age = 42, s = 9.62) from Western Australian and Australian Football Leagues	Semi-structured face-to-face interviews lasting 30-90 were recorded and transcribed verbatim. Interviewees later sent a list detailing major MT characteristics and situations requiring MT identified through the interviews. Each was requested to list and describe the contrasting pole for each characteristic, rank each characteristic in order of importance to AFL and list all situations for which each characteristic was applicable	-Three independent categories (characteristics, situations, behaviours) were inductively derived and integrated into a model in which the importance of understanding each component was emphasised -The relationship between the three categories was also highlighted -Results identified the key MT characteristics and their contrasts, situations that demands MT and the behaviours commonly displayed by MT footballers -As well as a buffer against adversity, it was proposed that MT may also be a collection of enabling factors that promote and maintain adaption to other challenging situations -Whilst majority of characteristics identified were consistent with previous research suggesting the presence of several global MT characteristics exist, evidence was provided for unique characteristics specific to AFl
Nicholls, Polman, Levy & Backhouse (2008) Mental	677 athletes 454M and 223F age ranged 15-58 years (Mean age =	MTQ48 (6 factor solution) Coping Inventory for Competitive Sport (CICS:	-Significant correlation between 8 out of 10 coping subscales and optimism -Higher levels of MT associated with increased problem or approach coping

toughness, optimism, pessimism and coping among athletes	22.66 years, s = 7.20) competing at International (60), National(99),County (198), Club/University (289) and Beginner (31) levels	Gaudreau & Blondin, 2002) Life Orientation Test (LOT: Scheier & Carver, 1985)	strategies and less use of avoidance coping -8 coping scales correlated with optimism and pessimism -Findings emphasise the need for the inclusion of coping and optimism training in MT interventions
Crust (2009) The relationship between mental toughness and affect intensity	112 sport performers (55M, 57F) from basketball, association football, hockey, gymnastics, netball, badminton, golf, long-distance running and triathlon, who ranged from recreational to national level participation. Age ranged from 18-51 years (mean M = 30.1 years, s = 11.6, F = 28.6 years, s = 8.9)	MTQ48 (6 factor solution), Affect Intensity Measure (AIM; Larsen, 1984),	-MT and affect intensity found to be unrelated – high or low MT individuals do not experience more or less intense emotions -If mentally tough athletes have similarly intense emotional experience as other athletes then it may emphasise the importance of emotional control as a component of MT
Crust & Azadi (2009) Leadership preferences of mentally tough athletes	103 UK athletes of club/university to county standard from a variety of team sports, 66 M (Mean age = 22.58 years, s = 4.99) and 37 F (Mean age = 21.11 years, s = 2.80)	MTQ48 (6 factor solution) Leadership Scale for Sports (LSS: Chelladurai & Saleh, 1978)	-MT significantly related to preference in training and instructive behaviours -Commitment and Challenge subscales were significant predictors of preference for training and instructive behaviours -Overall, MT athletes show preferences for leadership behaviours that are aimed at improving performance and skill development
Gucciardi (2009) Do developmental differences in mental toughness exist between specialized and invested Australian footballers?	350 M Australian footballers, aged13-18 years (Mean age = 15.88, s = 1.71). Specialisers (n = 144, Mean age = 14.06, s = .89) played a secondary sport, Investors (n =206, Mean age = 17.02, s = 1.12) engaged solely in Australian football	AfMTI (Gucciardi, Gordon & Dimmock, 2009)	-CFA analysis of the AfMTI did not reveal support for its psychometric structure, however a revised version received support -Significant differences between the developmental groups were identified, indicating that desire success and sport awareness subscales contribute to the effect -Indicated that developmental differences should be considered in future theorising on the development of MT
Gucciardi & Gordon (2009) Development and preliminary validation of the Cricket Mental Toughness Inventory (CMTI)	11 Indian and 5 Australian elite M international cricketers (5 currently playing, 11 in admin or coaching roles)	Study 1 – Model generation Semi-structured face-to-face interviews lasting 30-120 min, all were recorded in their entirety and transcribed verbatim.	-Yielded six overarching categories of MT in cricket; Affective intelligence, Attentional control, Self-belief, Resilience, Desire to achieve, and Cricket smarts. -Supports the notion that MT is multifaceted and made up of multiple key components made up of attitudes, cognitions, emotions and behaviours
	9 M Australian first-class cricketers, aged 21-28years (Mean age = 24.67years, s = 2.28)	Study 2 – Item generation Two focus groups conducted to pilot test the 42 item questionnaire for clarity, conciseness and intelligibility	-First focus group added six specific questions to original 42-item pool, second focus group added two producing a list of 50 items. -Minor modifications to the wording of several questions was recommended by both focus groups
	International sample – 570 M first-class cricketers from various cricket playing countries, age range 14-39 years (Mean age = 23.7 years, s = 7.5) Australian sample – 433 Australian cricketers, 355M and 78 females (Mean age = 23.35 years, s = 7.48) from U17 to National level	Study 3 – Within-network properties 50 item mental toughness inventory for cricket Factor structure of the scores was evaluated using confirmatory factor analysis	-CFA procedures resulted in the deletion of 25 items due to poor model fit and low factor loadings and a further 10 items due to cross-loadings displayed -Resulted in a 15-item model, the CMTI
	Australian sample of cricketers (n = 433) from Study 3	Study 4 – Between-network properties PVS III-R, Dispositional Flow Scale-2 (DFS-2; Jackson	-CMTI subscales showed negative correlations with all three burnout subscales and positive correlations with dispositional flow, resilience and hardiness

		& Eklund, 2004), Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) and Connor-Davidson Resilience Scale (CDRS; Connor & Davidson, 2003)	-Provided some support that MT is conceptually related but distinct from psychological constructs such as flow, resilience and hardiness -Provided preliminary support for the factor structure, internal reliability and construct validity of the CMTI
Gucciardi, Gordon & Dimmock (2009) Advancing mental toughness research and theory using personal construct psychology		Review of current MT literature and identifies avenues for future research	-Reviews sport-general and sport-specific research highlighting the need for theoretically driven research -Offers a MT model grounded in Personal Construct Psychology to organise the knowledge base and provide a platform for future research
Gucciardi, Gordon & Dimmock (2009) Development and preliminary validation of a mental toughness inventory for Australian football	Study 1: 418 M elite and sub-elite Australian footballers, aged 15-30 (Mean age = 18.97,s = 3.71)	Preliminary Australian football Mental Toughness Inventory (PAfMTI) Marlowe-Crowne Social Desirability Scale (Reynolds, 1982) Dispositional Resilience Scale (Bartone, Ursano, Wright & Ingraham, 1989) Dispositional Flow Scale-2 (Jackson & Eklund, 2002) Confirmatory Factor Analysis was conducted to examine the 11-factor, 60 item model	-Given inadequate fit for the initially hypothesised model (PAfMTI) via CFA, items were deleted resulting in an 11-factor 33-item model -Following EFA, a final four-factor solution that contained 24 items which accounted for 47% of the total variance was produced known as the AfMTI -Correlation between the four factors of the AfMTI and flow, and dispositional resilience were moderate whilst correlations with social desirability were small and non-significant
	Study 2: 120 players aged 15-16 (Mean age = 15.45 years, s = .36), 5 coaches, 120 parents from 5 youth-aged football teams	Australian football Mental Toughness Inventory (AfMTI) – three versions were used, self, coach and parent to provide multi-source ratings of MT	-Prelim factor structure, internal reliability and construct validity of the AfMTI were encouraging -Multisource data was somewhat equivocal – correlation data suggested disagreement between raters whereas ANOVA suggested agreement
Gucciardi, Gordon & Dimmock (2009) Evaluation of a mental toughness training program for youth-aged Australian footballers: I. A quantitative analysis	3 under 15's youth aged male football teams, a parent of each player and coaching staff	Multi-source ratings of AfMTI (Self-report, parent and coach) Dispositional Resilience Scale (DRS; Bartone, Ursano, Wright & Ingraham, 1989) Dispositional Flow Scale-2 (Jackson & Eklund, 2002) Consultant Evaluation Form (CEF) and a Social validation questionnaire Each group randomly assigned to one of three conditions; Control group, Psychological Skill Training (PST) group and Mental Toughness Training (MTT) group. Interventions conducted and concluded two weeks prior to competitive season. Data collected prior to intervention and on completion of the competitive season.	-Both the traditional PST program and the MTT program interventions reported more positive changes in subjective ratings of MT, resilience and flow compared to the control group. Similar rating were reported by the parents and coaches -Both the PST and the MTT packages appeared to be equally effective in enhancing MT
Gucciardi, Gordon & Dimmock (2009) Evaluation of a mental toughness training program for youth-aged Australian footballers: II. A qualitative analysis	Players, parents and coaches from the MTT program (Gucciardi et al., 2009) wereinvited. 10 players (Mean age = 14.43 years, s = .53), one of their parents (5 fathers and 5mothers), and 3 coaches	Semi-structured 1-1 interviews, lasting 45- 90 min, were recorded and transcribed verbatim	-Several benefits of the program were described; valuing the importance of quality preparation, being more receptive to criticism, team cohesion, an increased work ethic, tougher attitudes, and the development and identification of transferable skills -Four process identified as ways that the program contributed to enhanced MT include; enhanced self-awareness, techniques for self-monitoring, techniques for self-regulation and multiple perspective discussions -Identified the need for more parent involvement, coach and parent education programs to supplement the interventions, and considering periodisation

			principles when designing the program to ease the workload
Gucciardi, Gordon, Dimmock & Mallett (2009) Understanding the coach's role in the development of mental toughness: Perspectives of elite Australian football coaches	Each of the 11 M coaches from Gucciardi et al., (2008) were re-sampled (Mean age = 42.0 years, s = 9.6).	Semi-structured 1-1 interviews lasting between 45-90 min, were recorded and transcribed verbatim	-Five categories that appeared to be central to the coach's role in the development of MT emerged, four were said to facilitate the development process (coach-athlete relationship, coaching philosophy, training environments and specific strategies) and one was said to impede this process (negative experiences and influences) -Presented a notion that the aforementioned categories enabled coaches to nurture a "generalised form" of MT acquired during one's formative years into a "sport-specific form" pertinent to Australian football
Horsburgh, Schermer, Veselka & Vernon (2009) A behavioural genetic study of mental toughness and personality	152 pairs of adult monozygotic and 67 pairs dizygotic twins, 438 participants in total, age ranged from 18-82 years (Mean age = 23.88 years, s = 6.22)	MTQ48 (6 factor solution) 16-item zygosity questionnaire (Nicholls & Bilbro, 1966) NEO-PI-R (Costa & McCrae, 1992)	-Revealed individual differences in MT (and personality) were largely attributable to genetic and non-shared environmental factors suggesting that MT behaves like many other personality traits -Revealed phenotypic correlations between MT and personality were attributable to common genetic and common non-shared environmental factors -Suggests that it may be easier to increase certain components of MT (commitment and control) with the lowest heritability -Reported conducting Exploratory and Confirmatory factor analyses with four-factor solution providing a better fit than a single-factor solution – fit indices were not reported however
Kaiseler, Polman & Nicholls (2009) Mental toughness, stress, stress appraisal, coping and coping effectiveness in sport	482 UK based athletes, 305M and 177F (Mean age = 20.44 years, s= 3.98) competing at international (15), national (60), county (220) and club/university (175) level	MTQ48 (6 factor solution) MCOPE Stressor type and stressor appraisal bipolar scales	-MT associated with stress intensity and control appraisal but not with type of stressor -Total MT and subcomponents predicted coping and coping effectiveness -High MT was associated with more problem-focused coping but less emotion-focused and avoidance coping, all subscales negatively associated with active coping -Perceived coping effectiveness influenced by coping strategy
Nicholls, Polman, Levy & Backhouse (2009) Mental toughness in sport: Achievement level, gender, age, experience and sport type differences	677 athletes, 454M and 223F age ranged 15-58 years (Mean age = 22.66, s = 7.20) competing at International (60), National (99), County (198), Club/University (289) and Beginner (31) levels. 482 consisted of team-sport and 195 individual-sport athletes, 311 from contact and 366 non-contact sports	MTQ48 (6 factor solution) Age, gender, contact/non-contact, competitive level, Years experience	-Significant relationship between MT and age, gender, sporting experience was identified -M scored significantly higher than F on Total MT, Challenge, Emotional Control, Life Control and Confidence in Abilities -Age and experience relations suggestive that learning experience and/or biological changes might be responsible for small changes in MT attributes -No significant association between MT and achievement level were found suggesting conceptualisations based on elite athlete and coaches only may have limitations -No significant differences in MT by type of sport were found
Ryba, Stambulova & Wrisberg (2009) Forward to the past: Puni's model of volitional preparation in sport		Examination of the Soviet notion of volitional preparation used by sport psychologist Avksenty Cezarevich Puni	-Volition is described as a complex psychic phenomenon encompassing a neurological bases and interaction of cognitive, affective and operational components, as well as an entity characterised by a variety of functions -Specific manifestations of volition are called volitional qualities and include purposefulness, persistence and perseverance, decisiveness and courage, initiative and independence, and self-control and composure -Suggests that may be useful in theorising the development of MT

Sheard (2009) A cross-national analysis of mental toughness and hardiness in elite university rugby league teams	49 M elite university student rugby league footballers representing Australia (n= 25) and Great Britain (n = 24),ranging in age from 18-26 years (Mean age = 21.7, s = 2.3)	Psychological Performance Inventory-Alternative (PPI-A; Golby, Shear & van Wersch, 2007) Personal Views Survey III-R (PVS III-R; Maddi & Khoshaba, 2001)	-Australian university players has significantly higher mean score on Positive Cognition, Visualisation, Total MT and Challenge than their GB opponents -Australian players were tournament winners therefore provided support indicating superior MT and hardiness are positively related to individuals adaptive responses to stressors, and these responses in turn positively affect performance -Indicated that although MT and Hardiness share the same conceptual space, they also show some sufficient distinctiveness
Sheard, Golby & van Wersch (2009) Progress toward construct validation of the Sports Mental Toughness Questionnaire (SMTQ)	Study 1: 633 UK athletes, 427M and 206F, age ranging 16-63 years (Mean age = 21.5 years, s = 5.48) drawn from 25 sport classifications competing from club to international standard	Questionnaire Item generation and development using athletes and coaches from a variety of sports and then reviewed by experts in MT investigation Exploratory Factor Analysis of response to the SMTQ	An initial pool of 53 items was refined and a final set of 18 items were retained for analysis RAF yielded a four-factor structure that explained 38.9% variance, 2 items were removed and a final three-factor 14-item model was proposed consisting of Confidence, Constancy and Control
	Study 2: 509 UK athletes, 351M and 158F, age ranging 18-48 years (Mean age = 20.2 years, s = 3.35) drawn from 26 sport classifications competing from club to international standard	Confirmatory Factor Analysis of the SMTQ Construction of a Higher-Order Factor Model Divergent validity using the PVS III-R, LOT-R and PANAS Differences between Competitive Standard, Gender and Age were assessed	CFA confirmed the overall structure , a single underlying MT was identified using the Schmid-Leiman procedure Collectively satisfying absolute and incremental fit-index benchmarks, the inventory was shown to possess satisfactory psychometric properties, with adequate reliability, divergent validity and discriminant power
Connaughton, Hanton & Jones (2010) The development and maintenance of mental toughness in the world's best performers	11 of the 15 of Jones et al.'s (2007) original sample. 7 Super-Elite performers (4M, 3F, aged between 25 - 48), 2 coaches (2M, aged 40 and 62) and 2 sport psychologists (2M, aged40 and 47). Sports represented were swimming, athletics, judo, rowing, pentathlon, squash and rugby union, while nationalities included Australia, England, Canada and Wales	Semi-structured face-to-face interviews. All interviews were recorded in their entirety and transcribed verbatim. Each interview lasted between 120 and 180 min (performers) and 90-120 min (coaches/sport psychologists)	-Development and maintenance of MT occurred over the four distinct career phases; three developmental and one maintenance phase -Influential factors included; skill mastery, competitiveness, successes, international competitive experience, education and advice, the use of psychological skills, access to an understanding supportive network and reflective practice -Positive and negative critical incidents were highlighted to act as catalysts in initiating or enhancing specific components of MT -Proposed that MT development began in the attitude/mindset dimension first with the two subcomponents 'Belief' and 'Focus,' followed by the training, competition and post-competition dimensions respectively
Coulter,Mallett & Gucciardi (2010) Understanding mental toughness in Australian soccer: Perceptions of players, parents and coaches	4 male coaches, aged 40-47 (mean = 44.3 years, sd = 3.4), all held National A Licenses (highest coaching award in Australia) 6 male professional players, aged 25-34 years (mean = 29.3, sd = 3.8) all with 3 years min International experience 5 parents (2M,, 3F) aged 57-64 years (mean = 59.4, sd = 3.3)	Stage 1 – coach interviews and the identification of mentally tough players within the A-League Stage 2 – interviews with players identified by participant coaches as being mentally tough Stage 3 – parental interviews of those mentally tough players interviewed in Stage 2 Semi-structured face-to-face interviews ranging from 45 to 125 min which were transcribed verbatim.	-As well as eliciting perspectives on key MT characteristics and their contrasts, situations demanding MT and behaviours displayed, this study also elicited cognitions employed by mentally tough soccer players -Provides further evidence that MT is conceptually distinct from hardiness -Support for Gucciardi et al.'s (2009) process model of MT is provided and minor revisions to Gucciardi and colleagues definition of MT are proposed -A winning mentality and desire was identified as a key attribute of MT in soccer in addition to previously reported qualities -Key cognitions reportedly enabled mentally tough soccer players to remain focused and competitive during training and matches and highlighted self-talk as important for dealing with challenging situations
Crust & Azadi (2010) Mental toughness and athletes' use of psychology strategies	107 athletes, 67M (Mean age = 22.6 years, s = 5.0) and 40F (Mean age = 21.1 years, s = 2.8) from a variety of team and individual sports ranging	MTQ48 (6 factor solution), Test of Performance Strategies (TOPS; Thomas, Murphy & Hardy, 1999)	-MT significantly related to performance strategy use in both training and competition -In competition, low to moderate positive correlations were found between 5 of 8 strategies and a significant negative correlation with one, in practice,

	from club/university to county standard or higher		significant positive correlations were observed with 4 of 8 strategies -Commitment was found to be the most consistently used with 13 of 16 correlations -Differences in MT levels between competitive level were reported -Weak to moderate correlations suggest MT is more than just a set of context-specific psychological strategies
Crust & Keegan (2010) Mental toughness and attitudes to risk-taking	105 student athletes, 69M (Mean age = 22.2 years, s = 5.3) and 36 F (Mean age = 24.6 years, s = 7.7) from a variety of sports including football, badminton, basketball, boxing, cricket, distance running, field hockey, golf, martial arts, netball, rugby, tennis, trampolining and triathlon	MTQ48 (6 factor solution) The Attitudes Towards Risks Questionnaire (ATRQ; Franken, Gibson & Rowland, 1992)	-Significant positive correlations between overall MT and attitudes towards physical risk but no relationship with psychological risk -Challenge was the most significant predictor of attitudes towards physical risk -Interpersonal confidence the only MT subscale to be significantly positively related to attitudes towards psychological risk -Significant gender differences reported between overall MT, Confidence in abilities, and attitudes towards both physical and psychological risk
Crust & Swann (2010) Comparing two measures of mental toughness	110 M club and university athletes (Mean age = 20.81 years, s = 2.76) from mostly team sports and represented 10 sports	MTQ48 Sport Mental Toughness Questionnaire (Sheard, Golby & van Wersch, 2009)	-Significant and positive relationship between higher order MT scores by the MTQ48 and SMTQ was found -Correlations between total and global MT was large (r = .75) but accounted for only 56% of common variance -Correlations between similar MT subscales were found to be positive and significant but somewhat lower than expected -Results suggest instrument subscales with similar labels are not measuring the same components of MT and as a result comparisons between these measures should be interpreted cautiously
Gucciardi (2010) Mental toughness profiles and their relations with achievement goals and sport motivation in adolescent Australian footballers	214 non-elite (local junior level), M Australian footballers aged 16-18 years (Mean age = 16.8years, s = 0.7)	Australian football Mental Toughness Inventory (AfMTI; Gucciardi et al., 2009) Achievement Goals Questionnaire-Sport (AGQ-S; Conroy, Elliot & Hofer, 2003) Sport Motivation Scale-6 (SMS-6; Mallett, Kawabata, Newcombe, Otero-Forero & Jackson, 2007)	-High MT groups favoured mastery- and performance-approach goals and self-determined as well as extrinsic motivation tendencies -Suggestive that different MT profiles show varying relations with achievement goals and sport motivation -Demographic analysis revealed differences in MT by numbers of years playing experience but not age
Thelwell, Such, Weston, Such & Greenlees (2010) Developing mental toughness: Perceptions of elite gymnasts	10 F gymnasts, 5 from Great Britain age range 15-22 years (Mean age = 18, s = 2.90) and 5 from the United States age range 17-20 years (Mean age = 18.4, s = 1)	Semi-structure face-to-face interviews lasting 45-60 min were recorded in their entirety and transcribed verbatim	-Inductive content analysis revealed four general dimensions that contributed to the development of MT (sport process, sporting personnel, non-sporting personnel and environmental influences) -Many of the findings reflect those from previous research but with a specific sport context -Unique findings of cultural differences were found

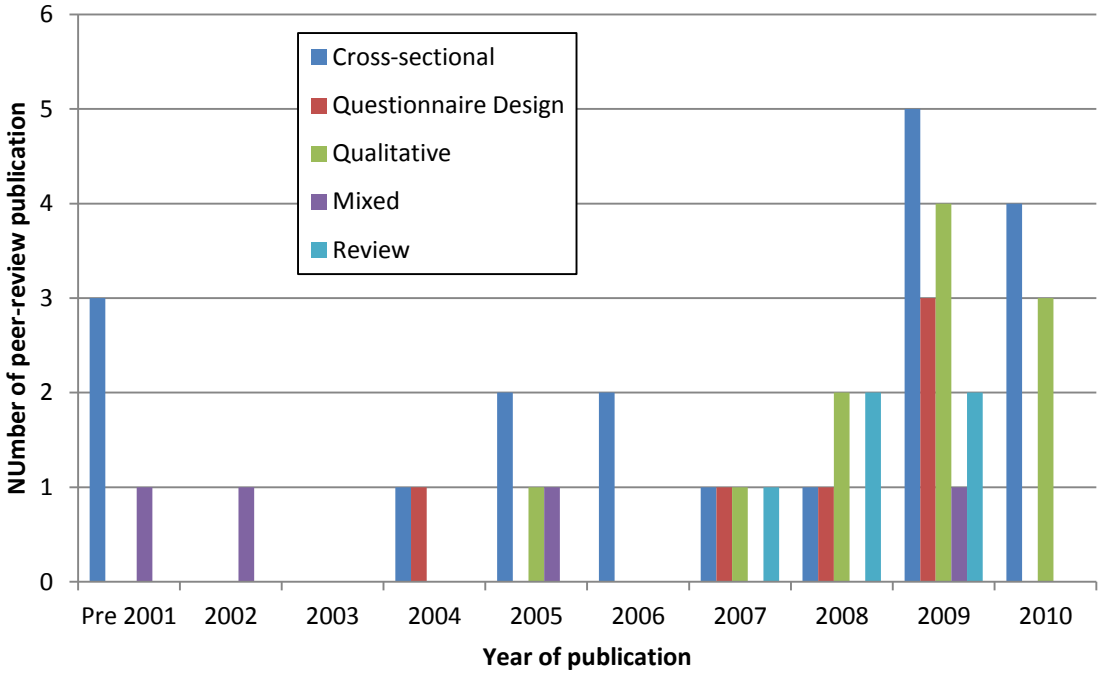

Figure 2.3 Chronological overview of the type of mental toughness papers published in peer-reviewed journals

Across the quantitative studies (N = 31, mixed-method studies inclusive), of the 9096 participants used, 6184 were male (67.99%), 2637 were female (28.99%), and 275 (3.02%) were not identified. Data was gathered from the assessments of 8308 athletes, 624 non-athletes, eight coaches, and 156 parents. The number of participants ranged from 31 to 677 (M = 259.89, SD = 209.36), whilst the mean age of participants ranged from 13.48 to 32.5 years (M = 21.28 years, SD = 4.60). In the qualitative studies (N = 13, mixed-method studies inclusive), of the 287 participants used, 220 were male (76.66%), and 67 were female (23.34%). Data was gathered from the opinions of 110 athletes, 156 coaches, 15 parents and six psychologists. The number of participants ranged from six to 131 (M = 20.5, SD = 32.09), whilst the mean age of participants ranged from 14.43 to 59.40 years (M = 34.85 years, SD = 12.96). For a complete summary of sample demographics see Appendix 2.2.

Definition and Conceptualisation

Given the number of 'experientially-based' definitions that are evident within the literature (Gibson, 1998; Goldberg, 1998, Williams, 2001) it was apparent that until recently, an empirically based and widely accepted definition of mental toughness had not existed. It appeared that there

has been such confusion and conceptual ambiguity surrounding the construct of mental toughness, that mental toughness has been construed to represent a wide variety of terms. The concept has been defined in terms of anything from coping effectively with pressure and adversity, recovering from setbacks, failures and disappointments, persistence and perseverance, to being insensitive or resilient, to simply possessing superior mental skills.

In this review, nine studies (19.6%) were identified as focusing on providing a more rigorous definition and conceptualisation of mental toughness. A pioneering study by Fourie and Potgieter (2001) was the first to adopt a qualitative approach to investigating the components of mental toughness. Written responses from expert coaches (N=131) and elite-level sport performers (N=160) across 31 different sports identified 41 higher-order themes that were categorised into 12 key components of mental toughness, including motivation level, coping skills, confidence maintenance, cognitive skills, discipline and goal directedness, competitiveness, possession of prerequisite physical and mental requirements, team unity, preparation skills, psychological hardiness and ethics. Despite being the first formal investigation into mental toughness, Fourie and Potgieter (2001) offered no definition from their findings. The first study to offer an operational definition was that conducted by Jones et al. (2002) which unearthed 12 distinct attributes of mental toughness that were considered fundamental to the make-up of a mentally tough performer irrespective of sport. Inherent in their definition was the contention that mental toughness is in part "natural", in that athletes bring some mentally tough qualities to the sport environment, and that it is also possible for mental toughness to be "developed". A distinction was also made between general and specific dimensions, with emphasis placed on both competition and other related factors (e.g. training and lifestyle) required to attain superior performance.

In a follow-up study, Jones et al. (2007) replicated procedures of the previous study with a broader sample of 'super-elite' athletes, coaches and sport psychologists. Whilst the study found support for Jones et al.'s (2002) proposed definition, this sample portrayed a greater insight and understanding into the precise make-up of mental toughness, offering 30 attributes of the mentally tough performer. The subsequent attributes were categorised into 13 sub-components and arranged across four dimensions. The categorisation highlighted specific aspects of mental toughness, believed to have been developed in order to achieve a desired state in each dimension.

The review found support for Jones et al.'s (2002) definition in two single-sport investigations in cricket (Bull et al., 2005) and football (Thelwell et al., 2005) respectively. Thelwell et al. (2005) offered one amendment, offering that mentally tough performers "always cope better" than their opponents, rather than generally coping better as suggested by Jones and colleagues. Whilst Thelwell et al. (2002) identified 10 key attributes to mental toughness, each ranked in order of perceived importance, Bull et al. (2005) presented 20 global themes depicted as key characteristics of the mentally tough cricketers, and presented their findings in a conceptual pyramid framework encompassing a performer's environment, character, attitudes and thinking. Both these approaches were important in furthering the understanding of mental toughness, supporting the contention that mental toughness could be acquired.

An alternative conceptualisation of mental toughness was offered by Gucciardi et al. (2008) that integrated a framework of personal construct psychology (Kelly, 1955/1991) to unearth a holistic understanding of mental toughness in the context of Australian football. Mental toughness was defined as a quality that brought together several features (e.g., a collection of values, attitudes, behaviours and emotions) and was believed to be responsible for getting the best out of performers' ability. Three independent categories (characteristics, situations, and behaviours) were derived and integrated into a model which highlighted the relationship between the categories and the performance process. Eleven key characteristics were presented as bipolar constructs ranked in order of importance (i.e., self-belief vs. self-doubt). Whilst originating from the specific domain of Australian-rules football, the review found support for the definition across other sports such as cricket (Gucciardi & Gordon, 2009) and soccer (Coulter et al., 2010) with minor revisions observed in relation to specific behaviours and cognitions commonly displayed and experienced by performers as they approach, respond to, and appraise different situations.

Another popular conceptualisation frequently cited in the review is that provided by Loehr (1986) which assesses an athlete's mental strengths and weaknesses on seven factors; self-confidence, attention control, negative energy, motivation, attitude control, positive energy, and visual and imagery control. Loehr (1986) postulated that mentally tough performers are disciplined thinkers, who respond to pressure by remaining relaxed, calm and energised, coining the term mental toughness as being able to perform at the upper range of one's ability, regardless of

competitive circumstances. Despite widely assessed via a self-report measure designed to operationalise the conceptualisation (PPI; Psychological Performance Inventory), Loehr's (1986) approach was challenged under significant scrutiny given that no evidence of its development or conceptualisation is provided in published, peer-reviewed literature (Middleton et al., 2004). Despite being based solely on personal experiences from working with successful athletes, the seven fundamental attributes of mental toughness proposed by Loehr (1986) show close similarities with those proposed by other recent investigations possessing acceptable scientific rigor (Fourie & Potgieter, 2001; Jones et al., 2002, 2007).

Similarly, in an attempt to bridge the gap between theoretical research of mental toughness and applied practice, Clough et al. (2002) presented an alternative definition and offered their 4C's conceptualisation, that too has yet to be presented in a peer-reviewed publication. Integrating a model that proposed to represent the unique demands of sport, Clough et al. (2002) drew upon studies of hardy personality and the stress-illness relationship from health psychology (Kobasa, 1979), physiological toughness (Dienstbier, 1989) and the ecologically valid views of athletes, coaches and practitioners, and depicted mental toughness as a trait-like dimension of personality. Whilst this conceptualisation is cemented more in personal experience and anecdotal evidence rather than rigorous scientific protocol, the conceptualisation remains to have intuitive appeal offering a number of similarities to the characteristics identified by Jones et al., (2002, 2007). Whilst the 4C's conceptualisation failed to meet the review inclusion criteria (i.e., not published in peer-reviewed journals), it was felt pertinent to make reference to it given the popularity with researchers utilising the Mental Toughness Questionnaire-48 which assesses respondents in relation to this model.

Whilst there appeared to be some relative consistency emerging in the conceptualisations of mental toughness, with approaches adopted to unearth not just what mental toughness is, but also what mental toughness is not, the review indicated that there are still challenges in relation to the current definitions which are worth considering. With Jones et al. (2002), mental toughness was depicted in reference to overcoming an opponent which is problematic as it renders the possession of mental toughness dependent upon the outcome of an event which is more indicative of superior athleticism. In suggesting that to be mentally tough, one must generally be better that one's

opponent take one's mental toughness out of one's control. What is more, the absolute language of descriptions of mental toughness including "unshakeable belief", "insatiable desire" and "fully focused" are problematic, as they feed off the potentially culturally constructed ideals of the construct and not the realities of sport. For example, an unshakeable belief would be one that could not be modified or changed, and insatiable desire suggests one that could never be filled and has closer relevance to pathological conditions and maladaptive behaviours than was first intended.

Development and Maintenance of mental toughness

Following the emergence of the more scientifically constructed definitions of mental toughness, twelve studies (26.1%) were identified in this review to have specifically examined the development of mental toughness. In relation to Jones and colleagues conceptual definition (Jones et al., 2002) and the mental toughness framework (Jones et al., 2007), Connaughton and colleagues proposed possible underlying development mechanisms of mental toughness by drawing on the intimate knowledge and experiences of the participants in the original studies of Jones and colleagues. Two studies were conducted, each with the respective 'elite' (Connaughton et al., 2008) and 'super-elite' (Connaughton et al., 2010) samples, both of which found support for the development of mental toughness over three career phases, which aligned with Bloom's (1985) early, middle and later years of talent development, with significant events characterising the transition between phases. Key processes implicated across the studies included the pivotal role of environmental influences and motivational climates, the contributions of various sporting and non-sport personnel, the support from social networks and the experience of critical incidents. Findings also supported the contention that, once acquired, levels of mental toughness can fluctuate and as a result must be maintained.

As with the definition and attributes associated with mental toughness, the review identified subtle differences within specific sports that may determine how mental toughness develops. Three independent sport-specific studies have all highlighted the significance of the environment in the development of mental toughness (Bull et al., 2005; Thelwell et al., 2005; Thelwell et al., 2010) with emphasis placed on the parental influence, childhood background, exposures to challenges and opportunities to survive early setbacks, all presented as important in the formative stages of development. Specific to English cricket, Bull et al. (2005) highlighted the interaction of a

performance environment, character, attitude and thinking as a possible means of developing mental toughness, arranged in a pyramid framework with the environment providing the foundation for the process. While mental toughness development has been typically associated with responses to negative experiences, references are also made to the how positive experiences can be significant as well, with other sport processes relating to training, competition and being part of a team or club being important to consider also (Thelwell et al., 2010).

Whilst debate was apparent over whether mental toughness is a stable trait-like component of personality (Clough et al., 2002), or a set of context specific characteristics and cognitive skills, findings from both of Connaughton and colleagues work (Connaughton et al., 2008, 2010) would suggest that psychological skills training has a salient role to play in the development of mental toughness. Given the emphasis placed on the development and maintenance of both basic and advanced psychological skills, the reviewed identified studies in which Gucciardi and colleagues (Gucciardi, et al., 2009c, 2009d) examined the usefulness of such a programme to enhance mental toughness which provided preliminary support for their use. Previously, Bhrambi, Dhillon and Sahni (2005) and Sheard and Golby (2006) had demonstrated the effectiveness of a multi-modal psychological skills training programmes on mental toughness development as well as a range of other positive psychological constructs.

Grounded in the theoretical tenets of personal construct psychology, Gucciardi et al. (2009a) forwarded a process model of mental toughness development. Building on the emerging conceptualisation (Gucciardi et al., 2008), Gucciardi and colleagues postulated that mental toughness was developed, modified and maintained based on the influence of key components manipulating the way in which individuals covertly and overtly approached, appraised and responded to events demanding varying degrees of challenge, adversity and pressure. In an exploratory study, Gucciardi, Gordon, Dimmock and Mallett (2009) uncovered coaches' perceptions of how they can both facilitate and impede the development of mental toughness characteristics. Five categories appeared to be central to the coaches role, four of which were facilitative (i.e., coach-athlete relationship, coaching philosophy, training environments and specific strategies) whereas only one was thought to impede this process (negative experiences and influences). In line with the developmental stages presented by Connaughton et al. (2008), an

investigation into development differences between 'specialised' and 'invested' Australian-rules footballers provided some preliminary quantitative evidence to support their assertions (Gucciardi, 2009).

Unique developments were unearthed in two studies in the review whereby researchers sought to investigate the potential role of genetic factors in mental toughness development. Golby and Sheard (2006) evaluated the relationship between genotype and positive psychological development in national-level swimmers using the serotonin transporter 5-HHT gene, and Horsburg et al. (2009) sought to determine the extent to which genes and/or environmental factors contributed to individual differences in mental toughness in a first behavioural genetic (BG) investigation of mental toughness. Whilst no significant associations where found between 5-HHT and mental toughness, Horsburg et al. (2009) revealed that the individual differences in mental toughness were largely attributable to genetic and non-shared environmental factors. Acting similar to that of other personality traits, results indicated that the concept is quite heritable and therefore, it may be harder to strengthen or modify ones overall level of mental toughness than first suggested.

Instruments and Methodologies

Whilst the interest in the field of mental toughness was found to be strong dating back to the 1950's, it was not until Jones et al.'s (2002) seminal study that more rigorous scientific approaches were adopted to guide the research. The literature in this review was seen to generally use one of two methodologies. Firstly, a number of studies have used the interview-based, qualitative method that was originally employed by Jones and colleagues, whilst secondly, other researchers employed various self-report measures of the psychological characteristics conceptualised to underpin mental toughness in an attempt to discriminate between populations.

From this review, twenty-eight studies (60.9%) were found to have adopted quantitative approaches with the predominant methodological approach to the measurement of mental toughness identified as the use of self-report inventories. Despite advances in the conceptual evolution of the mental toughness phenomenon, various self-report inventories have since come under much scrutiny given either the limited scientific rigor in their design and/or subsequent

insufficient detail disclosed in the literature regarding the necessary statistical procedures required for inventory development and validation.

Nine studies were found to have employed the Psychological Performance Inventory (PPI; Loehr, 1986), the inventory developed to operationalise Loehr's (1982) definition of mental toughness. Despite the persuasive discussion offered for the inventory and the rationale for the subscales, no psychometric support was presented, and little conceptual or theoretical foundation to the instrument was provided. Furthermore, evidence has emerged to suggest that the PPI does not possess the adequate psychometric properties and as such its use in future scientific investigations has been questioned (Middleton et al., 2004; Golby et al., 2007).

In contrast to the PPI, Clough et al. (2002) presented the Mental Toughness Questionnaire-48 (MTQ48) to operationalise the 4C's model of mental toughness. This review identified 10 studies that have used the measure, one of which adopted a shortened 18-item version, the MT18 (Levy et al., 2006). Similar to the PPI, the MTQ48 has also been subjected to challenge in relation to its theoretical underpinning and psychometric integrity. Despite studies offering support for the face validity of the measure, the overly brief account of psychometric development provided by Clough et al. (2002) fails to convey the extent to which methodologies employed in its development possess sufficient scientific rigor, reliability and validity. What is more, insufficient rationale is provided for the association with hardiness that is ultimately the basis of the 4C's conceptual model. Whilst numerous studies have utilised this measure, this review identified that the psychometric properties are yet to be adequate reported in the literature and it appears further use of this measure would be questionable until such clarity is provided.

Other measures identified include two sport-general measures of mental toughness, the Mental, Emotional and Bodily Toughness Inventory (MeBTough; Mack & Ragan, 2008), and the Sport Mental Toughness Questionnaire (SMTQ; Sheard et al., 2009) and two sport-specific measures, the Australian football Mental Toughness Inventory (AfMTI; Gucciardi, Gordon & Dimmock, 2009b) and the Cricket Mental Toughness Inventory (CMTI; Gucciardi & Gordon, 2009). Whilst the SMTQ is still in its infancy, preliminary evidence suggests that the multidimensional measure of mental toughness possesses encouraging psychometric properties, with adequate reliability, divergent validity and discriminative power demonstrated (Sheard et al., 2009).

Nevertheless, on inspection of its content validity the measure appears limited in its ability to capture the breadth of the construct and the logical validity of some of the items appears questionable. For example, the item “I can regain my composure if I have momentarily lost it” appears more logically connect to the Control subscale as opposed to the Confidence scale it is designated. Furthermore, the items measuring the subscale Constancy also appear to tap into a wide range of factors from concentration (“I get distracted easily and lose my concentration”) to personal responsibility (“I take responsibility for setting myself challenging targets”). As a consequence it is hard to theoretically ascertain how these elements logically fit together. In this instance it appears that through exploratory factor analysis techniques, the SMTQ has combined into single scales, components that other research groups have identified as being distinct components in other models of mental toughness (Jones et al., 2002, 2007).

In relation to the MeBTough, whilst the scale demonstrated potential validity with encouraging psychometric properties, the restrictive sampling methods (i.e., college athletes only) and conceptual foundations (i.e., based upon Loehr’s (1994) seven-factor model), raises questions over its suitability as a sound measure of mental toughness across other sporting populations. In contrast having been developed from adequate conceptual foundations (Gucciardi et al., 2008; Gucciardi & Gordon, 2009), the AfMTI and CMTI possess strong support for their application as context specific, single-sport measures of mental toughness. However, despite the scientific rigor undertaken with their development and the initial psychometric properties presented, the context specificity of the AfMTI and CMTI limits the generalizability and practical utility of the measures beyond the specific contexts of Australian rules football and cricket respectively.

Of the 26 quantitative studies reviewed, 19 have been cross-sectional studies (67.9%) adopting a between-sport perspective utilising the general mental toughness measures such as the PPI (Loehr, 1986), the MTQ48 (Clough et al., 2002) and the SMTQ (Sheard et al., 2009) investigating relationships with key correlates such as coping (Nicholls et al., 2008; Kaisler et al. 2009), optimism (Golby & Sheard, 2006; Nicholls et al., 2008), leadership preferences (Crust & Azadi, 2009), hardiness (Golby & Sheard, 2004; 2006; Sheard, 2009), risk-taking (Crust & Keegan, 2010) and psychological skill use (Crust & Azadi, 2010). Seven studies adopted sport-specific approaches investigating table-tennis (Lee et al., 1994), wushu (Kuan & Roy, 2007), Australian

rules football (Gucciardi et al., 2009c, 2009d, Gucciardi et al., 2009, Gucciardi, 2010) and cricket (Gucciardi & Gordon, 2009), of which five utilised sport specific measures including the AfMTI (Gucciardi et al., 2009b) and the CMTI (Gucciardi & Gordon, 2009). One study used the mental toughness subscale of the Motivation Rating Scale (Dennis, 1978) and three studies have used remodelled versions of previous measures for the use with injury rehabilitation athletes (MT18: Levy et al., 2006; MeBTough: Mack & Ragan, 2008) and a comparison with hardiness (PPI-A: Sheard, 2009).

Of the 13 studies (28.3%) identified in the review that adopted qualitative approaches, 12 utilised semi-structured interviews with a combination of athletes, coaches, parents and psychologists, four recruited focus groups, and five adopted mixed method designs which incorporated some form of quantitative analysis following theme generation (i.e., ranking of attributes). Of the qualitative studies reviewed, the common theory adopted to guide the research has been personal construct theory (Kelly, 1955/1991), which has been employed extensively in other areas such as nursing, education and psychotherapy (Walker & Winter, 2007). Whilst early descriptive studies offer some existence in advancing conceptualisations of mental toughness, being founded in strong theoretical approaches adds credence to the research and provides a medium through which other researchers can compare and contrast findings within and between sports, as well as other performance settings such as business, military, education and the arts (Williams, Hardy & Mutrie, 2008).

Jones et al. (2002) was the first study to be guided by theory and subsequent research by Gucciardi and colleagues (Coulter et al. 2010; Gucciardi et al., 2008; Gucciardi & Gordon, 2008, 2009) has supported its utility in developing other multidimensional conceptualisations. The yields of these studies have been the identification of a plethora of characteristics, attitudes, beliefs, and cognitions related to mental toughness and no fewer than four conceptual models or frameworks (Bull et al., 2005; Coulter et al., 2010; Gucciardi et al., 2008; Jones et al., 2007). Four studies specifically explored the developmental process underpinning mental toughness, using elite (Connaughton et al., 2008; Thelwell et al., 2010) and world's best samples (Connaughton et al., 2010), and one uncovered insights specifically of coaches and their personal role in either enhancing or impeding development (Gucciardi et al., 2009).

Practical implications and intervention programmes

Whilst it must be acknowledged that in relative terms, the research area of mental toughness is still in its infancy, the review of the findings offer a number of practical implications for both athlete, coach, parent and practitioners attempting to understand and develop this much sought after construct. Of those reviewed, three studies (6.5%) explicitly looked at implementing intervention programmes designed to enhance levels of mental toughness. The first by Brambri, Dhillon and Sahni (2005), found support for the use of a combination of psychological interventions, whilst Gucciardi and colleagues (Gucciardi et al., 2009c, 2009d) found that both a Psychological Skills Training (PST) programme and a specifically tailored Mental Toughness Training (MTT) programme were equally effective in enhancing mental toughness compared to control groups. Whilst the quantitative analysis of this study (Gucciardi et al, 2009c) reported positive changes in subjective ratings of mental toughness, resilience and flow, the qualitative analysis identified a number of benefits of the programme including valuing the importance of quality preparation, being more receptive to criticism, team cohesion, an increased work ethic, tougher attitudes, and the development of transferable skills. Processes thought to underpin these developments in mental toughness were enhanced self-awareness, improved techniques for self-monitoring and self-regulation, and the experience of multiple perspective discussions. Together, these studies emphasised the efficacy of PST programmes for enhancing mental toughness and warrants further investigation.

As well as these intervention focused studies, there are a number of practical implications that are offered which relates to the definition, conceptualisation and developmental focused studies. The assertions made by Jones and colleagues (Jones et al., 2002, 2007) referring to both “natural” and “developed” elements of mental toughness provide some important implications for practice. Identification of this “natural” element of mental toughness that performers possess and bring into the performance environment is important as it may assist youth development and athlete-talent identification initiatives. What is more, highlighting the aspects of mental toughness which can be developed and understanding the process through which this occurs, may assist the coach and practitioner in enhancing mental toughness in their athletes. More specifically, with the aid of an accurate assessment tool, high risk athletes such as those who are naturally gifted or

talented, but are identified to be less mentally tough, can be better supported through strategies implemented to target specific deficiencies which will enable them to fulfil their potential.

From the review, whilst it appears researchers and practitioners are supportive of PST programmes to cultivate and maintain mental toughness, whilst these have a salient role, it appears there are many more factors that may require further attention such as the role of significant others, experiencing competitive success and failure, reflective practice and support networks. Nevertheless, it is apparent from the review that the development and maintenance of mental toughness is an extensive process, involving a multitude of underlying process which operate in symbiosis and, as a result, it is essential athletes, coaches and practitioners become cognisant with the appropriate development approaches and strategies (Bull et al., 2005; Connaughton et al., 2008, 2010; Thelwell et al., 2010).

The growing consensus around a core constellation of mental toughness characteristics, consistently cited across a number of the studies reviewed (e.g., self-belief, motivation, commitment, attention control, resilience, handling pressure), has a number of implications for researchers and practitioners. Settling on what mental toughness is has important implications for the development of the construct and as such it may appear that researchers are better placed to unearth the underlying process that enable one to be mentally tough. Subsequently, if the elements of mental toughness that positively influence performance can be identified and understood, then it is also feasible that these can then be taught and utilised by athletes in order to enhance their performance (Fourie & Potgieter, 2001).

Given the recommendations from a number of studies emphasising the importance of developing an impactful environment (Bull et al., 2005; Gucciardi, 2010; Gucciardi et al., 2009; Thelwell et al., 2005; Thelwell et al., 2010) there is support for sport psychology consultants and practitioners to work closely with their coaches. Together they can work to construct an appropriate motivational climate and associated high performance environment designed to facilitate mental toughness development, as well as integrating PST throughout the program designed to provide individuals with the relevant strategies for coping with a multitude of situations, as opposed to a stand alone function which has traditionally been the approach adopted.

Discussion

From this review, 46 studies of mental toughness available in peer-reviewed literature up to and including the period of November 2010 were identified. Given the relative infancy of the literature, interest has largely focused on establishing an agreement on an operational definition of mental toughness, understanding the operational mechanisms underpinning mental toughness and its development, and the development of measurement tools for assessing mental toughness among athletes. The review highlighted an upward trend in activity in these areas and consequently there have been several advances in relation to these areas. The purpose of this study was to conduct a systematic review of mental toughness literature to date, to consolidate the findings cited, and to highlight any specific conceptual and methodological issues that exist. In doing so, a clearer perspective of "where we are now" in terms of empirical mental toughness research is provided, limitations of the study are acknowledged and the chapter concludes with a direction for future research.

Defining mental toughness

The first aim of this systematic review was to examine the operational definition of mental toughness. Whilst the existence of recurring themes helps in the development of a general understanding of mental toughness and its components, the theoretical development in the early mental toughness literature has been limited by non-empirical studies which appear to be based more on anecdotal, experiential consultations and applied work with elite performers, rather than a result of rigorous systematic programs of research. Whilst recent studies have implemented a more rigorous and systematic approach to researching and understanding mental toughness, these too have been identified as somewhat problematic and the review found that these too have received some criticism. Whilst Clough et al. (2002) may be accused of finding a theory (i.e. hardiness) and fitting mental toughness into it without sufficient justification or rationale (Crust, 2007, 2008), Jones et al.'s (2002) definition could also be seen as limited.

Despite the appeal of Jones et al.'s (2002) definition and the comprehensive list of attributes that emerged (Jones et al., 2002; 2007), their definition appears insufficient in that it only describes the outcomes of mental toughness (i.e., what it enables an athlete to do) and fails to

describe and define what exactly mental toughness actually is (Crust, 2007). What is more, the overriding emphasis on the outcomes of mental toughness does little to explain what this "natural or psychological edge" is, likewise defining mental toughness with respect to beating an opponent can infer that mental toughness simply reflects superior athleticism rather than a superior ability to deal with, overcome and thrive through challenge and adversity. Similarly, little attempt was made to establish or integrate the findings with established psychological theory, nor was any attempt made to develop a conceptual model with no insight provided into how mental toughness operates or is developed.

Whilst advances in methodological design and qualitative approaches are commendable, the narrow focus on elite and super elite athlete samples (Bull et al., 2005; Fourie & Potgieter, 2002; Jones et al.'s, 2002, 2007) are somewhat restrictive given that successful outcomes are perhaps more appropriately conceived in relative, rather than absolute terms (Crust, 2008). Limiting mental toughness conceptualisations to only the perceptions of the 'elite' and 'super-elite', has the potential to infer a halo-effect of mental toughness qualities being ordained on these individuals. In this instance, it may be that the researcher is not actually referring to mental toughness, but more to superior athletic performance. As well as enlisting the opinions of the performers who have not obtained elite status but are still considered mentally tough, Bull et al.'s (2005) offer suggestions for three other groups of performers who are worthy of future investigation; the *'continued-success or repeat performers group'*, the *'decline-and-come-back or adversity avengers group'*, and the *'unable-to repeat or one-hit-wonders group'*. Each of these facets have achieved success throughout their career, but intuitively each would provide a different perspective of mental toughness, the attributes and the mechanism thought to underpin its development and maintenance.

Given the considerable volume of research into mental toughness, there is still much debate regarding its definition and conceptualisation. Despite the emergence of various conceptualisations from independent research groups, the review highlights the need for clarity and consistency with regard to the definition and conceptualisation of mental toughness moving forward. Promisingly, given the contrast of between–sport and within-sport approaches, there appears to be growing support for the contention that irrespective of sport, mental toughness can

be defined in a similar way. Collectively they make reference to mental toughness as an amalgam of interrelated protective and enabling factors that allow performers to cope with the various demands and pressures of sport and produce consistent superior performances.

Within the literature, most conceptualisations offered are multidimensional in nature and there is an emergent replication of multiple key components which can be broadly classified into various values, attitudes, cognitions and emotions that enable people to behave in such a way as to achieve their goals in the face of obstacles. Taken together, the commonalities in these hypothesised psychological characteristics (e.g. self-belief, attention control, motivation, commitment and determination, resilience, and handling pressure) provide some support for the assertion that mental toughness can be defined in a similar manner, irrespective of sport. Nevertheless, consideration that these studies are not representative of all sports and that studies have also identified sport-specific variances (Gucciardi & Gordon, 2009, Gucciardi, et al., 2008, Coulter et al., 2010) would suggest that mental toughness may be somewhat contextually driven (Bull et al., 2005).

Given the isolated nature of the theoretical bodies of mental toughness literature, it is proposed that a directive is needed whereby researchers accumulate, consolidate and synthesise the current research literature that has uncovered multiple components of mental toughness in athletes in order to establish a more succinct yet complete understanding of mental toughness in sport. Such a synthesis approach may then accomplish a more conceptually focused and integrative model that incorporates the most common components identified, one that best operationalises the breadth and depth of the construct. In doing so, this would then move existing mental toughness literature beyond description towards a more extensive theoretical definition and conceptualisation of mental toughness. In addition, it would provide a simplified, understandable and applicable framework that can be used to provide a rigorous and robust foundation to develop mental toughness research and theory further.

Developing mental toughness

With a growing understanding of what mental toughness is, and studies supporting the contention that mental toughness could be acquired and developed (e.g., Jones et al., 2002; 2007; Thelwell, et al., 2005) allows research to begin exploring the mechanisms by which mental

toughness develops. The review identified that the development of mental toughness has been explored from various perspectives, incorporating the views of performers, coaches, psychologists and parents alike, adopting approaches from a within-sport (Bull et al., 2005; Gucciardi et al., 2009; Thelwell et al., 2010) as well as between-sport perspective (Connaughton et al., 2008, 2010). A number of common themes, shared experiences and strategies for development emerged.

The influence of the environment is a prominent influence across the studies reviewed. Bull et al. (2005) suggested the need to develop an environment within which players are given maximum opportunity to benefit in terms of character and attitude development as well as tough thinking. However, no explanation of what environment is required is given other than considering the performers upbringing and transitions into appropriate sporting environments. Connaughton et al. (2008) also cited the importance of environmental and 'parental influence' and Thelwell et al.'s (2010) insights from gymnastics highlighted four key mechanisms of environmental influences, namely, the training environment which instilled perseverance, the family environment which promoted self-belief, modelling of better gymnasts which heightened the determination to succeed, and finally the country which inspired and instilled belief to continue the tradition of success.

Another prominent theme to be revealed is the role of the coach and how they may facilitate the development of mental toughness. Guccardi et al. (2009e) highlighted overarching categories that accounted for the strategies, experiences and mechanisms employed by coaches to develop mental toughness specific to Australian football. These included: early childhood experiences, which played an important role in nurturing a 'generalised form' of mental toughness, with football experiences, the coach-athlete relationship, coaching philosophy, the training environment and other specific strategies used to transform this generalised mental toughness into 'sport-specific forms'. Gucciardi et al. (2009) also highlighted the coach's ability to hinder optimal mental toughness development. Key issues included: an unbalanced desire for success overruling individual player development needs, focusing on and over-emphasising player weaknesses, imposing low or unrealistic expectations, and fostering 'easy' training environments. Given both the facilitative and debilitative influence coaches possess in the psycho-social development of athletes (Wyllemann & Lavallee, 2004), it is highlighted that both educational and training programmes

identifying strategies and mechanisms to help the mental toughness developmental process of athletes would be beneficial.

Findings from perceptions of performers from a between-sport perspective (Connaughton et al., 2008, 2010) revealed a range of experiences, strategies and mechanisms which offered support for those aforementioned in Australian football and which were depicted to operate over four distinct career phases: initial involvement to intermediate level, intermediate to elite, elite to Olympic or World Champion status and finally, a maintenance level. Overall, findings also revealed a variety of influential individuals (e.g., parents, coaches, family and friends) and factors such as the environment and the experience of (perceived) positive and negative critical incidents, which impacted either directly or indirectly on the development process. Once acquired, Connaughton et al. (2010) also emphasised the need for mental toughness to be maintained through the use of psychological skills and strategies (i.e., self-talk, cognitive reconstruction, pre-performance routines, simulation training), however this was only explored in relation to Jones et al.'s (2007) 13 subcomponents, and not each of the 30 specific attributes which warrants further consideration.

A key question within the field is the contribution of genetic factors over environmental influences. More specifically, there is debate over whether mental toughness is an inherited, personality characteristic (Golby & Sheard, 2006; Horsburgh et al., 2009) or is it developed through a socialisation process either through specific training (e.g. psychological skills or coach-mediated training) or "caught" through life experiences. Whilst the reported research supports the view that mental toughness can be developed differentially, it appears that there is an inestimable amount of mental toughness which is "caught" through social experiences and key supportive agents (i.e. parents, coaches, significant others), nevertheless, at least some aspects of mental toughness can be "taught" through specific techniques (Gordon, 2005; Connaughton et al., 2008, 2010). Jones et al.'s (2002) definition provides support for this divided assertion given their acknowledgement that athletes possess inherited characteristics that relate to a "natural" aspect of mental toughness, while proposing that aspects may also be "developed" throughout their careers via learning new skills, experiences of success and failure, with components which must also be "maintained" (Jones et al., 2007). Whilst mental toughness may incorporate some inherent dispositional qualities (Golby & Sheard, 2006; Horsburg, et al., 2009), it appears that the construct is largely developed

through and influenced by experiences with, and interpretations of, an individual's internal and external environment (Gucciardi et al., 2009c).

Taken together, the review suggests that experiences and environments that individuals are exposed to in the formative years of development are crucial in determining the "caught" aspects of mental toughness. Other aspects developed through the middle years, where performers benefit from others (i.e., expert coaches, elite performers, role models) and finally through the use and development of psychological skills and strategies to enhance and maintain mental toughness are the "taught" components of the construct. What remains to be seen is establishing the most appropriate and effective approaches to assist the development of the aspects absent in individuals when not exposed to such facilitative environments.

Measuring mental toughness and methodology

Despite progress being made through more scientifically rigorous qualitative investigations in mental toughness from both general between-sport and specific within-sport perspectives, from the review it was apparent that insufficient effort has been devoted to the development of reliable and valid measures of mental toughness in sport. In summarising the qualitative literature, it would appear that the majority of researchers agree that mental toughness is a (dispositional) multidimensional construct that allows individuals to manage the demands of pressure, challenge and adversity in sport. Nevertheless, whilst there have been attempts to construct inventories designed to measure the various conceptualisations, the limited supporting psychometric evidence presented regarding either their development, the procedures undertaking to confirm their factor structure, or simply the rationale behind the conceptualisations (i.e., Clough et al., 2002; Loehr, 1982), has left their application in research open to scrutiny.

To date the most-popular strategy for data collection has been the application of self-report instruments of mental toughness as part of a cross-sectional and correlational design. In moving towards greater conceptual clarity, it appears to be of paramount importance that quantitative approaches become a greater focus for future investigations as they afford a means by which to sample a greater number of athletes and strengthen generalisations inferred from qualitative research (Crust & Azadi, 2009). Nevertheless, there must be confidence in the psychometric properties of the measures used, one supported by demonstrations of robust validity and reliability

based on a sound knowledge base of dedicated empirical research. Whilst confirmation of the development procedures and psychometric properties is of paramount importance, so too is the production of norms. Not only would this aid the identification of individuals regarded as mentally tough, but it will also facilitate the comparison between populations which would aid not only academic enquiry but also the work of practitioners charged with developing mental toughness in individuals.

A second challenge identified in the review is the prevalence of cross-sectional correlational studies and the absence of longitudinal approaches. This dominance has prevented the exploration of causality and created a perspective of mental toughness as a state rather than a chronic process which several qualitative studies would suggest (Bull et al., 2005; Gucciardi, et al., 2008). Whilst this state perspective has identified a number of factors associated with mental toughness (i.e., stress, coping approaches, dispositional optimism), this approach has delimited understanding of the cause-and-effect mechanisms at play and therefore if mental toughness is to be identified early and inventions applied effective, then greater understanding of how mental toughness manifests itself should be sought after.

If empirical investigations of mental toughness are to continue, a psychometrically and theoretically sound measure of mental toughness must be developed. Whilst progress has been made in the development and validation of sport-specific measure of mental toughness for Australian football (Gucciardi et al., 2009b) and cricket (Gucciardi & Gordon, 2009), their specificity offers little range of usefulness (i.e., sole use with Australian footballers and cricketers). Furthermore, with concerns surrounding the psychometric integrity of the various sport-general measures of mental toughness (i.e., PPI, MTQ48, MeBTough) either from conceptual or methodological standpoints (i.e., overly brief accounts of psychometric development processes) has resulted in researchers urging caution until scientifically rigorous, psychometric evidence supporting the factorial validity of these measures is provided (Connaughton & Hanton, 2009).

In assessing the current measures identified in this review, based on conceptual and statistical adequacy, it is concluded that at present, no measure sufficiently satisfies both criteria and as a result further work is required to address the limitations of current available measures. Failing that, work is needed towards developing a new mental toughness inventory that is

grounded in empirical knowledge, one that is underpinned by a sound theoretical framework and definition of mental toughness and one that possesses sufficient psychometric properties as outlined in recommendations by Marsh (1997, 2002) in relation to construct validation procedures (i.e., within- and between-network examinations).

Practical applications and interventions

Whilst there appears a clear salient role for psychological skills training for the development of mental toughness, a number of other factors have also been highlighted in the review that may contribute to the process. Overall, it appeared that it is important coaches and practitioners should consider a multitude of factors (i.e. environment, personnel, exposure) when attempting to cultivate or maintain mental toughness and wherever possible interventions should be tailored to meet the demands of the sport and the individual. The education of athletes, coaches and parents through educational or experiential workshops appears fruitful and the recurring global mental toughness characteristics appears a good place from which to start. Providing exposure to a variety of situations in training, competition and the exploration of critical incidents appears particularly fruitful in developing athletes' knowledge of how to handle negative life experiences and the important role played by coaches, parents and significant others in an athlete's support network, within and outside of the sporting environment should not be underestimated.

Directions for future research

Despite the considerable volume of research into mental toughness highlighted in this review, it is evident that there is still debate regarding its definition, conceptualisation and its measurement. Collectively, the studies seem to agree that mental toughness is a (dispositional) multi-dimensional construct that allows individuals to deal with challenges, pressure and adversities that they encounter, however there is still much confusion over the exactly composition of the construct, its definition and conceptualisation given the isolated nature of these programmes of research (i.e., Clough et al., 2002; Jones et al., 2002, 2007; Gucciardi et al. 2009). Whilst the empirical and conceptual foundations of mental toughness is developing, the emergence of differing conceptualisations, some between-sports (Jones et al., 2002, 2007) and some within-sports such as cricket (Bull et al., 2005; Gucciardi & Gordon, 2009), only further clouds the already murky conceptual waters. Despite advances, common limitations have been inherent, in part due to

simplistic methodologies lacking sufficient rigor that have been exploratory and anecdotal rather than scientifically rigorous in nature (i.e., Clough et al., 2002; Loehr, 1986). What is paramount is that researchers work to agree a common definition and conceptualisation of mental toughness and clearly define the relations between the multidimensional construct and its dimensions. In doing so it will provide support for mental toughness as a construct and not just a collection of related variables, whilst also assisting the development of practical implications of how to operationalize the construct.

At present, there also still appears to be an apparent need to develop a valid and reliable between-sport measure of mental toughness, one based on a sound theoretical knowledge base and one that possesses strong psychometric properties. Such an instrument would not only allow researchers to conduct more fine grained investigations into mental toughness, but the efficacy of the findings would be more resounding, an issue which has plagued the use of current unsubstantiated measures (i.e., PPI, MTQ48). A conceptually accurate and psychometrically valid and reliable inventory would be hugely significant in the field as it could be utilised to identify performers who possessed high or low levels of specific attributes or characteristics of mental toughness, enable cross-sectional group comparisons, as well as assist the design, implementation and assessment of specialised intervention programmes.

Limitations

Whilst previous reviews of mental toughness literature exist (Crust, 2007, 2008; Connaughton et al., 2008), the dissatisfaction of more traditional narrative reviews is that they tend to be descriptive in nature and seldom make sense of the collection of studies reviewed; this has led to the growth in systematic reviews (Noblit & Hare, 1988). To date, no known systematic review of mental toughness within the field of Sport and Exercise Psychology had been conducted and hence it was seen as a valuable contribution to knowledge. This approach is not without limitations however. Whilst the methodology used was based on popular guidelines (Chalmers & Haynes, 1995; Lloyd Jones, 2004; Mulrow, 1995), reported in the fields of health care (Edwards, Hannigan, Fothergill & Burnard, 2002; Egger & Smith, 2001), occupational psychology (Cooper, 1982, 2003) and sport psychology (Goodger, Gorely, Lavellee & Harwood, 2007; Nicholls & Polman, 2007),

methodological concerns have been raised over search, inclusion and exclusion criteria, as well as potential sources of bias via publication and language criteria (Stern & Simes, 1997).

Whilst an extensive literature search was undertaken to identify all published and un-published studies, using only those published in peer-reviewed journals and in the English language is acknowledged as a limitation. This is extremely pertinent given the apparent overwhelming commentary from non-empirical studies (Clough et al., 2002), numerous articles (Goldberg, 1998; Hodge, 1994; Jones, 1982; Williams, 1988) and popular literature (Bull et al., 1996, Gibson, 1998; Goldberg, 1998; Loehr, 1982, 1986, 1995; Williams 1998) which has guided early conceptualisation and understanding of mental toughness to date. Whilst no restriction of source was implemented during the electronic and manual searches, for richness of data, such that possessed scientific rigour, only published data in English language was included. Whilst this represents a publication bias approach (Egger & Smith, 2001), it was deemed impractical and expensive beyond means to obtain copies of unpublished documents and translate foreign written transcripts for inclusion. Furthermore, the limited available information provided in published conference proceedings is insufficient to determine the scientific rigour of the studies and hence were excluded. Given the time frame imposed on this investigation in order to allow the research programme to proceed, a follow-up summary of more recent literature published beyond this point is provided later in the Discussion (see Chapter VI).

Conclusions in relation to the thesis

While the study of mental toughness has advanced since the adoption of more scientifically rigorous approaches, there are still a number of limitations and theoretical concerns that remain which should be considered when interpreting their findings. The state of the current literature examined in this systematic review suggest the research area is still limited in that popular definitions are predominantly outcome focused, characteristics are largely descriptive in nature, there is little clarity around the underlying processes by which mental toughness operates and currently no psychometrically sound objective measure of mental toughness appears to be available. While the qualitative approaches have assisted in the development of rich, descriptive, interpretations of what mental toughness is, the emergence of these studies in isolation has only

led to further confusion around the nature of the construct, its definition, conceptualisation and the composition of its key constituents.

Most pressingly, is the lack of evidence available outlining the construction or confirming the psychometric properties of the sport-general measures of mental toughness currently in circulation (i.e., PPI, MTQ48). From this review, whilst initial explorations of the PPI have been undertaken, it appeared that the MTQ48 has been uncritically adopted as the preferred tool for measuring mental toughness without any thorough examination of its psychometric integrity conducted previously. Given the lack of published evidence supporting the psychometric properties of the most widely used, yet unsubstantiated measure of mental toughness, it remains imperative that this measure undergoes the scrutiny of the necessary psychometric procedures to confirm its psychometric integrity before further use and the interpretations of studies utilising the measure are supported.

Subsequently in the next chapter (Study 2), an examination of the factorial validity of the MTQ48 using a construct validity (within-network) approach is presented. Specifically, it was sought to establish or refute support for a measurement model of Clough et al.'s (2002) 4C's conceptualisation of mental toughness through examination of the two proposed factor solutions of the MTQ48 (four- or six-factor) currently present in the literature. The examination of the factor structure of the MTQ48 is an important contribution to the research area as it seeks to alleviate concerns over the lack of empirical evidence detailing the scale construction, the lack of evidence outlining the psychometric properties of the measure, alongside the sparse rationale for the close proximity of the underlying model with hardiness theory.

Chapter III

Study 2 – Evaluating the factor structure of the Mental Toughness Questionniare-48

Summary

In this chapter, the evaluation of the psychometric properties of a popular yet unsubstantiated measure of mental toughness – the Mental Toughness Questionnaire 48 – is presented. A construct validity (within-network) approach was conducted to examine the latent structure of the inventory. As confirmatory factor analysis yielded a poor fit and improper solution for both the 4-factor and 6-factor *a priori* models presented in the literature, independent analysis of each respective scale as well as exploratory factor analysis was pursued. Overall the results of this study could not provide support for the hypothesised factor structure of the MTQ48, supporting concerns over the psychometric reliability and validity of the measure of mental toughness and considerations for future practice are offered. Consequently, further testing and development of the measure is proposed and the need for the development of an alternative inventory, one based upon strong theoretical rationale and possessing adequate psychometric strength in terms of within-network and between-network validity is postulated.

Introduction

Following a systematic review of mental toughness literature (Study 1), it was identified that to date, no known published research has empirically examined the structure of the most popular measure of mental toughness – the Mental Toughness Questionniare-48 (MTQ48; Clough, et al., 2002). Given the lack of published evidence supporting the psychometric properties of the most widely used, yet unsubstantiated measure of mental toughness, it was considered imperative that this measure undergoes the scrutiny of the necessary psychometric procedures to confirm its psychometric properties before further use and the interpretations of studies utilising the measure are supported. The examination of the factor structure of the MTQ48 is an important contribution to the research area as it seeks to alleviate concerns over the lack of empirical evidence detailing the scale construction, the lack of evidence outlining the psychometric properties of the measure, alongside the sparse rationale for the close proximity of the underlying model with hardiness theory.

In presenting the measure, Clough and colleagues provide only a brief account of the methodologies employed to develop their 4C's conceptual model of mental toughness and the

associated inventory, and in doing so, they fail to provide sufficient detail regarding the psychometric developmental processes employed to demonstrate sufficient psychometric rigor, reliability and validity. Whilst there is support for the construct validity of the MTQ48 advocated through the low-to-moderate correlations with related constructs such as coping, optimism, leadership preferences and control appraisal (Crust & Azadi, 2009; Kaisler et al., 2009; Nicholls et al., 2008, 2009), the insufficient understanding of the psychometric properties of the MTQ48 is problematic on two fundamental levels. Firstly, because without understanding the psychometric strength of the inventory, it is uncertain as to whether the inventory is actually measuring what it is purporting to measure (i.e., the 4C's model of commitment, control, challenge and confidence), and therefore it is not possible for the researcher to test the underlying theory. Secondly, if there is ambiguity around the construct validity of the inventory, then any research utilising the inventory could be clouded in uncertainty in terms of the validity of the findings and conclusions made, until the issue of psychometric clarity of the inventory used is resolved.

Accordingly, a construct validity (within-network) approach was conducted to examine the latent structure of the MTQ48 based on Clough et al.'s (2002) 4C's conceptualisation of the construct. Specifically, it was sought to evaluate the psychometric properties of the MTQ48 through examination of its proposed factor structure. Subsequently, this involved clarifying which of the two proposed factor solutions of the MTQ48 (four- or six-factor) currently present in the literature best captured the latent mental toughness construct.

Establishing a measurement model of mental toughness

Despite the recent surge in studies utilising the MTQ48 as the preferred inventory for mental toughness measurement (Crust, 2009; Crust & Azadi, 2009; 2010; Crust & Keegan, 2010; Kaisler et al., 2009; Levy, Polman, Clough, Marchant & Earle, 2006; Nicholls, et al., 2008; 2009), the lack of published empirical evidence supporting the psychometric properties and structure of the MTQ48 suggests there is still ambiguity in how mental toughness is best measured. An issue that becomes more problematic when unearthing the differing factor structures reported in various studies, namely, four (Clough et al., 2002;), six (Crust & Azadi, 2009, 2010; Nicholls, et al., 2008; 2009) and nine factor models (Horsburg et al., 2009). Alarmingly, if the construct validity of the measure is open to dispute, then it is implausible to test the underlying theory until the matter of

validity and reliability of the inventory being utilised, in this case the MTQ48, is resolved. Despite studies boasting sample sizes in excess of 400 (e.g., Kaisler et al., 2009; Nicholls et al., 2008; 2009) which would allow for the examination of the dimensionality of the MTQ48, the only study that attempted to address the concerns around the MTQ48 factor structure was that conducted by Horsburg et al. (2009). However, they too failed to report any empirical data (i.e. fit indices, parameter estimates) to support their conclusions regarding the four-factor model displaying superior properties to the one-factor model.

Consequently, in response to the untested concerns, the primary aim of this study was to examine the factorial validity of the MTQ48 in a broad sample of athletes, given the majority of published research has used the measure in sporting contexts. Although four (e.g., Clough et al., 2002; Veselka et al., 2009), six (e.g., Crust & Azadi, 2009, 2010) and nine factor models (e.g., Horsburgh et al., 2009) of the MTQ48 have been employed in previous research, the primary focus was on the four and six factor models which is consistent with the original 4C's conceptualisation forwarded by Clough and colleagues and that cited most commonly in the current studies. Because there is a hypothesised conceptual model underlying the MTQ48, analytical techniques such as Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA), which tests an *a priori* structure against the data, were adopted to examine the psychometric properties of the MTQ48 and the robustness of the measurement model.

Method

Participants

The participants used in this sample were 615 student athletes: 377 were male (61.7%), 234 were female (38.3%), and four were non-specified. Ages ranged between 18 and 50 years (M = 20.08 years, SD = 3.02) with experience in their sport ranging from 1 year to 34 years (M experience = 9.33 years, SD = 4.58). The sample consisted of sports performers competing at international (n = 23), national (n = 55), county (n = 95), club/university (n = 381) and beginner (n = 52) levels. All participants completed an informed consent form (see Appendix 3.1) prior to study participation. Ethical clearance for this research was achieved through the research ethics committee at the University of Roehampton.

Measures

Mental toughness. The *Mental Toughness Questionniare-48*, (MTQ48; Clough et al., 2002) is a 48-item inventory, which requires responses to statements on a 5-point Likert scale ranging from (1) *strongly disagree*, to (5) *strongly agree* (see Appendix 3.2). The questionnaire yields a Total Mental Toughness score and four subscales of mental toughness: Challenge, Commitment, Control and Confidence. Confidence and Control scales also have two subsets: Confidence (abilities and interpersonal) and Control (emotion and life). The scales relate to; (1) *Challenge*, which describes the extent to which individuals view problems as opportunities for personal development and thrive in challenging environments; (2) *Commitment*, which reflects being deeply involved in what one is doing and being able to persist despite obstacles or difficulties; (3) *Emotional control*, which describes ones ability to keep anxieties in check and be less likely to reveal their emotions to others; (4) *Life control*, which reflects a belief in personal influence as opposed to powerlessness; (5) *Confidence in abilities*, which describes the tendency to be more optimistic and less dependent on external validation and (6) *Interpersonal confidence*, which reflects individuals who are more assertive and less likely to be intimidated in social settings.

In the original publication (Clough et al., 2002), a reliability coefficient of .90 is provided and in testing of construct validity, the MTQ48 is shown to have been correlated significantly with self-image (.42), life satisfaction (.56), self-efficacy (.68) and trait anxiety (.57), as well as providing a significant correlation with personal endurance (Crust & Clough, 2005). In a technical manual produced (http://www.aqr.co.uk/html/top_menu/Psychometrics/Products/Downloads), more information is provided on the development of the MTQ48 whereby PCA with varimax rotation revealed six factors with eigenvalues greater than one which together accounted for 62.7% of variance.

Procedure

Following ethical approval being obtained from the University of Roehampton's Research Ethics Committee, volunteers were sought from undergraduate and postgraduate sport programmes in universities across the south of England. Initial recruitment was conducted via personal communication, letter and email invitation to program convenors. Following acceptance, data collection was arranged, at the beginning of which the aims and objectives of the research

were briefly stated and issues of confidentiality were explained and discussed. Participants remained naïve to the research hypotheses. However, on completion of the questionnaire, all participants were debriefed fully and provided the opportunity to answer any questions related to the research project. Ethical procedures conforming to standards set by the British Psychological Society (2009) were adhered to throughout the research process. All participants provided informed consent and were assured confidentiality. Students who agreed to participate were provided with a questionnaire booklet containing a participant information sheet, an informed consent form, a demographic questionnaire, and the MTQ48.

Data Analysis

Data were first screened for outliers and measures of skewness and kurtosis were computed to assess for normality. Pearson Product Moment Correlations were computed to assess relationships between age, experience and overall mental toughness and its subscales. Follow–up independent *t*-tests were used to assess for differences between gender. Due to the differences reported, a 5 (competition level) by 2 (gender) MANOVA was conducted to assess differences in subscales across performance levels. Separate univariate analysis of co-variance (ANCOVA) was conducted from total mental toughness (total mental toughness could not be included in the MANOVA) whilst controlling for gender as a covariate. Finally, linear regression analysis to ascertain the relationship between years of experience, and age (predictor variables) with overall mental toughness and subscales was conducted.

Model Analysis

The first stage of this study was to examine a first-order CFA model of the MTQ48 designed to test the multidimensionality of the theoretical construct. Specifically, this application tested the hypothesis that mental toughness is a multidimensional construct composed of four or more recently, six factors. The original factor structure proposed by Clough et al. (2002) presented mental toughness as a multidimensional construct consisting of four factors; Challenge (CH), Commitment (COM), Control (CNT), and Confidence (CNF). More recently however the dimensions of control and confidence have been subsequently sub-divided (Earle, 2006; Nicholls et al., 2008) to unearth a six-factor model of mental toughness (CH = Challenge, COM = Commitment, CE = Emotional Control, CL = Life Control, CA = Confidence in Abilities, CI =

Interpersonal Confidence). To date, no statistical evidence to support either the four or six factor solutions of this mental toughness conceptualisation has been reported or published. The objective of this study was therefore, to test the original hypothesis that mental toughness is a four-factor structure comprising CH, COM, CNT and CNF against two alternative hypothesis; that mental toughness is a 6-factor structure comprising (CH, COM, CE, CL, CA, CI), or that mental toughness is a one-factor global structure (MT) where there is no distinction between sub-dimensions of mental toughness.

Hypothesis 1: Mental toughness is a four-factor structure (First-order CFA model)

The model presented in Figure 3.1 schematically represents Hypothesis 1 and provides the mechanism by which it can be tested statistically. The hypothesised four-factor model has a number of distinct component parts;

i) There are four MT factors (as indicated by the four circles labelled FI to F4).
ii) The four factors are inter-correlated (as indicated by the two-headed arrows).
iii) There are 48 observed variables (as indicated by the 48 rectangles labelled V1 to V48).
i) The observed variables load onto the factors in the following pattern V1 to V8 load onto Factor 1 (Challenge); V9 to V19 load on Factor 2 (Commitment); V20 to V33 load onto Factor 3 (Control); and V34 to V48 load onto Factor 4 (Confidence).
iv) Each observed variable loads on one and only one factor.
v) Errors of measurement associated with each observed variable (E1 to E48) are uncorrelated.

Accordingly, we can state that the CFA model presented in Figure 3.1 hypothesizes *a priori* that;

a) MT responses can be explained by four factors; CH, COM, CNT, and CNF.
b) Each subscale measure has a nonzero loading on the MT factor that it was designed to measured (termed a target loading) and zero loadings on all other factors (termed nontarget loadings).
c) The four MT factors, consistent with the theory, are correlated.
d) Error/uniqueness associated with each measure are uncorrelated.

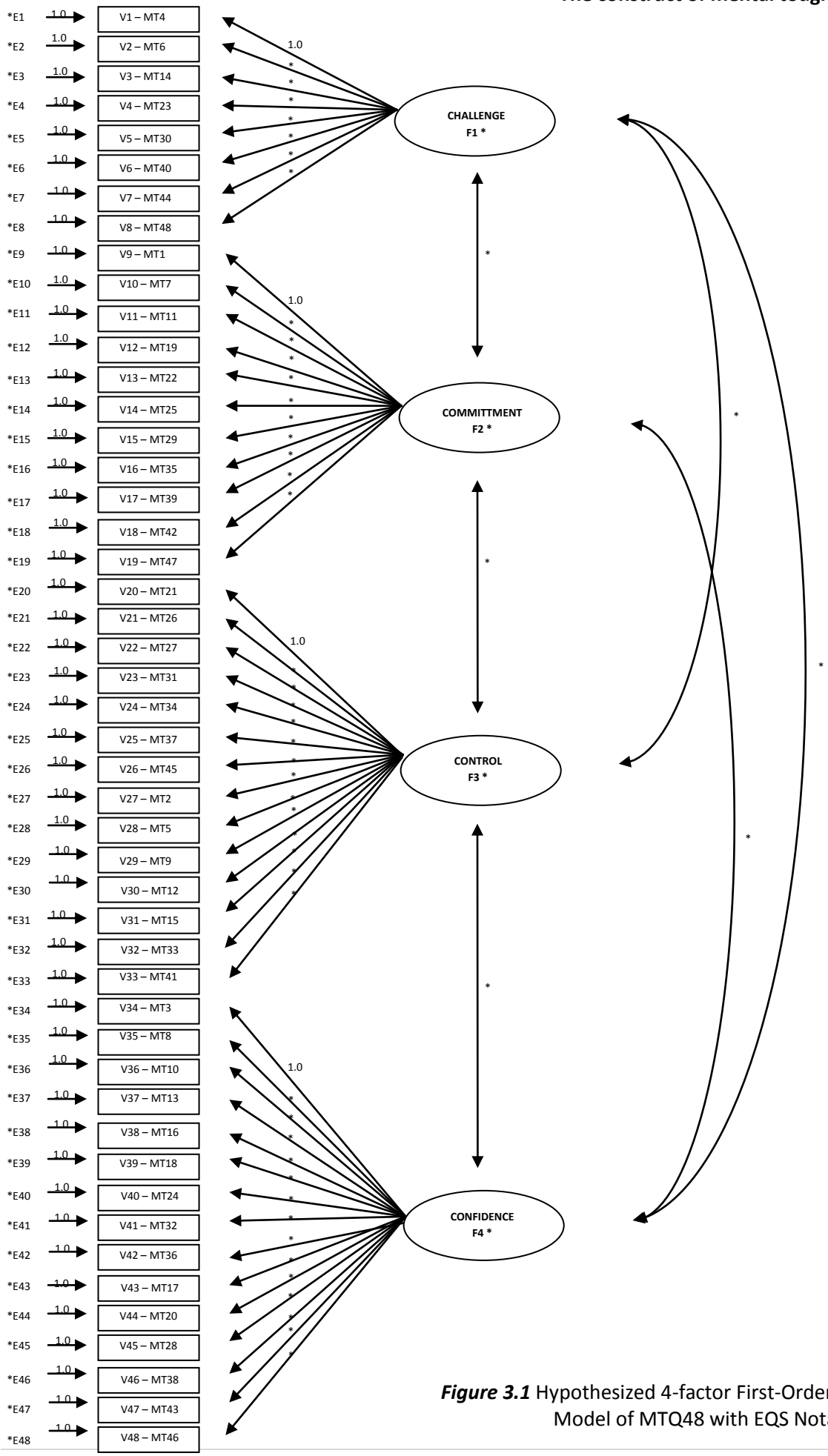

Figure 3.1 Hypothesized 4-factor First-Order CFA Model of MTQ48 with EQS Notation

Hypothesis 2: Mental toughness is a six-factor structure (First-order CFA model)

The model presented in Figure 3.2 schematically represents Hypothesis 2 and provides the mechanism by which it can be tested statistically. The hypothesised six-factor model has a number of distinct component parts;

i) There are six MT factors (as indicated by the four circles labelled FI to F6).

ii) The six factors are inter-correlated (as indicated by the two-headed arrows).

iii) There are 48 observed variables (as indicated by the 48 rectangles labelled V1 to V48).

iv) The observed variables load onto the factors in the following pattern V1 to V8 load onto Factor 1 (Challenge); V9 to V19 load on Factor 2 (Commitment); V20 to V26 load onto Factor 3 (Emotional Control); V27 to V33 load onto Factor 4 (Life Control), V34 to 42 load onto Factor 5 (Confidence in Abilities); and V43 to V48 load onto Factor 6 (interpersonal Confidence).

v) Each observed variable loads on one and only one factor.

vi) Errors of measurement associated with each observed variable (E1 to E48) are uncorrelated.

Accordingly, we can state that the CFA model presented in Figure 4.2 hypothesizes a priori that;

a) MT responses can be explained by six factors; CH, COM, CE, CL, CA and CI.

b) Each subscale measure has a nonzero loading on the MT factor that it was designed to measured (termed a target loading) and zero loadings on all other factors (termed nontarget loadings).

c) The six MT factors, consistent with the theory, are correlated.

d) Error/uniqueness associated with each measure are uncorrelated.

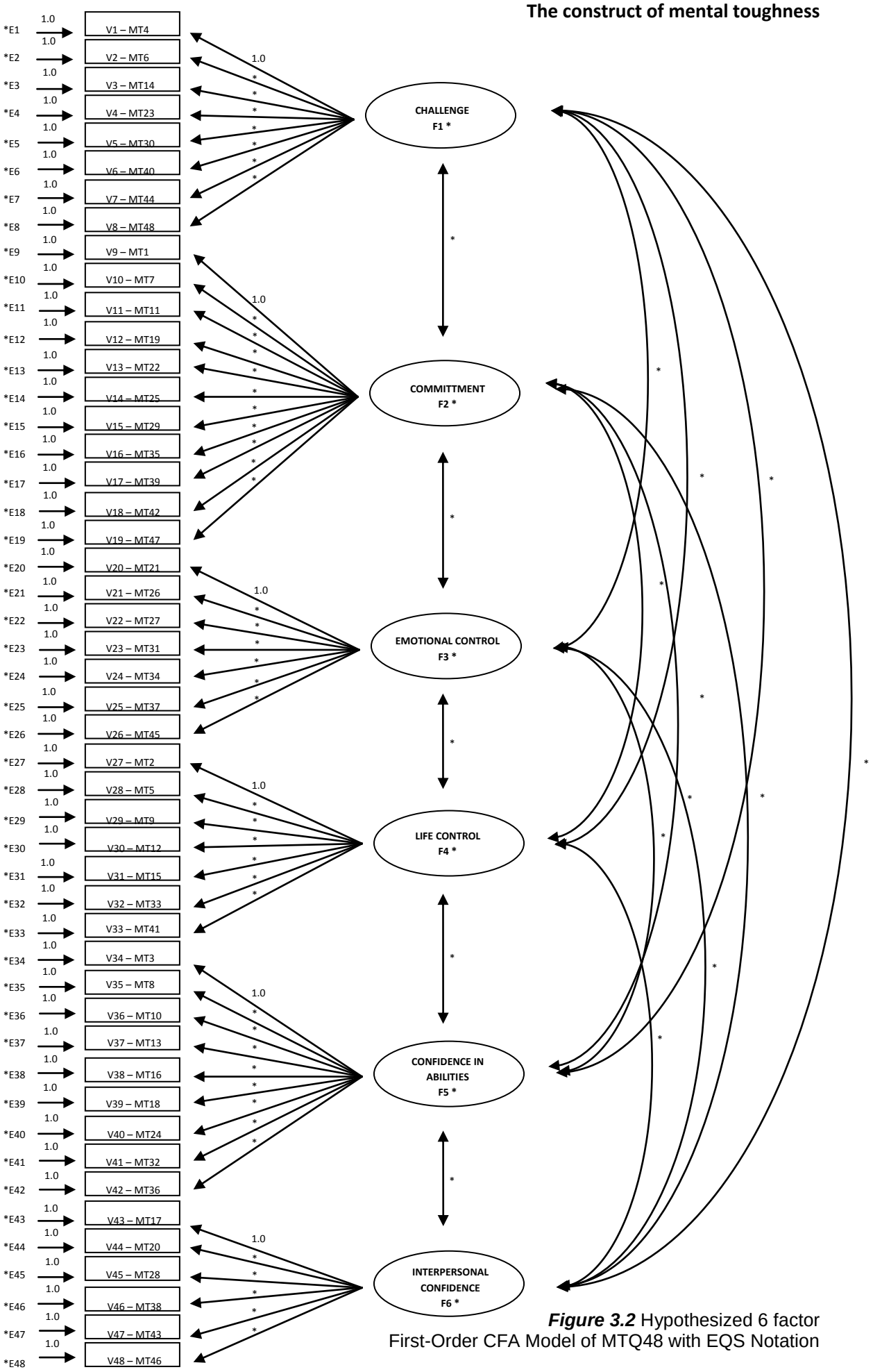

Figure 3.2 Hypothesized 6 factor First-Order CFA Model of MTQ48 with EQS Notation

Hypothesis 3: Mental toughness is a single-factor structure

The model presented in Figure 3.3 schematically represents Hypothesis 3 and provides the mechanism by which it can be tested statistically. The hypothesised single-factor model has a number of distinct component parts;

i) MT is a single factor (as indicated as F1).

ii) There are 48 observed variables (as indicated by the 48 rectangles labelled V1 to V48).

iii) All the observed variables load onto the one and only single MT factor

iv) Errors of measurement associated with each observed variable (E1 to E48) are uncorrelated.

Accordingly, we can state that the CFA model presented in Figure 3.3 hypothesizes a priori that;

a) MT responses can be explained by a single-factors; MT.

b) Each measure has a nonzero loading on the MT factor that it was designed to measured (termed a target loading) and zero loadings on all other factors (termed nontarget loadings).

c) Error/uniqueness associated with each measure are uncorrelated.

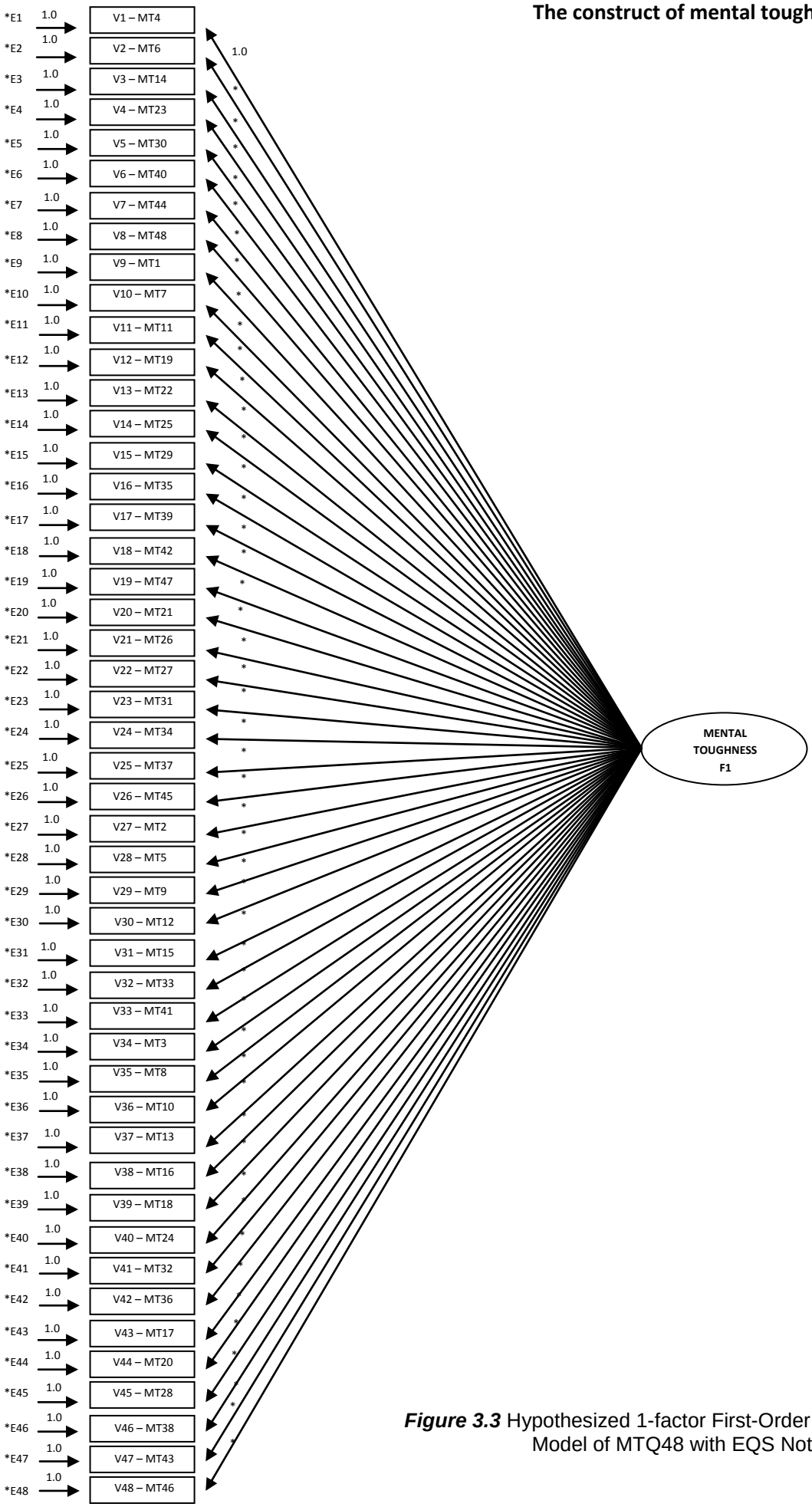

Figure 3.3 Hypothesized 1-factor First-Order CFA Model of MTQ48 with EQS Notation

Statistical analyses

CFA was conducted using covariance matrices with the robust maximum likelihood (ML) estimation method with EQS 6.1 for Windows (Bentler, 2006). CFA tests the hypothesised, underlying model and is considered a robust test of factorial validity. Diminutive missing data were found for the responses to the MTQ48 (0.75% = 221/29,520) and were treated by the Mean Imputation method (MI). To identify the scale of a measurement model, one of the factor loadings was fixed to 1.0. No cross-loading of items were postulated and all factors were allowed to correlate freely.

Multiple fit indices were used to evaluate the overall fit of the proposed models of the MTQ48. The choice of cut-off criteria used to evaluate model adequacy is a contentious issue. Some researchers favour a two-index strategy as proposed by Hu and Bentler (1999), with the indices selected on the basis of sample size, model complexity and the distributional properties of the data. In this study, the choice of fit statistics was informed by Byrne's (2006) recommendation to utilise fit indices taken from three different classes (absolute fit, absolute fit with penalty clauses, and incremental or comparative fit). These included the overall chi-squared (χ^2) statistic, the comparative fit index (CFI; Bentler, 1990), the standardised root-mean square residual (SRMR; Browne & Cudeck, 1993), the Bentler-Bonett non-normed fit index (NNFI; Bentler & Bonett, 1980), and the root mean square error of approximation (RMSEA; Steiger, 1990). The Akaike information criterion (AIC; Akaike, 1987) was also used to facilitate subjective model comparisons.

The χ^2 statistic assesses the magnitude of discrepancy between the hypothesised covariance matrix (Σ) and the sample covariance matrix (S) and a significant test result indicates a poor fit. However, when the sample is large, the χ^2 value is a very conservative estimate of model fit (Byrne, 2006) consequently a χ^2/degrees of freedom ratio (χ^2/df) is also calculated. For this fit statistic, values lower than 5.00 reflects reasonable fit with values closure to 1.00 reflecting a better fit (Marsh & Hocevar, 1985). Values on the CFI and NNFI that are generally greater than 0.90 are generally taken to reflect acceptable fit to the data although Hu and Bentler (1999) suggest a value of 0.95 might be more desirable. For the RMSEA and SRMR, values of 0.05 or less indicate a close fit, and 0.08 indicate an adequate fit (Browne & Cudeck, 1993). For completeness, the 90% confidence interval is also provided for RMSEA. Although there are no criterion values for the AIC,

the model that produces the minimum AIC may be considered to be a potentially most useful model because AIC favours parsimonious models (Bentler, 2006). A summary of goodness of fit criteria and acceptable fit interpretation is provided in Table 3.1 (below).

Table 3.1 Goodness of fit (GOF) criteria and acceptable fit interpretation

GOF Criteria	***Acceptable Level***	***Interpretation***
Chi-square (χ^2)	Tabled χ^2 value	Compares obtained χ^2 value with tabled value for given *df*
Root-mean-square residual (RMSR)	Researcher defines level	Indicates closeness of Σ to *S* matrix
Root-mean-square error of approximation (RMSEA)	<.05	Values less than .05 indicates a good model fit
Comparative fit index (CFI)	0 (no fit) to 1 (perfect fit)	Values greater than .90 reflects an acceptable model fit with .95 a good fit
Non-Normed fit index (NNFI)	0 (no fit) to 1 (perfect fit)	Values greater than .90 reflects an acceptable model fit with .95 a good fit
Akaike information criterion (AIC)	0 (perfect fit) to positive value (poor fit)	Compares values in alternative models

Note: Σ = reproduced matrix, *S = observed matrix*

To evaluate the fit of individual parameters, statistical significance of each estimated parameter in the hypothesised model were examined by critical ratios (*t*-values). A *t*-value larger than ±1.96 indicates a parameter is significantly different from zero. Items were considered to be stronger indicators of their factor if they had (a) large standardised factor loadings, (b) small standardised residuals, and (c) no modification indices suggesting re-specification of the hypothesised model (i.e. addition of cross-loadings or error covariances). Based on Kline (2005), items associated with several standardised residuals greater than 0.10 were considered statistically problematic. In addition, suggested model modifications provided by the Wald and Lagrange multiplier tests were examined. The Wald test identifies statistically non-significant paths in a specified model, and the Lagrange multiplier test identifies paths that would be statistically significant if they were included in the model (Bentler, 1980).

Results

Descriptive statistics

While age did not differ significantly across gender groups (Male M = 20.12, SD = 2.76, Female M = 19.93, SD = 3.26, t_{606} = .825, p >.05), or significantly relate to overall mental toughness (*r* = .058*, p* >.05), a weak significant relationship however was found between age and the mental toughness subscale of Interpersonal Confidence (*r* = .127*, p* < .01). On average, male participants reported higher levels of experience (M = 9.68 years, SD = 4.59) compared to females (M = 8.8 years, SD = 4.52) which was significant t_{497} = 2.097, *p* < .05. Experience was also found to relate significantly to overall mental toughness (*r* = .121, *p* < .01), Control of Life (*r* = .134, *p* < .01), Confidence in abilities (*r* = .122, *p* < .01), and Interpersonal Confidence (*r* = .090, *p* <.05), but not Challenge, Commitment, or Control of Emotion subscales (*r* = .067, .055 and .057 respectively, all *p* >.05). All correlations were weak however and linear regressions showed playing experience can only account for 1.3% of the total mental toughness (F = 7.397, *p* < .01).

Table 3.2 *Descriptive data of gender differences*

	Male		*Female*		*t*	*P*
	M	*SD*	*M*	*SD*		
Challenge	*29.50*	*3.43*	*28.65*	*3.25*	*3.027*	*.003*
Commitment	*39.70*	*5.35*	*39.04*	*4.64*	*1.571*	*.117*
Emotional Control	*22.31*	*3.74*	*20.85*	*3.83*	*4.656*	*.0005*
Life Control	*24.66*	*3.35*	*24.19*	*3.03*	*1.714*	*.087*
Confidence in abilities	*31.23*	*4.53*	*29.52*	*4.42*	*4.571*	*.0005*
Interpersonal Confidence	*22.12*	*3.68*	*21.11*	*3.87*	*3.248*	*.001*
Total MT	*169.52*	*17.42*	*163.35*	*15.64*	*4.416*	*.0005*

Note: Sample (Total = 615; Male, N = 375; Female, N = 234)

Independent *t*-tests found that men gave significantly higher self-ratings of overall mental toughness (t_{607} = 4.416, *p* < .001) than females, and reported significantly higher self-ratings on the mental toughness subscales of Challenge (t_{607} = 3.027, *p* < .01), Emotional Control (t_{607} = 4.656, *p* < .001), Confidence in abilities (t_{607} = 4.571, *p* < .001) and Interpersonal Confidence (t_{607} = 3.248, *p* < .001). No significant differences were reported in either subscales of Commitment or Life Control (t_{607} = 1.571, and t_{607} = 1.714, *p* > .05) (See Table 3.2).

The descriptive statistics for gender and skill level in relation to the six subscales and total mental toughness are presented in Table 3.3. Due to the differences reported between male and female athletes, a 5 (competition level) by 2 (gender) MANOVA was conducted. There was a significant gender main effect (Wilks' λ = .969; $p < .01$), and competition level main effect (Wilks' λ = .914; $p < .001$) but a non-significant interaction effect (Wilks' λ = .951, $p > .05$). Given the differences in group sizes these should be interpreted with caution, nevertheless Box's test was non-significant ($p > .05$) and both the Pillai's trace (.080, $p < .01$), and Wilks' λ (.921, $p < .01$) met the significance criterion. The ANCOVA showed there was a significant effect of competition level on total mental toughness after controlling for gender ($F(4, 594) = 4.636$, $p = .001$) with participants competing in higher levels of competition reporting higher level of mental toughness.

Distribution of the MTQ48 items

Preliminary analysis examining the distributional properties of the items was conducted to determine the level of non-normality of the data. The univariate skewness values of MTQ48 items ranged from -1.088 to .563 (M = -.44), and univariate kurtosis from .979 to -3.10 (M = -.29) suggesting that all items were within acceptable ranges (Chou & Bentler, 1995; West, Finch & Curran, 1995). However, examination of Mardia's (1970) normalised coefficient of multivariate kurtosis revealed that the data departed from multivariate normality (Mardia = 350.987, normalised estimate = 62.817). This value exceed the cut-off point of 143, which is the maximum value of multivariate normality (Bollen, 1989; Mardia, 1970), therefore in line with recommendation of Chou, Bentler and Satorra (1991) the Satorra-Bentler statistics (S-B χ^2; Satorra & Bentler, 1988a, 1988b) and robust values fit indices and parameter errors were considered. Although multivariate normality is desired for maximum likelihood (ML) estimation, this approach was still preferred to other methods given that Olsson, Foss, Troye and Howell (2000) found that ML analysis outperformed generalised least squares (GLS) and weighted least squares (WLS) estimation techniques under conditions of model misspecification and/or non-normality. Nevertheless, the data was re-analysed with other estimation techniques to (e.g., GLS) to ensure that all methods provided similar model fit indices and parameter estimates.

Table 3.3 *Descriptive statistics for gender, skill level and mental toughness*

Gender	*N*	*Experience*	*Challenge*	*Commitment*	*Control of Emotion*	*Control of Life*	*Confidence in abilities*	*Interpersonal Confidence*	*Total Mental Toughness*
Male	*24*	*Beginner*	*28.75 (4.13)*	*37.68 (5.67)*	*21.65 (3.75)*	*24.25 (3.18)*	*30.24 (5.08)*	*21.08 (4.25)*	*163.65 (19.66)*
Female	*26*		*27.19 (3.06)*	*36.54 (5.29)*	*20.00 (3.81)*	*23.46 (3.01)*	*28.73 (4.52)*	*20.31 (4.17)*	*156.23 (16.61)*
Male	*244*	*Club/University*	*29.47 (3.45)*	*39.50 (5.33)*	*22.44 (3.77)*	*24.50 (3.42)*	*31.25 (4.66)*	*21.97 (3.67)*	*169.14 (17.31)*
Female	*134*		*28.49 (3.30)*	*38.89 (4.16)*	*21.69 (4.15)*	*23.87 (2.96)*	*29.36 (4.45)*	*21.50 (3.69)*	*162.59 (14.91)*
Male	*55*	*County*	*29.78 (3.45)*	*40.63 (5.50)*	*22.40 (3.57)*	*24.57 (3.57)*	*31.27 (4.46)*	*22.73 (3.57)*	*171.37 (19.20)*
Female	*39*		*29.41 (3.00)*	*39.60 (4.71)*	*21.69 (4.15)*	*24.76 (2.53)*	*30.36 (3.81)*	*20.82 (4.25)*	*166.64 (14.56)*
Male	*29*	*National*	*30.10 (2.96)*	*40.72 (5.46)*	*22.32 (3.44)*	*25.51 (2.42)*	*30.90 (4.28)*	*21.66 (3.49)*	*171.22 (14.33)*
Female	*26*		*29.56 (3.33)*	*40.96 (4.25)*	*21.72 (4.58)*	*25.81 (2.80)*	*29.98 (4.83)*	*21.54 (3.14)*	*169.59 (14.46)*
Male	*17*	*International*	*29.71 (3.29)*	*42.23 (5.10)*	*21.69 (4.57)*	*26.46 (3.13)*	*32.76 (2.93)*	*23.71 (3.14)*	*176.56 (15.35)*
Female	*6*		*30.49 (3.29)*	*43.33 (5.13)*	*23.81 (3.07)*	*26.74 (2.37)*	*31.33 (1.97)*	*18.17 (4.96)*	*173.87 (12.88)*
Male	*369*	*All*	*29.53 (3.45)*	*39.77 (5.35)*	*22.34 (3.74)*	*24.66 (3.37)*	*31.23 (4.56)*	*22.09 (3.69)*	*169.62 (17.53)*
Female	*231*		*28.67 (3.25)*	*39.10 (4.58)*	*20.86 ((3.84)*	*24.27 (2.95)*	*29.58 (4.36)*	*21.17 (3.85)*	*163.64 (15.33)*

Note. ( ) = standard deviation

Confirmatory Factor Analysis (CFA) of the MTQ48

Results of the CFA are presented in Table 3.4 and Table 3.5 containing the factor loadings of the *a priori* one-, four- and six-factor models. Neither the one-factor, four-factor or the six-factor models provided an acceptable fit to the data. Fit statistics revealed that the original four-factor model proposed by Clough et al. (2002) was inadequate, S-B $\chi^2_{(1074)}$ = 2080.61, p <.001, SRMR = .070, RNNFI = .583, RCFI = .603, RMSEA = .055, 90%CI = .053–.057, likewise the six-factor model was not optimal either, S-B $\chi^2_{(1065)}$ = 2753.37, p < .001, SRMR = .068, RNNFI = 646, RCFI = .666, RMSEA = .051, 90%CI = .048–.053. Although the analyses indicated that none of the fit indices suggested adequate fit for the four- or the six-factor models (i.e., RCFI below the .95 criterion and the RMSEA was only acceptable < .08), the results from the RMSEA and AIC provide some support to suggest that the six-factor model was the superior fitting solution. As a result, further analysis of parameter estimates was focused around the six-factor solution hereafter.

Table 3.4 Summary of CFA for the mental toughness measurement models

Model	S-B χ^2	*Df*	*P*	*SRMR*	*RMSEA (90% CI)*	AIC	RCFI	RNNFI	S-B χ^2 */df*
-6- Factor Model	2753.37	1065	*.0005*	.068	.051 (.048; .053)	623.37	.666	.646	2.59
-4-Factor Model	2080.61	1074	*.0005*	.070	.055 (.053; .057)	932.61	.603	.583	1.94
-1-Factor Model	3340.15	1080	*.0005*	.072	.058 (.056; .061)	1180.15	.552	.532	3.09

Note: RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval for the RMSEA point estimate; AIC = Akaike information criteria; RCFI = robust comparative fit index; RNNFI = robust non-normed fit index; S-B χ^2 */df = Satorra-Bentler scaled statistic /degrees of freedom ratio*

In search for a more acceptable measurement model, the parameter estimates of the six-factor model were inspected, along with the Wald and Lagrange multiplier tests, and the residuals. As stipulated by Byrne (2006), the decision to make any modifications to a measurement model must always be based on a judicious combination of both the statistical information provided in the output and the researcher's knowledge of the substantive area. Any model re-specification must make substantive sense as well as statistical sense. Standardised factor loadings across the

measurement model ranged from -.028 to .622 whilst average standardise residuals were .050 and .052 for average and average off-diagonals estimates respectively. In the largest of these standardised residuals, the largest misspecifications in the model reported to involve items MT37 and MT35 (V25, V16, estimate = .441) and MT34 and MT26 (V24, V21, estimate = .333). Ideally the spread of residuals should cluster around the zero point and although the bulk of these fall into this category, with values ranging from -.1 to .1 (87.84%), there is nonetheless some indication of misfit with 5.61% of residuals ranging from -.1 to -.3 and 6.56% ranging from .1 to .5. Results of the multivariate LM test indicated that 104 significant modifications that could be included to improve model fit of the six-factor model suggesting significant misspecification of the model. These results indicate that the model fit would be improved by correlating error variance for items with weak factors or for items to load onto more than one factor. As the hypothesised model depicts that items should loading only onto one factor, cross-loading of factors was not advocated at this point.

In advance of model re-specification, the strategy employed was to explore model fit for each factor independently, and make modifications independently to each factor resulting in a subscale consisting of the strongest factor loadings. Thereafter refined subscales would be reassessed as a complete measurement model. An important research decision in the development of a model concerns the number of items to include in each factor, particularly when brevity is important. Jackson and Marsh (1996) argued that the optimum number of items needed to describe a construct in a short questionnaire is four, whilst Bollen (1989) cautions against reducing the number of items in a factor to less than three. Clark and Watson (1995) reported that factors with less than four items typically fail to yield an internal consistency coefficient (Cronbach's alpha) above the generally accepted criterion value of 0.70. As a result, the aim was to produce the strongest fitting version of the MTQ48 with six factors containing no-less than four-items. Where the difference between items was marginal, a subscale of five-items would be considered. The decision to remove an item was based on factor loadings from the independent factor CFA results and complete model CFA results with the LM test results that indicated whether an item should correlate with other items (share error variance) or should load onto a second factor. The goal was to find items that loaded predominantly onto one factor and that did not correlate strongly with a second item. Results from the independent CFAs for each factor are reported in Table 3.6.

Table 3.5 Factor loadings, Inter-factor correlations and Internal reliabilities of the MTQ48 based on a Four-, Six- and One-Factor solutions

	4-Factor Model				6-Factor Model						1-Factor Model
Items	CH	COM	CNT	CNF	CH	COM	CE	CL	CA	CI	MT
4 - Challenges usually bring out the best in me	.514				.509						.455
6 - Unexpected changes to my schedule generally throw me	.231				.232						.231
14 - I often wish my life was more predictable	.315				.312						.350
23 - I generally cope well with any problems that occur	.491				.490						.473
30 - I am generally able to react quickly when something unexpected happens	.520				.526						.442
40 - I usually look forward to changes in my routine	.243				.244						.170
44 - I usually enjoy a challenge	.573				.576						.483
48 - I can usually adapt myself to challenges that come my way	.623				.622						.525
1 - I usually find something to motivate me		.374				.391					.293
7 - I don't usually give up under pressure		.492				.481					.435
11 - "I just don't know where to begin" is a feeling I usually have when presented with several things to do at once		.395				.394					.376
19 - I can generally be relied upon to complete the tasks I am given		.376				.376					.276
22 - I am easily distracted from tasks that I am involved with		.377				.386					.261
25 - I generally try to give 100%		.518				.526					.380
29 - When faced with difficulties I usually give up		..599				.587					.494
35 - I usually find it difficult to make a mental effort when I am tired		.421				.409					.323
39 - I can normally sustain high levels of mental effort for long periods		.484				.486					.423
42 - I usually find it hard to summon enthusiasm for the tasks I have to do		.465				.476					.387
47 - When I face setbacks I am often unable to persist with my goal		.454				.452					.404
21 - I generally find it hard to relax			.349				.426				.321
26 - When I am upset or annoyed I usually let others know			.060				.159				.078
27 - I tend to worry about things well before they actually happen			.461				.588				.431
31 - Even when under considerable pressure I usually remain calm			.463				.607				.475
34 - I generally hide my emotions from others			-.171				-.028				-.159
37 - When I am feeling tired I find it difficult to get going			.315				.327				.338
45 - I can usually control my nervousness			.487				.580				.476
2 - I generally feel in control			.544					.554			.536
5 - When working with other people I am usually quite influential			.368					.361			.363

9 - I usually find myself just going through the motions	.278			.318		.288
12 - I generally feel that I am in control of what happens in my life	.509			.531		.509
15 - Whenever I try to plan something, unforeseen factors usually seem to wreck it	.385			.422		.381
33 - Things just usually happen to me	.302			.342		.284
41 - I feel that what I do tends to make no difference	.489			.535		.478
3 - I generally feel that I am a worthwhile person		.525			.526	.495
8 - I am generally confident in my own abilities		.579			.580	.562
10 - At times I expect things to go wrong		.429			.433	.412
13 - However bad things are, I usually feel they will work out positively in the end		.421			.446	.422
16 - I generally look on the bright side of life		.487			.498	.496
18 - At times I feel completely useless		.527			.538	.515
24 - I do not usually criticise myself even when things go wrong		.130			.135	.089
32 - If something can go wrong, it usually will		.493			.515	.472
36 - When I make mistakes I usually let it worry me for days after		.526			.550	.490
17 - I usually speak my mind when I have something to say		.384				.573 .349
20 - I usually take charge of a situation when I feel it is appropriate		.332				.460 .344
28 - I often feel intimidated in social gatherings		.465				.518 .416
38 - I am comfortable telling people what to do		.398				.589 .375
43 - If I feel somebody is wrong, I am not afraid to argue with them		.325				.581 .289
46 - In discussions, I tend to back-down even when I feel strongly about something		.428				.581 .396

Inter-Factor Correlations and Factor Reliabilities (α) for Four-Factor and Six-Factor Models

4 factor solution	CH	COM	CNT	CNF
1 – Challenge	(.621)			
2 – Commitment	.472	(.735)		
3 – Control	.534	.486	(.653)	
4 – Confidence	.543	.442	.634	(.775)

6 factor solution	CH	COM	CE	CL	CA	CI
1 – Challenge	(.621)					
2 – Commitment	.472	(.735)				
3 – Control of Emotion	.413	.294	(.556)			
4 – Life Control	.442	.500	.270	(.626)		
5 – Confidence in Abilities	.512	.458	.488	.592	(.714)	
6 – Interpersonal Confidence	.379	.258	.167	.423	.378	(.720)

Note: MTQ48 Factors (Clough et al., 2002) CH = Challenge; COM = Commitment; CNT = Control; CNF = Confidence; CE = Control of Emotion; CL = Life Control; CA = Confidence in Abilities; CI = Interpersonal Confidence; MT = Mental Toughness (Cronbach's alpha for 1 factor model = .881) All correlations significant at the 0.01 level**

Table 3.6 Confirmatory Factor Analysis of Independent factor solutions

	χ^2	*df*	*P*	*SRMR*	*RMSEA (90% CI)*	AIC	CFI	NNFI
Challenge	93.99	20	*.0005*	.054	.078 (.062; .093)	53.99	.867	.814
Commitment	175.66	44	*.0005*	.053	.070 (.059; .081)	87.66	.849	.811
Emotional Control	131.12	14	*.0005*	.076	.117 (.099; .135)	103.12	.738	.607
Life Control	62.20	14	*.0005*	.050	.075 (.056; .094)	34.20	.879	.818
Confidence in abilities	140.73	27	*.0005*	.056	.083 (.069; .096)	86.73	.856	.808
Interpersonal Confidence	32.50	9	*.0005*	.034	.065 (.042; .090)	12.50	.959	.931

Note: χ^2= chi-squares statistic; df = degrees of freedom; p =level of significance of χ^2; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval for the RMSEA point estimate; AIC = Akaike information criteria; CFI = comparative fit index; NNFI = non-normed fit index;

Independent factor analysis identified that only the Interpersonal Confidence factor provided suitable fit indices to the data, $\chi^2_{(9)} = 32.50$, $p < .001$, SRMR = .034, NNFI = .931, CFI = .959, RMSEA = .083, 90%CI = .042–.090. Based on the strongest factor loadings of each of the independent factors, four-item factors were then analysed (see Table 3.7). CFA of these factors identified substantial improvement in fit to the data with all six factors demonstrating good fit according to RMSEA and CFI fit indices. Despite improvements observed in factor loadings (ranging from .331 to .648), average standardised residuals (average and average off-diagonal .3042 and .3072, respectively) and fewer proposed modifications, the proposed modified six-factor, four-item per factor model did not provide an acceptable fit to the data either, $\chi^2_{(237)} = 790.96$, $p < .001$, SRMR = .057, NNFI = .784, CFI = .814, RMSEA = .062, 90%CI = .057–.066.

Table 3.7 Confirmatory Factor Analysis of reduced Independent factor solutions and complete model

	χ^2	*Df*	*P*	*SRMR*	*RMSEA (90% CI)*	AIC	CFI	NNFI
Challenge	29.54	2	*.0005*	.048	.150 (.105; .200)	25.54	.922	.766
Commitment	3.29	2	.19	.021	.032 (.000; .093)	-.71	.982	.946
Emotional Control	26.89	2	*.0005*	.048	.142 (.098; .192)	22.89	.917	.751
Life Control	7.80	2	.02	.027	.069 (.023; .122)	3.80	.973	.918
Confidence in abilities	14.70	2	*.0005*	.035	.102 (.057; .153)	10.70	.955	.865
Interpersonal Confidence	3.27	2	.20	.015	.032 (.000; .092)	-.73	.996	.989
Complete Model	790.96	237	*.0005*	.057	.062 (.057; .066)	316.96	.814	.784

Note: Challenge = Items 4, 30, 44, 48; Commitment = 1, 11, 19, 35; Emotional Control = 21, 27, 31, 45; Life Control = 2, 12, 15, 41; Confidence in Abilities = 3, 8, 18, 36; Interpersonal Confidence = 17, 38, 43, 46

Exploratory Factor Analysis of the MTQ48

Given the lack of psychometric support provided in the CFA presented, further investigation of the factorial composition of the MTQ48 was conducted via internal consistency analysis and exploratory factor analysis (EFA).

Internal consistency

Cronbach alpha coefficients (see *Table 3.5*) were calculated to assess the internal consistency of the factors of both the 4-factor and 6-factor solutions. The criterion for acceptability for an internally reliable scale is normally set at 0.70 (Tabachnick & Fidell, 2001), with a suggested acceptable alpha of 0.60 for factors with only four items (Loewenthal, 2001). Results indicated that only the Commitment (COM = .735) and Confidence factors in both 4-factor (CNF = .775) and 6-factor (CA = .714, CI = .720) solutions demonstrated adequate internal reliability. Analysis at the individual item level is reported in Table 4.6. The strength of an item is indicated by high factor loadings and low standard errors. Comrey and Lee (1992) suggested that factor loadings higher than 0.71 (50% overlapping variance) are excellent, 0.63 (40% overlapping variance) very good, 0.55 (30% overlapping variance) good, 0.45 (20% overlapping variance) fair and 0.32 (10% overlapping variance) poor (Tabachnick & Fidell, 2001, p. 625). In this study, based on the results on the six-factor model, only 13 items could be considered good (27.08%), with 17 items fair (35.42%) and 18 (37.50%) items considered poor. The poor psychometric strength of the items

along with the poor internal reliability of the factors indicated that significant revisions to the current structure of the model were warranted.

Principle component analysis

Inter-item correlations, means and standard deviations are presented in Appendix 3.3. On the correlation matrix, principle component analysis was performed on the 48 items of the MTQ48 with SPSS Version 17.0 (SPSS, Inc., Chicago, IL), using oblique rotation (direct oblimin), which allows for correlation among subscales (Costello & Osborne, 2005). Criteria for an acceptable factor solution were four-fold. Firstly, factors must have a minimum eigenvalue of 1.00 (Kaiser, 1960), secondly, the exclusion of factor loadings below .40 (Blaikie, 2003), thirdly, the exclusion of items loading .40 or more if there was cross-loading greater than .30 on any other factors (Tabachnick & Fidell, 2007) and fourthly, a minimum of three items on each factor (Tabachnick & Fidell, 2007). A scree plot was initially used to determine the possible number of factors before rotated solutions were studied. For the initial solution, 12 factors had eigenvalues greater than one and accounted for 53.92% of the variance. However, this particular solution provided no meaningful psychological explanation. Upon examination of the scree plot, a six factor solution appeared to offer a more accurate description of the data.

Principle component analysis, where factors were freely selected by the analysis and were not imposed *a priori*, yielded a problematic factor structure to the MTQ48 as items within each factor were not clearly defined within the factors which they were initially hypothesised to belong (Table 3.8). The analysis was generally supportive of the 6-factor mental toughness model proposed by Clough et al. (2002), accounting for 39.28% of the total variance, nevertheless there was frequent cross-loading on common factors which violated a number of the criteria for acceptable solution fit. The best fitting subscale was Interpersonal Confidence whereby all six items loaded together onto Factor III. The only potential problematic items in this factor were items 28 and 48, which also loaded on Factor II. The second strongest subscale was Commitment of which five of its nine items loaded onto Factor V. Both subscales Emotional Control of Life Control had four of their seven items loading onto individual factors, Factor IV and Factor II respectively. The Challenge subscale had half of its eight items loaded on Factor I with the other half loading onto four separate factors. The Confidence in Abilities subscale also had four of its nine items load

Table 3.8 *MTQ48 Item-Total correlations (r) and pattern and structure coefficients*

Item	*	*r*	Pattern Coefficients Factor						Structure Coefficients Factor					
			I	II	III	IV	V	VI	I	II	III	IV	V	VI
MT4	CH	**.40**	**.36**	.02	-.15	.03	.04	.30	**.46**	.13	-.29	.11	.23	.36
MT6	CH	.25	-.05	.14	.01	**.52**	.06	-.07	.07	.19	-.07	**.53**	.13	-.07
MT14	CH	.36	.01	**.43**	-.13	.34	-.17	.13	.15	**.45**	-.22	.37	.01	.13
MT23	CH	.44	**.43**	.02	-.03	.27	.00	.14	**.50**	.14	-.20	.35	.20	.18
MT30	CH	.41	.19	-.07	-.20	.29	.09	**.33**	.36	.06	-.32	.34	.25	**.37**
MT40	CH	.16	.07	-.26	-.14	**.41**	.03	.08	.16	-.18	-.18	**.41**	.09	.07
MT44	CH	.44	.25	-.13	**-.27**	.13	.19	.29	**.42**	.03	-.39	.21	.34	.35
MT48	CH	.48	**.35**	-.10	-.19	.22	.08	**.35**	**.50**	.05	-.34	.30	.29	*.41*
MT1	COM	.24	**.39**	.14	.12	-.27	.07	.29	**.39**	.20	-.02	-.20	.21	.34
MT7	COM	.34	**.27**	-.08	-.14	.03	.24	.24	**.40**	.06	-.27	.11	.37	.31
MT11	COM	.38	-.11	.36	.00	.13	**.40**	.04	.10	*.44*	-.11	.19	**.46**	.10
MT19	COM	.24	.09	.02	-.07	.01	.09	**.51**	.20	.09	-.15	.04	.21	**.53**
MT22	COM	.25	-.09	.31	.17	.00	**.38**	.24	.06	.36	.07	.04	**.42**	.29
MT25	COM	.32	.27	.05	.07	-.11	.24	**.45**	.37	.15	-.07	-.05	.38	**.51**
MT29	COM	.46	.16	.10	-.09	.17	.25	**.34**	.35	.22	-.23	.24	**.40**	*.40*
MT35	COM	.32	-.21	-.02	-.05	.03	**.78**	.07	.06	.11	-.12	.10	**.73**	.16
MT39	COM	.39	.29	-.05	.03	-.15	**.52**	.04	*.42*	.10	-.13	-.04	**.58**	.15
MT42	COM	.37	.06	**.47**	.08	-.05	.21	.24	.20	**.51**	-.05	.02	.34	.30
MT47	COM	.38	-.02	**.39**	-.12	.05	.16	.22	.17	**.45**	-.22	.11	.29	.27
MT21	CE	.31	.16	.30	-.04	**.40**	-.11	-.25	.24	.34	-.14	**.46**	.02	-.25
MT26	CE	.11	.00	.11	.37	**.57**	.02	.09	.02	.11	.29	**.53**	.06	.05
MT27	CE	.45	.10	.17	-.11	**.45**	.24	-.36	.27	.27	-.23	**.53**	.32	-.31
MT31	CE	.47	**.41**	-.16	-.06	.37	.17	-.03	**.51**	-.01	-.22	*.46*	.32	.02
MT34	CE	-.14	.01	-.32	.26	**.43**	-.06	.07	-.06	-.32	.27	**.36**	-.10	.02
MT37	CE	.33	-.07	-.03	.02	-.00	**.78**	-.10	.15	.10	-.08	.09	**.73**	.00
MT45	CE	**.45**	.27	-.07	-.21	.19	**.31**	-.21	**.42**	.08	-.34	.30	*.41*	-.13
MT2	CL	.49	**.60**	.11	-.05	-.03	.04	-.05	**.64**	.23	-.25	.10	.25	.03
MT5	CL	.33	.10	.00	**-.48**	-.07	.05	.09	.26	.10	**-.52**	.01	.17	.14
MT9	CL	.27	.05	**.43**	-.04	-.09	.02	.16	.15	**.45**	-.12	-.04	.14	.20
MT12	CL	.47	**.50**	.20	-.06	.04	-.05	.06	**.55**	.30	-.24	.15	.17	.12
MT15	CL	.39	.00	**.63**	-.05	.15	-.05	.04	.15	**.65**	-.16	.21	.11	.06
MT33	CL	.27	.12	**.59**	.06	-.07	-.05	-.11	.17	**.59**	-.05	.00	.08	-.07
MT41	CL	.45	.21	**.48**	-.16	-.07	-.00	.07	.34	**.54**	-.29	.03	.19	.13
MT3	CA	.44	**.62**	.07	-.12	-.13	.01	-.16	**.64**	.19	-.30	.01	.20	-.07
MT8	CA	.51	**.56**	-.02	-.17	.06	.11	-.13	**.64**	.13	-.35	.20	.30	-.04
MT10	CA	.40	.10	**.34**	-.11	-.01	.26	-.20	.25	**.42**	-.23	.10	.35	-.13
MT13	CA	.36	**.69**	.04	.10	.02	-.10	-.01	**.64**	.13	-.10	.12	.11	.05
MT16	CA	.45	**.59**	.11	-.02	.07	-.08	.05	**.61**	.21	-.22	.18	.15	.10
MT18	CA	.50	.18	**.42**	-.10	.07	.22	-.16	.34	**.51**	-.25	.18	.36	-.08
MT24	CA	.08	.27	-.13	.01	.02	.09	**-.41**	.22	-.08	-.05	.08	.08	**-.38**
MT32	CA	.47	.18	**.59**	.00	.05	.09	-.13	.31	**.64**	-.16	.15	.25	-.07
MT36	CA	.50	.22	.23	-.02	**.35**	.25	-.31	.37	.34	-.19	**.45**	.37	-.25
MT17	CI	.31	.11	.00	**-.62**	-.11	-.05	-.06	.26	.10	**-.63**	-.02	.07	-.01
MT20	CI	.31	.03	-.03	**-.50**	-.01	.03	.25	.21	.07	**-.52**	.04	.15	.28
MT28	CI	.41	-.03	.21	**-.51**	.18	.06	-.20	.18	.30	**-.55**	.26	.17	-.16
MT38	CI	.33	.04	-.06	**-.69**	-.10	.05	.01	.23	.06	**-.69**	-.01	.16	.06
MT43	CI	.26	-.11	-.02	**-.74**	-.01	-.04	-.04	.10	.07	**-.69**	.05	.05	-.01
MT46	CI	.38	-.12	.33	**-.57**	.14	-.11	.06	.11	.39	**-.59**	.19	.05	.08
% Variance			17.66	5.50	4.97	4.71	3.43	3.00						

Note: The highest pattern and structure coefficient in each factor is in boldface and underline; salient coefficients (.40) are in italic; coefficients of .30 or more are underlined. * CH = Challenge; COM = Commitment; CE = Emotional Control; CL = Life Control; CA = Confidence in Abilities; CI = Interpersonal Confidence.

onto Factor I with Challenge however these factor loadings were greater. The only factor not to support a predetermined subscale was Factor VI.

Discussion

The purpose of this study was to assess the psychometric properties of the Mental Toughness Questionnaire-48 (MTQ48) in an attempt to obtain clarity on the status of the currently well utilised, yet unsubstantiated mental toughness measure. Understanding of the psychometric properties of the MTQ48 was important in order to confirm that the measure is indeed measuring the proposed model of mental toughness and therefore future research can have confidence in testing the underlying theory. There is support for the construct validity of the MTQ48 given the low-to-moderate correlations with related constructs such as coping, optimism, leadership preferences and control appraisal (Crust & Azadi, 2009; Kaisler et al., 2009; Nicholls et al., 2009). However, results of the systematic review in Study 1 indicated that up until November 2010, the psychometric properties of the MTQ48 had yet to be adequately reported in the literature.

Clough et al. (2002) developed the MTQ48 to assess factors believed to be dimensions of mental toughness as depicted in their proposed 4C's conceptual model. The factors possess good face validity and are considered to be conceptually compelling (Crust, 2008). However, the examination of the factor structure in this study using confirmatory factor analyses resulted in a poor fit to the data and improper solutions. Neither the four-factor nor the six-factor solutions provided an adequate fit to the data and consequently further use of the MTQ48 as a measure of mental toughness is not supported. Although analyses failed to find support for either of the solutions on any of the predetermined fit indices, comparatively the six-factor solution appeared to possess the most desirable fit statistics. Follow-up analyses on the parameter estimates and modifications to the measurement model based on independent factor analysis produced improvements to observed factor loadings of the six-factor model. Nevertheless the proposed modified model did not provide an acceptable fit to the data either.

Findings were supported by follow-up exploratory factor analyses that also indicated that the latent dimensionality of the MTQ48 appears to be inadequately represented by the anticipated six factors. The factor loadings identified are inconsistent with the factors proposed during the

construction of the original measure (Clough et al., 2002). Only one of the factors, Interpersonal Confidence, appears to have any psychometric robustness although this factor too appears to possess two potentially problematic items. All other factors appear to be questionable from an empirical-validity and theoretical-validity perspective. Although it is frequently reported that independent researchers Horsburgh et al. (2009) have provided support for the factor structure of the MTQ48 using exploratory and confirmatory factor analytical techniques, full details of this assessment such as the fit indices have not been reported. Therefore any published evidence of an independent scrutiny of this measure is still lacking.

Overall, the results of this study failed to provide support for the MTQ48 as a psychometrically reliable and valid measure of mental toughness, which represents an important contribution to the research area. Whilst the aim of the study was to establish clarity regarding the factor structure of the inventory, the unsupportive evidence would suggest that there is some considerable doubt surrounding the proposed theoretical model or the associated inventory, or both. It is proposed that it is at a theoretical level that the 4C's conceptualisation is problematic given that 75% of the underlying model is hardiness theory. The lack of information presented on the rationale for the underlying theoretical model, the lack of empirical evidence to support its development and validation (i.e., scale construction, development procedures, factorial validity), and now the findings of this study, would support the concerns surrounding the suitability of the 4C'c conceptualisation as well as the usefulness of the MTQ48 as a measure of mental toughness (Connaughton & Hanton, 2009). Consequently, further testing and development of the measure is an immediate priority to confirm or refute the findings of this study and address the potential conceptual and psychometric challenges it has unearthed. Alternatively, the development of an alternative inventory, one based upon strong theoretical rationale and possessing adequate psychometric strength in terms of within-network and between-network validity, is required.

Limitations

When interpreting the conclusions from this study it is important to acknowledge some possible limitations that are inherent within the investigation. Firstly, it is acknowledged that the MTQ48 is a self-report measure and as a result is open to violation and possible bias. Despite efforts at the outset of the data collection procedure, participants may have responded in relation to

how they thought they "should" respond rather than actually how they felt at the time which may have contributed to the results and conclusions forged. In future, research may attempt to utilise broader measures derived through the triangulation of reports from significant others (i.e. coaches) or through observational techniques, performance outcomes and even physiological measurements. In the interest of developing theory into mental toughness, it may be pertinent to consider controlling for social-desirability (Crowne & Marlowe, 1960; Reynolds, 1982) and self-presentation response distortion when using questionnaires.

Another limitation is the sample of participants used within the study. Whilst there was an array of athletes from different sports, backgrounds and competitive levels, the sample was heavily weighted by university and club level athletes, which may have negated the distributional capacity of the responses. Previous qualitative studies have suffered similar limitations given their preference for the insights from only elite and super elite athletes (Jones et al., 2002, 2007) which has exposed the findings to a potential halo-effect with mental toughness being ordained on these individuals based more on success rather than actual mental toughness qualities. Nevertheless, it is an important consideration when interpreting the findings. In future studies, it is of paramount importance to utilise samples from various backgrounds, with varying experiences and across a wide range of competitive levels to ensure the generalizability and utility of the conceptual model and associated inventory.

The final limitation highlighted, but not limited to, one that is apparent throughout all quantitative mental toughness research to date, is that the data collected was cross-sectional in nature. Whilst this approach offers some insight into mental toughness in that instance, it fails to offer any insight into how this may change or how an individual may develop aspects of mental toughness based on experience. A future research direction would be to collect data across more than one time point and examining related processes and outcomes over time in order to assess mental toughness from a longitudinal perspective and to determine the predictive validity of the construct and associated instrument.

Future research directions

Despite the limitations, there are a number of valuable insights gained from this study that can help guide directions for future research attempts to construct a sound measure of mental

toughness. First is the overwhelming apparent need for a strong conceptual and theoretical rational for the selection of dimensions or factors of mental toughness. Whilst the 4C's conceptualisation has encouraging face validity, the factors proposed are intuitively appealing and there is some support evident from other qualitative research into mental toughness (Coulter et al., 2010; Gucciardi et al., 2008; Jones et al., 2002, 2007; Sheard et al., 2009), this is negated given its development based on the dispositional construct of hardiness (Kobasa, 1979) which is founded in health psychology. An issue which is only heightened by the lack of detail presented around the development procedure used to construct the 4C's model, and the insufficient rationale as to why mental toughness was a sport-specific form of hardiness, transposed by the additional construct of confidence. In order to address these limitations, researchers must seek to understand mental toughness by combining the current qualitative findings in mental toughness literature before linking with already well establish psychological theory (i.e., relating to self-efficacy, motivation and coping). This will then enable them to move towards a more conceptually and theoretically sound model of mental toughness.

The second lesson highlighted was the importance for adequate relatedness between the proposed dimensions or factors of mental toughness and key correlates, including possible antecedents (i.e., personality, optimism, goal orientation) and outcomes (i.e. affect, well-being) as well as performance. Constructs which appear to emerge consistently in research incorporating mental toughness include; self-confidence, self-efficacy, motivation, perceived control, concentration, attention control and coping. All constructs feature prominently in the qualitative literature and as a result a valid psychometric measure should be able to confirm such apparent associations. A limitation to the MTQ48 is that in failing to report the psychometric properties of the measure, Clough et al. (2002) have also neglected to demonstrate how their 4C's model can be differentiated from psychometrically sound measures of hardiness (e.g., Personal Views Survey III-R; Maddi & Khoshaba, 2001). Given the apparent conceptual overlap between other constructs such as resilience and hardiness, it is vital to demonstrate that mental toughness share similar contextual space but are yet distinct. In attempts to validate future conceptual models and their associated inventories, researchers should adequately demonstrate the association with key correlates that clearly demonstrate the convergent and discriminate validity of the measure and their conceptual model.

The third consideration relates to the importance of vigilance throughout the process of item generation and development. This is necessary to ensure that the resulting measure has a sound factor structure as well as strength in relation to theoretical and conceptual grounds, an issue that has limited the MTQ48 and other mental toughness measures to date (i.e., PPI; Loehr, 1986, SMTQ; Sheard et al., 2009). Clark and Watson (1995) present guidelines for item wording that highlight the importance of ensuring clarity, specificity and brevity with each item. It is on this level that the MTQ48 presents its greatest challenge given that its conceptual basis and the emerging construct relatedness presented in this study was relatively sound. It appears that at the item level, the MTQ48 is at its weakest, and it is potentially for this reason that the psychometric analysis yielded such a poor goodness of fit and improper solution based on the responses to the MTQ48. In the development of future mental toughness measures, an exhaustive list of items should be generated, drawing on a number of sources such as raw data themes from mental toughness research, current sport-general and sport-specific mental toughness questionnaires and other measures closely related to mental toughness constructs. Each item should then be rigorously scrutinised in relation to content relevance, clarity (understanding) and phraseology by researchers, applied practitioners and intended population end-users.

Conclusions in relation to thesis

The findings of this study suggest that the psychometric properties of the MTQ48 do not adequately fit the proposed conceptual model. Combined with results from Study 1, it appears there currently exists no comprehensively sound measure of mental toughness and further testing and development of a more robust conceptualisation and supporting psychometric inventory of mental toughness is a priority. Encouragingly, a number of important insights relating to sound conceptual rationale, relatedness to established theory, and item development rigor, have emerged that will inform the development of a new conceptual model and associated inventory in the subsequent studies (Study 3 and Study 4) of this research programme.

What is clear is the apparent need for more carefully developed measures, better articulation of the links between theory, instrument design, construction and practice, and improved application of methodological and statistical techniques to support the process. As stipulated by Marsh (1997), from a construct validation perspective, theory, measurement, empirical research

and practice are intertwined and the neglect of one will only be at the detriment of the others. Moving forward it is important to remain conversant with the notion that construct validation is an ongoing process whereby theory and practice are used to develop a measure. The subsequent measure, and its underlying theory, is then tested using empirical research which then looks to inform both, and guide suitable revisions whereby new research is then conducted to test subsequent refinements. This along with other theory and research is then used to inform practice.

Acknowledgment

At this point in the research programme it is pertinent to acknowledge the recent published evidence that supports the findings of this study. Whilst more research is encouraged to determine the true psychometric integrity of the inventory, it is important to determine if the unsatisfactory loadings found in Study 2 are not simply a function of the idiosyncratic characteristics of this sample, or whether they are inherent weaknesses within the items and factors themselves, or even a product of the disputed underlying conceptual model (i.e., 75% adapted from hardiness theory) which has little supporting rationale. At the outset of the research programme this was not available, however also in pursuit of progressing measurement issues in mental toughness, an independent study conducted by Gucciardi, Hanton and Mallett (2012) provides a psychometric examination of the MTQ48. Using two independent samples of performers from various sports (N = 686) and the workplace (N = 639), Gucciardi and colleague sought to examine the factorial validity of the MTQ48 using CFA and exploratory structural equation modelling (ESEM). Collectively, CFA and ESEM model fit indices and parameter estimates did not support the hypothesised correlated four factor model of the MTQ48 in either athlete (CFA; $\chi^2_{(1074)} = 5511.88$, $p < .001$, CFI = .487, TLI = .462, SRMR = .104, RMSEA = .078, 90% CI = .076–.080; ESEM; $\chi^2_{(942)} = 2970.25$, $p < .001$, CFI = .766, TLI = .719, SRMR = .045, RMSEA = .056, 90% CI = .054–.058) or workplace samples (CFA; $\chi^2_{(1074)} = 4928.95$, $p < .001$, CFI = .521, TLI = .497, SRMR = .093, RMSEA = .075, 90% CI = .073–.077; ESEM; $\chi^2_{(942)} = 2744.20$, $p < .001$, CFI = .776, TLI = .732, SRMR = .045, RMSEA = .055, 90% CI = .052–.057). Both CFA and ESEM also revealed that six and nine factor models were also unsatisfactory according to the multiple criteria of model fit. Further reference to these complementary findings will be made in the Discussion section of the thesis (see Chapter VI).

Chapter IV

Study 3 – Establishing a new definition and conceptual model of mental toughness in sport

Summary

Following examination of the MTQ48 in Study 2, and acknowledging the limitations of the field of mental toughness in relation to conceptual clarity highlighted in the systematic review in Study 1, a meta-interpretation approach was adopted to systematically analyse and synthesize the current mental toughness literature. After an exhaustive process of sampling, identification, data extraction, progressive categorising, analysis, and synthesis of interpretations, a new definition of mental toughness is presented alongside eight conceptually distinct components of mental toughness that emerged, namely; *Self-belief, Drive, Discipline, Challenge Mindset, Attention Control, Emotional Control, Performance Intelligence,* and *Resilience.* In essence, mental toughness was considered to be an umbrella term ordained to a psychological disposition that brings together a collection of attitudes and abilities that enables an individual to consistently deliver high level performances in relation to ability level, in response to the many challenges and adversities associated with the pursuit of a goal. In an attempt to move beyond description towards a more theoretical conceptualisation, a multidimensional model of mental toughness was also proposed that reflects the complexity of the concept. The results are presented and practical implications and considerations for the next stages of the thesis are then offered.

Introduction

The construct of mental toughness has received much attention in the sport and exercise psychology literature, in part due to its communal reference for athletes, coaches and practitioners alike, but also its close affinity with performance (Clough & Strycharczyk, 2012). Despite appearing to behold a comprehensive body of literature, replete with definitions, measurement tools, developmental perspectives and intervention strategies designed to enhance mental toughness, researchers have struggled with its definition and most recently its measurement, as highlighted in the systematic review in Study 1 (Chapter II). Whilst researchers have attempted to assess mental toughness through a variety of measures, no standard for assessment has been met due to a lack of conceptual consistency in relation to its definition. A problem heightened in part by the over reliance of studies based on anecdotal evidence rather than specific empirical investigations. As concluded in Study 1, with no clear, accepted or consistent definition of mental toughness available, the majority of explanations have only served to add further conceptual confusion and

clouded the exact nature and make-up of the construct, especially in relation to other constructs thought to be similar (i.e., resilience, hardiness).

Whilst initial definitions and conceptualisations of mental toughness have been relatively simplistic, in some cases describing mental toughness as a singular trait (Cattell, 1957; Tutko & Richards, 1972), commonalities in more recent investigations have revealed more in-depth definitions, offering a more substantial appraisal of the concept as a multidimensional construct (Connaughton & Hanton, 2009; Gucciardi et al., 2009a). Nevertheless, such definitions and conceptualisations appear contradictory given one approach supports the notion that mental toughness is an inherited, innate personality characteristic (Clough et al., 2002), whereby others adopt a more longitudinal perspective suggesting the construct is acquired more due to interacting personal and environmental factors and learning experiences (Bull et al., 2005; Thelwell et al., 2005).

In order to establish a more complete understanding of mental toughness in sport, it is necessary to consider the experiences of a large number and wide range of performers, coaches and practitioners. To do so, it is proposed that researchers investigating the construct could move beyond conducting independent studies in isolation that sample only a limited number of performers (i.e., Jones et al., 2002, 2007; Connaughton et al., 2008, 2010), and look towards more innovative investigative approaches that combine the findings of multiple studies and present a unified body of literature. One method of investigation that may prove fruitful to accumulate and consolidate isolated knowledge is a research synthesis (Feldman, 1971; Price, 1965), whereby an attempt to summarise available knowledge is made by drawing overall conclusions from discrete investigations (Thomas & Harden, 2008) with findings displayed in taxonomic classifications, as demonstrated by researchers exploring organisational stressors in sport (Arnold & Fletcher, 2012b; Fletcher, Hanton, Mellalieu & Neil, 2012).

Consequently, in an attempt to accomplish a more conceptually focused and integrative approach to developing mental toughness research and theory, a *meta-interpretation* approach (Weed, 2005, 2006, 2008) is presented that synthesises the wealth of research into mental toughness and establishes a taxonomic classification of mental toughness components from a between-sport perspective. Taxonomy is a theoretical study of classification designed to arrange

units (also referred to as taxa) into a nomenclature of the construct of interest (Anderson & Krathwohl, 2001; Leech & Onwuegbuzie, 2008; Simpson, 1961); an approach, which offers much support for the synthesis process in this study.

The qualitative investigation into mental toughness has developed significantly over recent years, as highlighted in the systematic review presented in Chapter II (Study 1), with several comparable yet distinct theories emerging within the literature. These include but are not limited to the following: seminal studies into unearthing the construct in elite and super-elite performers (Jones et al., 2002; 2007), the transposition of hardiness and confidence into the 4C's conceptualisation (Clough et al., 2002), several within-sport investigations namely, cricket (Bull et al., 2005; Gucciardi & Gordon, 2009) and soccer (Thelwell et al., 2005), and most recently in Australian football guided by an approach underpinned by personal construct psychology (Gucciardi et al., 2008, 2009b). Given the isolated nature of these theoretical bodies of literature, the primary aim of this study was to accumulate, consolidate and synthesise the research that has uncovered multiple components of mental toughness in sport performers, and subsequently develop a new definition of mental toughness and construct a taxonomic classification of the key components of mental toughness in sport. It is proposed that such a taxonomy will provide an understandable and applicable framework that can be used to provide a rigorous and robust foundation to develop mental toughness research and theory.

In summary, the purpose of this study is the development of a new definition and conceptualisation of mental toughness based on current mental toughness literature. On the basis of this review, a synthesis model that incorporates the most common components identified, one that best operationalises the breadth and depth of the construct is proposed. This approach of clarifying the key components of mental toughness is deemed necessary for two main reasons. Firstly, whilst there will be some unique variance between sports, agreement on the common key components of mental toughness will facilitate the construction and development of a conceptually sound measure which incorporates recent empirical and theoretical advances in shared understanding of the phenomenon. Secondly, clarity around the key components will not only assist in ascertaining the exact uniqueness of mental toughness as a latent construct, but it will

also extend to confirming how it differs from other related concepts such as resilience and hardiness.

Method

Method of synthesis

Research methods such as grounded theory (Glaser & Strauss, 1967; Strauss & Corbin, 1990), cross-case comparison (Miles & Huberman, 1994), secondary analysis (Mishler, 1979) and interpretive phenomenological analysis (Smith, 1996), are usually conducted by an original investigator involved in a research project. Given this study is drawing on the findings of the published studies and not using the primary data collected through interviews and observations as the raw data, these approaches were not deemed appropriate. Whilst a number of aggregate research synthesis methods exist, namely, literature reviews, systematic reviews (Cook, Mulrow & Haynes, 1997; Tranfield & Denyer, 2002), meta-analysis (Evans & Chang, 2000) and meta-ethnography (Noblit & Hare, 1988), the specific method adopted in this study was a *meta-interpretation* (Weed, 2005, 2006, 2008).

The meta-interpretation approach was deemed most appropriate based on its suitability to broad research areas in which studies primarily employ qualitative methods, but most importantly, its interpretive rather than aggregative focus (Weed, 2005). The meta-interpretation approach has been developed from an extended analysis and evaluation of nine research methods involving synthesis alongside a broader review of research synthesis literature (Weed, 2008). Of the nine methods evaluated, five are methods of research synthesis (i.e., meta-analysis, systematic review, narrative review, meta-ethnography and meta-study), while four are better described as ones involving some form of synthesis as part of the approach (i.e., grounded theory, cross-case comparison, secondary analysis and interpretive phenomenological analysis). Underpinned by an interpretivist epistemology, the meta-interpretation sees the location of the researcher in the process as an important and vital part of the synthesis (Weed, 2008). The aim of the meta-interpretation approach in this study is to produce “a new and integrative interpretation of findings that is more substantive than those resulting from individual investigations” (Finfgeld, 2003, p.894),

which in turn allows novel patterns to emerge from the data so that an advanced and integrative definition and conceptualisation of mental toughness can be developed.

Data set development

The initial stage of data set development involved the identification of the seminal publication deemed by the research team as being central to the research area (Weed, 2005, 2008). Further studies for the data set in subsequent iterations were identified via iteration searches through a number of electronic databases. These were SPORTDiscus, PscyhINFO, Web of Knowledge and Science Direct, as well as the online British Library EThOS (Electronic Thesis Online Service) and the Australian Research Online system. Key search terms used in the electronic searches were mental toughness, mentally tough, psychologically tough, toughness and tough-mindedness. In addition, the technique of citation pearl growing (Hartley, Keen, Large & Tedd, 1990) was adopted to trace relevant studies through identifying other keywords and descriptors (i.e., elite, athlete, resilient, setbacks, pressure, performer, insatiable desire, discipline, control) in citations that could be incorporated into subsequent searches.

The combined searches returned a large volume of literature (N = 597) which was then subjected to clear exclusion criteria enforced in order to identify the most appropriate research that could provide conceptual and theoretical contributions on the area of mental toughness in sport. Studies were excluded based on a number of criteria including: not being published in peer-reviewed journals (e.g., Clough et al., 2002), work failing to present original data (e.g., Horsburgh et al., 2009), participants samples used who were not sport performers (e.g., Marchant et al., 2009), methodologies that were quantitative in design (e.g., Crust & Azadi, 2009, 2010), and publications being in languages other than English. To ensure studies adopting unorthodox methods but which possess the potential to contain relevant insights into mental toughness were not excluded prematurely, the exclusion criteria were established as the research synthesis progressed rather than being predetermined at the outset. Whilst not published, doctoral theses were deemed acceptable to the inclusion criteria based on the notions that they may provide valuable contributions to the synthesis process and that the research would have been subjected to peer-review and ratified through a University Research Board *viva* process to quality assure the research findings. To surmise, to be eligible for inclusion, studies were required to be peer-

reviewed, published (or in press), qualitative in design, presented original data, included samples of sport performers and were written in English. Other inclusion criteria recommended by Xu (2008) which included spatial (i.e. regional area or national constraints) or temporal (i.e., time cut-offs) criteria were not employed since it was deemed pertinent to include any theoretically relevant studies irrespective of culture or time period as long as they met the inclusion criteria aforementioned. All research was included up to the present moment of the search being conducted (December 2010).

Procedure

Presented in Figure 4.1 is an illustrated overview of the meta-interpretation process that began by identifying the research area, mental toughness, before selecting the initial seminal publication (Jones et al., 2002) that provided the greatest opportunity to uncover and establish an intimate understanding of the construct. A process known as maximum variation sampling (Patton, 2002) was conducted to generate theoretical sensitivity to the research area which, similar to grounded theory (cf. Pidgeon & Henwood, 1996), involves establishing a broad awareness of the field so that the first sample of studies can be identified (Weed, 2008). Following identification, this initial study was subjected to concurrent thematic, and context analysis to identify what conceptual and theoretical contribution it could make to develop a new definition and conceptualisation of mental toughness. Important to this analytical procedure was the extraction of interpretations of mental toughness from the original research. This extraction and synthesis of interpretations of mental toughness rather than the raw data itself is an important factor to acknowledge. Given that qualitative data sets are not widely available in journal publications means a secondary full analysis was not possible and as a result the meaning within the original research context needed to be maintained (Weed, 2005, 2008).

Moving forward, further theoretical sampling was conducted in a second iteration by specifically targeting relevant studies with the key terms identified at the outset and the citation pearl growing process. Systematically, further studies (N = 13) were identified and selected based on the inclusion criteria and were then subjected to their own concurrent thematic and context analysis, with consideration given to the relevance of the exclusion criteria from the previous iteration. Following analysis, the need to reject any of the identified studies was considered and the

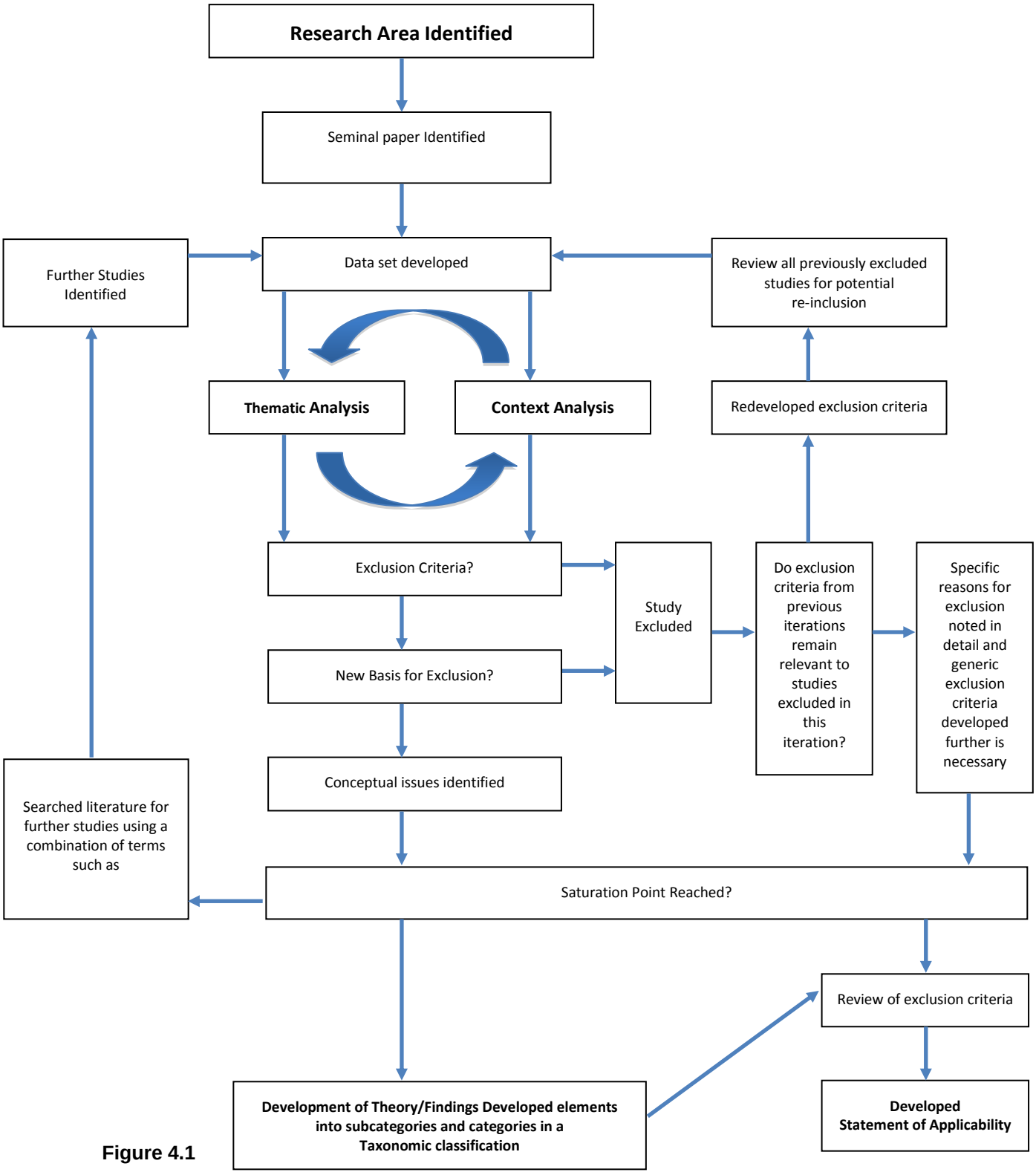

Figure 4.1

The meta-interpretation procedure adopted in this study

exclusion criteria presented above were established. To illustrate this process, after the second iteration it was evident that one study had explored mental toughness in relation to personnel other than sport performers (i.e., business managers). To ensure the data set addressed the primary

focus of the research, investigating mental toughness in relation to sport, this study was subsequently excluded. Further exploration of the elements extracted were conducted and the need for further theoretical sampling was assessed.

The meta-interpretation cycle was then repeated for a third iteration until it was deemed that the analysis became saturated and no further additional insights occurred (Weed, 2006, 2008). Saturation refers to the point at which sufficient information has been obtained from the research process which represents the depth as well as breadth of the target construct (Bowen, 2008). Taken from the original term of theoretical saturation developed in the approach of grounded theory (Glaser & Strauss, 1967), data saturation in this sense is taken to mean that data should be continued to be collected until no new themes, patterns or components emerge in the data set (Gaskell, 2000). The intention behind this process is to provide quality assurance to the qualitative approach and sampling adequacy suggestive of suitable breadth and depth of the findings which allows for maximum transferability of findings (O'Reilly & Parker, 2012).

Once data saturation was determined, elements and interpretations of mental toughness components cited were subsequently combined and catalogued into subcategories (i.e., 'Belief in abilities'). In an attempt to go beyond the original research findings (Thomas & Harden, 2008), subcategories were conceptualised into appropriate categories (i.e., 'Self-Belief) through the process of constant comparison, critical reflection and discussions between the principle researcher and the supervisory team. Approaches in line with thematic analysis procedures (Braun & Clarke, 2006) were adopted whereby emphasis was placed on reading and re-reading the key studies included in the synthesis, highlighting and extracting all relevant material and making annotations. The findings were then interpreted and presented in the form of separate taxonomic classifications which arranged the elements (also referred to as taxa) into a nomenclature of the construct of interest. Following this, the research team collectively reviewed the subcategories through a series of meetings and refined the categories and their definitions, using inductive and deductive reasoning until consensus was reached.

Following consensus on the taxonomic classification of the elements extracted and the identification of the key categories, then deemed to be components of mental toughness, the principle research and the supervisory team converged to interpret and construct a new definition

and conceptual model of mental toughness. In an attempt to move beyond description towards a more theoretical conceptualisation, a multidimensional model of mental toughness was then proposed that reflected the complexity of the concept.

On conclusion of the classification of the elements extracted from the synthesised literature into categories, further investment was given to identifying the contrasting pole of the categories identified and their definitions. Previously, the process of identifying and describing the key components of mental toughness has had the potential to be misconstrued as definitions are somewhat descriptive and in some cases overly simplistic. By adopting the approach endorsed by Gordon and colleagues (Gordon, Gucciardi & Chambers, 2007; Gucciardi & Gordon, 2008) who present a personal construct psychology (PCP; Kelly 1955, 1990) approach to investigating mental toughness, the emergent key components of mental toughness along with their opposite contrasts were presented. In line with construct development, PCP emphasises that we cannot fully understand what an emergent pole of a construct is, without gaining a sense of the contrast pole. In doing so, it enables the researcher to arrive at a more accurate understanding of the construct in the context of what it is not (Hagens, Neimeyer, & Goodholm, 2000; Neimeyer, Neimeyer, Hagans & van Brunt, 2002).

Whilst the taxonomic classification provided a comprehensive description of mental toughness components, the outcome is a product of, therefore should be reflective of, the intricate process of interpreting, categorising, organising and identifying the characteristics of each element, subcategory and category. Importantly, the taxonomic classification was used to ensure that elements, subcategories and categories were not biased or predetermined by previous research or existing frameworks in the area (i.e., Jones et al., 2007), but rather by independent meta-level interpretations of the emergent data. Following the interpretation of components of mental toughness, a statement of applicability was established (Weed, 2006) in order to enhance the quality and integrity of the meta-interpretation which clearly identifies the boundaries of relevance (Pawson, 2001) for the findings. The statement is as follows:

> *This study and its findings relate to the general, between-sport mental toughness characteristics performers demonstrate as part of their participation in competitive sport, irrespective of competition level. The meta-interpretation process synthesised*

interpretations of mental toughness attributes from published (or in press) research studies written in English. These studies sampled both male and female sport performers, who ranged in age from 14 to 85 years, were drawn from a number of different countries and sports, and competed at standards ranging from high school to international and professional level. A new definition and taxonomic classification of mental toughness is presented that is intended to provide researchers and practitioners with the most accurate, comprehensive, parsimonious and externally valid conceptualisation of mental toughness characteristics to date.

Rigor and Trustworthiness

In conducting a meta-interpretation it is essential that researchers demonstrate rigor and trustworthiness given they are active interpretive agents within the synthesis process (Denzin, 1998). This rigor can be enhanced by providing clear and comprehensive descriptions of the procedures that are used (Egger & Smith, 1998), hence a fundamental feature of the meta-interpretation is a transparent "audit trail" (Smith, 2003; Yin, 1989) that outlines any decisions and interpretations made (Weed, 2006). Consistent with these directives, not only is detailed information about the procedures used and decisions taken in this study provided to enhance the credibility of the research process, it also attempts to support the veracity of the findings and enlighten others about the methodology (Finfgeld, 2003).

When conducting a meta-interpretation, Weed (2006) advises to be cognizant of the triple hermeneutic effect that occurs when the synthesizers' interpretations are added to those of both the original researcher(s) and the participants. While this third layer of interpretation can provide significant value to the synthesis, it has the potential to lose some of the individual differentiations as the data moves from specific to generic. A concern highlighted by Rantala and Wellstrom (2001) is that in re-analysing 'inherited' secondary data, the researcher might understand the data differently from its collector, which is problematic in that as a consequence meaning in context is lost.

Furthermore, in recognition that there are a number of factors (i.e., personal values, attitudes, and beliefs) which may influence the researcher's position on the construct in question, a bracketing exercise (see Appendix 4.1 "The Researcher's Stance") was provided in an attempt to

disclose the researcher's personal experiences to date, as well as their reflections and personal views on mental toughness. Bracketing is a method commonly used in qualitative research to mitigate the potentially deleterious effect of unacknowledged preconceptions that may influence the research process and thereby increase the rigor of the project (Tufford & Newman, 2010). When undergoing any objective study of a topic usually regarded as being subjective, in order to promote impartiality and detachment from the data source, it is important to become conscious of and acknowledge personal experiences, judgments, perceptions and emotions. These included, but are not limited to, the researcher's *personal history*, *demographics* and *personal beliefs*. The bracketing conducted provided some intimate insight into these influences and as a result the reader is encouraged to examine the current study's results, interpretations and conclusions in lieu of the thoughts and observations disclosed.

To ensure that the results of this study represented a theoretically sound portrayal of mental toughness, an on-going peer-debriefing technique was conducted in parallel to the synthesis process. Peer-debriefing is an external check on the research process (Creswell, 2007) whereby independent researchers acting as '*critical friends'* (Faulkner & Sparkes, 1999) are used to question the synthesisers' interpretations and provides the opportunity to test and refine emerging themes to ensure that personal experiences, attitudes, values and/or beliefs did not unduly bias the findings. Due to the meta-interpretation approach adopted, it was difficult to employ traditional member-checking procedures such as follow up interviews and dialogue with all the original participants from the data sets used (Lincoln & Guba, 1985). Consequently, the supervisory team were consulted to provide feedback on the developing definition and conceptual model. The objective was not to generate a large amount of discourse, but to provide optimal challenge, encourage reflexivity and subject the interpretations to sufficient scrutiny to unearth alternative explanations and interpretations of the data (cf. Stewart, Smith & Sparkes, 2011).

Results

The meta-interpretation synthesised the findings of 14 studies before it was considered that theoretical saturation had occurred. Descriptive information on the studies included is presented in Table 4.1. Published between 2001 and 2010, the 14 studies sampled a total of 626 participants (363 males, 162 females, 101 unknown) with an age range from 14 to 85 years, drawn

from six countries (UK, Australia, Canada, India, South Africa and America) across in excess of thirty sports at standards ranging from high school to international and professional level. The diversity illustrates the breadth of contexts studied within this meta-interpretation. Emerging from the analysis were 213 elements of mental toughness, of which 10 were duplicates. The meta-interpretation abstracted all of the mental elements into 42 subcategories, which were subsequently organised to form eight distinct components; *Self-belief, Drive, Discipline, Challenge Mindset, Attention Control, Emotional Control, Performance Intelligence,* and *Resilience* (see Figures 4.2 - 4.9).

Contextualising Mental toughness

Dominant findings that emerged from the synthesis were that mental toughness relates to the conviction displayed in the pursuit of one's goals and exists in the presence of some form of pressure, challenge or adversity. Whilst some of the studies refer to mental toughness as "having a natural or developed psychological edge" (Bull et al., 2005; Jones et al., 2002; Thelwell et al., 2005), other depictions suggest it to be "a collection of values, attitudes, behaviours and emotions" (Gucciardi et al., 2008, 2009b). Nevertheless, this synthesis concludes that there is consensus that mental toughness is a quality that supports one's progress towards achieving one's goals which is a result of a superior ability to deal with, overcome and in some cases thrive through the many pressures, challenges and adversities associated with the pursuit.

Whilst some definitions (i.e., Jones et al., 2002; Thelwell et al., 2005) have implicitly inferred the notion of superior athleticism, making mental toughness dependent on overcoming an opponent, doing so removes one's control over being mentally tough and places it at the hands of the opponent. The interpretations in this synthesis deemed that the skill level of the individual is extraneous, and it is rather the consistency of the individual to demonstrate conviction in the pursuit of the goal and the ability to remain undeterred by the experience of setbacks, disappointments and/or misfortunes that classifies one as being mentally tough. It is the very notion that mental toughness is considered with respect to a goal pursuit that distinguishes the concept from other similar concepts that have been proposed to share a similar yet distinct conceptual space such as dispositional resilience (Bartone, Ursano, Wright & Ingraham, 1989; Luther & Cicchetti, 2000) and dispositional hardiness (Kobasa, 1979).

Table 4.1 Summary of studies included in the Meta-interpretation

Study	Year Published	Method	No. of Participants	Participant Gender	Mean Age (Range)	Participant Sport(s)	Participants Nation(s)	Participants Standard
Fourie & Potgieter	2001	Qualitative Questionnaire feedback	130 elite coaches 160 athletes	93 male 38 female 87 male 73 female	42.7 (22-85) 21 (14-35)	30 different sporting bodies	South Africa	university to international level
Jones, Hanton & Connaughton (2002)	2002	Focus group Individual interviews Follow-up interviews	10 athletes	7male 3 female	31.2 (–)	swimming, sprinting, artistic and rhythmic gymnastics, trampolining, middle-distance running, triathlon, golf, rugby union and netball		international sport performers from
Bull, Shambrook, James & Brookes	2005	Focus group meetings Follow-up semi-structured interviews	101 coaches 12 players	– 12 male	– (–)	Cricket	England	International
Thelwell, Weston & Greenlees	2005	Questionnaire + Interview	43 players	43 male	25.2 (–)	Soccer		Professional
Fawcett	2006 Doctoral Thesis	Semi-structured interviews	21 adventurer explorers 33 coaches 37 elite athletes	17 male 4 female 25 male 8 female 14 male 23 female	– (–)	Adventurer/Explorers Field hockey, Badminton, Cycling, Track and Field Athletics, Swimming, Basketball, Equestrian, Sailing & Windsurfing, Rugby, Bobsleigh, Canoe Slalom, Rowing, Snooker, Sailing & Windsurfing and Pentathlon	All GB coaches and athletes except one Australian coach and one Canadian athlete	Elite coaches Elite athletes
Middleton	2007 Doctoral Thesis	Semi-structured Interviews	33 Athletes Coaches & Sport psychologists	21 male 12 female	37.68 (25-70)			Current and former elite athletes
Jones, Hanton & Connaughton	2007	Focus group Individual interviews Follow-up interviews	8 “super-elite” performers 3 coaches 4 sport psychologists	5 male 3 female 3 male 4 male	– (25-48) – (38-60) – (35-45)	Boxing, swimming, athletics, judo, triathlon, rowing, pentathlon, squash, cricket and rugby union	Australia, England, Canada, and Wales	“Super-Elite”
Connaughton, Wadey, Hanton & Jones	2008	Semi-structured interviews	7 athletes	5 male 2 female	33 (–)	Artistic and rhythmic gymnastics, swimming, trampolining, triathlon and rugby union		Elite
Gucciardi, Gordon & Dimmock	2008	Semi-structured interviews Follow-up questionnaire	11 coaches	11 male	42 (–)	Australian Rules Football	Australia	Elite

Gucciardi & Gordon	2009	Semi-structured interviews	5 players 11 coaches	16 male	– (–)	Cricket	Indian and Australian	
		Focus groups	9 players	9 male	24.67 (21-28)	Cricket	Australian	
Gucciardi, Gordon, Dimmock & Mallett	2009	Semi-structured interviews	11 coaches	11 male	42 (–)	Australian Rules Football	Australian	Elite
Connaughton, Hanton & Jones	2010	Semi-structured interviews	7 performers	4 male 3 female	– (25-48)	Swimming, athletics, judo, rowing, pentathlon, squash and rugby union	Australia, England, Canada and Wales	"Super-elite"
			2 coaches	2 male	– (40-62)			
			2 sport psychologists	2 male	– (40-47)			
Coulter, Mallett & Gucciardi	2010	Semi-structured interviews	4 coaches	4 male	44.3 (40-47)	Australian Rules Football	Australian	National A Licenses (highest coaching award in Australia) Professional players all with 3 years min International experience
			6 players	6 male	29.3 (25-34)			
			5 parents	2 male 3 female	59.4 (57-64)			
Thelwell, Such, Weston, Such & Greenlees	2010	Semi-structured interviews	10 athletes	10 female	18.2 (15-22)	Gymnastics	Great Britain and the United States	

Note: (-) signifies no data provided

Given the assertion that mental toughness relates to the conviction in one's goal pursuit and appears to operate in the presence of pressure, challenge or adversity, then the underpinning components of mental toughness identified in this study were examined in how they play some part in supporting the pursuit and assist an individual to overcome such pressures, challenges and adversities.

Mental toughness as a psychological disposition

A frequently contested issue in the literature is whether mental toughness is a phenomenon best conceptualised as an innate personality trait or as a context specific, environmentally and experientially determined set of characteristics (see Anderson, 2010; Connaughton & Hanton, 2009). From this synthesis, it was deemed that mental toughness was best operationalised as a psychological disposition, not a personality trait. A psychological disposition refers to a person's habitual inclination or tendency to exhibit particular patterns of thinking, feeling and behaviour in particular conditions or circumstances, for example, prior to a competition or under pressure in such competition (Anshel, 2003). Dispositions (i.e., confidence, optimism, hardiness) differ from personality traits such as neuroticism, self-esteem, and emotional stability that are stable, predictable, cross-sectional and developed early in life, deeply embedded and sometimes inherited ways of thinking and acting. Unlike personality traits, dispositions can be learned, may be determined by a situation, and can be susceptible to interventions. They are broad, generalised ways of thinking that can be observed as tendencies (McCrae & Costa, 2003). As mental toughness encompasses many attributes more akin to dispositions than a personality trait, it is proposed that mental toughness should be depicted in this way as a broader personality disposition.

Mental toughness definition

In relation to its definition, mental toughness was considered to be an umbrella term ordained to a dispositional quality that brings together a collection of attitudes and abilities that enables an individual to consistently deliver high level performances in relation to ability level in response to the many challenges and adversities associated with a goal pursuit. The preliminary definition offered from the synthesis was as follows:

> *"Mental toughness is a psychological disposition that determines, in some part, whether an individual pursues his/her goals with optimal perseverance and conviction despite facing social or psychological pressures, stressors, challenges and adversities."*

Two important elements become apparent when comparing the proposed definition with previous efforts. Firstly, this definition not only describes what mental toughness is, *"a psychological disposition"*, it also refers to its function, *"determines, in some part whether an individual pursues his/her goals with optimal perseverance and conviction"*. Importantly, as a result, individuals of all skill levels, irrespective of the outcome of an event, (i.e., winning or losing), can be deemed mentally tough depending solely on their response to a challenge, pressure or adversity, and the consistency of their performance in relation to their goal pursuit. Another major strength to the proposed definition is the reference to the pursuit of one's goals, which distinguishes the concept from other conceptually similar constructs (i.e., hardiness and resilience) which have been proposed to share similar conceptual space and have caused more conceptual ambiguity rather than clarity to the research area.

Components of mental toughness

In an attempt to move beyond replication of descriptive approaches that have proceeded, the categories with their taxonomic classifications are presented and discussed in relation to the literature synthesised. Also presented in Table 4.2 are the emergent key components of mental toughness along with their contrast definitions. The intention behind this approach was to develop a deeper understanding of the theoretical underpinnings of mental toughness that in turn will provide a greater foundation for the advancement of research in this area.

Table 4.2 Mental Toughness components, contrast pole and definitions

Component	Definition	Contrast Definition	Contrast
Self-Belief	*A robust confidence and belief in one's abilities to deliver performances and achieve success in one's goals*	*Lacking confidence and belief in one's ability to deliver performances and achieve success in one's goals*	***Self-defeated***
Drive	*An insatiable internal drive to achieve success in one's training and performance goals*	*Lacking the inner drive to give all to every aspect of the game in training and/or competition*	***No Drive***
Discipline	*A commitment and conviction to ensure that one does everything within one's control to achieve one's goals*	*Lacking commitment and conviction to do everything within one's control to achieve one's goals*	***Unruly***
Challenge Mindset	*An outlook enabling one to thrive under exposure to challenge (in training and competition) through seeing opportunities to achieve one's goals and develop oneself*	*A susceptibility to become overwhelmed under challenge by the possibility of failure, driven by a tendency to avoid failure, loss or misfortune*	***Threat Mindset***
Attention Control	*The ability to maintain an appropriate focus and manage interferences (internal and/or external) to ensure optimal performance in the training and competition*	*Inability to maintain appropriate focus and manage interferences (internal and/or external) which negatively impacts on performance in training and competition*	***Distractible***
Emotional Control	*The ability to perceive, understand and regulate emotional processes in demanding situations in training and/or competitions which facilitates performance*	*An inability to perceive, understand and regulate emotions in demanding situations in training and/or competition resulting in poor performance execution*	***Lacks Emotional Control***
Performance Intelligence	*The ability to understand the training and competition environment, through having an in depth performance awareness and acumen, and the ability to apply this to achieve success (i.e. execute decisions at critical moments)*	*A inability to understand the training and competition environment, through lacking sufficient performance awareness and acumen and ability to apply this to achieve success*	***Performance Naivety***
Resilience	*The ability to persevere through and bounce back effectively from major setbacks with a strong will to succeed and focusing on the future rather than dwelling on the negative experience*	*Inability to persevere through adversity, dwells on the problem and struggles to bouncing back from misfortune, hardship or disappointment*	***Vulnerability***

Self-belief – *"the belief in one's abilities to achieve one's goals"*

The taxonomic classification for the first higher-order category, namely *Self-Belief* is presented in Figure 4.2. Unequivocally, self-belief was found to be an ever-present overarching theme across the mental toughness literature evaluated, one that offers the most direct parallels to other findings throughout the research field. Jones and colleagues (Jones et al., 2002, 2007) identified "having an unshakable self-belief in your ability" (p.210) and "that you possess unique

qualities" (p.210) as two of the three most important components of mental toughness as perceived by athletes and coaches, a notion supported by findings in football relating to "total self-belief at all times" (Thelwell et al., 2005, p.329), and in cricket in the form of "resilient confidence", a belief in "making the difference" and the possession of a "robust self-confidence" (Bull et al. 2005, p.217). Similarly, Gucciardi and colleagues offer several assertions around the significance of self-belief in the make-up of mental toughness referring to self-belief in one's "mental and physical ability under pressure and…to persevere and overcome an obstacle" (Coulter et al., 2010, p.705; Gucciardi et al., 2008, p.269), and "to perform in any circumstance" (Gucciardi & Gordon, 2009, p.1297) with Fourie and Potgieter's (2001) also making reference to a 'Confidence Maintenance' factor which referred to "the ability to reveal competence, self-confidence and attitude" (p.67). This prominence emphasises how self-belief remains a prominent figure regardless of sport or context, and that irrespective of context or situational demands, mentally tough individuals possess a genuine belief in their ability to achieve their goals.

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"Having an unshakable self-belief that you possess unique qualities and abilities that make you better than your opponents"	6 (2)	Belief in abilities	
"Believing that your desire or hunger will ultimately result in you fulfilling your potential"	5	Belief in potential	
"Belief in making the difference"	5	Influential	
"Having the belief that you can punch through any obstacle people put in your way"	5	Robust confidence	**Self-Belief**
"Having an unshakable self-belief as a result of total awareness of how you got to where you are now"	2	Experience	
"Feeding off the physical condition"	1	Physically strong	
"Having an inner arrogance that makes you believe that you can achieve anything you set your mind to"	1	Inner arrogance	
"Optimism was perceived to be influential in allowing players to focus on the positives from demanding circumstances and to have a hopeful outlook that the future will be positive and will present with it opportunity'	1	Optimism	
Higher level mental skills, knowing how to win, the winning mentality, ability to seize the opportunity, showing resilience, having the killer touch, making it happen, doing it when it matters, grinding a result, not showing a weakness, being single minded, being ruthless, making effective decisions	1	Winning mentality	

Figure 4.2 A taxonomic classification of mental toughness attributes: *Self-belief*

The significance of possessing a robust self-belief to mental toughness is that these athletes tend to think that *they can*, and therefore *they do*. Mentally tough individuals who possess a high sense of self-belief routinely conceive themselves being successful and keep a focus on the

positive aspects of one's life and performance despite the pressure, challenge or adversity. Rather than worrying about a poor performance or the negative consequence of failure, they remain positive and back their ability, which enables them to get the most out of their abilities and remain on course in pursuit of their goals irrespective of the challenges they face.

Drive – *"the internal desire to achieve one's goals"*

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"The ability of the athlete to show perseverance, determination, desire, responsibility and commitment"	9	Perseverance & Determination	
"Having an insatiable desire and internalized motives to succeed."	8	Motivated to achieve	**Drive**
"Having a competitive desire and looking forward to the challenge of testing your skills against the best"	5	Competitiveness	
"Driving ambition, wanting it badly enough"	5	Ambition	
"Identifying your goals, what needs to be done to achieve those goals and adjusting (re-shaping) those goals when faced with an obstacle or adversity"	4	Goal focused	

Figure 4.3 A taxonomic classification of mental toughness attributes: *Drive*

The second category identified is that of *Drive*, with the taxonomic classification presented in Figure 4.3. From the synthesis, motivation was a key component of mental toughness that received substantial support throughout the literature. Jones and colleagues refer initially to the importance of "having an insatiable desire and internalised motive to succeed" (Jones et al., 2002, p.211) whereas "using long term goals as a source of motivation" (Jones et al., 2007, p.253) features prominently in their mental toughness framework. Gucciardi et al. (2008) also emphasise the use of goals, as well as stressing the importance of a high work ethic and describe motivation as being internal which encompasses a "desire for competitive challenges" (p.270) as well as "team success". Specific to cricket, Gucciardi and Gordon (2009) emphasised the importance of "an internalised, insatiable desire and commitment to consistently improve one's performances" (p.1297), likewise Coulter et al. (2010) emphasised the need to possess a "winning desire that drives you to overcome challenge and adversity" (p.705). Middleton (2005) highlights the role of a "drive to pursue personal best performances" (p. 87) and the personal significance the task holds for the individual as being important motivational components of mental toughness. A notion supported by Fourie and Potgieter (2001) when referring to determination and commitment. Given the range of factors reported in the mental toughness literature that relate to different types of

motivation, it was unclear as to which source is best suited for mental toughness. Nevertheless, the consensus emerging highlights motivations that are internally derived are believed to be of most importance to mental toughness (Gucciardi & Gordon, 2009; Gucciardi et al. 2009b).

Discipline – *"the personal standards that influence one's approach towards one's goals"*

The taxonomic classification for the third higher-order category, namely *Discipline* is presented in Figure 4.4. Frequent within the mental toughness literature was the acknowledgment of the importance for players to demonstrate dedication and discipline both in their personal lives as well as in sport (Fawcett, 2006; Fourie & Potgieter, 2001; Gucciardi et al., 2008), to take responsibility and accountability for their game development and their behaviour (Coulter et al., 2010), as well as being willing to make sacrifices of valued elements of their personal lifestyles in order to achieve success (Bull et al., 2005; Coulter et al., 2010; Gucciardi et al., 2008). Synonymous with the notion of discipline appears to be the concept of commitment, referred to by Middleton (2005) as "the act of binding oneself (intellectually and emotionally) to a goal or a course of action" (p.98).

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"Total commitment to your performance goal until every possible opportunity of success has passed"	10 (1)	Commitment	
"Taking an honest stance when self-appraising your own performances and not making excuses when you do perform poorly"	10 (4)	Professional Attitude	
"A philosophy characterised by always working hard and pushing yourself through (physically and mentally) demanding situations in competition, training and preparation to achieve your goals and vision"	7	Work ethic	**Discipline**
"Placing meaning on personal values and living by personal standards to being a better person and player"	7	Strong Personal Values	
"Mentally tough players reported that they were able to accept they needed to take responsibility for themselves and their future"	6	Personal Responsibility	
"Doing everything in your preparation and leaving no stone unturned to ensure that you are prepared mentally and physically"	4	Quality Preparation	
"Managing your time efficiently to balance the many demands associated with elite football to get the very best out of yourself"	3	Self-management	

Figure 4.4 A taxonomic classification of mental toughness attributes: *Discipline*

Specific to the current conceptualisation of mental toughness, *Discipline* refers to the conviction in an athlete's approach to manage the demands encountered as part of the engagement of exhaustive deliberate practice and regular performance (in training and

competition) that is necessary for the attainment of their goals. It is the emphasis on the possession of strong personal values that distinguished *Discipline* from other psychological tenets such as high levels of motivation (Deci & Ryan, 1985, 2000; Nicholls, 1984), or the ability to focus on a given task. It is the importance and significance that the individual places on the personal values that they hold, that enables them to commit to their goals with conviction and remain steadfast in the face of challenge or adversity. In essence, the mentally tough achieve this by taking an honest stance when appraising their performance and do not make excuses following a disappointment, setback or poor performance. They take ownership and responsibility for their attitude and behaviour and are professional in all aspects of their approach (i.e., diet, training, preparation, competition, rehabilitation). In this sense, discipline also refers to the acknowledgement of the sacrifices (on and off the pitch) that are necessary and in some cases inevitable if the athlete is to achieve his or her goals.

Challenge Mindset – *"the tendency to appraise and respond to tough situations as opportunities for development"*

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"Enjoying the pressure associated with performance"	6 (1)	Thriving on pressure	**Challenge Mindset**
"A willingness to take risks both on the pitch and in one's life/career to increase the opportunity of success"	6	Willing to take risks	
"Being able to execute skills and procedures under pressure and stress, and accepting these pressures as challenges to test yourself against"	5	Embrace challenge	

Figure 4.5 A taxonomic classification of mental toughness attributes: *Challenge Mindset*

The fourth higher-order category is that of *Challenge Mindset* (see Figure 4.5 for taxonomic classification). Throughout the literature synthesised, it was commonly inferred that a mentally tough athlete is more likely to perceive competition as a challenge and an opportunity to learn and develop themselves as opposed to seeing the prospect as a threat (Gucciardi et al., 2008; Jones et al., 2007). On the one hand, there were athletes who actively sought out challenges, saw them as opportunities and thrived in continually changing environments, and on the other, there were athletes who preferred to minimise their exposure to change and the problems that come with uncertainty and instability. Similar references of this challenge approach is provided in the attributes of competitiveness (Bull et al., 2005; Fourie & Potgieter; 2001), the ability to thrive on the

pressure of competition (Bull et al., 2005; Jones et al., 2002; 2007) and the maintenance of a high performance level under pressure and specifically viewing obstacles as challenges (Coulter et al., 2010; Gucciardi et al., 2008; Jones et al., 2007).

In relation to the new conceptual model of mental toughness, the component of *Challenge Mindset* was believed to be vital in mobilising an individual's efforts towards the pursuit of a goal. Irrespective of the challenge, pressure or adversity with which he or she is presented, the *Challenge Mindset* allowed one to respond in a challenge approach through either greater perceived control or given the knowledge that the experience, irrespective of the immediate outcome, can lend itself to further personal growth and development which in turn can lead to future success. What is more, this approach behaviour towards the onset of challenge, pressure and/or adversity lends itself to a more controlled emotional and physiological reaction and adaptation to the situation, due to the lowered perceived threat. In comparison, their less mentally tough counterparts may be more prone to stronger anxieties driven by a lower sense of perceived control resulting in greater uncertainty and perceived danger to well-being and/or self-esteem and the tendency to more readily focus on the potential loss or threat associated with the situation.

Attention Control – *"the ability to regulate one's focus to facilitate performance"*

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"The unshakeable concentration of mental processes on a task whilst excluding other distractions from concentration"	8	Task Focused	
"Remaining fully focused on the task at hand in the face of competition specific distractions"	7 (2)	Managing External Distractions	**Attentional Control**
"Having the ability to ignore distractions and remain focused"	5	General Distraction Management	
"Dealing with distractions, blocking out, keeping it all in perspective, not thinking too much about it all"	3	Managing Internal Distractions	
"Recognise the importance of knowing when to switch on and off from your sport"	2	Able to Switch on & off	

Figure 4.6 A taxonomic classification of mental toughness attributes: *Attentional Control*

Throughout the mental toughness literature reviewed in the synthesis, there were numerous references to a superior ability to remain focused (Jones et al., 2002, 2007), ignore distractions (Fawcett, 2006; Jones et al., 2007; Thelwell et al., 2005), maintain concentration (Fourie & Potgieter, 2001; Middleton, 2005), as well as having a single-mindedness to focus

(Coulter et al., 2010; Gucciardi et al., 2008). Given the close association with mental toughness and the ability to remain focused and unaffected by distractions (internal or external), competition-specific or in relation to personal factors, the fifth category identified was that of *Attentional Control* (see Figure 4.6 for the taxonomic classification).

Attention Control related to an individual's flexibility in directing the focus of one's attention towards appropriate cues and aspects of performance on demand, and withdrawing thoughts and images that may cause interference or distraction from the pursuit of their goal. Whilst the exact content of focus will vary enormously as it is a function of numerous factors related to the sport, the context, the individual and the specific time, there are some consistencies that would be associated with a mentally tough approach. Typically mentally tough individuals accept that there are factors in the performance environment that are beyond their control, that they cannot influence and therefore they choose to identify these and focus solely on the things within their control. Likewise, mentally tough individuals tend to focus mainly on the processes of performance, not just the outcome, and work hard to stay in the present and focus on what is happening in the moment, not getting caught up in the past or too far ahead in the future. Not only do they stay focused on the positive and remain composed on the task at hand but they are also able to shut out distractions, internal (i.e., thoughts, worries and doubts) as well as external (i.e., crowd, opposition), and are able to recover from unexpected, uncontrollable events that have the potential to derail their less mentally tough counterparts. Together, the possession of an attention flexibility and an ability to switch one's focus rapidly between oneself and the environment is a crucial aspect of the maintaining focus on the pursuit of one's goal and remain on task irrespective of the challenge, pressure or adversities encountered in the process.

Emotional Control – *"an awareness of and ability to regulate one's emotions to facilitate performance"*

The sixth category identified was that of *Emotional Control* (see Figure 4.7 for the taxonomic classification). Reference to an ability to control feelings and emotions to facilitate performance was common amongst the mental toughness literature reviewed (Clough et al., 2002; Fourie & Potgieter, 2001; Jones et al., 2007; Thelwell et al., 2005). Gucciardi and colleagues specifically identify 'Emotional Intelligence' (Coulter et al., 2010; Gucciardi, et al., 2008) and

'Affective Intelligence' (Gucciardi & Gordon, 2009), as a key component of mental toughness, referring to individuals having an honest and accurate self-awareness and understanding of their emotions when under pressure, and possessing an ability to manage and regulate their emotions and mood in any circumstances to facilitate performance. In has been postulated that emotions play a central role in sport performance (Jones, 2003). Whilst victory or defeat can result in different emotional responses, an athlete's emotional state may also affect their outcome of a competition by influencing performance, both during training and whilst in competition. Accordingly, it is important that athletes are able to draw on a number of strategies to enhance emotional control to facilitate performance functioning.

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"the ability to regulate one's emotions and moods in any circumstance to facilitate performance"	9	Regulating Emotions	
"The process of being positive and remaining positive in the face of adversity or challenge"	6	Regulating Negative Thinking	**Emotional Control**
"An honest and accurate self-awareness and understanding of your emotions when under pressure or facing an obstacle, and the ability to manage your emotions to enhance performance across all situations"	5	Awareness	
"Accepting that competition anxiety is inevitable and knowing that you can cope with it"	4	Channelling Nerves & Anxiety	
"Remaining in control and not controlled"	4	Regulating Behaviour	

Figure 4.7 A taxonomic classification of mental toughness attributes: *Emotional Control*

Emotional Intelligence (Goleman, 1995, 1998; Mayer & Salovey, 1997) relates to an individual's ability to: make accurate self-appraisals, perceive and understand one's emotions and the emotions of others, form an maintain intimate relationships, express and manage emotions, demonstrate self-control, validate one's thinking and feelings, handle change and effectively solve problems. In relation to the literature synthesised, emotional intelligence, affective intelligence or emotional control as it has been referred to, related to one's awareness, understanding and management of emotions in order to facilitate performance. Mental toughness differs from Emotional Intelligence in that the latter adopts an overarching focus on self-management and the management of others, where the former relates to the awareness, understanding and management of emotions in relation to a goal pursuit and performance.

In this conceptualisation, *Emotional Control* is not so much about emotions *per se*, but more about the way in which individuals effectively integrate emotions with thoughts and behaviours and in doing so act to reduce the adverse emotional experiences consistent with pressure, challenge and adversity. In essence the mentally tough performer possesses a good understanding of themselves and is able to recognise their feelings, their antecedents, and understands the impact they have on behaviour and performance. Importantly, this understanding allows them to be more flexible and adjust their thoughts, feelings and emotions to better manage their behaviour according to situational demands and conditions, compared to their less mentally tough counterparts. The mentally tough performer is able to regulate their emotions, have satisfaction in themselves, and generally maintains a realistically positive attitude, in particular in the face of challenge and adversity, whereas a less mental tough individual is subsumed by negative affect and adopts a pessimistic outlook to proceedings. The mentally tough, are able to tolerate stress more, remaining calm and composed, and in control of their emotions, withstanding the conflicting emotions and negative impulses that they may be experiencing due to adverse events.

Performance Intelligence – *"an awareness, understanding of and ability to regulate one's environment and performance to achieve one's goals"*

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"Having an ability to read the game, having strong tactical awareness, and understanding your role on the pitch to execute decisions at critical moments"	7	Decision-making Ability	
"An awareness and understanding of the game and the processes required to perform well"	6	Performance & Training Knowledge	**Performance Intelligence**
"Being able to recognise and understand the obstacles, challenges and pressures involved and accurately self-assessing your individual performances"	4	Self-awareness & Continuous Learning Approach	
"Using all aspects of a very difficult competition environment to your advantage"	4	Application of Knowledge for Success	
"Previous experience o being there before, athletic maturity"	3	Experience	

Figure 4.8 A taxonomic classification of mental toughness attributes: *Performance Intelligence*

The taxonomic classification for the seventh higher-order category, namely *Performance Intelligence* is presented in Figure 4.8. Within the mental toughness literature synthesised, Gucciardi and colleagues make two direct references to "Sport Intelligence" as a key characteristic

of mental toughness (Coulter, et al., 2010; Gucciardi et al. 2008). Defined as "having the ability to perceive and understand both the training and competitive environment, and having the self-awareness to identify and understand your role within the team and any potential adversities that you may face" (p.272) Gucciardi et al. (2008) emphasise Sport Intelligence and the importance of knowing your role and having a good understanding of the game. Coulter et al. (2010) described Sport Intelligence with more reference to game and tactical awareness and highlighted the ability to make decisions in critical moments. Similarly, Gucciardi and Gordon (2009) identified 'Cricket Smarts' as a key characteristic referring to awareness and understanding of the game of cricket, a notion supported by Bull et al. (2005) and in soccer by Thelwell et al. (2005). Jones et al. (2007) also highlighted the ability to make correct decisions that secure optimal performance under pressure, which is elsewhere similarly thought to be a result of previous exposure and experience (Bull et al., 2005; Fawcett, 2005), task familiarity (Middleton, 2005) and having good self-awareness (Gucciardi et al., 2008) and performance awareness (Coulter et al., 2010).

Given the identification of Sport Intelligence in two sport specific studies and the cross-over with attributes in other sport-specific (Coulter et al., 2010; Gucciardi & Gordon, 2009; Gucciardi et al., 2008) and between-sport studies (Jones et al., 2007; Middleton, 2005), sufficient support was inferred for the inclusion of *Sport Intelligence* as a higher-order category. It was concluded that *Sport Intelligence* relates to the individual's awareness, knowledge and understanding of the contextually specific nature of the sport they are involved in and the specific situations they experience in training and competition, and the individual's ability to regulate behaviour and performance accordingly. This includes having the ability to read the game and situation, the ability to make the correct decisions and choosing the right options that secure optimal performance in pursuit of a goal. It involves being able to raise your game when it matters most, understanding your role, the potential pressure, challenges and adversities you may face and being able to use aspects of the environment to your advantage, in training as well as in competition.

Resilience – *"the ability to persevere through and respond positively to adversity"*

The eighth and final higher-order category identified was that of *Resilience* (see Figure 9). Frequently cited within the mental toughness literature is the notion of being able to bounce back from performance setbacks (Jones et al., 2002; Gucciardi & Gordon, 2009), handle failure (Jones

et al., 2007; Fawcett, 2006) and an apparent ability to overcome adversities with persevering determination (Gucciardi et al., 2008). All of which are attributes synonymous with the concept of dispositional resilience with the main function being described as an encouraging positive adaption despite the presence of risk or adversity (Luthar & Cicchetti, 2000; Masten, 1994; Masten & Reed, 2002). Although distinct, resilience is commonly reported to share similar conceptual space with mental toughness (Connaughton & Hanton, 2009).

Whilst there are similarities between resilience and mental toughness where both are qualities which refer to an individual's ability to bounce back following adversity, the former originates predominantly from clinical and psychiatric populations (Rutter, 1985), whereas mental toughness is purported to preside in the context of performance (Jones et al., 2002). Where there appears the greatest distinction, is that mental toughness appears to refer to one 'thriving' on the experience and excelling despite adversity, not merely returning to 'normal' functioning which resilience would appear contained. Nevertheless, resilience does offer some support for the current research program in that both consider contextual elements of an individual interacting with the stressor (Connor & Davidson, 2003).

Element (Example only)	Frequency (Duplicates)	Subcategory	Category
"The ability to withstand and bounce back from situations in which negative outcomes are experienced (i.e. pressure, adversity, challenge)"	7	Positive Responding	**Resilience**
"Recognising and rationalising failure and picking out the learning points to take forward"	4	Rationalising Setbacks & Failure	
"Persevering through adversity both in and out of soccer with ''bullet proof'' determination to stay focused and to maintain a consistently high level of performance"	3	Adversity Persistence	

Figure 4.9 A taxonomic classification of mental toughness attributes: *Resilience*

Given that the proposed conceptualisation of mental toughness is purported to occur in the presence of some form of challenge, pressure or adversity, and the regular reference of Resilience as a characteristic of mental toughness (Coulter et al., 2010; Gucciardi et al., 2008; Gucciardi & Gordon, 2009) it would appear pertinent to include approaches and behaviours consistent with those described as being resilient, as a key component of mental toughness. In the proposed conceptualisation of mental toughness, *Resilience* refers to an individual's ability to persevere through and bounce back from major setbacks, disappointments or mistakes with a stronger will to succeed. More specifically, a mentally tough individual is able to recognise their own thoughts and

beliefs, and possesses the flexibility of thinking to manage the emotional and behavioural consequence of the adversity more effectively and remain on task in pursuit of their goal. Resilient behaviours include but are not limited to a perseverance and increased commitment to succeed despite a setback, the ability to remain unfazed by making mistakes and being quick to return and respond following disappointment which allows one to achieve personal growth and development.

Establishing a conceptual model

Following the identification of eight distinct components of mental toughness (*Self-belief, Drive, Discipline, Challenge Mindset, Attention Control, Emotional Control, Performance Intelligence,* and *Resilience),* a multidimensional model of mental toughness was proposed that attempts to reflect the complexity of the concept (see Figure 4.10). The model was a product of the interpretations within the synthesis with all eight components represented within factors considered to represent two functional higher-order dimensions of mental toughness; "*Mental Toughness Attitude*" and "*Mental Toughness Approach*".

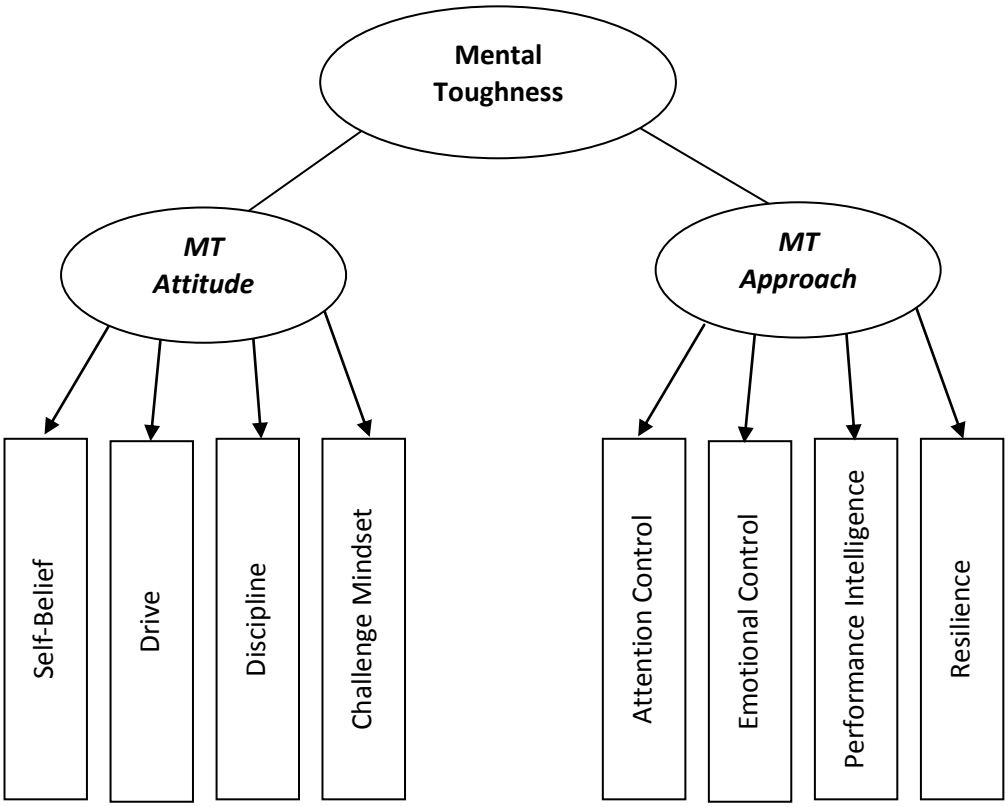

Figure 4.10 Proposed conceptual model of Mental Toughness

The separation of mental toughness into *'Mental Toughness Attitude'* and *'Mental Toughness Approach'* components was a result of interpretations of two key observations synonymous with those presented by Middleton (2005). Firstly, due to references within the synthesised literature from athletes, coaches, parents and sport psychologists describing mental toughness from these two perspectives. That is those interviewed have tended to describe mental toughness with respect to certain approaches they have seen others or they themselves have done which has demonstrated mental toughness (e.g., being focused, persevering, controlling their emotions), but also those interviewed have cited aspects which they felt influenced someone's disposition to be mentally tough (e.g., self-belief, motivation orientation/desire to achieve). The second observation was that when all the data was considered for its content, it became apparent that there were factors that were actions or approaches (e.g., coping strategies, behaviours and skills) and there were factors that were personal characteristics or attitudes (e.g., self-beliefs, orientations and perspectives). Given the disparity between these two types of mental toughness, it was deemed important that the conceptual model should reflect this.

Discussion

Due to the isolated nature of the theoretical bodies of mental toughness literature, the primary aim of this study was to accumulate, consolidate and synthesise the research that has uncovered multiple components of mental toughness in athletes. This would then move existing mental toughness literature beyond description towards a more extensive theoretical definition and conceptualisation of mental toughness developed through a taxonomic classification of the key components identified in the literature. It was proposed that such taxonomy would provide a simplified, understandable and applicable framework that can be used to provide a rigorous and robust foundation to develop mental toughness research and theory (i.e., measurement). Given the complexity and the multi-contextual nature of the construct, the synthesis of literature would also provide insight which reflects the multidimensionality of the construct and has implications for future research from a theoretical, assessment and applied developmental perspective.

The yields of the meta-interpretation adopted in this study included, a new definition of mental toughness and a new conceptualisation encompassing eight conceptually distinct components of mental toughness that emerged from the synthesised literature, namely; *Self-belief,*

Drive, Discipline, Challenge Mindset, Attention Control, Emotional Control, Performance Intelligence, and *Resilience.* In essence, mental toughness was concluded to be a psychological disposition that brings together a collection of attitudes and abilities that enables an individual to consistently deliver high level performances in relation to ability level, and in response to the many challenges and adversities associated with the pursuit of a goal. In an attempt to move beyond description towards a more theoretical conceptualisation, a multidimensional model of mental toughness was proposed that captured the complexity of the concept.

The meta-interpretation approach extends previous research and proposed frameworks of mental toughness in three key ways. Firstly, unlike previous popular conceptualisations that have relied on existing theory from other domains of psychology, such as Kobasa's (1979) dispositional hardiness theory underpinning Clough et al.'s (2002) 4C's conceptualisation, this taxonomic classification is based solely on empirical data relating to characteristics of mental toughness. Secondly, whilst previous attempts to unearth mental toughness characteristics have typically relied on small, discrete samples of elite and super-elite athletes, coaches, parents and sport psychologists, this study organises the characteristics recognised by 626 participants who ranged in age, gender, nationality, sport and competitive standard. Thirdly, in comparison to Jones et al.'s (2002) original theoretical suggestion of 12 mentally tough characteristics, this study identified 213 distinct characteristics of mental toughness that were classified into 42 subcategories and eight categories. In doing so, the findings offer a more substantial overview of mental toughness which captures both the depth and breadth of the construct allowing for greater transferability of the findings across sports and athletic populations.

In search of clarity…indicator or correlate?

Whilst the meta-interpretation amalgamated the plethora of characteristics common in the current literature, challenges to the components identified in the proposed model were evident in the quality check exchanges between the principle researcher and the supervisory team acting as critical friends. First was the concern around the incorporation of other psychological constructs within the model that did not make theoretical sense in the proposal of mental toughness as a distinct construct. For example, whilst *Resilience* is commonly reported to share similar conceptual space with mental toughness (Connaughton & Hanton, 2009), it was deemed conceptually vital that

the two constructs remain separate if mental toughness was to be depicted as a unique independent construct. The identification of *Resilience* within the synthesis was apparent given its common association as either a component or close correlate of mental toughness however, it was deemed that including *Resilience* as a component of mental toughness in this conceptualisation would potentially create further ambiguity between the constructs. The incorporation of other constructs potentially portrays mental toughness as some kind of 'super-trait' which incorporates a multitude of psychological constructs and strategies. Nevertheless it was deemed important to still understand how they relate to each other.

A possible explanation for the development of this 'super-trait' fallacy is the apparent confusion in the literature between factors which are indicators of mental toughness (i.e., principle components which make up the construct), and those that are correlates or covariates of the construct (i.e., constructs which it is closely related to). In previous attempts to define and unearth the components of mental toughness (Jones et al., 2002, 2007; Gucciardi et al., 2008), there appears to be confusion over what mental toughness *is* (i.e., the possession of robust self-belief, motivation, disciplined commitment) and what mental toughness *allows one to do* (i.e., the ability to concentrate, control emotions, handle pressure). The conceptualisation presented here is thought to extend the current literature by making this distinction through the proposed two functional higher-order dimensions of mental toughness; "*Mental Toughness Attitude*" and "*Mental Toughness Approach*". The '*Attitude*' components were deemed to be true indicators of what mental toughness *is*, with the '*Approach*' components capturing what mental toughness enables *one to do*. The '*Approach*' components were deemed to be correlates of mental toughness, not indicators, which in turn accounted for the conceptual confusion caused by their prevalence within the mental toughness literature. It was concluded that mental toughness was best captured in the '*Attitude'* elements of the proposed model, an amendment that would be consistent with the earlier proposal of mental toughness as a psychological disposition (Clough et al., 2002), with the theoretical vigour that this conceptualisation was grounded in mental toughness literature.

Whilst this represents a significant shift from the yields of the meta-interpretation, it is highlighted that without interpretation, the systematic nature of the synthesis lends itself to being open to replicating theoretical inaccuracies of previous research. It was deemed imperative to

make this distinction in light of the interpretative synthesis of the studies, and given that failing to adequately define the conceptual domain of a construct causes several problems (MacKenzie, 2003). Firstly, poor construct definition can lead to further conceptual confusion when addressing similarities and differences between it and other constructs. Secondly, indicators may either be deficient due to a lack of clarity of the focal construct or contaminated because the definition overlaps with other constructs that exist in the field, which would have been the case with the inclusion of the 'Approach' components identified. Thirdly, invalid conclusions about relationships with other constructs may later have to be rejected due to indicators not capturing what they are intending to capture.

With the shift in the conceptualisation, it is important to acknowledge that the aim of the study was to address the conceptual confusion that has previously clouded the exact nature and make-up of the construct, especially in relation to other constructs thought to be similar (i.e., resilience, hardiness). Whilst the aim was to produce integrative interpretations of findings, accumulating and synthesising multiple bodies of literature, the interpretations still have to make theoretical sense based on the researchers' intimate understanding and interpretation of the construct. Given the interpretivist epistemology that underpins the meta-interpretation approach that positions the researcher as an integral element of the synthesis process, it is important to be mindful of the subjective element to the research process, whilst also being cognizant of the various measures taken to ensure outputs are not biased or predetermined by previous research, existing frameworks in the area, or personal biases, and that meta-level interpretations of the emergent data remain independent. To quality assure for rigor and trustworthiness throughout the synthesis process, various measures including comprehensive descriptions of procedures, transparent audit-trails, a bracketing exercise, and on-going peer-debriefings, where all operationalized to constantly question the synthesisers' interpretations and provide the opportunities to test and refine emerging themes and interpretations.

With the above in mind, this interpretation extends previous research by offering a clear distinction between what mental toughness *is* (i.e., "*Attitude*" dimension) and what mental toughness *allows one to do* (i.e., "*Approach*" dimension). It can be concluded that the strength of the findings is that not only does it provide the most accurate, comprehensive and parsimonious

conceptualisation of mental toughness in sport, but also the conceptual model is valid, generalizable, and applicable to a large number of sport performers and across a wide range of sports. Where previous studies have conducted independent studies in isolation that have utilised small samples, this study has looked towards more innovative investigative approaches that combine the findings of multiple studies and presents a more robust and unified model of mental toughness in sport. What is more, where conceptual confusion has been evident in the inclusion of constructs thought to be similar to mental toughness (i.e., resilience, hardiness), this interpretation has sought to address these misconceptions and provide a clearer, and more theoretically distinct conceptualisation of the construct.

As a result, future researchers need to be cognizant with regard to what aspect of mental toughness they are interested in examining – what it *is* or what it can enable people *to do*. As measures already exist to measure the '*Approach*' aspect of mental toughness (e.g., Attentional Control Scale; Derryberry & Reed, 2002; Emotion Regulation Questionnaire; Gross & John, 2003; Connor-Davidson Resilience Scale; Connor & Davidson, 2003), and considering the on going need to develop a measure of mental toughness *per se*, the first aim for future researchers is to develop a measure of mental toughness 'Attitude' dimension (see Study 4). Once researchers have developed such a measure, they will then be in a better position to explore the relationship between mental toughness and performance, as well as the factors and mechanisms through which this occurs (i.e., mental toughness 'Approach' strategies).

Limitations

Whilst the meta-interpretation method is a promising new approach within sport and exercise psychology research (Arnold & Fletcher, 2012a), it is worth considering some of the limitations of the approach. As stated by Weed (2005) the true value of a meta-interpretation can be found in the extent to which it provides a total effect that is greater than the sum of the individual studies that it synthesizes. In line with this, it is prudent to highlight that the approach adopted in this study has advanced the research area through synthesising 14 studies, unearthing 213 characteristics of mental toughness and provided a taxonomic classification highlighting the significance of eight core components. In adopting such methods outlined by Weed (2005), the study has addressed the limitations of previously isolated unpublished work (Clough et al., 2002;

Loehr, 1986), provided a comprehensive insight into the existing knowledge base of published work, and generated more comprehensive answers to previous research questions relating to definition and conceptualisation (Fourie & Potgieter, 2002; Jones et al., 2002).

In relation to the limitations of this study however, it could be argued that the study reflects a publication bias, since it only included studies that were published (and in press) at the time of the meta-interpretation process. This was deemed necessary for the ease of retrieval but also to guarantee the quality of the research having undertaken the rigors of a peer-review process (Xu, 2008). Another limitation is the detached nature between the researcher and the original research participants given the assimilation and integration of previously analysed and interpreted data. The challenge with this is the potential to lose the integrity and vitality of the experiences represented in the original studies (Sandelowski, Docherty & Emden, 1997). Conversely, it can be argued that in adopting the synthesis process, it enables the researcher to unearth new insights and understanding of constructs. In doing so, it challenges and "moves the debate away from the assumption that the essence of phenomena has been revealed in a final, unarguable summary and towards an appreciation that synthesis is an ever-expanding, boundary breaking exercise" (Walsh & Downe, 2005, p. 205). Nevertheless, it could be postulated that this meta-interpretation approach collectively offers the most accurate, comprehensive, parsimonious, and externally valid conceptualisation of mental toughness to date. One which has the potential to provide a stronghold for future research to build from. For example, unearthing the developmental processes underpinning the construct, and/or the development of a valid and reliable assessment indicator.

Whilst this approach shows promise for advancing mental toughness research and theory, it is important to acknowledge that despite the declaration of saturation of current literature synthesised, the current meta-interpretation cannot provide a definitive account of mental toughness. Whilst Pawson (2002) postulates that synthesisers should "resist the more-research-is-needed call" as it intimates that saturation of knowledge was not achieved during the iteration process, it is important to highlight that the underlying purpose of the synthesis is to add to the body of knowledge and that synthesis themselves should be synergistic in function. As with all constructs, the research area will continue to expand and evolve as researchers continue to examine the construct from either within- or between-sport perspectives, across varying levels of

competitions and across sport populations (i.e. spatial or culture differences). As such, the findings of these studies should continue to inform, challenge and/or confirm the findings presented in this study. Whilst these findings attempt to address the challenges in relation to the definition and conceptualisation of mental toughness, further work is needed to draw on relevant theory to inform *a priori* hypothesis testing, develop valid and reliable measurement tools, and conduct experimental studies that focus on the development of mental toughness. Nevertheless, the synthesis and taxonomy presented simply represents an interpretation of the current research to date and given that phenomenon of mental toughness is complex and its understanding is continually evolving, it is likely that new characteristics will emerge in the future which would justify the need for further refinement and extension of the current conceptualisation of mental toughness.

Conclusions in relation to thesis

To summarise, the purpose of this study was to synthesise the current body of literature on mental toughness in sport and develop a new definition and conceptualisation that best operationalises the breadth and depth of the construct. The yields of this study included an innovative taxonomy of common characteristics, as well as a new definition and conceptual model of mental toughness in sport. The study provides an appealing approach for considering the construct of mental toughness in the future and offers a number of strongholds for both theory development and application. From a theoretical perspective, the conceptual model presented brings together a largely confusing body of literature and unearths a core arrangement of components of mental toughness that are consistent throughout the literature and offers clarity over what mental toughness *is* and what mental toughness *enables one to do*. Something that has eluded previous literature to date. These key components are presented in a multidimensional model that attempts to move the literature beyond being largely descriptive and outcome focused and gives greater distinction over the key indicators of mental toughness from common correlates which it is closely related to.

From an applied perspective, there are also a number of potential strengths to the proposed model. By drawing together the wider community of mental toughness conceptualisations, the model presented provides a more succinct approach to considering the construct. Whilst other conceptualisations integrate a number of complex concepts and separate

constructs (i.e., resilience, affective/emotional intelligence, focus/attentional control), the model provides a more user-friendly approach for athletes and coaches to consider their levels of mental toughness which is more easily identifiable, understandable and readily explained.

The model also represents a significant development in the area of mental toughness assessment, intervention and development. Firstly, the development of an empirically sound conceptual model moves the field closer to the development of an effective measure of mental toughness, one that possesses sound theoretical underpinning. Having provided clarity over what mental toughness *is*, we are now in a stronger position to develop a new measure to assess the construct through the indicator components (i.e. '*Attitude*' dimension). Once a conceptually and psychometrically valid measure of mental toughness is established, then the efficacy of strategies and interventions designed to develop and maintain mental toughness can become a reality. In addition it may then be possible to examine relationships with performance and the mechanisms that account for the relationship between '*Attitude*' and '*Approach*' dimensions identified.

To conclude, the yields of this study represent a significant step forward in attempts to define the construct of mental toughness and provide a conceptual model with strong theoretically underpinning. Having presented a new definition and conceptual model of mental toughness, the research programme will now focus on developing a reliable and psychometrically valid instrument for assessing mental toughness in athletes, focused on assessing the 'Attitude' components which are deemed to reflect the true indictors of the construct. This extends previous researchers that have developed measures and represents a positive step forward in the development of a psychometrically sound measure of mental toughness as it has a clear conceptual underpinning. An issue which has eluded previous measures as highlighted in the systematic review in Study 1 (see Chapter II) and the evaluation of the MTQ48 in Study 2 (see Chapter III). Encouragingly, a number of important insights were obtained from Study 2 that will inform the development of the new inventory in the subsequent study. What is clear is the apparent need for more carefully developed measures with clear instrument design, and improved application of methodological and statistical techniques to support the process. As stipulated by Marsh (1997), from a construct validation perspective, theory, measurement, empirical research and practice are intertwined and the neglect of one will only be at the detriment of the others.

Chapter V

Study 4 – Development and initial validation of a new psychometric measure of mental toughness:

The Sport Mental Toughness Profiler (SMTP)

Summary

In this chapter, the development and preliminary validation of an empirically driven measure of mental toughness within a multi-method research framework is presented. The purpose of the current study was to develop a new measure of mental toughness to operationalise the new conceptualisation of mental toughness presented in Study 3. Specifically it involved, two qualitative approaches to generate an inventory with items that assess the key mental toughness components of the new conceptual model and two quantitative approaches, involving within-network and between-network examinations. The preliminary validation approach is presented in five phases. Phase One involved the generation of a pool of items designed to capture mental toughness behaviours from a general, between-sport perspective. Phase Two presented evidence for the content validity of the items, with Phase Three explaining the construction of the *preliminary*-Sport Mental Toughness Profiler *(p*-SMTP*).* More specifically, Phase Four describes the evaluation of the 32-item *p*-SMTP and a preliminary psychometric evaluation of the inventory using a 3-stage exploratory confirmatory factor analytical approach. Finally, Phase Five describes a between-network examination exploring the relationship between the hypothesised factor structure of the final SMTP and other constructs hypothesised to have some logical, theoretical relationship with mental toughness. Separate sample CFA's were conducted to confirm the factor structure and follow-up internal-reliability analysis was conducted using test-retest and multisource rating approaches. In addition, the influence of age, gender, sport-type (individual vs team) and playing level (elite vs sub-elite and amateur) on mental toughness subscale scores and psychometric integrity were also examined.

Introduction

Whilst the need to develop sport-specific measurement instruments and evaluate them within a construct validity framework is well versed within the field of Sport and Exercise Psychology (Duda, 1998; Gauvin & Russell, 1993), results from the systematic review in Study 1 (Chapter II) indicated that this is not always commonplace within the field of mental toughness. Further, results from the psychometric evaluation of the MTQ48 in Study 2 (Chapter III) highlights the concern over researchers using such measures without undergoing the necessary psychometric procedures to confirm the validity of its properties before its use in independent

research. With any instrument development process, Marsh (1997) advocates for the construction of multidimensional instruments based on the foundation of sound theory, item and reliability analysis, substantial exploratory and confirmatory factor analysis, supportive assessments of convergent and divergent validity, with validation in relation to external criteria, and application in research and practice. Whilst two reviews (Boudreau, Gefen & Straub, 2001; Straub, 1989) have shown there to be no shortage of papers written on the technical procedures required for the validation of scales (Anderson & Gerbing, 1998, 1991; Bagozzi & Phillips, 1991; Edwards, 2001, 2003; Nullally & Bernsterin, 1994), it is proposed that it is the complex nature of the approach and the requirement of suitable technical knowledge that results in a lack of understanding of how to implement the recommendations made in these approaches (MacKenzie et al., 2011).

In an attempt to provide clarity on these procedures and improve current scale development and validation practice, Mackenzie et al. (2011) provide a comprehensive set of recommendations that integrates new and existing approaches to offer a framework for developing valid measures. As presented in Figure 5.1, the process of scale development begins with construct conceptualisation (or re-conceptualisation of an existing construct) and culminates in the development of the norms of the scale having completed a series of validation procedures. Whilst there are other procedures that can be conducted in a scale development procedure, the process proposed by MacKenzie et al. (2011) represents a balance between depth and breadth of coverage in a validation approach which is presented to then guide this research program.

The initial stage of the development and validation process requires defining the conceptual domain of the construct which not only relates to the identification of what the construct is, what it represents and what it captures, but also requires a discussion of what it is not, and how the construct differs from other related constructs. More specifically, this requires the explicit specification of the exact nature of the construct, including the conceptual domain, whether the construct refers to a thought (e.g., cognition, value), a feeling (e.g., attitude, emotion), a perception, an action, an outcome or an intrinsic characteristic, and the entity to which it applies (e.g., a person, a task, a process, a relationship, a group/team, a network or an organisation). It is also important to specify the conceptual theme in unambiguous terms and in a manner that is consistent with previous research (MacKenzie, 2003).

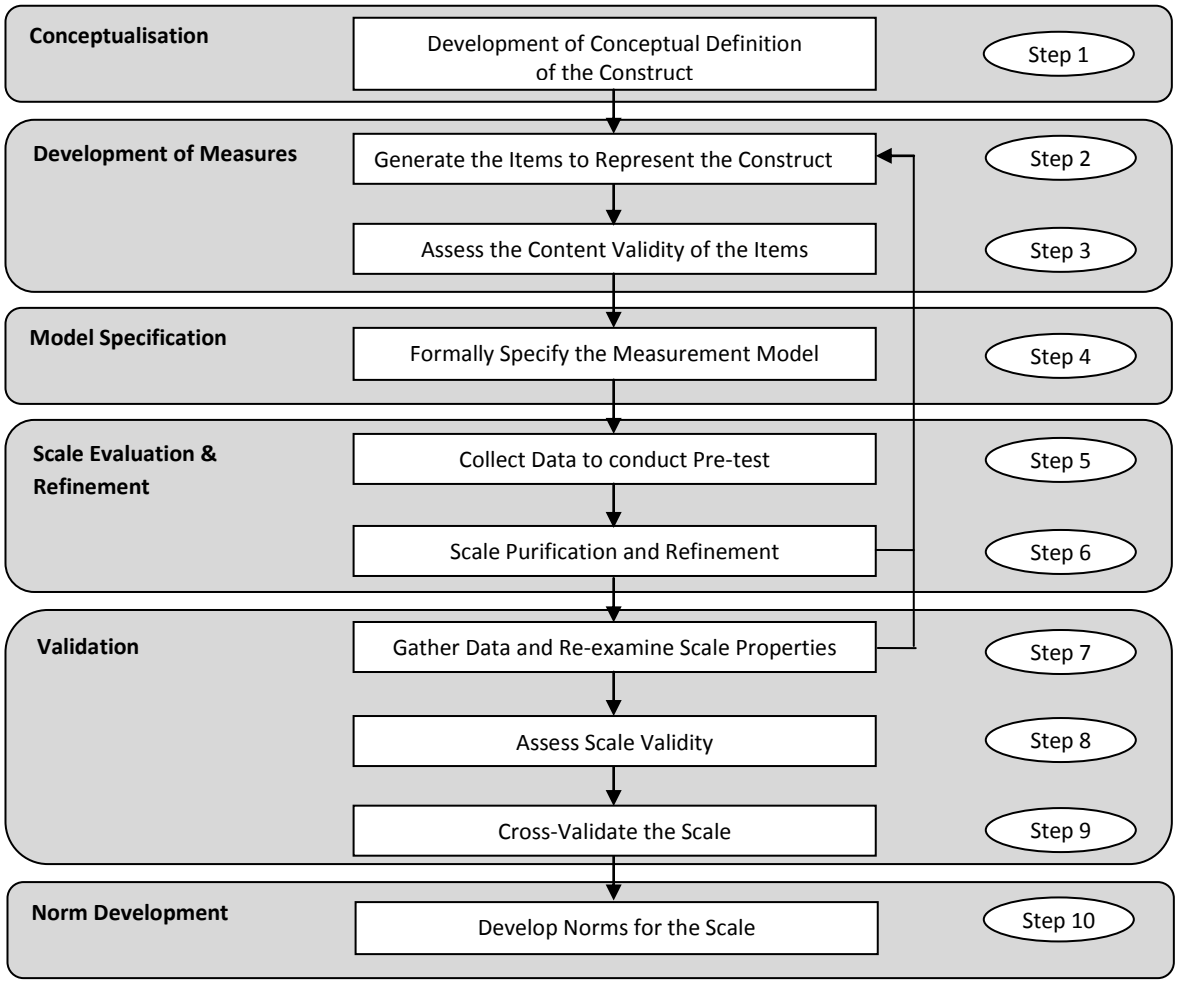

Figure 5.1 Overview of Scale Development Procedure proposed by MacKenzie et al. (2011)

Following construct conceptualisation, MacKenzie et al. (2011) highlight the importance of evaluating the construct dimensionality, more specifically, whether there are multiple sub-dimensions of the focal construct and how they relate to the focal construct and each other. It is stated that "if a construct is multidimensional, then it is important to define each of the sub-dimensions with the same care that was used in the case of the focal construct itself" (p. 300). In the case of multidimensionality, it is then proposed to consider the nature of the relationship between sub-dimensions and the higher-order (more general) construct. Consideration is needed to establish whether sub-dimensions are thought of as *formative* indicators of a second-order focal construct, or in contrast, as *reflective* manifestations of a focal construct whereby the focal construct exists separately at a deeper and more embedded level that its sub-dimensions. Nevertheless, it is an essential facet of a construct conceptualisation to accurately specify the

manner in which the sub-dimensions combine in order to give the construct its meaning (Goertz, 2006).

After the conceptualisation of the construct, the next step in the scale development process proposed involves the generation of an extensive item pool that fully represents the conceptual domain of the construct and its sub-dimensions, incorporating items which capture all of the essential aspects of the construct whilst minimising any cross-over outside of the domain of the focal construct. In generating the items, MacKenzie et al. (2011) emphasise that consideration should be taken to ensure that items are as clear and precise as possible, no double-barrelled items should be used, likewise every effort should be made to refine or remove items that contain any form of social desirability. Once generated, items should then be evaluated for their content validity, which concerns the degree to which items reflect the construct to which the instrument will generalise (Straub, Boudreau & Gefen, 2004). When assessing for content validity, two judgments are made. Firstly in relation to whether the individual items are representative of an aspect of the construct and secondly, as a set, are the items collectively representative of the entire content domain of the construct.

Once items have been deemed valid in terms of content, the next step is the formal specification of the measurement model that then captures the expected relationships between the indicators and the focal construct and/or sub-dimensions they are intended to represent. This involves setting the scale of the measurement and ensuring that the parameters of the model are all identified. Following specification, data should then be obtained from a target sample in order to examine the psychometric properties of the scale and in relation to convergent (i.e., alternative measures of the same construct), discriminant (i.e., measures of similar constructs that are potentially confounded with the focal construct) and nomological validity (i.e., measures of constructs that are theoretically related to the focal construct).

Once a recommended sample size has been obtained, 100 to 500 (Comrey & Lee, 1992) or based upon minimum ratios of respondents to the number of items from 3:1 to 10:1 (Cattell, 1978; Evritt, 1975), the scale can then undergo purification and refinement procedures. Irrespective of the type of the measurement model estimate, the ‘goodness-of-fit’ of the measurement model is evaluated in order to determine whether the solution is proper, the hypothesised individual

relationships are statistically significant and the relationships are consistent with the sample data (as a group). Whilst the chi-squared statistic is the best inferential test of overall model fit, it can be compromised by sample size, model complexity and non-normality therefore a range of goodness-of-fit indices are utilised to determine consistencies with the data. MacKenzie et al. (2011) offer several methods to assess the validity and the reliability of the indicators at the construct level, which in turn begins to identify problematic indicators. Those with low validity, low reliability, strong and significant measurement error covariances and/or non-hypothesised cross-loadings that are strong and significant are deemed problematic and are therefore candidates for elimination.

Following the scale purification process of adding, removing or rewording items, the next stage in the process is to re-estimate the measurement model with a new sample of data. Whilst this is to permit a valid statistical test of the fit of the measurement model, it is also important to establish the extent to which the psychometric properties of the scale may have been a result of the idiosyncrasies of the data sample. Once the measurement model is re-evaluated using a secondary sample, and assuming the properties of the scale are acceptable, the next stage of the developmental process is to establish whether responses to the scale behave in the manner in which one would expect if it was a true representation of the focal construct. In short, this process of assessing the scale validity has four main objectives. Firstly, establishing that the indicators/items are an accurate representation of the underlying construct, this can be achieved through experimental manipulation or comparing contrasting groups known to differ on the construct (High and Low Mental Toughness). Secondly, assessing the extent to which the indicators capture the multidimensional nature of the construct. Thirdly, that items are distinguishable from the indicators of other constructs (discriminant validity) and finally, that they are related to measures of other constructs specified in the construct's theoretical network (nomological validity).

The penultimate step in the development process is to cross validate the psychometric properties of the scale using new samples of populations to whom the construct would be expected to apply. MacKenzie et al. (2011) propose the use of multi-group analysis in order to compare a series of nested models with systematically increasing equality constraints across groups to establish invariance across groups (i.e. gender, competition level, type of sport). In this approach,

constraints would initiate with assessing the equivalence of the covariance matrices, to the configural equivalence of the factor structure, to the metric equivalence of the factor loadings and culminating in the scalar equivalence of the item intercepts. In principle, this approach is designed to assess the consistency of the proposed measurement model across different groups (e.g., gender, performance level, sport type) and confirm the generalizability of the measure. If there is variance in the measurement model between groups then this would indicate different measurement models apply to different groups and therefore different factor structures would be needed to assess specific groups which would then not permit the comparison or generalisation of results to be inferred.

The final step in the proposed scale development process is then to develop norms to assist the interpretation of scores on the scale. Norms can be obtained for a given population collecting a sufficient data sample to ensure the scores obtained are stable and then calculating the mean and standard deviation of the scores and examining the distributional (i.e., skewness and kurtosis) properties of the sample. Estimating the population distribution of the scale requires administering the measure to a representative sample of the population of interest and it is important to note that these norms should be periodically updated as norms may change over time.

In light of the MacKenzie et al.'s (2011) guidelines, and given the methodological issues that have been highlighted in previous mental toughness measures in Studies 1 and 2 of this research programme, a five-phase scale development protocol incorporating the steps advocated was employed to develop and validate a new measure of mental toughness in sport based on the new conceptual model presented in Study 3 (Chapter IV). In the first phase, construct dimensionality was confirmed and an item pool was generated based on the new proposed conceptual definition and conceptual model. Phase two consisted of an assessment of items across various individual and team sports with the aim of providing content validity of the item pool and gauge applicability and generalizability across sporting populations. In phase three, the final item pool was used to develop the measurement model and the *preliminary-Sport Mental Toughness Profiler* was established and subjected to a pilot test. In phases four and five, the reliability and validity (i.e., construct, convergent, and discriminant) of the newly developed inventory was then assessed, with items evaluated, refined and purified, culminating in a final

assessment of construct validity of the inventory using item-, factor- and group-level analyses. In summary, the overall aim of the study was to develop a psychometrically sound instrument that measures mental toughness from a general between-sport perspective.

Phase I: Construct dimensionality and Development of an item pool

The purpose of Phase I was to confirm the construct dimensionality and to create a pool of items based on the proposed definition and conceptual model presented in Study 3 (Chapter IV). The main objective was to create a sufficient pool of items that comprehensively captured the four 'Attitude' components of the new mental toughness conceptual model, namely *Self-Belief, Drive, Discipline* and *Challenge Mindset*.

Method

Creation of items

*T*he initial pool of items was developed after taking into account several sources in accordance with Mackenzie et al. (2011). Firstly, the raw data themes and quotes from qualitative studies into mental toughness obtained in Study 3 were considered. Secondly, the items from various sport-general (i.e., PPI, PPI-A, SMTQ) and sport-specific mental toughness questionnaires (i.e., CMTI, AfMTI) already in the literature were explored along with measures closely related to mental toughness (i.e., Connor-Davidson Dispositional Resilience Scale; Connor & Davidson, 2003; Revised Life-Orientation Test; Scheier, Carver & Brdiges, 1994) which were somewhat similar to the mental toughness constructs. From these questionnaires, only the phraseology and content of each scale was observed to inform item development. No identical items from any existing scale have been taken, nor have any original items from other instruments been used and revised.

Results

As the new conceptualisation of mental toughness had been proposed in Study 3, it was clarified how the multiple sub-dimensions of the focal construct (mental toughness) related to the focal construct and to each other. As the components (sub-dimensions) were viewed as defining characteristics of mental toughness, it was proposed that the sub-dimensions are best thought of

as formative indicators. This was due to the notion that a change in any one of the sub-dimensions (i.e., Challenge Mindset) could be associated with a change in the focal construct (i.e., mental toughness). This is in contrast to reflective indicators whereby the focal construct exists separately at a deeper level than its sub-dimensions and therefore a change in the focal construct would expect to produce a change in all of its sub-dimensions. It is important to note that most constructs can be modelled as having either formative or reflective indicators depending on the researcher's theoretical expectations, nevertheless, the decision is important to the conceptualisation of any construct.

In relation to item pool generation, a corpus of sport-relevant items (N = 53) was developed for the four 'Attitude' components of mental toughness identified in the new conceptualisation proposed in Study III. Clark and Watson's (1995) guidelines for item wording were closely followed to ensure their clarity, their specificity and their shortness. Each item was worded so that athletes of adolescent years and older would understand, and given the intended potential utilisation of this measure in multi-national populations, colloquialisms were avoided. What is more, sport-specific expressions were also avoided in order to broaden the applicability of the inventory across sports. To correct for "acquiescence bias", which is the tendency for participants to give positive responses to questions, both negatively and positively directed items were also included (Cooper, 2002).

Phase II: Content Validity Check

Phase two aimed to examine and establish the content validity of the proposed items by recruiting athletes, coaches, practitioners in sport and researchers within the field of mental toughness to evaluate the format of the inventory and the items in relation to the new conceptual model, culminating in the development of the *preliminary-Sport Mental Toughness Profiler (p-SMTP)*. This validity check was an important aspect of the scale development process as it determines to what extent items are relevant to, and representative of, the targeted construct being measured (Haynes, Richard & Kubany, 1995), as well as offering support for the applicability and generalizability of items developed across sports.

Method

Content Validity. After an exhaustive list of potential items (N = 53) was generated, 14 individuals were recruited to assess the content validity of the items as part of an expert panel. The panel consisted of three athletes, three coaches, three doctorate level researchers in Sport and Exercise Psychology and five applied practitioners. Specifically, the athletes (all female) had a mean age of 26.33 years (SD = 2.87) and playing experience range of 7 to 16 years (M = 12.33, SD = .4.73) with one amateur, one currently representing Great Britain and one Paralympic Gold medallist. The three coaches (two male, one female, M age = 29.33 years, SD = 3.79) were all Level IV qualified in their representative sports (cricket and tennis), all with Bachelor's degrees in Sport Sciences and one had an MSc degree in Applied Sport Psychology. The three doctorate level researchers (one male, two female) had a mean age of 26.33 years (SD = 2.31) were considered because they had university degrees in sport and exercise psychology, PhD's in sport psychology, taught in universities, had experience in questionnaire development, and either currently or previously participated in their sport at a representative level. Of the five applied practitioners (two male, three female, M age = 30.6 years, SD = 2.07), all were Accredited through the British Association of Sport and Exercise Science, three were Chartered practitioners, and all were operating as sport psychology consultants across various competitive levels from elite national sport teams and recreational athletes.

Each member of the panel received a copy of the items with a brief explanation of the research project and an outline of the conceptual framework guiding the item generation process. Using a dichotomous scale (*applicable* versus *inapplicable*) the judges were instructed to assess the applicability of each item in their respective sports that they either compete or work in. For the applicable items, the athletes and coaches were also asked to rate the clarity of each item using a seven-point Likert-scale (1 = *Not at all clear*, 7 = *Extremely clear*) and to give comments with alternative wordings for items that were not clear (see Appendix 5.1). Based on the ratings and comments provided by the athletes and coaches, seven items were rewritten in order to improve their clarity and to broaden the applicability across sports.

The resulting pool of items were then reviewed by six researchers and applied practitioners involved in previous mental toughness investigations (Age M = 36 years, SD = 8.07, Experience M

= 12 years, SD = 6.78). These experts were asked to assess the content relevance and the homogeneity of the four scales. Based on the scale definitions, raters were asked to indicate the extent to which they perceived each item to tap the designated scale using a four-point Likert scale where *1 = not relevant, 2 = somewhat relevant, 3 = quite relevant,* and *4 = highly relevant*, as advocated by Davis (1992) (see Appendix 5.2). This was conducted to provide evidence of content validity by computing a Content Validity Index (CVI; Lynn, 1986). Whilst several definitions of content validity exist (Waltz, Strickalnd & Lenz, 2005; Wynd, Schmidt & Schaefer, 2003), the general consensus is that content validity "concerns the degree to which a sample of items, taken together, constitute an adequate operational definition of a construct" (Polit & Beck, 2006, p.490). In principle, content validity is largely a matter of judgment involving two distinct phases; the first involving *a priori* efforts of the researcher or scale developer to ensure content validity through careful and considered conceptualisation and domain analysis prior to item generation, and the second through posterior efforts to evaluate the relevance of the scale's content through expert assessment.

A number of approaches of quantifying experts' degree of agreement regarding content relevance have been proposed, including averaging experts' ratings with predetermined acceptability criteria (Beck & Gable, 2001), coefficient alphas of three or more raters (Waltz et al., 2005), multi-rater kappa coefficients (Wynd et al., 2003), and average congruency percentage (Popham, 1978). The most widely reported approach however is the Content Validity Index or CVI. A four-point scale was adopted to avoid having a neutral and ambivalent mid-point present in three-point or five-point scales. A CVI value can be calculated for each item on a scale as well as for the overall scale. To calculate the item level CVI (I-CVI) ratings of item relevance reported as either 3 ("quite relevant") and 4 ("highly relevant") are computed and divided by the number of experts – that is, the proportion in agreement about relevance (i.e., four out of five ratings as "quite" or "highly relevant' would have an I-CVI of .80). Widely cited guidelines for acceptable I-CVI are provided by Lynn (1986) stating that when there are five or fewer experts, the I-CVI must be 1.00 – that is, all experts must agree that the item is content valid. When there are six or more, then the I-CVI must be at least .83.

Results

The judge panel assessment of the items showed that all items proposed were applicable to mental toughness but not all were generalizable across all individual and team sports. Having evaluated the relevance and clarity of each item, 21 were determined inapplicable and were thus eliminated, and seven items were rewritten to improve their clarity and broaden their applicability across sports. Content Validity analyses for each of the items are presented in Table 5.1. In relation to the *Belief* and *Discipline* scales, six out of eight items demonstrated acceptable CVI's and as a result, two items on each scale were reworded based on reviewer comments. The *Drive* scale demonstrated four items with acceptable CVI's, with one item *("I do not like to be tested against the toughest of opposition"*) identified as being better suited to the *Challenge* scale. Consequently, three items were reworded and one new item generated. Six items were also found to be acceptable on the *Challenge* scale however the addition of the item from the *Drive* scale meant one item was removed and one item was reworded.

The modifications produced a final revised pool of 32 items (see Table 5.2) that tapped into the four components of mental toughness from a theoretical perspective, and were deemed by those on the panel to be clear and applicable to the context of sport for athlete, coaches and practitioners alike.

Table 5.1 Expert Item Ratings and CVI ratings

	Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	I-CVI
Self-belief *– the belief in one's abilities to achieve one's goals*								
1	I believe I have what it takes to achieve my goals	4	4	4	4	4	4	1.0
2	I have doubts in my ability to consistently produce good performance s (R)	3	4	4	3	4	4	1.0
3	I have doubts in my ability to achieve my goals (R)	4	4	4	4	4	4	1.0
4	When faced with a setback, I doubt my ability to overcome it (R)	1	4	4	2	4	2	.50
5	I believe in my ability to overcome setbacks	1	3	4	2	4	2	.50
6	I believe in my ability to deliver under pressure	2	3	4	4	4	4	.83
7	When under pressure, I begin to doubt my ability to deliver (R)	3	4	4	4	4	4	1.0
8	I believe in my ability to consistently produce good performances	3	3	4	4	4	4	1.0
Drive *– the internal desire to achieve one's goals*								
1	I am determined to achieve my goals	4	4	4	3	4	4	1.0
2	I have little desire to improve (R)	2	2	3	4	4	4	.67
3	When faced with a setback, I am determined to overcome it	2	3	4	2	4	3	.67
4	I do not like to be tested against the toughest of opposition (R)	3	2	3	4	4	2	.67
5	I want to test myself against the toughest of opposition	3	3	3	4	4	3	1.0
6	I lack the motivation to achieve my goals (R)	4	4	4	4	4	4	1.0
7	When face with a setback, I tend to give up easily (R)	2	2	4	2	4	2	.33
8	I possess a strong desire to improve	2	4	3	4	4	4	.83
Discipline *– the personal standards that influence one's approach towards one's goals*								
1	I take responsibility for my performance	3	4	4	4	4	4	1.0
2	I have a strong work ethic in training	3	4	4	4	4	4	1.0
3	I do just what I need to in training to get by (R)	3	3	4	3	4	4	1.0
4	I am committed to doing all that it takes to achieve my goals	4	2	3	3	4	4	.83
5	There are just some things I'm not willing to sacrifice to achieve my goals (R)	4	3	2	4	3	3	.83
6	I need motivating by others to work on my performance (R)	3	2	3	2	4	3	.67
7	I prefer to only work on the aspects of my performance that I am good at (R)	2	4	2	4	1	3	.33
8	I make the sacrifices needed to achieve success in my goals	4	4	2	4	3	4	.83
Challenge Mindset *– the tendency to appraise and respond to tough situations as opportunities for development*								
1	I thrive on the pressure of competition	3	4	4	3	4	4	1.0
2	For me, challenges are an opportunity to test myself	4	4	4	4	4	4	1.0
3	Under pressure, I think about what I might lose if I fail (R)	4	4	4	4	1	4	.83
4	I see the pressure of competition as an opportunity to challenge myself	4	4	4	4	4	4	1.0
5	I see tough challenges as situations where I could embarrass myself (R)	4	4	4	4	1	4	.83
6	I do not enjoy the pressure of competition (R)	2	4	3	3	4	4	.83
7	When under pressure, my performance begins to suffer (R)	2	4	2	3	4	3	.67
8	When under pressure, I remain in control of my performance	2	4	2	3	4	3	.67

Table 5.2 Final preliminary-Sport Mental Toughness Profiler (SMTP) Items

Component	Item
Self-Belief - *the belief in one's abilities to achieve one's goals*	I believe I have what it takes to achieve my goals
	I have doubts in my ability to consistently produce good performances (R)
	I have doubts in my ability to achieve my goals (R)
	I lose belief in my ability to be successful (R)
	My belief in my ability to succeed is hard to undermine
	I believe in my ability to deliver under pressure
	When under pressure, I begin to doubt my ability to deliver (R)
	I believe in my ability to consistently produce good performances
Challenge Mindset - *the tendency to appraise and respond to tough situations as opportunities for development*	I thrive on the pressure of competition
	For me, challenges are an opportunity to test myself
	Under pressure, I think about what I might lose if I fail (R)
	I see the pressure of competition as an opportunity to challenge myself
	I see tough challenges as situations where I could embarrass myself (R)
	I do not enjoy the pressure of competition (R)
	I want to test myself against the toughest of opposition
	I do not like to be tested against the toughest of opposition (R)
Discipline - *the personal standards that influence one's approach towards one's goals*	I take responsibility for my performances
	I have a strong work ethic in training
	I do just what I need to in training to get by (R)
	I value being committed to doing all that it takes to achieve my goals
	I find myself making excuses for my performance (R)
	It is important to me to persist until I achieve success in my goals
	I make the sacrifices needed to achieve success in my goals
	There are just some things I'm not willing to sacrifice to achieve my goals (R)
Drive - *the internal desire to achieve one's goals*	I am determined to achieve my goals
	I struggle to push myself towards higher goals (R)
	I have a strong desire to succeed
	I don't mind if I don't achieve my goals (R)
	I am determined to reach my potential
	I lack the motivation to achieve my goals (R)
	I tend to lose motivation easily (R)
	I possess a strong desire to improve

Phase III: Development of the preliminary-Sport Mental Toughness Profile

Questionnaire structure

The next stage of the inventory development process, involved the consideration for an appropriate response scale. Consideration was given for whether respondents should evaluate the extent to which each item was a true reflection of the individuals' perception of self ('*False, 100% of the time'*-to-'*True, 100% of the time'*), the extent to which individuals agreed with statements ('*Agree'*-to-'*Disagree'*), or in relation to the frequency of behaviour ('*Always'*-to-'*Never'*). Based on the notion that the proposed conceptual definition refers to the factors working in association to produce consistent performances, it was decided that the items and response scales would be crafted and targeted to measure the frequency with which respondents demonstrated mental toughness attitudes or behaviours. It was therefore decided that a Likert-scale framing responses of an item on an *'Almost Always'* to *'Almost Never'* continuum was chosen.

In order to reduce potential "end-aversion bias", which is the tendency for respondents to avoid extreme scale positions, the use of a 6-point scale was preferred to a 4, 5 or 7-point scale, and the adverb *'Almost'* at the end points rather that absolute statements such as *'Always'* and *'Never'* was adopted. An even number of responses was also utilised so that respondents could not "sit on the fence" by selecting a neutral option such as "neither agree nor disagree". The scoring procedure proposed for the *p*-SMTP was; *Almost Never* (= 1 point), *Rarely* (= 2 point), *Sometimes* (= 3 points), *Often* (= 4 points), Very Often (= 5 points) and *Almost Always* (= 6 points), indicating the extent to which they demonstrated each statement. Standard antisocial desirability instructions were provided, outlining the confidentially of their answers and highlighted the need for honesty and concentration when completing the inventory. Finally, there were 14 negatively worded items to counter acquiescence (Ray, 1979). The initial form of the questionnaire pack included an instruction page and a section for demographic information, followed by the 32 items and took approximately 10 minutes to complete.

Member checking. Following the experts examination of the questionnaire, the revised version containing 32 items, was pilot tested using 30 university sport team athletes and three university coaches. The athletes and coaches were asked to complete the questionnaire pack

containing instructions, the p-SMTP, a demographics section and consent form, and provide feedback with regard to the clarity of the instructions, the time required for completion and suggestions for layout modifications. Feedback was supportive of the pack with only minor amendments to the instructions section suggested. The completion time ranged from 6 minutes 23 seconds to 9 minutes 23 seconds (M = 8.11 minutes SD = 0.76).

Phase IV: Assessing the internal (within-networks) properties of the p-SMTP

The next step in the inventory development process was to administer the *preliminary*-SMTP to a large sample in order to assess the factorial composition of the items generated in Phases I and II via confirmatory factor analysis (CFA) utilised in an exploratory fashion. Such approach was adopted to establish the factor structure of the *p*-SMTP and provide initial support for its psychometric integrity.

Method

Participants

Three hundred and two athletes, ranging from 16 to 63 years of age (M = 25.61 years, SD = 8.19 years) participated in the *p*-SMTP scale development and evaluation phases. The sample consisted of 208 males (68.9%) and 94 females (31.1%), drawn from 31 sport classifications. 192 classified themselves as amateur athletes, 32 semi-professional and 78 professional. Playing experience ranged from 1 to 50 years' experience (M = 12.12 years, SD = 7.58), 5 athletes did not provide experience information. The sample consisted of performers competing at recreational/Intra-Mural (41 = 13.6%), University (52 = 17.2%), Club (41 = 13.6%), County (132 = 43.7%), National (19 = 6.3%), and International (16 = 5.3%) standards. One athlete failed to report their current performance level.

Procedure

Institutional ethics approval was obtained and ethical procedures conforming to standards set by the British Psychological Society (2006) were adhered to through the research process. Volunteers were recruited via personal communication, letter and email invitation to abroad sample of club and governing bodies in the United Kingdom. Participants were purposefully sampled in line

with characteristics of performance for which the questionnaire was designed. As such, participants had been recruited form recreational through to professional levels of participation. In line with the generic aims of the research, broad sampling techniques was utilised to include multiple sports, males and females, and no restriction on age other than that above the age of consent (i.e. 16). Prior to completing the inventory, all participants provided informed consent and were assured of confidentiality. All participants completed the *p*-SMTP along with the Sport Mental Toughness Questionnaire and the Social Desirability Scale.

Measures

Preliminary-Sport Mental Toughness Profiler (p-SMTP) is a 32-item measure assessing mental toughness which yields four subscales, Belief, Challenge, Discipline and Drive. Participants respond to items using a 6-point Likert scale, (1= *Almost Never* to 6 = *Almost Always*) rating the extent to which they display each of the statements (see Appendix 5.3).

Sport Mental Toughness Questionnaire (SMTQ; Sheard, Golby & van Wersch, 2009) is a 14-item measure which provides a global measure of mental toughness as well as three subscales of Confidence, Constancy and Control. Participants respond to items using a 4-point Likert scale, ranging from (1) *not at all true*, to (4) *very true* (see Appendix 5.4). Sheard et al. (2009) report to have demonstrated acceptable internal consistency ($\alpha \geq .70$; Kline, 2005) for each of the three factors; Confidence =.80, Constancy =.74 and Control = .71. In this study the Cronbach's alpha for Confidence, Constancy and Control were, .76, .45 and .69. respectively. Cronbach's alpha for Global Mental Toughness was .81.

Social Desirability *(SDS; Reynolds,1982).*To assess the athletes' possible tendency to give socially desirable responses, it was attempted to minimize social desirability problems by stressing the non-evaluative aspect of the inventories, as well as its anonymity and confidentiality. Additionally, social desirability scores were examined through the administration of a short form of the original 33-item Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960; Reynolds, 1982). This scale includes 13 items developed on a true (1) /false (0) response format. The higher the total score the higher the need for social approval is indicated. The SDS values ranged from 0 (non-socially desirable) to 13 (socially desirable). A cut-off value of nine was set to identify participants presenting socially desirable bias (Conroy, Motl, & Hall, 2000). Research has

provided support for the short form in terms of model fit (Fischer & Fick, 1993; Loo & Thorpe, 2000), adequate internal consistency (α = .74, Barger, 2002) and having sufficient correlation with the 33-item version (r = .91; Reynolds, 1982).

Data Analysis

Confirmatory Factor Analysis. The factor structure of the scores on the *p*-SMTP were evaluated using CFA and the maximum likelihood estimation with EQS 6.1 for Windows (Bentler, 2006). To ensure that the inventory was brief and concise, yet maintained adequate psychometric properties (e.g., internal reliability, acceptable goodness-of-fit statistics), exploratory data analytical approaches were adopted. In line with a strategy advocated by Jöreskog (1993) and employed by others (e.g., Lonsdale, Hodge & Rose, 2008; Mullan, Markland & Ingledew, 1997) analysis was conducted in three stages. In all stages, items were allowed to load on only one hypothesised factor, factors were allowed to correlate freely, and error terms were not allowed to correlate.

Stage one involved performing CFAs on each subscale in isolation with items appearing to be adequate indicators of the latent variable retained for the next stage of analysis. In stage two, each subscale was paired with each of the other subscales in a series of two-factors CFAs. When *a priori* measurement models in the first two stages were of poor fit, items were considered for deletion if they displayed; large standardise residuals (> 2), if modifications indices suggested error terms of an item correlated with that of another item, if an item had a low factor loading (< .55; Mullan et al., 1997), or if modification indices suggested that an item cross-loaded on an unintended latent variable. As stipulated by Byrne (2006), the decision to make any modifications to a measurement model must always be based on a judicious combination of both the statistical information provided in the output and the researcher's knowledge of the substantive area. Any model re-specification must make substantive sense as well as statistical sense.

In the third and final stage, the resultant 16-item SMTP model was evaluated. The adequacy of the model to the data was evaluated using multiple fit indices. Firstly, this included the chi-squared (χ^2) goodness-of-fit statistic, the comparative fit index (CFI; Bentler, 1990), the Bentler-Bonett non-normed fit index (NNFI; Bentler & Bonett, 1980), the standardised root mean residual (SRMR; Hu & Bentler, 1998) and the root mean square root approximation (RMSEA; Steiger, 1990). Values on the CFI and NNFI greater than .90 and .95 are generally taken to reflect

acceptable and excellent fits to the data respectively and for the SRMR and RMSEA, values of .08 and .06 or less respectively (Browne & Cudeck, 1993). These indices provide a more comprehensive evaluation of model fit than any single index alone. Secondly, the factorial validity of the scores derived from the 16-item SMTP was assessed by examining the standardised factor loadings, standardised residules and modification indices to screen for model misspecification. Factor loadings lower than .40 were considered small and indicated the need for further item development. Finally, the internal consistency of scores from each subscale was assessed by examining Cronbach's alpha coefficients. Preliminary discriminant validity was also investigated through inspection of the factor correlations, and the tenability of a hierarchical model and an alternative one-factor model were tested.

Correlational Analysis. In developing measures designed to assess constructs, the importance of assessing the convergent and discriminant validity of the instrument is considered vital (Marsh, 2007). This approach involves utilising instruments that purport to assess the same or substantially overlapping constructs which are then administered to the same sample of participants. Large correlations between matching scales (i.e., similar or identical) provides support for convergent validity, likewise low correlations in non-matching scales depicts support for discriminant validity. In this study the SMTQ was utilised to assess the convergent and discriminant validity of the resultant SMTP. The SMTQ was preferred over other available measures such as the Psychological Performance Inventory (PPI; Loehr, 1986), the Mental Toughness Inventory (MTI; Middleton, Marsh, Martin, Richards & Perry, 2004) and the PPI-Alternative (Golby, Sheard & van Wersch, 2007) because despite being a relatively new measure, the SMTQ presents some evidence to suggest it possesses satisfactory psychometric properties with adequate reliability, divergent validity and discriminative power (Sheard, et al., 2009).

While the conceptualisations of the SMTP and the SMTQ are somewhat different there appears to be some apparent similarity in the terms of the reported scales, most notably the Confidence and Belief scales. On this basis, comparisons were made between the scales based on the content of items from the subscales yielding a number of *a priori* predictions regarding the relationship between the measures. Given the close resemblance and similarity of items, the SMTP subscale of Belief was predicted to be strongly related to SMTQ Confidence, as was SMTP's

Challenge to SMTQ's Control subscale. The SMTQ subscale of Constancy was believed to be most related to Discipline subscale of the SMTP. As the SMTP does not offer a global score, no predictions with the Global MT score of the SMTQ was offered.

When assessing the psychometric properties of the SMTP it was important to control for social desirability which may influence the estimates of factor loadings for each of the SMTP subscales and the relationships among variables. Socially desirable responding is important as it represents one of the most prominent sources of systematic error and its presence represents a considerable threat to the validity of participant responses (Podsakoff, MacKenszie, Lee & Podsakoff, 2003). If social desirability is to have little effect on the loadings then it was expected that correlations between the SDS and the subscales of the SMTP would be low and non-significant.

Results

Distribution of the SMTP items

Data was examined for missing values prior to the main analyses. For completeness of data, only complete datasets were used. Preliminary analysis examining the distributional properties of the items was conducted to determine the level of non-normality of the data. No significant multivariate outliers ($p < .011$) were identified. All SMTP items displayed univariate normal distributions (Skewness, <2; Kurtosis, <7) where univariate skewness values ranged from -1.151 to -.251 (M = -.699, SD = .233), and univariate kurtosis from -.557 to 1.402 (M = .118, SD = .549) indicating that all items were within acceptable ranges (Chou & Bentler, 1995; Kline, 1998; West, Finch & Curran, 1995). However, examination of Mardia's (1970) normalised coefficient of multivariate kurtosis revealed that the data departed from multivariate normality (Mardia = 190.965, normalised estimate = 35.57). Accordingly, the data were analysed with normal theory maximum likelihood (ML) estimation with the 'Robust' statistics option. In line with recommendation of Chou, Bentler and Satorra (1991) the Satorra-Bentler statistics (S-B χ^2; Satorra & Bentler, 1988a, 1988b), a scaling correction computed on the basis of estimation method and robust values fit indices and parameter errors were considered. Although multivariate normality is desired for ML estimation, this approach was still preferred to other methods given that Olsson et al. (2000) found that ML

analysis outperformed generalised least squares (GLS) and weighted least squares (WLS) estimation techniques under conditions of model misspecification and/or non-normality. Under violation of distributional assumptions the scaled chi-square statistic has been shown to have more trustworthy standard errors (Bentler, 1990; Byrne, 2006; Hu & Bentler, 1999).

Stage One: Single factor CFAs

In stage one, the series of single subscale CFAs resulted in the deletion of 11 items. Poor model fit (see Table 5.3) and low factor loadings below the elevated threshold of .55 indicated that each of these items did not correspond with the other items loading on the factor it was assigned to. The items removed from the respective scales were; *Belief* – item 16 *"My belief in my ability to succeed is hard to undermine"* (factor loading = .412); *Challenge* – items 15 *"Under pressure, I think about what I might lose if I fail"* (.313), item 22 *"I see tough challenges as situations where I could embarrass myself"* (.384) and 24 *"I do not enjoy the pressure of competition"* (.465); *Discipline* – items 2 *"I take responsibility for my performances"* (.430), item 10 *"I do just what I need to in training to get by"* (.467), item 19 *"I find myself making excuses for my performance"* (.189), item 31 *"There are just some things I'm not willing to sacrifice to achieve my goals"* (.432) and *Drive* – items 6 *"I struggle to push myself towards higher goals"* (.408), item 12 *"I don't mind if I don't achieve my goals"* (.375) and item 27 *"I tend to lose my motivation easily"* (.481).

Table 5.3 Independent One-Factor Confirmatory Factor Analyses

Factor	χ^2	*Df*	SRMR	CFI	NNFI	*RMSEA (90% CI)*
Belief	135.859	*20*	.062	.884	.838	*.139 (.117, .161)*
Challenge Mindset	169.044	*20*	.078	.806	.728	*.157 (.136, .179)*
Discipline	76.134	*20*	.059	.928	.899	*.097 (.074, .119)*
Drive	110.325	*20*	.065	.897	.856	*.1222 (.100, .145)*

Note: *Note:* χ^2 *= chi-squares statistic, df = degrees of freedom, RMSEA (90% CI) = root mean square error of approximation and 90% Confidence Interval, SRMR = standardised root mean residual, CFI = comparative fix index, NNFI = non-normed fit index,*

On the basis of less than acceptable goodness of fit indices obtained for the independent factors, specifically CFI and NNFI indices below the .90 acceptance threshold, scope for further item deletion and scale refinement was indicated.

Stage Two: Paired CFAs

In the second stage of analysis, each of the four subscales were paired with each of the other subscales in order to examine their psychometric integrity in the presence of the other related factor. The aim was to retain only those items clearly loaded on the appropriate factor and delete any ambiguously loading items. From the six two-factor CFAs, five items were removed. The *Belief* items *"I believe I have what it takes to achieve my goals"* (item 1), and *"I have doubts in my ability to consistently produce good performances"* (item 5) were removed because they cross-loaded onto the *Drive* subscale. An issue also identified in the *Drive* item *"I lack the motivation to achieve my goals"* (item 20) which loaded on the *Discipline* subscale. Two items were removed because modifications indices suggested that the error terms of an item correlated with that of another item, namely *Belief* item 13 (*"I lose belief in my ability to be successful"*) and item 9 (*"I have doubts in my ability to achieve my goals"*), and *Challenge* item 29 ("I do not like to be tested against the toughest of opposition") and item 32 ("I want to test myself against the toughest of opposition"). All remaining items demonstrated suitable factor loadings above the .55 threshold therefore were retained.

Stage three: Complete model

The resultant four-factor, 16-item model was tested and presented acceptable goodness of fit to the data. Whilst the CFA produced a significant χ^2 statistic ($\chi^2_{(98)} = 223.094$, $p < .001$) it should be noted that this statistic is sensitive to minor discrepancies between observed and implied variance-covariance matrices (Byrne, 2006). Overall, the other goodness of fit indexes suggested that the model fitted the data well, $\chi^2_{(98)} = 223.094$, $p < .001$, SRMR = .056, NNFI = .942, CFI = .953, RMSEA = .065, 90%CI = .054–.076. All four 4-item factors in the model all demonstrated acceptable internal consistencies (α > .70). Table 5.4 displays the item means, standard deviations, standardised factor loadings, and residuals for this solution, as well as factor correlations and internal consistencies. In addition to the composite reliability coefficient, inter-item correlations, and minimum corrected item-total correlations were used to assess internal reliability. All of the items in the final CFA solution (see Figure 5.2) met the aforementioned criteria outline by Kidder and Judd (1986).

In addition, a hierarchical model was tested in which the four first-order latent factors were represented by one higher order latent factor. The fit of the hierarchical model was similar to that of the first-order model, $\chi^2_{(99)} = 328.229$, $p < .001$, SRMR = .093, NNFI = .895, CFI = .914, RMSEA = .088, 90%CI = .077–.098, nevertheless the first-order model was superior. A one-factor model was also tested and this produced a very poor fit to the data; $\chi^2_{(104)} = 1731.30$, $p < .001$, SRMR = .104, CFI = .749, NNFI = .710, RMSEA = .140, 90%CI = .134–.145, supporting the notion that mental toughness is a multidimensional construct represented by a number of separate, but related factors.

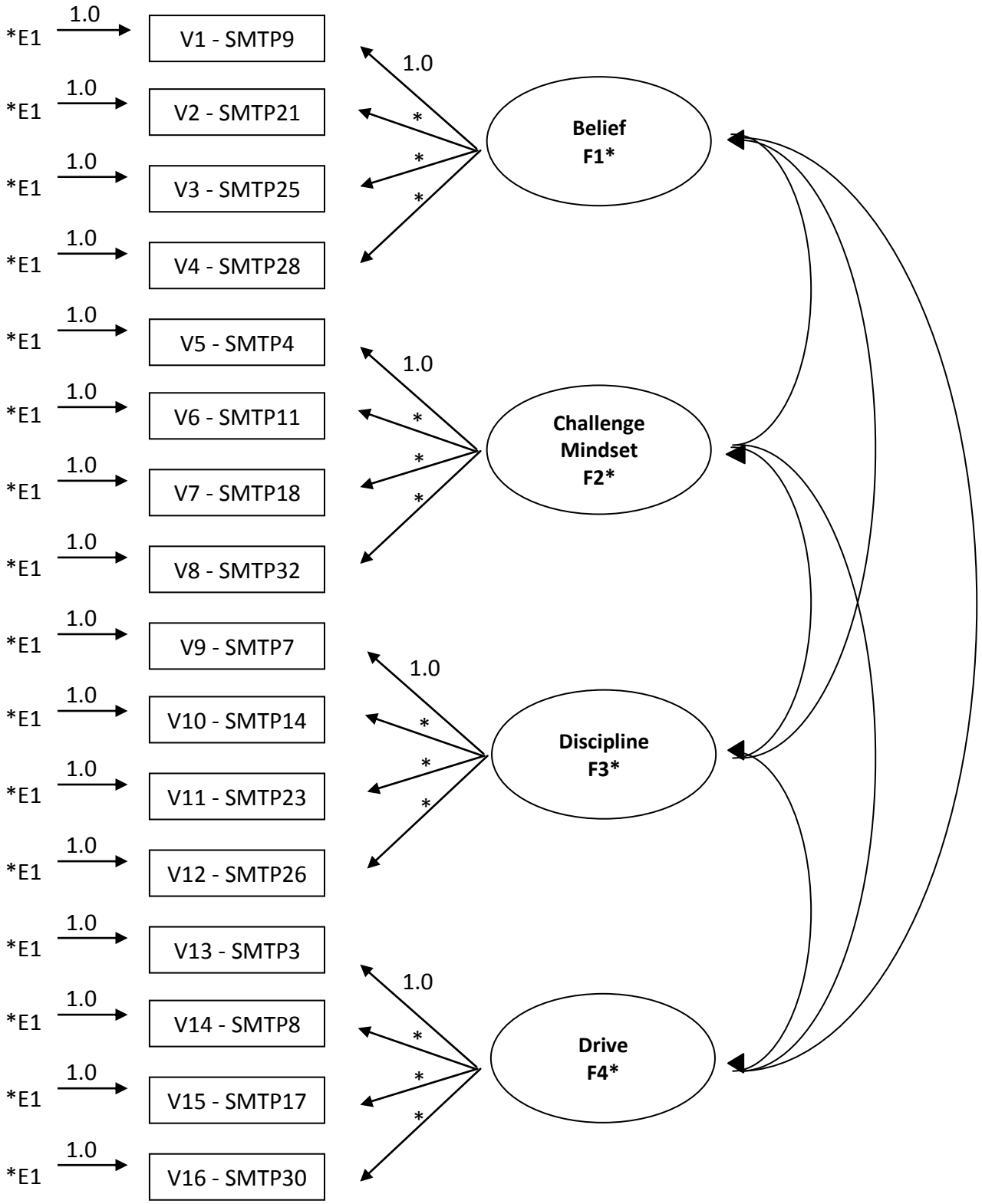

Figure 5.2 First-order model of the SMTP

Table 5.4 SMTP16 Items, Mean, Standard Deviations, Factor Loadings, residual, skewness and kurtosis

Scale	*Item*	*M*	*SD*	*Factor Loading*	*R^2*	*Skewness*	*Kurtosis*
Belief							
9	I have doubts in my ability to achieve my goals (R)	*4.404*	*1.064*	*.521*	*.272*	*-.830*	*.851*
21	I believe in my ability to deliver under pressure	*4.512*	*1.077*	*.856*	*.732*	*-.541*	*-.376*
25	When under pressure, I begin to doubt my ability to deliver (R)	*4.549*	*.948*	*.694*	*.481*	*-.873*	*1.079*
28	I believe in my ability to consistently produce good performances	*4.282*	*1.026*	*.819*	*.670*	*-.252*	*-.269*
Challenge Mindset							
4	I thrive on the pressure of competition	*4.503*	*1.152*	*.645*	*.416*	*-.586*	*-.090*
11	For me, challenges are an opportunity to test myself	*4.798*	*.966*	*.679*	*.461*	*-.633*	*.159*
18	I see the pressure of competition as an opportunity to challenge myself	*4.732*	*1.089*	*.812*	*.659*	*-.661*	*-.151*
32	I want to test myself against the toughest of opposition	*4.762*	*1.251*	*.696*	*.485*	*-.781*	*-.173*
Discipline							
7	I have a strong work ethic in training	*4.772*	*1.166*	*.726*	*.526*	*-.837*	*.280*
14	I value being committed to doing all that it takes to achieve my goals	*4.738*	*1.028*	*.799*	*.639*	*-.657*	*.082*
23	It is important to me to persist until I achieve success in my goals	*4.791*	*.950*	*.816*	*.666*	*-.390*	*-.546*
26	I make the sacrifices needed to achieve success in my goals	*4.325*	*1.220*	*.791*	*.626*	*-.498*	*-.271*
Drive							
3	I am determined to achieve my goals	*5.089*	*.930*	*.746*	*.557*	*-.752*	*-.140*
8	I have a strong desire to succeed	*5.215*	*.899*	*.730*	*.532*	*-1.157*	*1.446*
17	I am determined to reach my potential	*4.970*	*1.070*	*.832*	*.693*	*-.841*	*-.099*
30	I possess a strong desire to improve	*5.099*	*.987*	*.807*	*.651*	*-1.015*	*.484*

Factor Correlations and Internal Consistency (α)		***1***	***2***	***3***	***4***
1.	Belief	*(.817)*			
2.	Challenge	*.657***	*(.790)*		
3.	Discipline	*.384***	*.501***	*(.861)*	
4.	Drive	*.582***	*.608***	*.729***	*(.860)*

Note: All factor loadings are statistically significant (p <.05). Alpha coefficients (α) *are presented on the diagonal of the factor correlation matrix.*

Convergent validity with the SMTQ

Pearson product moment correlations (*r*) were used to investigate the strength and direction of relationships between SMTP and SMTQ subscales (see Table 5.5). Significant correlations were evident between all latent variables of both scales with moderate to strong positive convergent validity coefficients ($p < .001$) obtained between conceptually analogous subscales of the two measure; SMTP-Belief and SMTQ-confidence $r = .705$, SMTP-Challenge and SMTQ-confidence $r = .670$ and, SMTP-Discipline and SMTQ-constancy $r = .528$.

Table 5.5 Correlations between the SMTP, SMTQ and SDS

	Confidence	Constancy	Control	Social Desirability
N	299	299	299	298
M	17.35	13.68	11.03	6.84
SD	3.11	1.60	2.53	2.10
α	.762	.450	.692	.369
Belief	.705**	.463**	.591**	-.196**
Challenge Mindset	.670**	.472**	.445**	-.198**
Discipline	.406**	.528**	.194**	-.142*
Drive	.527**	.544**	.290**	-.135*

Social Desirability

Encouragingly, correlation examinations of social desirability were small and negatively associated ($r = -.135$ to $-.198$) suggesting that the four factors assessed by the SMTP were not strongly influenced by attempts to respond in a socially desirable manner. The significant yet low negative correlations between the factors of the SMTP and the SDS suggests that socially desirable responding have little effect on the SMTP factors and that spurious relations among the variables were minimal.

Phase V: Assessing the external (between-network) properties of the SMTP

The results of Phase IV represent an important part of the construct validation process surrounding the development and future use of the SMTP as a valid measure of mental toughness in sport. Nonetheless, further external validity evidence is also required to further justify inferences and decisions made on the basis of the SMTP scores (Mackenzie et al., 2011, Messick, 1989, 1995).

According to Messick (1989), external validity refers to "the extent to which [a] test's relationships with other tests and non-test behaviours reflect the high, low and interactive relations implied in the theory of the construct being assessed" (p. 45). External (between-network) validity can be obtained by examining the relationships between the test scores and scores obtained by other inventories designed to measure similar (and dissimilar) constructs (Messick, 1989, 1995).

Campbell and Fiske (1959) defined convergent validity coefficients as correlations between measures of conceptually analogous constructs assessed by different instruments (e.g., the SMTQ, Sheard et al., 2009) as addressed earlier. In contrast, discriminant validity coefficients were defined as correlations between a measure of a construct-of-interest (e.g., DRS; Bartone, et al., 1989) and conceptually dissimilar constructs assessed by different instruments (e.g., DASS-21; Anthony, Bieling, Cox, Enns & Swinson, 1998). The constructs proposed to assess the between-network validity of the SMTP included dispositional resilience, dispositional optimism, general self-efficacy as well as well-being indicators such as positive and negative affect, depression, anxiety, and stress.

In relation to this phase, a number of *a priori* hypothesis were offered. Dispositional optimism, defined as "a major determinant of the disjunction between two classes of behaviour: (a) continued striving versus (b) giving up and turning away" (Scheier & Carver, 1985, p. 227), is a trait which has close associations to mental toughness. Likened to a predictor of sport performance (Norlander & Archer, 2002), research has also suggested that more optimistic individuals exhibit increased levels of effort to achieve goals compared to their less optimistic counterparts who are more likely to withdraw or disengage attempts at achieving a goal (Carver, Blaney & Scheier, 1979; Gaurdreau & Blondin, 2004). Consequently, it was expected that dispositional optimism would be

positively related to mental toughness and all its subscales, most specifically Belief and Challenge, both of which relate in some way to positive beliefs about future outcomes or determine effort and persistence towards a goal pursuit.

Whilst it could be contested that it is when belief in ones abilities or confidence in a given situation or outcome is low, that the need for mental toughness is more apparent. When an individual is in a slump, when the odds are stacked against them, the outcome is uncertain, or they are facing true or extreme pressure or adversity, then it is then that mental toughness comes to the forefront. Nevertheless, it was still expected that those who rated higher in mental toughness would express a more confident outlook and positive appraisal of themselves therefore mental toughness would correlate positively with self-efficacy scores. More specifically, it was expected that both Belief and Challenge subscales would correlate strongly with self-efficacy.

Several qualitative studies (Jones et al., 2007; Thelwell et al., 2005; Thelwell, et al, 2007) have suggested that mentally tough athletes cope more effectively with the challenges and demands they face, nevertheless, it is yet unclear whether this is; i) a consequence of experiencing dissimilar stressor types; ii) interpreting these stressors in a different way (i.e., with reduced intensity and/or greater perceived control); iii) the use of different coping strategies or the same but using them more effectively. Regardless, it is clear that mentally tough individuals appear to be less affected in terms of well-being and cope better when faced with stressors, pressures and adversity compared to their less mentally tough counterparts. It would therefore suggest that mental toughness acts, in some part, as a buffer to stress and the negative affective outcomes associated with it such as anxiety, depression and negative mood and affect.

Consistent with this perspective, Jones et al. (2002) identified that a key attribute of mental toughness was “accepting that competition anxiety is inevitable and knowing that you can cope with it’” (p. 212) which highlights the importance of the appraisal of the stressor or anxiety sensation and implies that anxiety can have facilitative as well as debilitative effects on performance (Jones & Swain, 1995). To date, no research has investigated the relationship between anxiety, depression and mental toughness however it is expected that the mental toughness subscales would be negatively related with stress, anxiety, depression and negative affect, but positively with positive affect. More specifically, it is anticipated that aspects of Drive,

would have the strongest negative relationships with depression, as will Belief, which would also have strong negative associations with stress and anxiety.

Finally, in relation to dispositional resilience, previous research has revealed qualitative evidence describing the relationship and distinction between mental toughness and resilience (Gucciardi et al., 2008, 2009b). It was anticipated that mental toughness subscales would be positively related to resilience.

In an attempt to further examine the strength and integrity of the proposed model several other methods were adopted in this phase, specifically a multisource rating, test-retest reliability analysis and group-level invariance analysis. In previous construct validation of self-report inventories, it had been suggested that scores derived from significant others such as coaches, peers and/or parents should be explored (Gucciardi et al, 2009; Middleton et al., 2004). In doing so, it not only broadens the exploration of construct validity, it allows the researcher to address the limitations associated with social desirability.

Another assessment of factorial stability is the evaluation of test-retest reliability obtained through repeat assessments over a designated time period. A one-week period is often considered appropriate (Lane, Nevill, Bowes & Fox, 2005; Lonsdale et al., 2008), with changes in constructs likely to be minimal (or nil) over this period. As a result, substantial changes in SMTP scores would demonstrate a lack of test reliability and not a true change in mental toughness.

In summary, Phase V utilised five approaches to produce supportive external and further internal validity evidence for the SMTP. The first approach aimed to confirm the factor structure of the SMTP on a separate sample of athletes to confirm the psychometric properties established in Phase IV. The second focused on establishing construct validity through examination of the meaningful theoretical relationships between the SMTP and dispositional resilience, dispositional optimism, self-efficacy and well-being indicators (concurrent validity). These approaches are presented in Stage 1. The third focused on exploring the construct validity via multisource ratings (i.e., self and coach) in an attempt to address limitations associated with the social desirability of the inventory (see Stage 2). The purpose of the fourth approach (Stage 3) was to examine the internal stability of the inventory through a *test-retest* assessment with the fifth and final approach (Stage 4) adopting a group-level analysis to assess the stability of the model structure across

groups using invariance analysis. For the ease of interpretation, each of the approaches are presented as independent stages below.

Stage 1

The purpose of Stage 1 was to re-examine the four-factor model supported in Phase IV and examine the concurrent validity of the SMTP by observing the relationships between mental toughness and other relevant concepts.

Method

Participants

Five hundred and one athletes, ranging from 16 to 54 years of age (M = 20.20 years, SD = 4.21 years) participated. The sample consisted of 339 males (67.7%) and 161 females (32.1%), drawn from 37 different sport classifications. 397 (79.2%) classified themselves as amateur athletes, 90 (18%) semi-professional and 10 (2%) professional. Four did not report a classification. Playing experience ranged from 1 to 32 years experience (Mean = 8.39 years, SD = 4.72), four athletes did not provide experience information. The sample consisted of performers competing at recreational/Intra-Mural (41 = 8.2%), University (95 = 19%), Club (208 = 41.5%), County (96 = 19.2%), National (38 = 7.6%), and International (23 = 4.6%) standards. One athlete failed to report their current performance level.

Procedures

Consistent with the procedures adopted in previous studies in the research programme, institutional ethics approval was obtained and ethical procedures were adhered to through the research process. Prior to completing the inventory, all participants provided informed consent and were assured of confidentiality. Athletes completed a demographic questionnaire, the SMTP and one of the following measures below (DRS, GSE, LOT-R, DASS, PANAS). The inventories were separated to minimise the burden of participants completing large questionnaire packs, which may have impacted on responding.

Data Analysis

Consistent which approaches adopted in Phase IV, the factor structure of the scores on the SMTP were evaluated using CFAs and the ML estimation with EQS 6.1 for Windows (Bentler, 2006). After the reliability of items and factors of the SMTP had been established, pearson product moment correlations (*r*) were used to investigate the strength and direction of relationships between the four latent variables of the SMTP and subscales of the other relevant construct scales.

Measures

Sport Mental Toughness Profiler (SMTP) is a 16-item measure assessing mental toughness which yields four subscales, *Belief, Challenge, Discipline* and *Drive*. Participants respond to items using a 6-point Likert scale, (1= Almost Never to 6 = Almost Always) rating the extent to which they display each of the statements.

Dispositional Resilience Scale (DRS; Bartone et al., 1989). The DRS is a modified version of Kobasa's (1979) hardiness scale that contains 30 items rated on a four-point Likert scale (0 = not at all true; 3 = completely true). The DRS is a global measure designed to assessed dispositional resilience incorporating three theoretically salient personal protective factors; control (i.e. whether one has agency in life, or is instead subjected to whims of powerful others), commitment (i.e. conscientiousness with regard to engaging in and following through on meaningful activities), and challenge (i.e. characteristically perceives challenges as opportunities for growth rather than disruption or threat). High values are associated with higher levels of hardiness, and low values are associated with lower levels. The DRS has demonstrated adequate internal consistency (α = .70-.89; Funk, 1992; Maddi, Khoshaba, Harvey, Lu & Persico, 2002) and there is evidence for its convergent, discriminant and predictive ability (Oulette, 1993). In the current study, internal consistency was just acceptable with Cronbach alpha of .696.

General Self-Efficacy Scale (GSES; Schwarzer & Jerusalem, 1995) is a tool used extensively as a measure of general self-efficacy. The scale contains 10 questions which are rated on a 4-point Likert scale from (1) *not at all true,* to (4) *exactly true*. The GSES is found to be highly reliable, stable and to form only one global dimension (Legager, Kraft & Roysamb, 2000; Scholz,

Dona, Sud & Schwarzer, 2002), yielding Cronbach's alphas ranging from .76 to .90. In the present study, Cronbach's alpha was .864.

Dispositional Optimism. Dispositional Optimism was measured using the revised version of the *Life Orientation Test* (LOT; Scheier & Carver, 1985; revised LOT-R; Scheier, Carver & Bridges, 1994). The LOT-R consists of 10 statements of which six comprise the optimism scale (e.g. "In uncertain times, I usually expect the best"; "If something can go wrong for me it will") and four items are fillers. Participants responded to the items on a scale from (0) s*trongly disagree* to (4) s*trongly agree*. The LOT-R has demonstrated an internal consistency of .78 and in the present study Cronbach's alpha was .803.

Depression Anxiety Stress Scales-21 (DASS-21; Anthony et al., 1998) is a short form of Lovibond and Lovibond's (1995) 42-item self-report measure of depression, anxiety and stress (DASS). The DASS-21 consists of three 7-item self-report scales relating to *Depression* (e.g. "I found it difficult to work up the initiative to do things"), *Anxiety* ("I felt scared without any good reason"), and *Stress* (e.g. "I found it hard to wind down"). A 4-point severity scale measured the extent to which each statement has been experienced over the past week anchored from (0) *did not apply to me at all,* to (3) *applied to me very much*, or most of the time. The obtained Cronbach's alpha reliability estimates for each scale were; Depression = .865, Anxiety = .741, and Stress = .809.

Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen,1988) assesses positive and negative affect referring to the present using 27 descriptors, 13 items relating to positive affect and 14 items for negative affect. The PANAS uses a 5-point scale, from (1) *very slightly or not at all,* to (5) *extremely*. In this study, Cronbach's alpha for positive affect and negative affect were .849 and .872 respectively.

Results

Structural validity

The four-factor, 16-item model was tested and presented acceptable goodness of fit to the data. Whilst the CFA produced a significant χ^2 statistic ($\chi^2_{(98)} = 315.654$, $p < .001$) the overall

goodness of fit indexes suggested that the model fitted the data well, SRMR = .050; NNFI = .931; CFI = .944; RMSEA = .067 (90% CI = .058–.075). All four 4-item factors in the model demonstrated acceptable internal consistencies; *Belief (*.829), *Challenge (*.777), *Discipline* (.793), and *Drive* (.850).

In addition, a hierarchical model was tested in which the four first-order latent factors were represented by one higher order latent factor. The fit of the hierarchical model was similar to that of the first-order model, $\chi^2_{(99)}$ = 502.692, p <.001), SRMR = .082; NNFI = .873; CFI = .985; RMSEA = .090 (90% CI = .082, .098), nevertheless the first-order model was superior. A one-factor model was also tested and this produced a very poor fit to the data; $\chi^2_{(104)}$ = 1091.364, p <.001), SRMR = .101; CFI = .744, NNFI = .705; RMSEA = .138 (90% CI = .130, .145) supporting the notion that mental toughness is a multidimensional construct represented by a number of separate, but related factors.

Construct validity

Descriptive statistics and correlations between the SMTP and dispositional resilience, optimism, self-efficacy, affect and well-being measures are presented in Table 5.6. Encouragingly, correlations with the SMTP were as hypothesised, with negative correlations identified between mental toughness and depression, anxiety, stress and negative affect, and positive relationships with dispositional resilience, dispositional optimism, self-efficacy and positive affect. Internal reliability estimates for dispositional optimism (α = .803), positive affect (α = .849), negative affect (α = .872), depression (α = .865), anxiety (α = .741) and stress (α = .809) were acceptable and above the recommended level of .70 (Nunnally & Bernstein, 1994). Estimates for dispositional resilience were just at the recommended level however (α = .699) therefore caution is urged when interpreting the resilience scores.

Consistent with the hypotheses, dispositional optimism and self-efficacy scales showed positive correlations with all four SMTP subscale scores with Belief demonstrating the strongest relationships, r = .560 ($p < .01$) and r = .567 ($p < .01$) respectively. In relation to well-being indicators, negative correlations were found with all SMTP subscale scores and Depression, Anxiety, Stress and negative affect subscales; the only exception being a low non-significant

Table 5.6 Descriptives, Reliabilities and Correlations between the SMTP and key correlates

	DRS	LOT-R	GSES	PANAS		DASS-21		
	Dispositional Resilience	**Optimism**	**Self-Efficacy**	**Positive Affect**	**Negative Affect**	**Depression**	**Anxiety**	**Stress**
N	155	137	137	113	114	86	86	86
M	60.82	14.16	31.31	45.63	25.76	6.56	6.65	9.93
SD	8.26	4.08	4.09	7.53	8.78	7.57	6.66	8.22
α	.696	.803	.864	.849	.872	.865	.741	.809
Belief	.375**	.560**	.567**	.486**	-.387**	-.485**	-.351**	-.445**
Challenge Mindset	.340**	.448**	.482**	.521**	-208*	-.358**	-.148	-.165
Discipline	.483**	.296**	.499**	.490**	-.050	-.171	-.004	.123
Drive	.440**	.379**	.552**	.475**	-.214*	-.320**	-.160	-.114

*Note: N = sample size, M = mean, SD = standard deviation, α = Alpha coefficient ** Correlation is significant at the p <.01 level * at the p <.05 level*

relationship between the Discipline subscale and Stress. Moderate-to-strong positive correlations were found with all four SMTP subscale scores and positive affect. Whilst Drive was predicted to have the strongest negative relationship with Depression, Belief was shown to have the strongest relationship with all four negative well-being indicators (r = -.351 to -.485). In relation to positive affect, all four SMTP demonstrated significant moderate-to-strong relationships, with Challenge the highest (r = .521 p <*.01*). In general, SMTP subscale scores demonstrated low-to-moderate relationships with dispositional resilience. More specifically dispositional resilience correlated most strongly with the Discipline (r = .483, p <.01) and Drive (r = .440, p <.01) subscales. The implications of these findings will be considered further in the discussion.

Stage 2

Criterion validity test (Coach rating)

In search of further support for construct validity, reports derived from significant others were explored via multisource ratings, specifically, self- and coach-ratings. This approach advocated by Middleton et al. (2004) and adopted by Gucciardi et al. (2009c) in previous mental toughness psychometric development studies allowed the research programme to address potential limitations associated with social desirability employed in previous phases involving the sole use of self-report inventories.

Method

Participants

The study consisted of 40 male hockey players, aged 18-30 years (M = 22.83, SD = 3.68) and four male elite International coaches from the Great Britain and England Hockey Performance Programme. The players competitive experience ranged from 4-23 years (M = 9.93, SD = 4.69) with 22 players from the Great Britain & England senior international squad and 18 players from the England U21 squad. The coaches had 29 years coaching experience combined (M = 7.25, SD = 2.87), and coaching experiences with the players ranging from 1-10 years (M = 4.15, SD = 2.72).

Procedures and Measures

Consistent with the procedures adopted in previous studies, institutional ethics approval was obtained and ethical procedures were adhered to through the research process. Prior to completing the inventory, all participants provided informed consent and were assured of confidentiality.

Athletes completed a demographic questionnaire and the SMTP (self-rating). In relation to the coach ratings, coaches were asked to provide background information in relation to their coaching experience and perceived understanding of the player in relation to them as players, their approach in training and their approach in competition. Using a 10 point Likert-scale coaches were asked to provide an overall Mental Toughness rating based on the proposed definition, along with individual ratings for each of the four components using the same 6 point Likert-scale as the SMTP. Items for the four components included *"Has a robust belief in his/her abilities to achieve his/her goals"* (Belief), *"Has an internal desire to achieve his/her goals"* (Drive), *"Has robust standards which make him/her work hard to achieve his/her goals"* (Discipline) and *"Has a tendency to perceive tough situation as opportunities for personal growth"* (Challenge). Consideration was given for using a re-worded SMTP in its entirety however this was rejected given the demand it would have placed on each of the coaches completing multiple questionnaires for the players on their respective squads. Descriptive statistics were calculated for each subscale of the SMTP for each rating source (self and coach), with correlations and paired *t*-test analyses used to examine whether relationships and significant differences existed in the reports of mental toughness between rating sources.

Results

Descriptive statistics, reliabilities and correlations between self and coach ratings for each SMTP subscale are presented in Table 5.7. Reliability estimates (α) for each subscale exceeded the .70 minimum recommended standard (Nullally & Bernstein, 1994). Correlations revealed significant moderate correlations between the four mental toughness scales with self (r = .319-.807) and coach ratings (r = .417-.784, p <.01) with the exception of the self-rated Discipline scale

which demonstrated non-significant low correlations with Belief (r = .305, p >.05) and Challenge (r = .283, p >.05) subscales.

Correlations between self-ratings and coach-ratings were inconsistent with some subscales showing significant and moderate correlations (*Belief*, r = .405, p <.01, *Drive* r = .360, p < .05) while others showed non-significant and small correlations (*Challenge, r* = .125, *Discipline, r* = .077, p > .05). Paired-sample t-test revealed significant differences between self and coach ratings on all four subscales; *Belief* ($t_{(39)}$ = -6.611, p <.00), *Challenge* ($t_{(39)}$ = -6.760, p <.00), *Discipline* ($t_{(39)}$ = -4.676, p <.00) and *Drive* ($t_{(39)}$ = -6.364, p <.00).

Table 5.7 Descriptives, reliabilities (α) and correlations between Self and Coach ratings

			Self-Rating				**Coach-Rating**			
	M	**SD**	**B**	**Ch**	**Dis**	**Dr**	**B**	**Ch**	**Dis**	**Dr**
Self-rating										
Belief	19.05	2.855	(.873)							
Challenge	20.28	2.242	.607**	(.697)						
Discipline	20.43	2.479	.305	.283	(.772)					
Drive	22.08	2.189	.319*	.518**	.807**	(.851)				
Coach-rating										
Belief	3.80	.939	.405**	.246	.104	.170	1			
Challenge	3.75	1.171	.280	.125	-.157	-.163	.513**	1		
Discipline	4.28	.987	.232	.046	.077	.192	.476**	.638**	1	
Drive	4.58	.984	.300	.054	.328*	.360*	.516**	.417**	.784**	1

Note: M = Mean, SD = Standard deviation, B = *Belief,* Ch = *Challenge*, Dis = *Discipline*, Dr = *Drive*

Stage 3

Test-retest reliability

A third within-network approach to scale development was conducted involving evaluating the test-retest reliability of SMTP items and subscale scores.

Method

Participants

The study consisted of the same 40 male hockey players utilised in the criterion validity test study.

Procedures & Measures

Consistent with the procedures adopted in previous phases, institutional ethics approval was obtained and ethical procedures were adhered to through the research process. Prior to completing the inventory, all participants provided informed consent and were assured of confidentiality. Athletes completed a demographic questionnaire, and the SMTP before training sessions 7-days apart. Consistent with previous studies in motivation (Lane et al., 2005) and behavioural regulation (Lonsdale et al., 2008), a one-week period was deemed appropriate to examine test-retest reliability because changes in mental toughness were likely to be minimal (or nil) over this period. As a result, substantial changes in SMTP scores would have demonstrated a lack of test reliability and not a true change in mental toughness. Descriptive statistics were calculated for each item and subscale of the SMTP, with correlations and paired *t*-test analyses used to examine the stability of responses across the one-week period.

Results

Descriptive statistics, correlations and *t*-test scores for SMTP items and subscale scores are presented in Table 5.8. At the item-level, correlations revealed moderate-to-high significant correlations (r = .583-.847, p <.001) with the exception of item SMTP11 which demonstrated only a low-to-moderate significant correlation, (r = .394, p <.05). Further *t*-test analyses revealed non-significant differences between respective scores for 13 of the 16 items (p > .05). Three items demonstrated significant differences; SMTP1 ($t_{(39)}$ = -2.467, p < .05), SMTP2 ($t_{(39)}$ = -4.639, p < .001) and SMTP3 ($t_{(39)}$ = -2.449, p < .05).

At the subscale-level, correlations revealed high and significant relationships between the four subscales across the two time points (r = .865-.944, p <.001). Follow up *t*-test analyses between subscales revealed non-significant differences between *Challenge* ($t_{(39)}$ = -.725, p > .05) and *Discipline* ($t_{(39)}$ = .000, p > .05) scores and low significant differences across *Belief*

Table 5.8 Descriptives, correlations and test-retest scores across two time periods

Item		T1		T2					
		M	**SD**	**M**	**SD**	***r***	***t***	***df***	***P***
SMTP1	I believe in my ability to consistently produce good performances	4.75	.840	4.97	.800	.754***	-2.467	39	.018
SMTP5	I have doubts in my ability to achieve my goals (R)	4.65	.802	4.70	.883	.789***	-.572	39	.570
SMTP10	I believe in my ability to deliver under pressure	5.00	.847	5.00	.816	.704***	.000	39	1.000
SMTP13	When under pressure, I begin to doubt my ability to deliver (R)	4.65	.864	4.70	.791	.781***	-.572	39	.570
SMTP2	For me, challenges are an opportunity to test myself	4.58	.813	4.97	.698	.749***	-4.639	39	*.0005*
SMTP6	I want to test myself against the toughest of opposition	5.40	.778	5.23	.733	.692***	1.862	39	.070
SMTP9	I thrive on the pressure of competition	5.15	.700	5.00	.816	.718***	1.637	39	.110
SMTP16	I see the pressure of competition as an opportunity to challenge myself	5.15	.802	5.20	.758	.751***	-.572	39	.570
SMTP3	I have a strong work ethic in training	4.95	.846	5.15	.893	.825***	-2.449	39	.019
SMTP7	I make the sacrifices needed to achieve success in my goals	5.13	.822	5.10	.928	.789***	.274	39	.785
SMTP12	I value being committed to doing all that it takes to achieve my goals	5.08	.694	5.05	.815	.583***	.227	39	.822
SMTP15	It is important to me to persist until I achieve success in my goals	5.28	.847	5.13	.822	.833***	1.964	39	.057
SMTP4	I have a strong desire to succeed	5.58	.751	5.48	.751	.688***	1.160	39	.253
SMTP8	I possess a strong desire to improve	5.45	.714	5.30	.791	.708***	1.637	39	.110
SMTP11	I am determined to achieve my goals	5.53	.640	5.40	.672	.394*	1.094	39	.281
SMTP14	I am determined to reach my potential	5.53	.716	5.40	.744	.847***	1.955	39	.058
Subscales									
Belief		19.05	2.855	19.38	2.686	.944***	-2.177	39	.036
Challenge Mindset		20.28	2.242	20.40	2.509	.901***	-.725	39	.473
Discipline		20.43	2.480	20.43	2.934	.870***	.000	39	1.000
Drive		22.08	2.188	21.58	2.630	.865***	2.395	39	.022

Notes: (N = 40, T1 = Time 1, T2 = Time 2)

($t_{(39)}$ = -2.177, p < .05) and *Drive* ($t_{(39)}$ = 2.395, p < .05) scores. Overall the results supported the test-retest reliability of the SMTP subscale scores across a 1-week period.

Stage 4

Group-level analysis: Age, Experience, Gender, Competitive Standard, and Sport Type,

Finally**,** a group-level analysis was adopted to assess relationships between age, experience and the stability of the model structure across groups defined by gender (Male vs Female), competitive standard (elite vs sub-elite) and sport type (individual vs Team) and using invariance analysis**.**

Participants

Overall, a total of eight hundred and four athletes, ranging from 16 to 63 years of age (mean age 22.23 years, SD = 6.58 years) participated in the SMTP scale development and evaluation phases. The sample consisted of 547 males (68.1%) and 255 females (31.8%), drawn from 54 sport classifications, one athlete did not specify their gender. 589 classified themselves as amateur athletes, 122 semi-professional and 88 professional, 4 athletes did not give their status. Playing experience ranged from 1 to 50 years experience (Mean = 9.78 years, SD = 6.22), 5 athletes did not provide experience information. The sample consisted of performers competing at recreational/Intra-Mural (82 = 10.2%), University (147 = 18.3%), Club (249 = 31.0%), County (228 = 28.4%), National (57 = 7.1%), and International (39 = 4.9%) standards. One athlete failed to report their current performance level.

Method

Data Analysis

Descriptive statistics were calculated for each subscale of the SMTP. Pearson Product Moment Correlations were computed to assess relationships between age, experience and mental toughness components with independent *t*-test analyses used to examine the stability of responses across gender, competitive standard and sport type. Players competing at Recreational, University,

and Club levels were assigned to the *'Sub-elite'* group with County, National and International assigned to the *'Elite'* group.

Invariance testing

A sequential model testing approach was employed via multi sample CFA to examine whether the SMTP displayed invariance across gender, competition level (elite vs sub-elite) and sport type (team vs individual). In relation to gender, a baseline model was established and then two increasingly constrained models were specified to examine the equality of measurement (i.e., item and factor loadings) and structural parameters (i.e., factor variances and covariances) across male and female samples (see Byrne, 2006). The procedure was then repeated to test for invariance across competition levels (elite vs sub-elite) and athletes involved in team and individual sports. The relative goodness of fit between increasingly constrained models was analysed via the S-B χ^2 difference test (Satorra & Bentler, 2001). Because the χ^2 statistic is influenced by sample size, recommendations by Cheung and Rensvold (2002) meant a change in CFI of ≤.01 was the preferred indicator of model invariance.

Results

Age, Experience and Gender

Table 5.9 Independent t-test between gender groups

	Male (N = 547)		*Female (N = 255)*		*t*	*P*
	M	*SD*	*M*	*SD*		
Belief	*17.97*	*3.42*	*16.35*	*3.26*	*6.346*	*.0005*
Challenge Mindset	*18.62*	*3.50*	*17.33*	*3.60*	*4.822*	*.0005*
Discipline	*18.29*	*3.66*	*18.47*	*3.35*	*-.665*	*.506*
Drive	*19.90*	*2.84*	*19.98*	*2.60*	*-.427*	*.670*

Note: M = mean, SD = standard deviation

Across the four mental toughness subscales, age was not seen to be correlated with Discipline (*r = .021, p >.05*) or *Drive* (*r = -.029, p >.05*) subscales, however significant weak correlations were found with Belief (*r = .140, p <.001*) and Challenge (*r = .140, p <.01*) subscales. Whilst experience was reported to have weak significant correlations with Belief (*r = .153, p <.001*), Discipline (*r = .119, p <.001*) and Discipline (*r = -.078, p <.05*), no significant relationship was found with Drive (*r = -.009, p >.05*). On average, men reported higher levels of Belief and Challenge than

their female counterparts (see Table 5.9) with independent *t*-tests identifying significant differences in self-ratings of Belief (t_{800} = *6.346, p <.001*) and Challenge (t_{800} = *4.822, p <.001*) subscales. Females reported higher levels of Discipline and Drive however no significant differences were reported (Discipline t_{800} = *-.665, p >.05*, and Drive t_{800} = *-.427, p >.05*).

Competitive Standard (Elite v Sub-elite)

On average, Elite athletes reported higher levels than their Sub-elite counterparts across all four subscales and independent *t*-tests found that all differences were significant (see Table 5.10).

Table 5.10 Independent t-test between competitive standard groups

	Elite (N = 298)		*Sub-elite (N = 505)*		*t*	*P*
	M	*SD*	*M*	*SD*		
Belief	*17.96*	*3.30*	*17.16*	*3.50*	*3.214*	*.001*
Challenge Mindset	*19.14*	*3.36*	*17.67*	*3.61*	*5.756*	*.0005*
Discipline	*19.61*	*3.32*	*17.60*	*3.49*	*8.008*	*.0005*
Drive	*20.74*	*2.41*	*19.45*	*2.85*	*6.556*	*.0005*

Note: M = mean, SD = standard deviation

Sport Type (Individual v Team)

On average, Individual sport athletes reported higher levels of Discipline and Drive than their Team sport counterparts with the reverse trend seen for Belief and Challenge subscales. Independent *t*-tests however found that only the differences reported in Discipline subscales (t801 = 2.723, *p* < .01) were significant (see Table 5.10).

Table 5.11 Independent t-test between sport types

	Individual (N = 230)		*Team (N = 573)*		*t*	*P*
	M	*SD*	*M*	*SD*		
Belief	*17.11*	*3.71*	*17.60*	*3.33*	*-1.794*	*.073*
Challenge Mindset	*18.02*	*3.70*	*18.29*	*3.54*	*-.963*	*.336*
Discipline	*18.89*	*3.63*	*18.13*	*3.52*	*2.723*	*.007*
Drive	*20.04*	*2.93*	*19.88*	*2.70*	*.731*	*.465*

Note: M = mean, SD = standard deviation

Invariance testing

Table 5.12 displays the goodness-of-fit indices for all multi-group models tested during the invariance analysis.

Gender. The gender (male vs female) multi-group baseline model showed acceptable fit to the data: S-B $\chi^2_{(196)}$ = 471.30, p <.001; SRMR = .057; CFI = .947; NNFI = .935; RMSEA = .042 (90% CI = .037–.047). After progressively constraining the factor loadings, factor variances, co-variance and error variances, all structural pathways were upheld. The fit of the most restrictive model was acceptable: S-B $\chi^2_{(218)}$ = 502.88, p <.001; SRMR = .074; CFI = .945; NNFI = .939; RMSEA = .040 (90% CI = .036–.045) and the decrease in the CFI value compared with the unconstrained multi-group model was less than .01, which is considered to be indicative of model invariance (Cheung & Rensvold, 2002).

Competition Level. The competition level (elite v sub-elite) multi-group baseline model showed acceptable fit to the data: S-B $\chi^2_{(196)}$ = 415.39, p <.001; SRMR = .046; CFI = .952; NNFI = .941; RMSEA = .037 (90% CI = .031–.042). After progressively constraining the factor loadings all structural pathways were upheld however, constraining factor variances found partial invariance across elite and sub-elite groups on the fourth factor (Drive). Consequently, an equality constraint was not place on the fourth factor. Further partial invariance was found across groups on Factor 3 (Discipline) when constraining factor covariances and was subsequently removed. The fit of the most restrictive model was acceptable: S-B $\chi^2_{(216)}$ = 432.98, p <.001; SRMR = .065; CFI = .953; NNFI = .947; RMSEA = .035 (90% CI = .031–.040) and the decrease in the CFI value compared with the unconstrained multi-group model was less than .01.

Sport Type. The sport type (individual vs team) multi-group baseline model showed acceptable fit to the data: S-B $\chi^2_{(196)}$ = 405.83, p <.001; SRMR = .053; CFI = .958; NNFI = .949; RMSEA = .037 (90% CI = .031–.042). After progressively constraining the factor loadings, factor variances, co-variance and error variances, all structural pathways were upheld. The fit of the most restrictive model was acceptable: S-B $\chi^2_{(218)}$ = 420.21, p <.001; SRMR = .034; CFI = .960; NNFI = .956; RMSEA = .064 (90% CI = .029–.039) and the decrease in the CFI value compared with the unconstrained multi-group model was less than .01.

Table 5.12 Fit indices for Invariance Analysis

Model	***S–B χ^2***	***Dof***	***P***	***SRMR***	***CFI***	***NNFI***	***RMSEA (90% CI)***
Gender (Male v Female)							
1. Unconstrained	*471.30*	*196*	*.0005*	*.057*	*.947*	*.935*	*.042 (.037 – .047)*
2. Constrained factor loadings	*486.72*	*208*	*.0005*	*.061*	*.946*	*.938*	*.041 (.036 – .046)*
3. Constrained factor variances	*495.10*	*212*	*.0005*	*.078*	*.945*	*.938*	*.041 (.035 – .045)*
4. Constrained covariances	*502.88*	*218*	*.0005*	*.074*	*.945*	*.939*	*.040 (.036 – .045)*
Competition Level (Elite v Sub-Elite)							
1. Unconstrained	*415.39*	*196*	*.0005*	*.046*	*.952*	*.941*	*.037 (.031 – .042)*
2. Constrained factor loadings	*425.39*	*208*	*.0005*	*.054*	*.953*	*.945*	*.036 (.031 – .041)*
3. Constrained factor variances	*438.85*	*212*	*.0005*	*.074*	*.950*	*.944*	*.037 (.032 – .041)*
4. Constrained covariances	*432.98*	*216*	*.0005*	*.065*	*,953*	*.947*	*.035 (.031 – .040)*
Sport Type (Individual v Team)							
1. Unconstrained	*405.83*	*196*	*.0005*	*.053*	*.958*	*.949*	*.037 (.031 – .042)*
2. Constrained factor loadings	*418.05*	*208*	*.0005*	*.057*	*.958*	*.952*	*.036 (.031 – .040)*
3. Constrained factor variances	*419.37*	*212*	*.0005*	*.064*	*.959*	*.953*	*.035 (.030 – .040)*
4. Constrained covariances	*420.21*	*218*	*.0005*	*.064*	*.960*	*.956*	*.034(.029 – .039)*

Note: S-B χ^2 = Satorra-bentler chi-squares statistic, CFI = comparative fix index, NNFI = non-normed fit index, SRMR = standardised root mean residual, RMSEA = root mean square error of appromixation, 90% CI = 90% confidence interval

Discussion

The purpose of this study was to develop and psychometrically evaluate an inventory designed to assess athlete perceptions of mental toughness based on the new conceptualisation proposed in Study III (Chapter IV). A systematic series of phases guided by those proposed by MacKenzie et al. (2011) were followed to provide substantial support for the validity and reliability of the scores derived from the new measure, the Sport Mental Toughness Profiler. The inventory, the SMTP, taps four separate factors of mental toughness in the context of sport, namely, *Belief, Challenge, Discipline* and *Drive*. The four factors of mental toughness are aligned well with current mental toughness research yet offer a new theoretical model as a contribution to the research area to guide future research. Collectively, the findings from this study and previous studies in this research programme suggest that the SMTP has the potential to be at the heart of research investigating mental toughness, offering a psychometrically valid and reliable measure with supporting theory which is currently sought after in the field of mental toughness (Connaughton & Hanton, 2009).

The four factors emerging from the research programme represent parsimonious, but inclusive, subscales of mental toughness and the stages outlined in the final phase of this study provided initial evidence regarding the reliability and validity of the SMTP scores across elite and sub-elite athletic populations. Following the three-step exploratory CFA process adopted in Phase IV, the resultant four-factor model displayed an excellent fit to the data, properties that were upheld in a separate cross-validation sample. The internal consistency of the SMTP scores received strong support throughout and an initial test-retest reliability of the scales was acceptable.

Support for the concurrent validity of the SMTP was provided by reporting significant negative correlations identified between mental toughness and depression, anxiety, stress and negative affect, and positive relationships with dispositional resilience, dispositional optimism, self-efficacy and positive affect. Some of these relationships are in accordance with the literature in sport and exercise psychology, which has indicated that mental toughness is important for both positive and negative life experiences (Connaughton & Hanton, 2009; Gucciardi & Gordon, 2011). However, further empirical research is required to examine the relationships in greater detail. From a theoretical perspective however, given the conceptual overlap between mental toughness and

resilience, the low-to-moderate relationship identified may provide evidence to support qualitative research (e.g., Gucciardi et al., 2008) that mental toughness is much more than being resilient or hardy.

Correlations between the four subscales across the different rating sources (self and coach) were inconclusive. Findings suggested strong relationship between self-reported mental toughness subscale scores and ratings from coaches, however, group analyses revealed significant differences between rating sources on each of the four subscales suggesting that there was some disagreement. More specifically, scores for *Belief* and *Drive* were moderately and significantly correlated with both self and coach ratings, whereas *Challenge* and *Discipline* demonstrated low and non-significant correlations. Such findings are consistent with organisational research where agreement between the focal individual and other raters (i.e., supervisors, peers) is generally low to moderate (Diedorff & Surface, 2007). An explanation for the findings may be that some elements of mental toughness are more readily observable (i.e., Drive) than others (i.e., Challenge), and as a result would demonstrate higher levels of convergence. The notion that both *Challenge* and *Discipline* aspects of mental toughness reflect the individual's perception of a given situation, and values or standards they behold and follow, respectively, it is possible that this may in part account for the differences reported. Furthermore it is worth acknowledging that the differences in ratings all demonstrated higher scores in the direction of the self-rating which may infer an element of socially desirable responding in the sample used.

Whilst results from the multi-source ratings were inconsistent, the approach represents an important advancement in psychometric development and evaluation approaches. A limitation may be the use of factor summaries for coach-ratings to ease the burden on the rater which may have compromised the construct under evaluation. Adopting an alternative approach endorsed by Gucciardi et al. (2009b) whereby inventories are completed by both raters in their entirety, with items re-worded to reflect the raters perception may be more appropriate. For example, "I possess a strong desire to improve" on the self-rated inventory may be changed to "He/she possesses a strong desire to improve" on the coach or peer rating inventory. From a practical point of view, adopting such an approach may provide more enriched multisource evaluations of the player in question and may also enable greater clarity that the same construct is being assessed across

raters. A factor that is important to ensure, otherwise differences between raters would be difficult to interpret (Cheung, 1999). Moving forwards, adopting such approach is recommended with further examination of the psychometric properties of the SMTP across rating sources using CFA is warranted.

In addition to examining the four-factor model, a one-factor model, as well as a hierarchical model, were tested in which the four first-order latent factors were represented by one higher order latent factor. In both development and cross-validation samples, the one-factor model displayed a very poor fit to the data supporting the notion that mental toughness is a multidimensional construct represented by a number of separate, but related factors. The fit of the hierarchical measurement model was similar to that of the first-order model in both samples, and in both cases the first-order model was superior. Whilst Marsh (2007) suggests that in the instance of comparable hierarchical and first-order models, the former should be preferred because it is more parsimonious, such a model is only useful for researchers interested in an overall measure of a construct (i.e., global mental toughness). Given the depiction of mental toughness as a multidimensional construct and the interest in examining the relationships between specific aspects of mental toughness (i.e., Belief, Drive), other concepts, and/or various outcomes, it is suggested that the four-factor model is the most applicable since it provides a more in-depth assessment.

Finally, initial support was also provided for the factor invariance of the SMTP by suggesting that the factor loadings, variances and covariances remained unchanged across both gender, sport type (individual/team) and sport level (elite/sub-elite). This represents an important development as it lends support to the model structure across samples and allows researchers to assess mental toughness across different groups of athletes and as a result make more meaningful comparisons between them. Nevertheless, future work should continue to test the validity of the SMTP by assessing whether its factorial structure is also invariant across age and competitive experience levels.

Overall, the findings of the studies presented here are promising and provide support to the validity and reliability of a new psychometric measure of mental toughness. In contrast to previous measures which have been found lacking in conceptual rationale or provide insufficient evidence regarding the psychometric procedures used during their development and validation (i.e., Clough

et al., 2002; Loehr, 1986), the SMTP represents the first empirically driven measure of mental toughness developed and evaluated within a multi-method construct development and validation framework (MacKenzie et al., 2010). Encouragingly, the SMTP provides researchers with a measure that, used in conjunction with other measures, can further our understanding of mental toughness in sport and the relationships between the main components. Whilst the results of the present study provide preliminary support for the factor structure, internal reliability and construct validity of the SMTP, these findings must be verified through further psychometric examinations before the measure can be considered a useful tool for assessing mental toughness.

Limitations and Future Directions

The primary purpose of this study was to provide the foundation for the development and preliminary validation of a sport-general measure of mental toughness, with overall findings providing substantial support for the new inventory. Nevertheless, as theory development is an on-going process involving both qualitative and quantitative investigations (Creswell, & Plano Clark, 2007), it is important to consider possible limitations and offer possible future avenues of investigation. As depicted by Marsh (1997, 2002), construct validation is an on-going assessment of both within-network (internal consistency, factor structure) and between network properties (relations with other constructs) which goes beyond the methods presented in this research programme. As such, further research is warranted to address issues beyond the limits of the present investigation.

First hand, stringent re-examinations of the psychometric properties of the SMTP are required using independent samples to ensure the strength and generalizability of the proposed factor structure. As highlighted by Marsh, Martin and Jackson (2010) to progress too quickly to exploring and examining between-construct properties, is potentially to risk within-construct issues that may still be inherent. Statistical procedures such as multi-sample CFA, and Exploratory Structural Equation Modelling (ESEM) where the strengths of both CFA and exploratory factor analysis (EFA) are integrated may then be fruitful. These will be discussed further in the Discussion chapter that follows.

Consistent with previous studies in this research programme, it is pertinent to emphasise the caution required when interpreting the results given the dependence upon single-case self-

report assessments and their inherent vulnerability to violation and possible bias. Despite the delivery of standard antisocial desirability instructions included in the administration protocol, respondents may still have skewed their responses. Whilst one of the strengths of this study was the inclusion of multisource ratings, it is proposed that measurement equivalence (i.e., factor structures) between rating sources is required before meaningful comparisons can be postulated. Moving forwards, the triangulation of assessment procedures, the use of performance data, observational techniques, and multimodal approaches to account for socially desirable responding are encouraged.

Conclusions in relation to thesis

In summary, although replication and extension is advocated, the results of this study serves to provide preliminary support for the SMTP as a valid measure of mental toughness for use within a sport context across levels of competition. Nevertheless, the factor structure, internal reliability and construct validity of the SMTP must be further verified before the SMTP is considered a useful tool for measuring mental toughness in research or applied domains, within the limits of generalizability.

Chapter VI

Discussion & Conclusion

Summary

The central purpose of this thesis was to examine issues pertaining to the conceptualisation of mental toughness in sport and its measurement through four central studies. First the current field of mental toughness literature was systematically examined (Study 1). Second, a rigorous examination of the psychometric properties of a popular, yet unsubstantiated, mental toughness inventory was conducted (Study 2). Third, a synthesis approach established a new conceptual model and definition of mental toughness (Study 3). Finally a sport-general multidimensional measure of mental toughness was constructed and subjected to rigorous psychometric evaluation to establish preliminary psychometric validation of the instrument (Study 4). The purpose of the final chapter was to bring together the findings of all four studies and present the implications of this programme of research. Specifically, this discussion chapter begins with an overview of the central aims of the thesis, followed by a summary of the aims and key findings from each of the four studies. A summary of recent advances (December 2010 – January 2014) is then provided to align the current findings from this thesis with contemporary research. An overview of the strengths and limitations of the thesis are shared and a discussion of the implications for theory, practice and future research are presented. The thesis is then drawn to a close with an overall conclusion of the central tenets of the programme of research.

Introduction

The purpose of this final chapter is to draw together the findings and present the implications of this research programme. The chapter is organised into five sections that provide: (a) a summary of the aims and key findings of each of the four studies; (b) an overview of the findings of the thesis in relation to contemporary mental toughness research (c) an overview of the strengths and limitations of the thesis with implications for future research; (d) practical implications; and (e) a conclusion that draws together the central aspects of the programme of research.

Aims and key findings of the thesis

The central purpose of this thesis was to examine issues pertaining to the conceptualisation of mental toughness in sport and its measurement. The specific aims of the

thesis were fourfold. First, to provide a summary of the recent findings and advances in the research area of mental toughness. Specifically in relation to operational definition, theoretical development frameworks, measurement methodologies and insights into practical application. Secondly, it was aimed to provide insight into the psychometric properties of the Mental Toughness Questionnaire-48 (MTQ48) in an attempt to inform the research area on the status of a currently well utilised, yet unsubstantiated, mental toughness measure. A third endeavour was to propose and develop a new conceptualisation and definition of mental toughness with stronger theoretical underpinning based on the current mental toughness literature. The final aim was to use this conceptualisation to inform the development and preliminary validation of a new sport-general measure of mental toughness – the Sport Mental Toughness Profiler (SMTP). Each of the chapters within this thesis addressed a particular aspect of this research programme. The following subsections provide an overview of these four studies.

Study 1: Systematic review of mental toughness literature in sport

Despite early challenges with conceptual clarity, wide-ranging definitions and inadequate measuring instruments, the review identified that research pertaining to mental toughness had shown substantial improvements in depth and scientific rigour. Emerging research since 2001 had led to a better understanding of what mental toughness is, what attributes characterise a mentally tough performer, the behaviours associated with such characteristics, and the situations that require a mentally tough approach. With an increased understanding of the conceptualisation of mental toughness and its measurement, a number of studies had looked to explore the relationship between mental toughness and a plethora of psychological characteristics, individual well-being and performance. Given the increased attention in the concept of mental toughness since the pioneering study by Jones and colleagues in 2002, Study 1 attempted to conduct the first systematic review of literature with the intention to consolidate findings up to the present time of November 2010 and identify the most appropriate direction for future research.

There were four main purposes to Study 1 identified: to examine the evidence for both the definition and conceptualisation of mental toughness as well as the identification of common and unique key attributes and characteristics; to examine the evidence for the underlying mechanisms purported to explain the development and maintenance of mental toughness; to examine the

current methodologies employed and instruments developed to assess mental toughness; and finally to highlight the practical implications of the recent investigations in relation to potential intervention programmes to enhance levels of mental toughness.

Study 1 identified 46 studies of mental toughness available in peer-reviewed literature up to and including the period of November 2010. A clear trend since 2002 was observed, whilst qualitative approaches were the initial method of choice (N = 10), an increasing prevalence of quantitative approaches (N = 28) had emerged in line with the influx of various mental toughness inventories designed to assess mental toughness from both sport-specific and sport-general perspectives. Of the studies reviewed, 18 adopted sport-specific investigations, focusing solely on one sport (e.g., soccer, gymnastics, cricket) whereas 17 studies investigated mental toughness from a general between-sport perspective across a variety of sports and disciplines.

The systematic review unearthed a number a key findings. Firstly, whilst there was consistency emerging in the conceptualisations of mental toughness, there were still challenges in relation to an over reference to overcoming an opponent. This compromised mental toughness to potentially being ordained on those who demonstrated superior athleticism, which did not take into account the ability to demonstrate mental toughness at lower levels of ability or in the absence of success. Secondly, grounded in the theoretical tenets of personal construct psychology and drawing on the intimate knowledge of the participants in the original conceptualisation studies, Connaughton and colleagues (Connaughton et al., 2008, 2010) found support for the development of mental toughness over three career phases, which aligned with Bloom's (1985) early, middle and later years of talent development. Also building on their emerging conceptualisation, Gucciardi and colleagues (Gucciardi, et al., 2009a) postulated a process model whereby mental toughness was developed, modified and maintained. This was based on the influence of key components manipulating the way in which individuals covertly and overtly approached, appraised and responded to events demanding varying degrees of challenge, adversity and pressure. Whilst other approaches investigating the potential role of genetic factors were highlighted, collectively it was concluded that research suggests that experiences and environments that individuals are exposed to in the formative years of development are crucial in determining the "caught" aspects of mental toughness. Whilst other aspects developed through the middle years, where performers benefit

from others (i.e., expert coaches, elite performers, role models) and finally through the use and development of psychological skills and strategies to enhance and maintain mental toughness are the “taught” components of the construct.

Concerning assessment, the predominant methodological approach to the measurement of mental toughness was shown to be through the use of self-report inventories. Whilst there appeared to be advances in the development of both general measures of mental toughness (MeBTough: Mack & Ragan, 2008; SMTQ; Sheard et al., 2009; PPI-A: Sheard, 2009) and sport-specific measures (AfMTI; Gucciardi et al., 2009; CMTI; Gucciardi & Gordon, 2009), there were apparent concerns surrounding the psychometric properties of the most widely used inventories (i.e., MTQ48; Clough et al., 2002; PPI; Loehr, 1986) which warranted further investigation.

Finally, in relation to practical applications, whilst there appeared a salient role for psychological skills training, a number of other factors were highlighted that were thought to contribute to the practical application of mental toughness theory. Emphasis was placed on the importance of developing an impactful environment (Bull et al., 2005; Gucciardi, 2010; Gucciardi et al., 2009a; Thelwell et al., 2005; Thelwell et al., 2010) and providing exposure to a variety of situations in training and competition that helped foster the characteristics, attitudes and skills identified as being central to mental toughness. The exploration of critical incidents was also highlighted as being potentially fruitful in developing athletes’ knowledge of how to handle negative life experiences, and the important role played by coaches, parents and significant others in an athlete’s support network, within and outside of the sporting environment, was seen as being of paramount importance.

Whilst Study 1 lends support to the suggestion that the area of mental toughness had advanced since the adoption of more scientifically rigorous approaches, there still appeared to be an apparent need to develop a valid and reliable between-sport measure of mental toughness, one based on sound theoretical knowledge and one that possesses strong psychometric properties. It was believed that such an instrument would not only allow researchers to conduct more fine-grained investigations into mental toughness but the efficacy of the findings would be more decisive, an issue which had appeared to plague the use of current unsubstantiated measures (i.e., PPI, MTQ48) in the growing body of literature. Study 1 findings indicated that the MTQ48 has been

uncritically adopted as the preferred tool for measuring mental toughness with no thorough examination of its psychometric integrity conducted previously which appeared problematic. The examination of the factor structure of the MTQ48 was seen to be an important contribution to the research area as it sought to alleviate concerns over the lack of empirical evidence detailing the scale construction, the lack of evidence outlining the psychometric properties of the measure, alongside the sparse rationale for the close proximity of the underlying model with hardiness theory.

Study 2: Psychometric Evaluation of the MTQ48

Whilst research with individuals from the general population has provided some support for the adequacy of the hypothesised four-factor model of the MTQ48 (Horsburgh et al., 2009), researchers have expressed both empirical (i.e., scale construction procedures, factorial validity evidence) and conceptual concerns (i.e., dominance of the underlying theoretical model with hardiness theory with little rationale provided) for the 4C's conceptualisation and its associated measure the MTQ48 (Connaughton & Hanton, 2009). Consistent with these concerns, the systematic review presented in Study 1 raised further questions about the validity of either the correlated four-factor and six-factor models hypothesised to underpin the MTQ48. Although the conceptual foundation for the development of the 4C's conceptualisation of mental toughness represented a key strength of the MTQ48, the lack of support available presented a major challenge to the confidence in the psychometric integrity of the inventory. The purpose of Study 2 was therefore to examine the psychometric properties of the MTQ48 with the primary aim of providing clarity on the factorial validity of the measure.

Examination of the factor structure of the MTQ48 using confirmatory factor analyses resulted in a poor fit to the data and improper solutions, and consequently the psychometric integrity of the MTQ48 as a measure of mental toughness was not supported. Follow-up analyses on the parameter estimates and modifications to the measurement model based on independent scale factor analyses produced improvements to observed factor loadings of the six-factor model, nevertheless the proposed modified model did not provide an acceptable fit to the data either. Follow-up exploratory factor analyses indicated that the latent dimensionality of the MTQ48

appeared to be inadequately represented by the anticipated six factors with inconsistent factor loadings with those proposed during the construction of the original measure (Clough et al., 2002).

The Study 2 findings highlighted the importance of developing measures that are not only strong in terms of conceptual basis, but also possess psychometric integrity from a within-network (e.g., factor structure, internal reliability) and between-network perspective (e.g., adequate relatedness between the component factors and key correlates). Neither the MTQ48, nor an alternative structure were able to demonstrate such validity and on this basis it was concluded that currently there was no sound sport-general measure of mental toughness available. Subsequently, the research programme identified the need to develop a new mental toughness instrument, one based on a sound theoretical base and one that possessed a sound factor structure.

The evaluation of the MTQ48 presented a number of key findings that guided the research programme and the development of a new mental toughness measure. Whilst providing valuable insight into the psychometric properties of the MTQ48, the process also identified key lessons regarding mental toughness conceptualisation and questionnaire design and development. First was the apparent need for a strong conceptual and theoretical rationale for the selection of dimensions or factors of mental toughness. The second was the importance for adequate relatedness between the proposed factors of mental toughness and key correlates whilst also remaining distinct. Given the perceived conceptual relatedness between other constructs such as resilience (Bartone et al., 1989; Luther & Cicchetti, 2000) and hardiness (Kobasa, 1979), it was deemed vital for measures of mental toughness to demonstrate that it shares similar contextual space, yet remains distinct. The third consideration related to the importance of vigilance throughout the process of item generation and development. It was deemed pertinent to ensure that the resulting measure has strength in relation to theoretical and empirical grounds, as well as having a sound factor structure from within and between network perspectives, an issue that results indicated a challenge to the integrity of the MTQ48.

Study 3: Establishing a new definition and conceptual model of mental toughness

In an attempt to establish a more complete understanding of mental toughness in sport, a move towards more innovative investigative techniques was presented in Study 3. To accomplish a more conceptually focused and integrative approach to developing mental toughness research and

theory, a meta-interpretation approach (Weed, 2005, 2006, 2008) was presented. This aimed at synthesising the wealth of isolated research into mental toughness and developing a new definition, conceptualisation and a taxonomic classification of mental toughness components from a between-sport perspective. Following the process of identification and analysis, the meta-interpretation synthesised the findings of 14 studies before it was considered that theoretical saturation of mental toughness literature had occurred.

In an attempt to make a meaningful and robust contribution to mental toughness research and theory, the meta-interpretation synthesised the current body of published peer-reviewed research uncovering characteristics of mental toughness in athletes and concluded with the development a taxonomic classification of key components. Emerging from the analysis were 213 components of mental toughness, which abstracted all mental components into 42 subcategories. These were subsequently organised to form eight distinct categories, namely; *Self-belief, Drive, Discipline, Challenge Mindset, Attention Control, Emotional Control, Performance Intelligence,* and *Resilience.* A multidimensional model of mental toughness was proposed and presented two functional higher-order dimensions of mental toughness; "*Mental Toughness Attitude*" and "*Mental Toughness Approach*" which reflected the complexity of the concept (see Figure 4.10). Where previous attempts to identifying and describing the key components of mental toughness has had the potential to be misconstrued due to overly simplistic definitions, in this study the approach endorsed by Gordon and colleagues (Gordon et al., 2007; Gucciardi & Gordon, 2008) was adopted to present the emergent key components of mental toughness along with their contrasts.

Dominant findings that emerged from the analysis of the mental toughness literature was that mental toughness could be best defined as a psychological disposition that concerned the conviction displayed in the pursuit of one's goals and existed in the presence of some form of pressure, challenge or adversity. Whilst previous definitions had implicitly inferred the notion of superior athleticism (Jones et al., 2002; Thelwell et al., 2005), it was proposed that the skill level of the individual was extraneous, and it is rather the consistency of the individual to demonstrate conviction in the pursuit of the goal and the ability to remain undeterred by the experience of setbacks, disappointments and/or misfortunes, that classified one as being mentally tough.

The meta-interpretation approach extended previous frameworks of mental toughness in three key ways. Firstly, unlike previous conceptualisations which have relied on existing theory from other domains of psychology (i.e., Clough et al., 2002), the taxonomic classification presented was based solely on empirical studies relating to characteristics of mental toughness. Secondly, whilst previous attempts to unearth mental toughness characteristics have typically relied mainly on small samples of elite and super-elite athletes, coaches and sport psychologists, this study identified and organised the characteristics recognised by 626 participants who ranged in age, gender, nationality, sport and competitive standard. Finally, where previous suggestions had unearthed just three components of mental toughness (i.e., Sheard et al., 2009), this study identified no fewer than 213 distinct characteristics of mental toughness that were later classified into 42 subcategories and eight categories.

Importantly, the conceptualisation presented extended the current literature by making the distinction through the proposed two functional higher-order dimensions of mental toughness; '*Mental Toughness Attitude'* and '*Mental Toughness Approach'*. In previous attempts to define and unearth the components of mental toughness (Jones et al., 2002, 2007; Gucciardi et al., 2008), there appears to be confusion over what mental toughness *is* (i.e., the possession of robust self-belief, motivation, disciplined commitment) and what mental toughness *allows one to do* (i.e., the ability to concentrate, control emotions, handle pressure). The '*Mental Toughness Attitude*' components were deemed to be true indicators of what mental toughness *is*, with the '*Mental Toughness Approach*' components capturing what mental toughness enables *one to do.* The '*Mental Toughness Approach*' components were therefore deemed to be correlates of mental toughness, not indicators, which in turn accounted for the conceptual confusion caused by the prevalence of factors such as Resilience, Emotional Control and Attentional Control within the mental toughness literature. It was concluded that mental toughness was best captured in the '*Mental Toughness Attitude'* elements of the proposed model, an amendment that would be consistent with the earlier proposal of mental toughness as a psychological disposition (Clough et al., 2002), with the theoretical vigour that this conceptualisation was grounded in mental toughness literature.

Overall, the yields of this study were thought to represent a significant step forward in attempts to define the construct of mental toughness and provide a conceptual model with strong theoretical underpinning. Collectively, this approach was believed to provide the most accurate, comprehensive, parsimonious, and externally valid conceptualisation of mental toughness to date. Having established a greater understanding of mental toughness, drawing on the growing body of mental toughness literature to guide and support the development of the conceptualisation, investigations to develop a reliable and valid instrument for measuring and assessing its presence and development within an applied context were then believed to be viable.

Study 4: Development and Validation of the SMTP

The purpose of Study 4 was the development and preliminary validation of an empirically driven measure of mental toughness within a multi-method research framework. Initially, two qualitative approaches were conducted to generate an inventory with items that assessed the key mental toughness components of the new conceptual model of mental toughness presented in Study 3. Two quantitative approaches then followed in which construct validation methodology (Marsh, 1997) was adopted involving within-network and between-network examinations. The preliminary validation approach was conducted in five phases. Phase One involved the generation of a pool of items designed to assess mental toughness behaviours from a general, between-sport perspective. Phase Two presented evidence for the content validity of the items, with Phase Three outlining the construction of the *preliminary*-Sport Mental Toughness Profiler *(p*-SMTP*).* More specifically, Phase Four described the evaluation of the 32-item *p*-SMTP and a psychometric evaluation of the inventory using a 3-stage exploratory confirmatory factor analytical approach. Finally, Phase Five described a between-network examination exploring the relationship between the hypothesised factor structure of the proposed SMTP and other constructs hypothesised to have some logical, theoretical relationship with mental toughness. Separate sample CFA's were conducted to confirm the factor structure and follow-up internal-reliability analysis was conducted using test-retest and multisource rating approaches. In addition, the influence of age, gender, sport-type (individual vs team) and playing level (elite vs sub-elite) on mental toughness subscale scores and psychometric integrity were examined.

The systematic series of phases provided substantial support for the validity and reliability of the SMTP. The inventory was shown to assess four separate factors of mental toughness in the context of sport, namely, *Belief, Challenge Mindset, Discipline* and *Drive*. The four factors emerging from the research programme represent parsimonious, but inclusive subscales of mental toughness, and the stages outlined in Study 4 provided initial evidence regarding the reliability and validity of the SMTP scores across elite and non-elite athletic populations. Following the three-step exploratory CFA process adopted in Phase Four, the resultant 16-item, four-factor model displayed an excellent fit to the data, properties that were upheld in a separate cross-validation sample in Phase Five. The internal consistency of the SMTP scores received strong support throughout and an initial retest study indicated that test-retest reliability of the scales were acceptable.

The four factors of mental toughness were aligned well with current mental toughness research, yet offered a new theoretical model as a contribution to the research area to guide future research and application. Support for the concurrent validity of the SMTP was provided by reporting significant negative correlations between mental toughness and depression, anxiety, stress and negative affect, and positive relationships with dispositional resilience, dispositional optimism, self-efficacy and positive affect. Correlations between the four subscales across the different rating sources (self and coach) were inconclusive. Findings suggested strong relationships between self-reported mental toughness subscale scores and ratings from coaches, however, group analyses revealed significant differences between rating sources on each of the four subscales reflecting some disagreement. Finally, initial support was also provided for the factor invariance of the SMTP by suggesting that the factor loadings, variances and covariances remained unchanged across both gender, sport type (individual/team) and sport level (elite/sub-elite). Collectively, the findings from Study 4 show promise for the SMTP to possess the potential to be at the heart of future research investigating mental toughness moving forward.

The results of Study 4 served to provide preliminary support for the SMTP as a valid measure of mental toughness for use within a sport context across the levels of competition. Nevertheless, as construct validation is an on-going process (Marsh, 1997, 2002), it is acknowledged that replication and extension is required to ensure robustness in the strength of validity and reliability of the measure. Moving forward, the factor structure, internal reliability and

construct validity of the SMTP must be further verified with independent samples before the SMTP is considered a viable tool for measuring mental toughness in research or applied domains, within the limits of generalizability. A key strength of the study is the brevity of the psychometrically sound scale yielded. Current existing scales have ranged in length from 14 (i.e., PPI-A; Golby et al. 2007) to 67 items (MTI; Middleton et al., 2005) with varying subscales and inconsistent reliability and validity information (MTQ48; Clough et al., 2002; PPI; Loehr, 1986). Not only did the SMTP demonstrate sound psychometric properties, its brevity allows for the ease of completion without imparting any unnecessary burden on the participant. Moreover, the succinctness also allows for multiple completions over a designated time period, which would allow for the successful collection of longitudinal data without being overly taxing on the participants.

Integration with contemporary research

Due to the time frame sanctioned on the research programme, notably the systematic review of literature in Study 1 and the meta-interpretation in Study 3, it is worth acknowledging and integrating the findings of this thesis with contemporary research findings in the mental toughness literature since the November 2010 cut off. A follow-up search adopting the same inclusion criteria as Study 1, identified 36 studies in the peer-reviewed literature between December 2010 and January 2014. A near doubling of the literature in just three years is indicative of the growing interest and potential advancements made in the area. Of those studies, 27 were quantitative, five qualitative and four were review articles. In line with the main themes of the research programme, this section is organised and presented in three themes; conceptualisation, theoretical and measurement issues.

Conceptualisation

Comparing and contrasting the present findings of the research programme with significant contemporary work in the area reveals some similarities which may reflect the growing consensus that mental toughness is a dispositional construct that allows an individual to deal with obstacles, stressors, pressures and adversity relating to sport. In an attempt to assess mental toughness behaviour, Gucciardi, Jackson, Hanton and Reid (2013) offered the assertion that mental toughness "encapsulates one's capacity to produce consistently high levels of subjective (e.g.

personal goals or strivings) or objective performance (e.g. race time) despite everyday stressors and significant adversities" (p. XX). Likewise, whilst offering a new conceptualisation of mental toughness was not the primary aim of their neuropsychological study of mental toughness, Hardy, Bell and Beattie (2013) also defined metal toughness as "the ability to achieve personal goals in the face of pressure from a wide range of different stressors" (p. 70). Collectively, these two independent definitions are comparable to that proposed in the meta-interpretation in Study 3, both reflecting mental toughness as a disposition associated with the pursuit of a goal and demonstrated in the presence of challenges and adversities.

Theoretical

In relation to key theoretical developments in the mental toughness literature, three studies continued to explore the key components and development processes of mental toughness examining the views of coaches (Driska, Kamphoff & Armentrout, 2012; Weinberg, Butt & Culp, 2011) and athletes (Butt, Weinberg & Culp, 2010). Driska et al. (2012) confirmed 11 of 13 subcomponents of Jones et al.'s (2007) framework using elite swimming coaches with 'coachability' and 'retaining psychological control on poor training days' offered as unidentified subcomponents of mental toughness. Weinberg et al. (2011) identified 81 responses, which were collated into seven lower-order themes and combined into three higher-order themes. These included; *Psychological sills* (i.e., focus, confidence, knowledge and mental planning), *Motivation to succeed* (i.e., motivation to work hard, persistence) and *Resilience* (i.e., rebounds from setbacks, handling and performing under pressure). These were consistent with those identified by Butt et al. (2010) with NCAA athletes which included; performing under pressure (e.g., coping with adversity, step-up under pressure), being motivated (e.g., drive to succeed, refusal to give up), positive psychological attributes (e.g., confidence, task focus), being a hard worker (e.g., pushing beyond your limits, working harder than others), and anticipation skills (e.g., anticipating and reading the game). A second higher-order theme to emerge was leadership. Specifically, in this theme, athletes highlighted that mental toughness incorporated athletes being able to demonstrate leadership qualities such as "doing the right thing for the team," or "stepping up to make decisions under pressure."

The attributes highlighted across the three studies, with the exception of Leadership (Butt et al., 2010), are all consistent with the categories presented in taxonomic classification of mental toughness components synthesized from the literature reviewed in Study 3. This would indicate that the eight components of; *Self-belief, Drive, Discipline, Challenge Mindset, Attention Control, Emotional Control, Performance Intelligence,* and *Resilience*, represent an accurate reflection of current and emerging perceptions of mental toughness in sport. What is more, the interpretation in Study 3 extends previous research by offering a clear distinction between what mental toughness *is* (i.e., "*Attitude*" dimension) and what mental toughness *allows one to do* (i.e., "*Approach*" dimension).

In relation to development processes, emergent themes were consistent with those previously identified (Connaughton et al., 2008, 2010; Thelwell et al., 2010). Butt et al. (2010) and Weinberg et al. (2011) both endorsed the need for coaches to create a tough and positive practice environment, with the importance of enhancing psychological skills and providing awareness/learning opportunities reinforced. Driska et al. (2012) presented six higher-order themes that clustered into two dimensions relating to the action of coaches (e.g., being challenging, demanding and having high expectations, approach to training and workout planning, motivational climate) and the action of swimmers (e.g., prepared methodically and rigorously, using psychological skills and cognitive strategies, had experienced and overcame hardship in sport).

Crust and Clough (2011) offered a summary of applying mental toughness development research into applied practice and Gordon (2012) offered a strengths-based approach to developing mental toughness in individuals and teams. In relation to experimental designs, the review also found three intervention studies (Abdelbaky, 2012; Bell, Hardy & Beattie, 2013; Parkes & Mallett, 2011), three longitudinal studies (Bell, Hardy & Beattie, 2013; Drees & Mack, 2012; Gerber et al., 2013a), and two experimental studies investigating the cognitive basis of mental toughness (Dewhurst, Anderson, Cotter, Crust & Clough, 2012) and the organisations effect of prenatal testosterone (Golby & Meggs, 2011).

In Hardy et al.'s (2013) neuropsychological study of mental toughness, Gray and NcNaughton's (2000) revised Reinforcement Sensitivity Theory (rRST) was used to explain individual differences in mental toughness and predict mentally tough behaviour. Reports

suggested that high coach informed ratings of mental toughness were consistent with players who were sensitive to punishment and insensitive to reward which were counter to original hypothesis. The findings reflected that players who were punishment sensitive, but not reward sensitive, detected threat earlier and could maintain goal-directed behavior under pressure from a range of different stressors. These findings were suggestive that players that are predisposed to identify threatening stimuli early, provides them the superior opportunity to prepare an effective response to the pressurized environments they encounter. In relation to the yields of this thesis, this may present a challenge to the conceptualisation offered which emphasized the significance of having high levels of belief, high levels of drive and notably a challenge mindset with the tendency to appraise and respond positively to tough situations. Exploring the current conceptualisation of mental toughness in relation to rRST, utilising both forms of mental toughness assessment, self-report and informant-rated may prove insightful.

Measurement issues

Central to the yields of the research programme are the studies that have explored the psychometric properties of the MTQ48 that came under scrutiny in Study 2 (Chapter III). In pursuit of progressing measurement issues in mental toughness, an independent study conducted by Gucciardi, Hanton and Mallett (2012) using two independent samples of performers from various sports and the workplace, examined the factorial validity of the MTQ48 using CFA and exploratory structural equation modelling (ESEM). ESEM is a methodological extension of traditional factor analyses in which the strengths of CFA and exploratory factor analysis (EFA) are integrated within a structural equation modelling (SEM) framework. When a strictly confirmatory approach is not well suited, ESEM offers an alternative that avoids the stringent CFA requirements by allowing all items to be directly influenced by all common factors, as in the case in EFA. Nevertheless, it still offers robust indicators of model adequacy (e.g., parameter estimates, goodness-of-fit statistics, standard errors). In comparison to CFA, ESEM is less likely to distort factors and structural relations by imposing non-target loadings to be constrained to zero, thereby improving the likelihood of adequate model-data fit (Asparouhov & Muthén, 2009). Collectively, CFA and ESEM model fit indices and parameter estimates did not support the hypothesised correlated four-factor model of the MTQ48 in either athlete or workplace samples which is consistent with findings in Study 2. Both

CFA and ESEM approaches also revealed that six- and nine-factor models were unsatisfactory according to the multiple criteria of model fit.

In response to Gucciardi et al.'s (2012) findings, Clough, Earle, Perry and Crust (2012) offered a critical commentary on the conclusions drawn by Gucciardi et al. (2012) citing both substantive (i.e., inadequate literature review) and methodological (i.e., inappropriate samples) concerns. In doing so, they offer a compelling riposte to the findings and challenge the suitability of CFA techniques, emphasizing that many of the most utilised personality questionnaires (i.e., 16PF, and NEO) have failed to meet CFA criteria (Hopwood & Donnellan, 2010). Nevertheless, many of the criticisms levelled at Gucciardi et al. (2012) appear contradictory (Gucciardi, Hanton & Mallett, 2013) and despite questioning the use of CFA, Clough and colleagues adopt the approach themselves (Gerber at al., 2013b; Perry, Clough, Crust, Earle & Nicholls, 2013).

In an attempt to provide support for the factorial validity of the MTQ48, Perry et al. (2013) present the findings of model fit analysis using CFA and ESEM using a sample of 8207 participants consisting of managers, clerical/administrative workers, athlete and student samples. Whilst claiming to provide support for the factorial validity of the MTQ48, with the six-factor model being superior to the four-factor and single-factor models, closer inspection shows that they refrain from referring to acceptable or not acceptable model fit. This is possibly due to the fact that the CFA fit indices presented do not reach the proposed acceptable levels (see Byrne, 2006). What is most concerning is that the weakest model fit was the athlete sample (CFA; $\chi^2_{(1065)} = 2535.4$, $p < .001$, CFI = .771, TLI = .758, SRMR = .063, RMSEA = .056, 90% CI = .053–.059; and ESEM; $\chi^2_{(855)} = 1354.8$, $p < .001$, CFI = .922, TLI = .897, SRMR = .031, RMSEA = .036, 90% CI = .033–.040) which is the population that the measure was primarily intended.

Gerber et al. (2013b) also offered supplementary CFA and ESEM information supporting their investigation into mental toughness and resilience, which utilised the MTQ48. CFA conducted on separate high school student and undergraduate students samples, as well as merged samples, did not provide support for the hypothesised six-factor structure. Nor did the ESEM examination on the combined sample, which also highlighted several significant loadings on unintended factors, whilst some factors had several non-significant loadings on the intended factor. More specifically, the *'Control of Emotion'* factor demonstrated significant cross-loadings on *'Challenge'*, while the

'Confidence in Abilities' factor cross-loaded significantly on *'Control of Life'*. Despite these cross-loadings and two Control subscales (Life and Emotions) containing several items that did not load onto their *a priori* factors, Gerber et al. (2013b) still reported to claim support for the factorial validity of the MTQ48. Whilst these studies represent an important development in relation to clarity surrounding the psychometric properties of the MTQ48, the confusion surrounding the use of different analytical approaches (i.e., CFA and ESEM), the range of models assessed (i.e., one-, four- and six-factors) and the lack of clarity around goodness of fit criteria being acceptable or unacceptable suggests the field is still unclear around the true psychometric integrity of the most widely used measure in mental toughness literature.

Further psychometric evaluation has also been conducted on other measures such as the PPI, the PPI-A (Gucciardi, 2012) and the MeBTough (Gao, Mack, Ragan & Ragan, 2012). Whilst convergent validity between global mental toughness and measures of achievement goals supported the validity of the PPI and PPI-A subscales, CFAs did not support the PPI in terms of model fit ($\chi^2_{(798)}$ = 1603.60, p = .001, Bollen–Stine p = .001, CFI = .790, IFI = .794, TLI = .774, SRMR = .071, RMSEA = .055, 90% CI = .051-.059), and despite encouraging model fit data for the PPI-A ($\chi^2_{(73)}$ = 160.14, p < .001, Bollen–Stine p = .004, CFI = .907, IFI = .909, TLI = .884, SRMR = .060, RMSEA = .060, 90% CI = .047-.073), neither obtained sufficient levels of internal consistency (α < .70). Taken together with previous findings (Middleton, et al., 2004), caution was urged when considering the PPI as a measure of mental toughness, with conceptual (e.g., lack of conceptual underpinnings) and methodological (i.e., revalidated a flawed inventory) concerns highlighted. In relation to the MeBTough, Gao et al. (2012) used differential item functioning (DIF) to detect potential biased items in the 43-item measure based on gender or athletic membership. The identification of DIF indicates an items potential bias towards a subgroup (i.e., female over male) that could represent a threat to the validity of an instrument, and undermines it potential to be used to compare population groups. Results indicated that DIF was present on four items of the MeBTough, with gender DIF existing at the scale level. As a result, caution was recommended when drawing conclusions around mental toughness differences between males and females using the MeBTough,

Also identified was the introduction of the Mental Toughness Scale (MTS; Madrigal, Hamill & Gill, 2013). In acknowledging that previous literature had focused on athletes at the elite level and measures were developed based on studies with elite athletes, the MTS was specially designed to focus on mental toughness in college athletes using Jones et al.'s (2007) framework as a guide. Items were generated directly from the attributes listed under the dimensions of attitude/mindset, training, competition and post-competition, with additional items created to add further distinction between factors. Exploratory factor analyses resulted in the reduction of items down to a final 11-item scale capturing specific elements of training and competition which then demonstrated moderate psychometric properties ($\chi^2_{(44)}$ = 67.50; CFI = .94, RMSEA = .062, LO 90 = .029, HI 90 = 0.090, PCLOSE = .239) and convergent, divergent and criterion validity through correlations with flow, self-efficacy and self-esteem along with comparable coach ratings.

In an attempt to address the limitation of self-report measures, which are victim to social desirability and self-presentation bias, and objective indicators of achievement that are confounded by talent, practice, skill level amongst other psychosocial and physiological variables, two informant-rated (e.g., a coach) measures were identified (Gucciardi, et al. 2013; Hardy, et al., 2013). Gucciardi et al. (2013) developed a measure to assess the extent to which others perceive individuals over time, to display mental toughness behaviours in tennis. This approach incorporated a temporal component, depicting mental toughness as being best assessed by the consistency one demonstrates salient behaviours across various situations and time points. Twelve mentally tough behaviours were generated from coach and athlete focus group discussions, with two removed due to crossovers. Structural equation modeling (SEM) revealed that harmonious passion (β = .26, p < .01) and frequency of inspiration (β =.32, p <.001) were associated with significantly higher levels of mentally tough behaviours, with fear of failure (β = −.32, p < .001) and obsessive passion (β = −.15, p < .01) inversely related. Alongside demonstrating sound factorial ($\chi^2_{(570)}$ = 1108.61, p < .001, CFI = .915, TLI = .906, SRMR = .053, RMSEA = .052, 90% CI = .048–.057) and internal reliability, the informant-rated approach represents a fruitful avenue for future research with the potential to examine a triangulation approach across different assessors (e.g., parent, coach and peer) for the same target player.

Based on Hardy et al.'s (2013) new definition, a second informant-rated scale was generated by the authors in conjunction with experienced high-performance coaches, with items focused on the pressure and stressors that performers typically faced in competition. 15 items were generated, with eight retained following CFA conducted in an exploratory fashion to examine the factor structure of the proposed Mental Toughness Inventory (MTI). Follow up CFA of the eight-item model revealed a very good fit ($X^2_{(20)}$ = 25.28, CFI = .98, RMSEA = .05, SRMR = .04) and showed promise in assessing mental toughness guarded from social desirability and self-presentation bias.

In a unique approach that provokes a potential methodological shift in mental toughness assessment, Guillen and Laborde (2013) investigated a higher-order structure of mental toughness by combining a battery of inventories validated for use on the general population. The study examined the mental toughness differences in athletes and non-athletes, investigating the higher-order structure of mental toughness based on four key characteristics of hope, optimism, perseverance and resilience. The latent mean differences analysis identified that athletes scored higher than non-athletes on mental toughness, with a large effect size and with each of the characteristics integrated thought to play a role. In relation to the conceptualization of the mental toughness into two functional higher-order dimensions of mental toughness; '*Mental Toughness Attitude*' and '*Mental Toughness Approach*' in Study 3, the approach of combining individual constructs into higher-order constructs (Johnson, Rosen, Chang, Djurdjevic, & Taing, 2012) may offer a way to inform the exploration of the relationship between the '*Mental Toughness Attitude*' and '*Mental Toughness Approach*' dimensions in the future.

In summary, whilst the exchange between the two parties Gucciardi and colleagues (Gucciardi et al., 2012, 2013) and Clough and colleagues (Clough et al., 2013) may continue, when the findings of Study 2 are considered alongside the factorial examinations of the MTQ48 (Gucciardi et al., 2012; Gerber et al., 2013a, 2013b; Perry et al., 2013) that have emerged since the development of this research programme, it is reasonable to conclude that there is justifiable uncertainty regarding Clough et al.'s (2002) 4C's conceptualisation and its operationalization in the MTQ48 as highlighted in Study 2. Taken together it would appear that there is sufficient evidence to suggest there is uncertainty around the MTQ48 on both a conceptual and psychometric level

given its been predicated primarily on hardiness theory without sufficient rationale to support such assertions and psychometric examinations of the various proposed factor structures in the literature have been inconsistently reported.

When considered alongside the evidence that discourages the use of other mental toughness measures such as the PPI, the PPI-A and the MeBTough and the SMTQ, then it would appear that there is scope for the SMTP to become established as the preferred between-sport measure of mental toughness in sport. It would appear that the yields of this research programme provide the most accurate, comprehensive, parsimonious, and externally valid conceptualisation of mental toughness to date, and although replication and extension is advocated, the results serve to provide preliminary support for the SMTP as the preferred valid measure of mental toughness for use within a sport context across levels of competition.

Limitations of the thesis

When interpreting any findings, it is pertinent to identify and acknowledge limitations associated with the research programme to support the credibility of the findings. The following summarises specific limitations associated with the current research programme.

Self-report data and defensive responding

Whilst acknowledged throughout the research programme, it is important to emphasise that the Sport Mental Toughness Profiler (SMTP), the Mental Toughness Questionnaire-48 (MTQ48), and all key correlate scales utilised rely solely on self-report data. Although the individual's own report provides insights into his or her perceptions of their mental toughness, the self-report approach can be confounded by attitudes, habitual coping responses and social constructions (Howard, 1994; Spector, 1994). Given the potential implicit social desirability of the construct, it is reasonable to suggest that athletes completing the measures may not always want others to know the exact nature of their mental toughness. Despite anti-social desirable responding initiatives used, athletes may still have responded to how they think they should respond to questions rather than how they actually felt at the time. Closely related is the notion of defensive and distorted responding whereby athletes have the potential to perceive the assessment of their mental toughness as a threat and therefore inflate their answers accordingly. Given that mental

toughness is generally a desirable quality, one with common associations with higher levels of performance and success, there may be an inherent falsification of responses in order to gain or maintain team selection (i.e., driven by a potential belief that lower mental toughness levels would detract from selection chances).

Cross-sectional and correlational data

Another inherent limitation to the research programme is the cross-sectional and correlational nature of all the quantitative data collected across the studies. Whilst gathering data at a singular time point provides a useful snapshot of mental toughness, the cross-sectional and correlational design does not lend itself to observe or infer how mental toughness develops or how individuals adapt to various experiences over time. As a result it is not possible to examine the related processes and outcomes of mental toughness or the predictive validity of the SMTP. This approach was deemed appropriate for initial assessment of the MTQ48 and developing and validating the SMTP (Marsh, 1997, 2002), however, it is recommended that future research should look to adopt longitudinal designs to better capture the stability and potential development of mental toughness over time. This may involve the repeat assessment of individuals across various intervals across a sufficient time-period (i.e., across a competitive season) across which the stability of components and overall mental toughness can be assessed.

Retrospective data and the need for challenge, pressure, adversity

In completing the SMTP, participants were assessed in controlled, non-confrontational or challenging testing settings, and were asked to rate themselves on various components of mental toughness based on their previous experiences. This relies on respondents to access retrospective accounts of behaviour and provides generalised assessments of their mental toughness. The qualitative assessment of the mental toughness literature also unearthed a conceptual definition that depicted the construct to be a disposition that enables an individual to consistently deliver performance (relative to skill level) in response to the many challenges and adversities associated with a goal pursuit. In assessing mental toughness through recall accounts there is the potential for responses to be distorted and therefore true assessments of mental toughness are not obtained. Subsequently, it appears beneficial to conduct data collection methods in close proximity to an actual experience or assessed *in situ* through observations and the use of behavioural measures

that might improve the validity and reliability of scores obtained. Whilst the brevity of the 16-item SMTP lends itself to being utilised during performance events without being too onerous on the respondent, a shortened version (i.e., a 4-item measure) could also be produced and validated whereby mental toughness is assessed in the immediate experience of the challenge and/or adversity of a goal pursuit in training and performance environments over time.

Performance data

Much sought after is understanding and confirming the extent to which mental toughness directly affects performance, the extent to which is it related to success, to overcoming adversity, as well as to what extent self-report levels of mental toughness can predict future occurrences of mental toughness. A limitation of the research programme is that it does not include performance data by which to infer such a relationship. As the development of a valid measure of mental toughness is an on-going process, it is encouraged that research can address the challenges above through well constructed research investigations and examine the mental toughness process with performance related outcomes. This may include using objective performance statistics relating to the individuals' sport and/or the completion of standardised sport-specific tests designed to control some of the extraneous variables that can affect regular competition (i.e., environmental conditions, opposition). An area which may prove fruitful to unearthing the mental toughness-performance relationship is clarifying the underpinning cognitive mechanisms like those adopted with other individual difference investigationss (e.g., Laborde, Lautenbach, Allen, Herbert & Achtzehn, 2014).

Strengths of the thesis

Having highlighted some of the potential limitations of the research programme, it is also pertinent to identify and acknowledge some of the strengths of the research design and highlight the significant contributions to new knowledge on the phenomenon of mental toughness.

Multi-method design and synthesis

A key strength of this thesis is the multi-method approach adopted in utilising both qualitative and quantitative methods to examine and further understanding pertaining to the conceptualisation of mental toughness in sport and its measurement. The integration of different

methods such as the systematic review of literature (Bland et al., 1995) in Study 1, the psychometric evaluation of the MTQ48 in Study 2, the meta-interpretation approach (Weed, 2005, 2006, 2008) in Study 3, and the construct validation approach (Marsh, 1997, 2002) in Study 4, represents an innovative way of collecting and analysing data relating to the phenomenon of mental toughness which covers the breadth and depth of the construct. In doing so it enabled the research to complement and elaborate on the results of other investigations and yielded a more complete analysis and comprehensive interpretation and understanding of the phenomenon of mental toughness. The adoption of the systematic review (Study 1) and the meta-interpretation approach (Study 3) are the first of their kind within the field of mental toughness and offer important contributions as they represent more objective, replicable and systematic approaches to the research area.

Psychometric integrity of the SMTP

An important aim of the thesis was to develop and psychometrically validate an inventory designed to assess athlete perceptions of mental toughness from a general between-sport perspective based on the new conceptualisation proposed in Study III. Having highlighted the concerns surrounding researchers using measures without undergoing the necessary psychometric procedures to confirm the properties before its use in independent research, it was paramount that the SMTP was based on the foundation of sound theory, item and reliability analysis, substantial factor analysis, and possessed supportive assessments of convergent and divergent validity. From a within-network perspective, internal properties of the SMTP (i.e., internal reliability, factor structure, test-retest reliabilities) were closely examined with the data providing strong support. In addition, tests of invariance demonstrated that factor loadings, variances and covariances remained unchanged across both gender, sport type (individual/team) and sport level (elite/sub-elite). Taken together, preliminary analysis indicate that the SMTP proved to be a sound instrument, one strong in theory, conceptualisation and internal properties.

In relation to between-network examinations, support for the concurrent validity of the SMTP was provided by reporting significant negative correlations identified between mental toughness and depression, anxiety, stress and negative affect, and positive relationships with dispositional resilience, dispositional optimism, self-efficacy and positive affect. Importantly, from a

theoretical perspective, given the common conceptual overlap between mental toughness and resilience, the low-to-moderate relationship identified provided evidence to support qualitative research (e.g., Gucciardi et al., 2008) that mental toughness is much more than being resilient or hardy. Whilst results from the multi-source ratings were inconsistent, the approach represents an important advancement in psychometric development and evaluation approaches.

Overall, the within- and between-network examinations were promising and provide support to the validity and reliability of the SMTP as a new psychometric measure of mental toughness. In contrast to previous measures which have been found lacking in conceptual rationale or provide insufficient evidence regarding the psychometric procedures used during their development and validation (i.e., Clough et al., 2002; Loehr, 1986), the SMTP represents the first empirically driven measure of mental toughness developed and evaluated within a multi-method construct development and validation framework (MacKenzie et al., 2010).

Addressing the 'Super-trait' fallacy

As highlighted from Study 1, in previous attempts to define and unearth the components of mental toughness (Jones et al., 2002, 2007; Gucciardi et al., 2008) there appears to be some confusion over what mental toughness *is* (i.e., the possession of robust self-belief, motivation, disciplined commitment) and what mental toughness *allows one to do* (i.e., the ability to concentrate, control emotions, handle pressure). The conceptualisation offered in this thesis as a result of the meta-interpretation of mental toughness literature (Study 3) is thought to extend the current literature by making this distinction through the proposed two functional higher-order dimensions of mental toughness; '*Mental Toughness Attitude*' and '*Mental Toughness Approach*'. The '*Mental Toughness Attitude*' components were deemed to be true indicators of what mental toughness *is*, with the '*Approach*' components capturing what mental toughness enables *one to do*. The '*Mental Toughness Approach*' components were deemed to be correlates of mental toughness, not indicators, which in turn accounted for the conceptual confusion caused by their prevalence within the mental toughness literature.

Whilst this represented a significant shift from the yields of the meta-interpretation**,** it was acknowledged that the aim of the study was to address the conceptual confusion that has previously clouded the exact nature and make-up of the construct, especially in relation to other

constructs thought to be similar (i.e., resilience, hardiness). With that in mind, this interpretation extends previous research by offering a clear distinction between what mental toughness *is* (i.e., '*Mental Toughness Attitude*' dimension) and what mental toughness *allows one to do* (i.e., "*Approach*" dimension). It can be concluded that the strength of the findings is that not only does it provide the most accurate, comprehensive and parsimonious conceptualisation of mental toughness in sport, but also the conceptual model is valid, generalizable, and applicable to a large number of sport performers and across a wide range of sports.

Future Research Directions

As a result of this programme of research, a number of recommendations for future research are considered. Given the increased attention to the scientific examination of mental toughness it is important to continue the consolidation of the emerging research so that findings continue the development in the theoretical understanding of the construct. Having offered a new definition and conceptualisation of mental toughness, it is important that these are examined and verified with other independent populations of athletes, coaches and practitioners to ensure they are generalizable to a wider sporting population. Whilst the psychometric properties of the SMTP are encouraging given the support offered in Study 4, it is important that independent studies verify or refute the within- and between-network properties of the measure by replicating the analysis with independent samples of athletes across a range of competitive levels.

Whilst this research programme offers a new theoretical definition and conceptualisation of mental toughness, understanding the developmental processes that underpin the development and maintenance of the construct was beyond the scope of the studies. It is therefore recommended that researchers investigate the perceptions of performers', coaches and practitioners to help unearth the mechanisms that help one acquire the psychological disposition of mental toughness. Whilst various studies have investigated the development of mental toughness based on Connaughton et al.'s (2008, 2010) framework and other sport specific studies (Bull et al., 2005; Gucciardi et al., 2009; Thelwell et al., 2010), it is important to assess these findings in relation to the new conceptual model produced in this programme with the potential to also use the SMTP to explore these processes over time.

Whilst replication is an integral part of scientific enquiry and integrity, the synthesis and identification of the key components of mental toughness in this research programme indicate the area of mental toughness is now in a position to adopt more innovative approaches to the study of the construct. Given the heavy reliance on self-report questionnaires and their innate limitations (e.g., social desirability or responding bias), the use of more creative and objective measures of mental toughness such as physiological (i.e., physical traces) or biological correlates (i.e., cortisol) or whereby components can be assessed indirectly (i.e., Implicit Association Test; Greenwald, McGhee & Schwartz, 1998) would be extremely desirable. Whilst the triangulation of assessment procedures offers a potentially more reliable indicator of mental toughness, it should be emphasised that participants need to be assured that assessment results are designed to help shape their personal development and assist their performance, and are not for selection purposes. For theory to develop, it appears important to explore the notion of social-desirability and self-presentation distortion in mental toughness research, as well as evaluating the validity of self-report measures as a reliable method for assessing mental toughness and its alternative.

There may also be the potential for the examination of scenario-based approaches (Peng, Nisbett & Wong, 1997), whereby individuals are asked to imagine themselves and indicate the likelihood of various affective, cognitive and behavioural reactions to a series of specific mental toughness inducing situations which would address the over reliance on retrospective recall. Another avenue that may prove fruitful is the adoption of observational analysis via the implementation of a behavioural checklist, which can provide complimentary support to the SMTP. Such an approach could be established in single-sport designs (Barker, Mellalieu, McCarthy, Jones & Moran, 2013; Hrycaiko & Marton, 1996), and then coaches and applied practitioners might be able to work with players to promote such desirable behaviours.

Whilst the cross-sectional approaches used to date have been informative, they provide the researcher with only a limited snapshot of the correlates of mental toughness and offers limited understanding of the *cause-and-effect* mechanisms. Future studies may therefore benefit from adopting longitudinal, developmental approaches that may yield new perspectives on mental toughness in relation to stability and the influence of environmental or developmental factors, as well as examining the predictive validity of the SMTP and its related processes and outcomes over

time. Given the recognised importance of mental toughness for achieving performance excellence by researchers, coaches and athletes, establishing links with objective indicators of performance or behaviour is an important issue worth considerable attention. Experimental approaches investigating aspects of mental toughness in relation to cognitive (i.e., decision-making and task learning), perceptual (i.e., focusing, concentration and awareness tasks) and physical tasks under non-stressful and stressful conditions may also prove informative.

Given the array of measurement issues inherent in accurately assessing mental toughness aforementioned (i.e., socially desirable and defensive responding, temporal proximity to actual events and retrospective recall bias), it would appear that the reliance of self-report inventories as the preferred form of assessment is potentially limiting. In developing a more robust and accurate measurement strategy, it appears pertinent to consider the validity of adopting a multi-method measurement approach whereby self-report measures are combined with more objective approaches (i.e., physiological traces or biological markers) to supplement assessments. When objective markers in the field are not possible however, if a relationship can be established between such markers and the SMTP (i.e., in controlled laboratory settings), then the SMTP may have significant utility in the field. As the SMTP is based on a strong theoretical conceptualisation, this is a real significant step towards achieving this and represents a significant contribution of the research programme.

One line of research that may offer value to the mental toughness measurement process is that provided by Dienstbeir (1989) and the review of arousal and physiological toughness. Dienstbier (1989) investigated the psychophysiological interrelationship between arousal, personality and performance, offering insight into how superior performance under stress may be associated with the mobilisation of specific hormones (i.e., adrenaline and cortisol) and a greater adaptive capacity or level of stress tolerance, with added implications towards greater social adjustment and emotional stability. Given that previous research has already considered physical toughness as a component of mental toughness (Gucciardi et al., 2007; Jones et al., 2002) and the relationships identified between physical endurance and pain tolerance (Crust & Clough, 2005), it would seem appropriate to consider the concept of physiological toughness as a potential method to explore and assess mental toughness and its development.

Dienstbier's (1989) approach, which is closely related to the model of stress and coping proposed by Lazarus and Folkman (1984), involved the examination of human and non-human confrontations with stress that evoked both central and peripheral physiological arousal. An important aspect of Dienstbier's (1989) work was the distinction in relation to different kinds of arousal investigated such as; Sympathetic Nervous System-adrenal-medullary arousal (SAM axis), which regulates the release of the catecholamines, adrenaline and nor-adrenaline, in contrast to Pituitary-adrenal-cortical arousal (PAC axis), which releases adrenocorticotropin (ACTH) which results in a heighten cortisol responses. Cortisol, which is a widely accepted biomarker of stress reactivity (Clow, 2004; Clow, Thorn, Evans & Hucklebridge, 2004) was used to assess the participants' response to, and adaption to, the elicited stressor. Studies suggest that elevated levels of cortisol were maintained by a lack of appropriate responses, likewise, increasing perceptions of control and enabling participants to define the situation as 'challenging' resulted in reduced elevations of cortisol and prevented the depletion of catecholamines (Miller, 1980). Deinstbier (1989) summarised such findings by suggesting that coping more effectively with stress appears to require an ability to suppress the cortisol response and resist catecholamine depletion.

In relation to mental toughness and the basis of psychophysiological research, it could be hypothesised that a mentally tough individual would exhibit different patterns of reactivity to, and recovery from, standardised stressors, compared to a less tough individual. Specifically, it could be hypothesised that higher levels of mental toughness would be characterised by greater increases in SAM axis-arousal in order to better meet the challenge (larger adrenaline increases), as well as a lower elevation in PAC axis-arousal (lower cortisol levels) and a reduced catecholamine depletion compared to their less mentally tough counterparts. Together these may be reflective of contrasting appraisals of a stressor (i.e., Challenge Mindset) and perceptions of control (i.e., Self-belief), both of which are key attributes of mental toughness, and could be indicative of a superior ability to cope with stressors more effectively. The establishment of links between multi-method measurement approaches (i.e., self-report and physiological markers) may help to establish a more accurate measurement strategy and not only represents a potential way to unearth how mental toughness operates, but also a way of assessing the impact of mental toughness training programmes.

Practical Implications

A number of practical implications emerged from this programme of research that may have relevance for athletes, coaches, sport medicine personnel and sport psychology practitioners. The presentation of a new definition and conceptual model, which simplifies a potentially confusing body of literature, provides some much needed insight into what mental toughness *is* and distinguishes it from what it *is not*. In deconstructing the phenomenon of mental toughness, this thesis contributes to the practical work of researchers and applied practitioners by beginning to better equip them to identify the key components concerned, and offers a brief tool to help understand an individual's current level of mental toughness which then allows them to implement targeted interventions. The subcomponents identified in this thesis may now allow, through the process of profiling (Butler & Hardy, 1992), coaches and practitioners to identify and highlight an individual's strengths and weaknesses, which can assist in tailoring specific intervention strategies. Importantly, if the elements of mental toughness that influence performance can be identified and the underlying mechanisms understood, then they can also be taught and learnt by athletes to utilise them to enhance their performance (Fourie & Potgieter, 2001).

With regards to cultivating mental toughness, previous studies have placed significant importance on the role of the coach (Gucciardi, Gordon, Dimmock & Mallet, 2009; Bull et al., 2005; Gucciardi et al. 2009b) and on the importance of learning basic and advanced psychological skills (Connaughton et al., 2008, 2010; Thelwell et al., 2010). Whilst this programme of research has not explored the developmental mechanisms underpinning the proposed model of mental toughness, one can infer support for the aforementioned from the conceptual model depicting the key components into separate '*Mental Toughness Attitude*' and '*Mental Toughness Approach*' dimensions. Whilst follow-up investigations through qualitative and quantitative approaches are needed, based on previous developmental studies (Connaughton et al., 2008, 2010; Thelwell et al., 2005; Thelwell, et al., 2010) it is hypothesised that the '*Mental Toughness Attitude*' elements may be developed as a result of support received in the climates they are exposed to, with the '*Mental Toughness Approach*' elements being more a by-product of learning and refining basic and advanced psychological skills. As a result, it would be advocated that applied practitioners be involved from an early stage to assist mental toughness development throughout a performer's

career. With sport psychologists working in close proximity with the coach, they can then also assist in the development of an impactful environment (Bull et al., 2005; Thelwell et al., 2005; Thelwell, et al., 2010), one that exposes performers to competitive stressors and experiences (Connaughton et al., 2008), whilst also providing recommendations regarding how to integrate psychological skills training into the overall training programme (Bull et al, 2005; Gucciardi & Gordon, 2009) as opposed to delivering the service as a standalone concept.

Utilising the SMTP

It must be emphasised that the SMTP was designed specifically for use with athletes in competitive sporting contexts. As such it is not advocated for use in other physical activity contexts such as physical education, exercise, health or other performance environments such as business and military settings. It is suggested that researchers employ questionnaires designed specifically for those contexts given the lack of ecological validity the SMTP would have in such environments. Importantly however, whilst the evidence presented here supports the reliability and validity of the SMTP scores, it is hoped that others will employ this new measure as they seek to advance the mental toughness in sport knowledge base. Nevertheless, as scale development is an on-going process, it is therefore urged for researchers to continue the process of psychometric evaluation of the SMTP and suggest revisions as necessary.

Conclusion

The central purpose of this thesis was to provide a systematic programme of research that contributed to a better understanding of the mental toughness phenomenon by examining issues pertaining to its understanding, conceptualisation and measurement. In relation to the main objectives of the research programme;

- A systematic review of current literature was conducted to ascertain the current knowledge and understanding of the popular construct. Findings highlighted both shared consensus and a diversification of definitions and components of the construct as well a range of measurement issues and Objective 1 was met.
- The psychometric evaluation of the MTQ48 could not offer support for either proposed factor structures, which in turn achieved Objective 2. This coupled with the findings of the systematic

review, highlighted the need for a new measure, one with better articulation of the links between theory, instrument design and construction, with improved application of methodological and statistical techniques to support the process.

- ❖ Using a meta-interpretation approach, the development of a new empirically driven definition and conceptualisation was presented which offered a more conceptually focused and integrative understanding of mental toughness. Collectively, the approach was believed to provide the most accurate, comprehensive, parsimonious, and externally valid conceptualisation of mental toughness to date, which met the requirements of Objective 3.
- ❖ A five-phase scale development protocol was deployed to drive the development and preliminary validation of a psychometrically sound instrument that measured mental toughness from a general between-sport perspective. In doing so Objectives 4 and 5 were achieved and began to address the current deficiency in the existing literature.

It is hoped that further research will be initiated to extend what is presented here and that practitioners will use the information provided to inform their applied work and professional practice. Taken together, it can be concluded that the programme of research resulted in several significant yields for research and practice, as follows:

- The study provided a comprehensive summary of current research into the phenomenon of mental toughness providing insight into key areas such as definition and conceptualisation, development approaches, measurement issues and practical implications;
- The study provides exploratory and confirmatory measurement work on the structure of a popular yet unsubstantiated measure of mental toughness currently being utilised yet unsupported within the field of sport and exercise psychology;
- The study is among the first to explicitly draw together a range of qualitatively derived components of mental toughness under a common conceptual framework with a supporting new definition;
- The study provides confirmatory measurement work on a new measure designed to specifically assess the new conceptual framework proposed.

In summary, the multi-method approach of this thesis has met the central aims of the programme of research and provided significant insight into mental toughness within the context of

sport. Conceptual and methodological issues of the Mental Toughness Questionnaire-48 in relation to construct development and validation were used alongside recommendations from MacKenzie et al. (2011) to guide the development of a new mental toughness measure derived from the qualitative mental toughness literature. Eight key components were identified and were drawn together into a multidimensional structure comprising two higher-order dimensions that attempted to reflect the complexity of the construct and address some of the conceptual ambiguity in the field. Subsequently, the Sport Mental Toughness Profiler was developed and examined through a series of construct validation procedures. Taken together, the findings of the research programme have achieved the central aim of the thesis and hold not only conceptual and methodological implications for researchers studying mental toughness and its measurement, but are also relevant to coaches, sports medicine personnel and practitioners aiming to assist athletes in their quest for mental toughness and sporting excellence.

References

Abdelbaky, F. M. (2012). Impacts of mental toughness on 20km race walking. *Science, Movement and Health*, 12(1), 67-71.

Akaike, H. (1987). Factor analysis and AIC. *Psychometrika*, 52, 317-332.

Alderman, R. B. (1974). *Psychological behavior in sport*. Toronto: W. B. Saunders Co.

Anderson, M. B. (2010). Who's mental, who's tough, and who's both? Mutton constructs dressed up as lamb. In D. F. Gucciardi & S. Gordon (Ed.), *Mental toughness in sport developments in theory and research* (pp. 50–80). Oxford: Routledge.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice – A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411-423.

Anderson, J. C., & Gerbing, D. W. (1991). Predicting the performance of measures in a confirmatory factor analysis with a pretest assessment of their substantive validities. *Journal of Applied Psychology*, 76(5), 732-740.

Anderson, J. C., Gerbing, D. W., & Hunter, J. E. (1987). On the assessment of unidimensional Measurement—Internal and external consistency, and overall consistency criteria. *Journal of Marketing Research*, 24(4), 432-437.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives*. New York, NY: Addison Wesley Longman, Inc.

Anshel, M. H. (2003). Sport Psychology: From theory to practice (4th ed.). San Francisco, CA: Benjamin-Cummings.

Anthony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales (DASS) in clinical groups and a community sample. *Psychological Assessment*, 10, 176-181.

Arnold, R., & Fletcher, D. (2012a). Psychometric issues in organizational stressor research: A review and implications for sport psychology. *Measurement in Physical Education and Exercise Science, 16,* 81–100. doi:10.1080/10913 67X.2012.639608

Arnold, R., & Fletcher, D. (2012b). A research synthesis and taxonomic classification of the organizational stressors encountered by sport performers. *Journal of Sport & Exercise Psychology, 34,* 397–429.

Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling, 16,* 397– 438. doi:10.1080/ 10705510903008204

Averill, J. R. (1973). Personal control over aversive stimuli and its relationship to stress. *Psychological Bulletin*, 80, 286-303.

Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, 36(3), 421-458.

Barker, J., Mellalieu, S., McCarthy, P., Jones, M., & Moran, A. (2013). *A review of single-case research in sport psychology 1997–2012: Research trends and future directions. Journal of Applied Sport Psychology*, 25 (1). 4-32. DOI**:**10.1080/10413200.2012.709579

Bartone, P. T., Ursano, R. J., Wright, K. M., & Ingraham, L. H. (1989). The impact of military air disaster on the health of assistance workers: a prospective study. *Journal of Nervous and Mental Disease*, 177, 317-328.

Beck, C. T., & Gable, R. K. (2001). Ensuring content validity: An illustration of the process. *Journal of Nursing Measurement*, 9, 201-215.

Bell, J. J., Hardy, L., & Beattie, S. (2013). Enhancing Mental Toughness and Performance Under Pressure in Elite Young cricketers: A 2-Year Longitudinal Intervention. *Sport, Exercise, and Performance Psychology*. Advance online publication. doi: 10.1037/a0033129

Bentler, P. M. (1980). Multivariate analysis with latent variables: Causal modelling. *Annual Review of Psychology*, 31, 419-456.

Bentler, P.M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107,* 238–246. PubMed doi:10.1037/0033-2909.107.2.238

Bentler, P. M. (2006). EQS 6 *structural equations program manual*. Encino, CA: Multivariate Software.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness-of-fit in the analysis of covariance structures. *Psychological Bulletin*, 88, 588-606.

Bhambri, E., Dhillon, P. K., & Sahni, S. P. (2005). Effect of psychological interventions in enhancing mental toughness dimensions of sports persons. *Journal of Indian Academy of Applied Psychology*, 31, 65-70.

Blaikie, N. (2003). Analyzing quantitative data: From description to explanation. London, Sage Publications.

Bland, C.J., Meurer, L.N., & Maldonado, G. (1995). A systematic approach to conducting a non-statistical meta-analysis of research literature. *Academic Medicine, 70,* 642–653.

Blascovich, J., & Mendes, W. B. (2000). Challenge and threat states: The role of affective cues. In J. P. Forgas (Ed.) *Feeling and thinking: The role of affect in social cognition* (pp. 59-82). Paris: Cambridge University Press.

Blascovich, J., & Tomaka, J. (1996). The biopsychosocial model of arousal regulation. *Advances in Experimental Social Psychology*, 40, 683-688.

Bloom, B. S. (1985). *Developing talent in young people*. New York: Ballantine.

Bolger, N., & Zuckerman, A. (1995). A framework for studying personality in the stress process. *Journal of Personality and Social Psychology*, 69, 890-902.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Willey.

Boudreau, M-C., Gefen, D., & Straub, D. W. (2001). Validation in information systems research: A state-of-the-art assessment. *MIS Quarterly*, 25(1), 1-16.

Bowen, G. (2008). Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research* 8(1): 137–142.

Brannen, J. (1992). Combining qualitative and quantitative approaches: An overview. In J. Brannen (Ed.), Mixing methods: Qualitative and quantitative (pp. 3-39), Avebury, England: Ashgate.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101. http://dx.doi.org/10.1191/1478088706qp0630a.

Brewer, J., & Hunter, A. (1989). *Multimethod research: A synthesis of styles*. Newbury Park, CA: Sage.

British Psychological Society (2009). *Code of Ethics and Conduct*. Leicester: British Psychological Society

Browne, M. W., & Cudeck, R. (1993). Alternative way of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 132-162). Newbury Park, CA: Sage.

Bull, S. J., Albinson, J. G., & Shambrook, C. J. (1996). The *mental game plan: Getting psyched for sport.* Eastbourne: Sports Dynamics

Bull, S. J., Shambrook, C. J., James, W., & Brooks, J. E. (2005). Towards an understanding of mental toughness in elite English cricketers. *Journal of Applied Sport Psychology, 17,* 209–227. doi:10.1080/10413200591010085

Butler, R. J., Hardy, L. (1992). The performance profile: theory and application. *The Sport Psychologist* 6:253–64.

Butt, J., Weinberg, R., & Culp, B. (2010). Exploring mental toughness in NCAA athletes. *Journal of Intercollegiate Sport*, 3, 316-332.

Byrne, B. M. (2006). *Structural equation modelling with EQS: Basic concepts, applications and programming* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81-105.

Carver, C. (1998). Resilience and thriving: Issues, models and linkages. *Journal of Social Issues*, 54, 245-266.

Carver, C. S., Blaney, P. H., & Scheier, M. F. (1979). Reassertion and giving up: The interactive role of self-directed attention and outcome expectancy. *Journal of Personality and Social Psychology*, 37(10), 1859-1870.

Cattell, R. B. (1957). *Personality and motivation structure and measurement.* New York: Harcourt, Brace and World

Cattell, R. B. (1978). *The scientific use of factor analysis*. New York: Plenum Press.

Cattell, R. B., Blewett, B. D., & Beloff, J. R. (1955). The inheritance of personality: A multiple variance analysis determination of approximate nature-nurture ratios for primary personality factors in Q data. *American Journal of Human Genetics*. 7, 122-146.

Chalmers, I., & Haynes, B. (1995). Reporting, updating and correcting systematic reviews of the effects of health care. In I. Chalmers & D.G. Altman (Eds.), *Systematic reviews* (pp. 86-95). London: BMJ Publishing Group.

Cheung, G. W. (1999). Multifaceted conceptions of self-other ratings disagreement. *Personnel Psychology*, 52, 1–36.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255.

Chou, C. P., & Bentler, P. M (1995). Estimates and tests in structural equation modelling. In R. H. Hoyle (Ed.), *Structural equation modelling* (pp. 37-55). Thousand Oaks, CA: Sage.

Chou, C. P., Bentler, P. M, & Satorra, A. (1991). Scaled test statistics and robust standard errors fro nonnormal data in covariance structure analysis. *The British Journal of Mathematical and Statistical Psychology*, 44, 347-357.

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment*, 7, 309-319.

Clough, P. J., Earle, K., Perry, J. L., & Crust, L. (2012). A response to 'Progressing measurement in mental toughness: A case example of the Mental Toughness Questionnaire 48' by Gucciardi, D., Hanton, S., & Mallett, C. (2012). *Sport, Exercise and Performance Psychology*, 1, 283–287. http://dx.doi.org/10.1037/ a0029771.

Clough, P. J., Earle, K., & Sewell, D. (2002). Mental toughness: the concept and its measurement. In I. Cockerill (Ed.). *Solutions in sport psychology* (pp. 32-43). London: Thomson Publishing.

Clough, P., & Strycharczyk, D. (2012). *Developing mental toughness: Improving performance and wellbeing and positive behaviours in others*. UK: Kogan Page Limited.

Clow, A. (2004). Cortisol as a biomarker of stress. *Journal of Holistic Healthcare*, 1(3), 10–14.

Clow, A., Thorn, L., Evans, P., Hucklebridge, F., (2004). The awakening cortisol response: methodological issues and significance. *Stress*, 7, 29–37.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, NJ: Lawrence Erlbaum.

Conroy, D. E., Motl, R. W., & Hall, E. G. (2000). Progress toward construct validation of the Self-Presentation in Exercise Questionnaire (SPEQ). *Journal of Sport and Exercise Psychology*, *22*, 21-38.

Connaughton, D., & Hanton, S. (2009). Mental toughness in sport: Conceptual and practical issues. In S. D. Mellalieu & S. Hanton (Eds.). *Advances in applied sport psychology: A review* (pp. 317-346). London: Routledge.

Connaughton, D., Wadey, R., Hanton, S., & Jones, G. (2008). The development and maintenance of mental toughness: Perceptions of elite performers. *Journal of Sport Sciences*, 26(1), 83–95.

Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). Depression and Anxiety, 18, 76–82. http://dx.doi.org/10.1002/da.10113.

Cook, D. J., Mulrow, C. D., & Haynes, R. B. (1997). Systematic reviews: Synthesis of best evidence for clinical decisions. *Annals of Internal Medicine, 126*(5), 376–380.

Cooper, H. (1982). Scientific guidelines for conducting integrative research review. *Review of Education Research*, 52, 291-302.

Cooper, C. (2002). *Individual Differences*, London: Hodder Arnold.

Cooper, H. (2003). Editorial. *Psychological Bulletin*, 129, 3-9.

Costa, P. T., & McCrae, R. R. (1992). *The revised NEO personality inventory (NEO-PI-R) and the NEO five-factor inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.

Costello, A. B., & Osborne, J. W., (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment Research & Evaluation*, 10(7).

Coulter, T. J., Mallett, C. J., & Gucciardi, D. F., (2010). Understanding mental toughness in Australian soccer: Perceptions of players, parents and coaches. *Journal of Sports Sciences*, 28(7), 699-716. doi: 10.1080/02640411003734085.

Creswell, J. W. (2003). Research design: Quantitative, qualitative, and mixed method approaches (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J. W. (2007). Qualitative inquiry and research design: choosing among five approaches (2nd ed.). London: Sage Publications, Ltd.

Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Creswell, J. W., Plano Clark, V. L., Guttman, M., & Hanson, W. (2003). Advanced mixed methods research designs. In A. Tashakkori, & C.Teddlie (Ed.), *Handbook of mixed methods in the behavioural social sciences*. (pp. 209-240). Thousand Oaks, CA: Sage.

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology, *Journal of Consulting Psychology*, 24, 349-354.

Crust, L. (2007). Mental toughness in sport: A review. *International Journal of Sport and Exercise Psychology, 5,* 270–290. doi:10.1080/1612197X.2007.9671836

Crust, L. (2008). A review and conceptual re-examination of mental toughness: Implications for future researchers. *Personality and Individual Differences, 45,* 576–583. doi:10.1016/j.paid.2008.07 .005

Crust, L. & Azadi, K. (2009). Leadership preferences of mentally tough athletes. *Personality and Individual Differences*, 47(4), 326-330.

Crust, L., & Azadi, K. (2010). Mental toughness and athletes' use of psychological strategies. *European Journal of Sport Science*, 10, 43–51. http://dx.doi.org/10.1080/17461390903049972.

Crust, L., & Clough, P. (2005). Relationship between mental toughness and physical endurance. *Perceptual & Motor Skills*, 100, 192–194. http://dx.doi.org/10.2466/ pms.100.1.192-194.

Crust, L., & Clough, P. (2011). Developing mental toughness: From research to practice. Journal of Sport Psychology in Action, 2, 21-32. DOI: 10.1080/21520704.2011.563436

Crust, L., & Keegan, R. (2010). Mental toughness and attitudes to risk-taking, *Personality and Individual Differences*, 49, 164-168.

Crust, L., & Swann, C. (2010). Comparing two measures of mental toughness, *Personality and Individual Differences*, 50, 217-221.

Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied Nursing Research*, 5, 194-197.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry*, 11, 227-268.

Dennis, P. (1978). Mental toughness and performance success and failure. *Perceptual and Motor Skills, 46,* 385–386 Retrieved from http://www.ammonsscientific.com/ AmSci/. doi:10.2466/pms.1978.46.2.385

Denzin, N. K. (1998). The art and politics of interpretation. In N.K. Denzin & Y.S. Lincoln (Eds.), *Collecting and interpreting qualitative materials* (pp. 313–344). London, UK: Sage Publications.

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*, 111, 225-236. doi:10.1037/0021-843X.111.2.225

DeVellis, R. F. (1991). *Scale development: Theory and applications.* Newbury Park, CA: Sage.

DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed.). London, UK: Sage Publications.

Dewhurst, S., Anderson, R., Cotter, G., Crust, L., & Clough, P. (2012). Identifying the cognitive basis of mental toughness: Evidence from the directed forgetting paradigm. *Personality and Individual Differences*, 53, 587–590. http://dx.doi.org/ 10.1016/j.paid.2012.04.036.

Diedorff, E. C., & Surface, E. A. (2007). Placing peer ratings in context: systematic influences beyond ratee performance. *Personnel Psychology*, 60, 93–126.

Dienstbier, R. A. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review*, 96(1), 84–100.

Drees, M. J., & Mack, M. G. (2012) An examination of mental toughness over the course of a competitive season. *Journal of Sport Behavior*, 35 (4), 377-386.

Driska, A. P., Kamphoff, C., & Armentout, S. M. (2012). Elite swimming coaches perceptions of mental toughness. *The Sport Psychologist*, 26, 186-206.

Duda, J. L. (Ed.). (1998). *Advances in sport and exercise psychology measurement*. Morgantown, WV: Fitness Information Technology.

Earle, K. (2006). *The construct of mental toughness: A psychometric and experimental analysis*. Unpublished PhD thesis, University of Hull.

Edwards, J. R. (2001). Multidimensional constructs in organizational behavior research: An integrative analytical framework. *Organizational Research Methods*, 4(2), 141-192.

Edwards, J. R. (2003). Construct validation in organizational behavior research. In J. Greenberg (ed.), *Organizational Behavior: The State of the Science* (pp. 327-371) Mahwah, NJ: Lawrence Erlbaum Associates.

Edwards, D., Hannigan,B., Fothergill, A., & Burnard, P. (2002). Stress management for mental health professionals: A review of effective techniques. *Stress and Health*, 18, 203-215.

Egger, M., & Smith, G.D. (1998). Bias in location and selection of studies. *British Medical Journal, 316*(7124), 61–66. PubMed doi:10.1136/bmj.316.7124.61

Egger, M., & Smith, G. D. (2001). Principles and procedures for systematic reviews. In M. Egger, G. Davey Smith, & D. G. Altman (Eds.), *Systematic reviews in health care: Meta-analysis in context* (pp. 23-42). London, England: BMJ Books.

Evans, D., & Chang, A. (2000). *Changing practice: Evidence based practice information sheets for health professionals.* Adelaide: The Joanna Briggs Institute for Evidence Based Nursing and Midwifery.

Everitt, B. S. (1975). Multivariate analysis: The need for data, and other problems. *British Journal of Psychiatry*, 126(2), 237-240.

Eysenck, H. J. (1995). Problems with meta-analysis. In I. Chalmers & D.G. Altman (Eds.), *Systematic reviews* (pp. 64-74). London: BMJ Publishing Group.

Favret, B., & Benzel, D. (1997). *Complete guide to water skiing.* Champaign, IL: Human Kinetics.

Fawcett, T. (2006). 'An investigations into the perceptions of mental toughness of adventurers/explorers, elite athletes and elite coaches', unpublished doctoral thesis, University of Northumbria at Newcastle, UK.

Faulkner, G., & Sparkes, A. (1999). Exercise as therapy for schizophrenia: an ethnographic study. *Journal of Sport & Exercise Psychology*, 21, 52-69.

Feldman, K.A. (1971). Using the work of others: Some observations on reviewing and integrating. *Sociology of Education, 44,* 86–102. doi:10.2307/2111964

Fletcher, D., Hanton, S., Mellalieu, S.D., & Neil, R. (2012). A conceptual framework of organizational stressors in sport performers. *Scandinavian Journal of Medicine & Science in Sports*. Advance online publication. doi:10.1111/j.1600-0838.2010.01242.x PubMed

Field, A. (2009). *Discovering statistics with SPSS: Introducing statistical methods* (3rd Ed.). London: Sage Publications.

Finfgeld, D. L. (2003). Meta-synthesis: The state of the art so far. *Qualitative Health Research, 13,* 893–904. PubMed doi:10.1177/1049732303253462

Fourie, S., & Potgieter, J. R. (2001). The nature of mental toughness in sport. *South African Journal for Research in Sport, Physical Education and Recreation*, 23, 63-72.

Funk, S. C. (1992). Hardiness: a review of theory and research. *Health Psychology*, 11, 335-345.

Gao, Y., Mack, M. G., Ragan, M. A., & Ragan, B. (2012). Differential Item Functioning Analysis of the Mental, Emotional, and Bodily Toughness Inventory. *Measurement in Physical Education and Exercise Science, 16*(3), 203-218. http://dx.doi.org/10.1080/1091367X.2012.693349

Gaskell, G. (2000). Individual and group interviewing. In: Bauer M and Gaskell G (eds) *Qualitative Researching with Text, Image and Sound*. London: Sage, 38–56.

Gaudreau, P., & Blondin, J. P. (2004). Differential associations of dispositional optimism and pessimism with coping, goal attainment, and emotional adjustment during sport competition. *International Journal of Stress Management,* 11, 245-269.

Gauvin, L., & Russell, S. J., (1993). Sport-specific and culturally adapted measures in sport and exercise psychology research: Issues and strategies. In R. N. Singer, M. Murphey, & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 891-900). New York: Macmillan.

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Pühse, U., Elliot, C., et al. (2013a). Adolescents' exercise and physical activity are associated with mental toughness. *Mental Health and Physical Activity*, 5, 35–42. http://dx.doi.org/ 10.1016/j.mhpa.2012.02.004.

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Pühse, U., Elliot, C., Holsboer-Trachsler, E., & Brand, S. (2013b). Are adolescents' with high mental toughness levels more resilient against stress. *Stress Health, 29(2)*, 164-71. doi: 10.1002/smi.2447.

Gibson, A. (1998). *Mental toughness.* New York: Vantage Press

Glaser, B. & Strauss, A. (1967). *The discovery of grounded theory; Strategies for qualitative research*. Chicago: Aldine.

Goertz, G. (2006). *Social science concepts: A user's guide*. Princeton, NJ: Princeton University Press.

Golby, J., & Sheard, M. (2006). The relationship between genotype and positive psychological development in national-level swimmers. *European Psychologist, 11,* 143–148. doi:10.1027/1016-9040.11.2.143

Golby, J., & Sheard, M. (2004). Mental toughness and hardiness at different levels of rugby league. *Personality and Individual Differences, 37,* 933–942. doi:10.1016/j. paid.2003.10.015

Golby, J , Sheard, M , & Lavallee, D (2003) A cognitive-behavioural analysis of mental toughness in national rugby league teams. *Perceptual and Motor Skills, 96*, 455-462.

Golby, J., Sheard, M., & van Wersch, A. (2007). Evaluating the factor structure of the psychological performance inventory. *Perceptual and Motor Skills, 105,* 309–325 10.1027/1016-9040.11.2.143. PubMed

Golby, J., & Meggs, J. (2011). Exploring the organizational effect of parental testosterone upon the sporting brain. *Journal of Sports Science and Medicine*, 10, 445-451.

Goldberg, A. S. (1998) *Sports slump busting: 10 steps to mental toughness and peak performance* Champaign, IL: Human Kinetics.

Goleman, D. (1995). *Emotional intelligence*. Ney York: Bantam Books.

Goleman, D. (1998). What makes a leader? *Harvard Business Review*, 76, 93-102.

Goodger, K., Gorely, T., Lavellee, D., & Harwood, C. (2007). Burnout in sport: A systematic review. *The Sport Psychologist*, 21, 127-151.

Gordon, S. (2005, August). Identification and development of mental toughness. In T Morris, P. Terry, S. Gordon, S. Hanrahan, L. Ievleva, G. Kolt, & P. Tremayne (Eds) *Psychology promoting health & performance for life: Proceedings of the ISSP 11th World Congress of Sport* [CDROM] Sydney: International Society of Sport Psychology (ISSP)

Gordon, S. (2012). Strengths-based approaches to developing mental toughness: Team and individual. International Coahcing Psychology Review, 7(2), 210-222.

Gordon, S., Gucciardi, D., & Chambers, T. (2007). A personal construct theory perspective on sport and exercise psychology research: The example of mental toughness. In T. Morris, P. Terry, & S. Gordon (Eds.), *Sport psychology and exercise psychology: International perspectives* (pp. 43-55). Morgantown, WV: Fitness Information Technology.

Gould, D., Dieffenbach, K., & Moffett, A. (2002). Psychological characteristics and their development in Olympic champions. *Journal of Applied Sport Psychology, 14,* 172–204. doi:10.1080/ 10413200290103482

Gray, J. A., & McNaughton, N. (2000). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*. Oxford: Oxford University Press.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, 74(6), 1464-1480.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation & Policy Analysis*, 11, 255-274.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships and well-being. *Journal of Personality and Social Psychology*, 85, 348-362. DOI: 10.1037/0022-3514.85.2.348

Gucciardi, D. F. (2009). Do developmental differences in mental toughness exist between specialized and invested Australian footballers? *Personality and Individual Differences, 47,* 985–989. doi: 10.1016/j.paid.2009.08.001

Gucciardi, D. F. (2009). Measuring mental toughness in sport: a psychometric examination of the psychological performance inventory-a and its predecessor. *Journal of Personality Assessment, 94(4),* 393–403. doi: 10.1080/00223891.2012.660292.

Gucciardi, D. F. (2012). Measuring mental toughness in sport: A psychometric examination of the Psychological Performance Inventory-A and its predecessor. *Journal of Personality Assessment, 94,* 393-403.

Gucciardi, D. F., & Gordon, S. (2008). Personal construct psychology and the research interview: The example of mental toughness in sport. *Personal Construct Theory & Practice*, 5, 119-130.

Gucciardi, D. F., & Gordon, S. (2009). Development and preliminary validation of the Cricket Mental Toughness Inventory (CMTI). *Journal of Sports Sciences*, 27, 1293–1310. http://dx.doi.org/10.1080/02640410903242306.

Gucciardi, D. F., & Gordon, S. (2011). *Mental toughness in sport: Developments in research and theory*. London: Routledge.

Gucciardi, D.F. & Gordon, S. (2011b). Mental toughness in sport: Past present, and future. In D.F. Gucciardi & S. Gordon (Eds.), *Mental toughness in sport: Developments in theory and research* (pp.233–251). London: Routledge

Gucciard, D. F., Gordon, S., & Dimmock, J. A. (2008). Towards an understanding of mental toughness in Australian football. *Journal of Applied Sport Psychology*, 20, 261-281.

Gucciard, D. F., Gordon, S., & Dimmock, J. A. (2009a). Advancing mental toughness research and theory using personal construct psychology. *International Review of Sport and Exercise Psychology*, 2(1), 54-72.

Gucciardi, D. F., Gordon, S., & Dimmock, J. (2009b). Development and preliminary validation of a mental toughness inventory for Australian football. *Psychology of Sport and Exercise, 10,* 201–209. doi:10.1016/j.psychs- port.2008.07.011

Gucciardi, D. F., Gordon, S., & Dimmock, J. A. (2009c). Evaluation of a mental toughness training program for youth-aged Australian footballers: I. A quantitative analysis. *Journal of Applied Sport Psychology, 21,* 307–323. doi: 10.1080/10413200903026066

Gucciardi, D. F., Gordon, S., & Dimmock, J. A. (2009d). Evaluation of a mental toughness training program for youth-aged Australian footballers: I. A qualitative analysis. *Journal of Applied Sport Psychology, 21,* 324–339. doi: 10.1080/10413200903026074

Gucciardi, D. F., & Gordon, S., Dimmock, J. A., & Mallett, C. J. (2009). Understanding the coach's role in the development of mental toughness: Perspectives of elite Australian football coaches. *Journal of Sports Sciences*, 27, 1483–1496. doi: 10.1080/02640410903150475

Gucciardi, D. F., Hanton, S., & Mallett, C. J. (2012). Progressing measurement in mental toughness: A case example of the Mental Toughness Questionnaire 48. *Sport, Exercise and Performance Psychology, 1,* 194–214. doi:10.1037/a0027190

Gucciardi, D. F., Hanton, S., & Mallett, C. J. (2013). Progressing measurement in mental toughness: A response to Clough, Earle, Perry, and Crust. *Sport, Exercise and Performance Psychology, 2,* 157-172. doi: 10.1037/spy0000002

Gucciardi, D. F., Jackson, B., Hanton, S., & Reid, M. (2013). Motivational correlates of mentally tough behaviours in tennis. *Journal of Science and Medicine in Sport*, (in press) doi: 10.1016/j.jsams.2013.11.009.

Gucciardi, D. F., Mallett, C. J., Hanrahan, S. J., & Gordon, S. (2011). Measuring mental toughness in sport: Current status and future directions. In D. F. Gucciardi & S. Gordon (Eds.), *Mental toughness in sport: Developments in research and theory* (pp. 108–132). London, England: Routledge.

Guillen, F., & Laborde, S. (2014). Higher-order structure of mental toughness and the analysis of latent mean differences between athletes from 34 disciplines and non-athletes. *Personality and Individual Differences*, 60, 30-35, http://dx.doi.org/10.1016/j.paid.2013.11.019.

Hagans, C. L., Neimeyer, G. J., & Goodholm, R., Jr. (2000). The effect of elicitation methods on personal construct differentiation and valence. *Journal of Constructivist Psychology, 13*, 155-173.

Hardy, L., Bell, J. J., & Beattie, S. J. (2013). A neuropsychological model of mentally tough behavior. *Journal of Personality, 81*(4), 344–364. doi:10.1111/jopy.12034

Harter, S. (1982). The Perceived Competence Scale for children. *Child Development*, 53, 87-89.

Hartley, R. J., Keen, E. M., Large, J. A., & Tedd, L. A. (1990). *Online searching: Principles and practice*. London, UK: BowkerSaur.

Haynes, S. N., Richard, D. C. S., & Kubany, E. S. (1995). Content validity in psychometric assessment: A functional approach to concepts and methods. *Psychological Assessment*, 7(3), 238-247.

Hopwood, C. J., & Donnellan, M. B. (2010). How should the internal structure of personality inventories be evaluated? *Personality and Social Psychology Review, 14,* 332–346. doi:10.1177/ 1088868310361240

Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A. (2009). A behavioural genetic study of mental toughness and personality. *Personality and Individual Differences,* 46, 100-105.

Howard, G. S. (1994). Why do people say nasty things about self-reports? *Journal of Organizational Behavior, 15,* 399-404.

Hrycaiko, D.W., & Martin, G.L. (1996). Applied research studies with single-subject designs: Why so few? *Journal of Applied Sport Psychology, 8,* 183–199.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. doi:10.1080/10705519909540118

Jackson, S. A. & Marsh, H. W. (1996). Development and validation of a scale to measure optimal experience: The Flow State Scale. *Journal of Sport and Exercise Psychology*, 18, 17-35.

Johnson, R. E., Rosen, C. C., Chang, C-H., Djurdjevic, E., & Taing, M. U. (2012). Recommendations for improving the construct clarity of higher-order multidimensional constructs. *Human Resource Management Review*, 22, 62–72. http://dx.doi.org/10.1016/j.hrmr.2011.11.006.

Jones, C. M. (1982, November). Mental toughness. *World bowls,* 30–31.

Jones, M. V. (2003) Controlling emotions in sport. *The Sport Psychologist*, 17, 471-486.

Jones, G., Hanton, S., & Connaughton, D. (2002). What is this thing called mental toughness? An investigation of elite sport performers. *Journal of Applied Sport Psychology, 14,* 205–218 10.1080/10413200290103509. doi:10.1080/10413200290103509

Jones, G., Hanton, S., & Connaughton, D. (2007). A framework of mental toughness in the world's best performers. *The Sport Psychologist*, 21, 243-264.

Jones, G., & Swain, A. (1995). Predispositions to experience debilitative and facilitative anxiety in elite and nonelite performers. *The Sport Psychologist*, 9, 201-211.

Jöreskog, K. G. (1993). Testing structural equation models. In K A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 294-316). Newbury Park, CA: Sage.

Kaiseler, M., Polman, R. C. J., & Nicholls, A. R. (2009). Mental toughness, stress, stress appraisal, coping and coping effectiveness in sport. Personality and Individual Differences, 47 (7), 728-733.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measure- ment, 20,* 141–151. doi:10.1177/001316446002000116

Kaun, G., & Roy, J. (2007). Goal profiles, mental toughness and its influence on performance outcomes among Wushu athletes. J ournal of Sports Science and Medicine, 6, 28-22.

Kelly, G. A. (1991). *The psychology of personal constructs: A theory of personality* (Vol 1). London: Routledge (Original work published 1955).

Kelly, G. A. (2003). A brief introduction to personal construct theory. In F. Fransella (Ed.), *International handbook of personal construct psychology* (pp. 3-20). Chichester, England: John Wiley & Sons.

Kidder, L. H., & Judd, C. M. (1986). *Research methods in social relations* (5th ed.). New York: Holt, Rinehart & Winston.

Klassen, T. P., Jahad, A. R., & Moher, D. (1998). Guides for reading and interpreting systematic reviews. *Archives of Pediatric Adolescent Medicine*, 152, 700-704.

Kline, R. (2005). *Principles and practice of structural equation modelling*. New York: Guildford.

Kobasa, S. C. (1979). Stressful life events, personality and health: An enquiry into hardiness. Journal of Personality and Social Psychology, 37, 1–11. http://dx.doi.org/10.1037/0022-3514.37.1.1.

Kroll, W. (1967). Sixteen personality factor profiles of collegiate wrestlers. *Research Quarterly*, 38, 49–57.

Laborde, S., Lautenbach, F., Allen, M. S., Herbert, C., & Achtzehn, S. (2014). The role of trait emotional intelligence in emotion regulation and performance under pressure. *Personality and Individual Differences*, 57, 43–47.

Lane, A. M., Nevill, A. M., Bowes, N., & Fox, K. R. (2005). Test-retest stability of the Task and Ego Orientation Questionnaire. Research Quarterly for Exercise and Sport, 76(3), 339-346.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal and coping*. New York: Springer.

Lee, K., Shin, D. S., Han, M., & Lee, E. (1994). Developing the norm of Korean table tennis players' mental toughness. *Korean Journal of Sport Science, 6,* 103-120.

Leech, N. L., & Onwuegbuzie, A. J. (2008). Qualitative data analysis: A compendium of techniques and a framework for selection for school psychology research and beyond. *School Psychology Quarterly, 23,* 587–604. doi:10.1037/1045-3830.23.4.587

Leganger, A., Kraft, P., & Roysamb, E. (2000). Perceived self-efficacy in health behaviour research: Conceptualisation, measurement and correlates. *Psychology & Health*, 15, 51-69.

Levy, A. R., Polman, R. C. J., Clough, P. J., Marchant, D. C., & Earle, K. (2006). Mental toughness and determinants of beliefs, pain and adherence in sport injury rehabilitation. *Journal of Sport Rehabilitation*, 15, 246-254.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Thousand Oaks, CA: Sage.

Lloyd Jones, M. (2004). Application of systematic review methods to qualitative research: Practical issues. *Journal of Advanced Nursing*, 48, 271-278.

Loehr, J. E. (1982). *Athletic excellence: Mental toughness training for sports.* New York: Plume.

Loehr, J. E. (1986). *Mental toughness training for sports: Achieving athletic excellence*. Lexington, MA: Stephen Greene press.

Loehr, J. E. (1995). *The new mental toughness training for sports.* New York: Plume

Loewenthal, K. M. (2001). *An introduction to psychological tests and scales*. Philadelphia, PA, US: Psychology Press, Taylor Francis Group.

Lonsdale, C., Hodge, K., & Rose, E. A. (2008). The Behavioral Regulation in Sport Questionnaire (BRSQ): Instrument development and initial validity evidence. *Journal of Sport & Exercise Psychology,* 30, 323-355.

Loo, R., & Thorpe, K. (2000). Confirmatory factor analyses of the full and short versions of the Marlowe-Crowne Social Desirability Scale. *Journal of Social Psychology*, 140, 628-635.

Lovibond, P. F., & Lovibond, S. H. (1995). *Manual for the Depression Anxiety Stress Scales*. Sidney, Australia: Psychology Foundation of Australia.

Luszki, W. A. (1982). Winning tennis through mental toughness. New York: Everest House.

Luthar, S. S., & Cicchetti, D. (2000). The construct of resilience: Implications for interventions and social policies. *Development and Psychopathology*, 12(1), 857-885.

Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*, 35, 382-385.

Mack, M., & Ragan, B. (2008). Development of the mental, emotional, and bodily toughness inventory in college athletes and non-athletes. *Journal of Athletic Training, 43,* 125–132 10.4085/1062-6050-43.2.125. PubMed doi:10.4085/1062-6050-43.2.125

MacKenzie, S. B. (2003). The dangers of poor construct conceptualization. *Journal of the Academy of Marketing Science*, 31(3), 323-326.

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS Quarterly, 35,* 293–334.

Maddi, S. R. (2006). Hardiness: The courage to grow from stresses. *Journal of Positive Psychology*, 1, 160-168.

Maddi, S. R., & Khoshaba, D. M. (2001). *Personal Views Survey* (3rd ed., rev.). Newport Beach, CA: Hardiness Institute.

Maddi, S. R., Khoshaba, D. M., Harvey, R. H., Lu, J. L., & Persico, M. (2002). The personality construct of hardiness, II: Relationships with measures of psychopathology and personality. *Journal of Research in Personality*, 36, 72–85.

Madrigal, L., Hamill, S., & Gill, D. L. (2013). Mind over matter: The development of the Mental Toughness Scale (MTS). *The Sport Psychologist, 27(1)*, 62-77.

Marchant, D. C., Polman, R. C. J., Clough, P. J., Jackson, J. G., Levy, A. R., & Nicholls, A. R. (2009). Mental toughness: managerial and age differences. *Journal of Managerial Psychology*, 24(5), 428-437. doi 10.1108/02683940910959753

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, 57, 519-530.

Marsh, H. W. (1997). The measurement of physical self-concept: A construct validation approach. In K. Fox (Ed.), *The physical self: From motivation to well-being* (pp. 27-58). Champaign, IL: Human Kinetics.

Marsh, H. W. (2002). The measurement of physical self-concept: A construct validation approach to theory, measurement and research. *The Journal of the Hellenic Psychological Society*, 9, 459-493.

Marsh, H. W. (2007). Application of confirmatory factor analysis and structural equation modelling in sport and exercise psychology. In G. Tenenbaum & R. C. Eklund.(Eds), Handbook of sport psychology (3rd Ed.). (pp. 774-978). Hoboken, NJ, US: John Wiley & Sons Inc.

Marsh, H. W., & Hocevar, D. (1985). Application of confirmatory factor analysis to the study of self-concept: First- and higher-order factor models and their invariances across group. *Psychological Bulletin*, 97, 562-582.

Marsh, H. W., Martin, A. J., & Jackson, S. A. (2010). Introducing a short version of the Physical Self Description Questionnaire: New strategies, short- form evaluation evaluative criteria, and applications of factor analyses. *Journal of Sport & Exercise Psychology, 32,* 438–482.

Masten, A. S. (1994). Resilience in individual development: Successful adaptation despite risk and adversity. In M. C. Wang & E.W. Gordon (Eds.), *Educational resilience in inner-city America: Challenges and prospects* (pp. 3-25). Hillsdale, N. J: Lawrence Erlbaum Associates.

Masten, A. S., & Reed, M. G. J. (2002). Resilience in development. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 74-88). New York, NY: Oxford University Press.

Mayer, J. D., & Salovey, P. (1997). What is emotional intelligence? In P. Salovey & D. Sluyter (Eds.) *Emotional development and emotional intelligence: Implications for educators* (pp. 3-31). New York: Basic Books.

McCrae, R. R., & Costa, P. T., Jr. (2003). *Personality in adulthood: A five-factor theory perspective* (2nd ed.). New York, NY: Guilford Press.

Meade, M.O., & Richardson, W. S. (1997).Selecting and appraising studies for a systematic review. *Annals of Internal Medicine*, 127, 531-537.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational Measurement* (3rd ed., pp. 13-104). New York: Macmillan.

Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist*, 50(9), 741-749.

Middleton, S. C., (2005). 'Mental toughness: Conceptualisation and measurement', PhD thesis, University of Western Sydney.

Middleton, S. C., Marsh, H. W., Martin, A. J., Richards, G. E., & Perry, C. (2005). *Discovering mental toughness: A qualitative study of mental toughness in elite athletes* (pp. 4-7). Paper presented at the 3rd International Biennial SELF Research Conference, Berlin, Germany, July.

Middleton, S., Marsh, H., Martin, A., Richards, G., Savis, J., Perry, C., & Brown, R. (2004). The psychological performance inventory: Is the mental toughness test tough enough? *International Journal of Sport Psychology, 35,* 91–108 Retrieved from http://www.ijsp-online.com/.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis.* Thousand Oaks, CA: Sage.

Miller, N. E. (1980). A perspective on the effects of stress and coping on disease and health. In S. Levine & H. Ursin (Eds.), *Coping and health* (pp. 323–354). New York: Plenum.

Mishler, E. (1979). Meaning in context. *Harvard Educational Review, 119*(1), 1–19.

Mullan, E., Markland, D., & Ingledew, D. K. (1997). A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences*, 23, 745-752.

Mulrow, C. D. (1994). Systematic Reviews: Rationale for systematic reviews. British Medical Journal, 309, 597-599.

Mulrow, C. D. (1995). Rationale for systematic reviews. In I. Chalmers & D.G. Altman (Eds.), *Systematic reviews* (pp. 1-8). London: BMJ Publishing Group.

Nederhof, A. J. (1985). Methods of coping with social desirability bias: A review. *European Journal of Social Psychology, 15,* 263–280. doi: 10.1002/ejsp.2420150303

Neimeyer, G.J., Neimeyer, R.A., Hagans, C.L., & van Brunt, D.L. (2002). Is there madness in our method? The effects of repertory grid variations on measures of construct system structure. In R. Neimeyer, & Neimeyer, G. (Eds.), *Advances in personal construct psychology* (pp. 3-22). Greenwich, CT: JAI Press.

Newman, I., Ridenour, C. S., Newman, C., & DeMarco, G. M.P., Jr. (2003). A typology of research purposes and its relationship to mixed methods. In A. Tashakkori, & C.Teddlie (Ed.), *Handbook of mixed methods in the behavioural social sciences*. (pp. 167-188). Thousand Oaks, CA: Sage.

Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review*, 91, 328-346.

Nicholls, A. R., & Polman, R. C. J. (2007). Coping in sport: A systematic review. *Journal of Sports Sciences*, 25(1), 11-31.

Nicholls, A. R., Polman, R. C., Levy, A. R., & Backhouse, S. (2008). Mental toughness, optimism, and coping among athletes. *Personality and Individual Differences*, 44, 1182–1192. http://dx.doi.org/10.1016/j.paid.2007.11.011.

Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2009). Mental toughness in sport: Achievement level, gender, age, experience, and sport type differences. *Personality and Individual Differences*, 47, 73-75.

Noblit, G. W., & Hare, R. D. (1988). *Meta-ethnography: Synthesising qualitative studies.* London: Sage.

Norlander, T., & Archer, T. (2002). Predicting performance in ski and swim championships: Effectiveness of mood, perceived exertion, and dispositional optimism. Perceptual Motor Skills, 94(1), 153-164.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.), New York: McGraw Hill.

Olsson, U. H., Foss, T., Troye, S. V., & Howell, R. D. (2000). The performance of ML, GLS, and WLS estimation in structural equation modelling under conditions of misspecification and nonnormality. *Structural Equation Modeling*, 7, 557-595.

O'Reilly, M. & Parker, N. (2012). 'Unsatisfactory saturation': a critical exploration of the notion of saturated sample sizes in qualitative research. *Qualitative Research*, 13(2), 190-197. http://dx.doi.org/10.1177/1468794112446106

Ouellette, S.C. (1993). Inquiries into Hardiness. In: Goldberger, L. and Breznitz, S. (eds), *Handbook of Stress: Theoretical and clinical aspects* (2nd edn). New York: The Free Press, pp. 77–100.

Pankey, B. (1993). Presence of mind: Five ways to lower class drop-out rate with mental toughness. *American Fitness*, 11, 18-19.

Parkes, J. F., & Mallet, C. J. (2011). Developing mental toughness: Attributional style retraining in rugby. *The Sport Psychologist*, 25, 269-287.

Patton, M. (2002). *Qualitative research and evaluation methods*. Newbury Park, CA: Sage.

Pawson, R. (2001). Evidence-based policy: the promise of realist synthesis. *Evaluation*, 8(3), 340-358.

Peng, K., Nisbett, R. E., & Wong, N. (1997). Validity problems of cross-cultural value comparison and possible solutions. *Psychological Methods, 2*, 329-341.

Peterson, R. A. (2000). *Constructing Effective Questionnaires*, Thousand Oaks, CA: Sage Publications.

Pidgeon, N., & Henwood, K. (1996). Grounded theory: Practical implementation. In John T. E. Richardson (Ed.), *Handbook of qualitative research methods for psychology and the social sciences* (pp. 86–101). Leicester: BPS Books.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903.

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing and Health*, 29, 489-497.

Popham, W. J. (1978). *Criterion-referenced measurement*. Englewood Cliffs, NJ: Prentice Hall.

Price, D. (1965). Networks of scientific papers. *Science, 149,* 510–515. PubMed

Punch, K. F. (2005). *Introduction to social research: Quantitative and qualitative approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Rantala, K., & Wellstrom, E. (2001). Qualitative comparative analysis and a hermeneutic approach to interview data. *International Journal of Social Research Methodology*, 4(2), 87-100.

Reynolds, W. M. (1982). Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *Journal of Clinical Psychology*, 38, 119-125.

Sandelowski, M., Docherty, S., & Emden, D. (1997). Qualitative metasynthesis: Issues and techniques. *Research in Nursing and Health*, 20, 365-371.

Satorra, A., & Bentler, P. M. (1988a). Scaling corrections for chi-square statistics in covariance structure analysis. *ASA 1988 Proceedings of the Business and Economic Statistics Section*, 308-313, Alexandria, VA: American Statistical Association.

Satorra, A., & Bentler, P. M. (1988b). Scaling corrections for statistics in covariance structure analysis. *UCLA Statistics Series #2*, University of California, Los Angeles.

Scheier, M. F., & Carver, C. S. (1985). Optimism, coping and health: Assessment and implications of generalized outcome expectancies. *Health Psychology*, 4, 219-247.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test). *Journal of Personality and Social Psychology*, 67, 1063-1078.

Scholz, U., Dona, B.G., Sud, S., & Schwarzer, R. (2002). Is general self-efficacy a universal construct? Psychometric findings from 25 countries. *European Journal of Psychological Assessment*, 18, 242-251. doi:10.1027//1015-5759.18.3.242

Schwarzer, R., & Jerusalem, M. (1995).Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35-37). Windsor, UK: NFER-NELSON.

Sheard, M. (2009). A cross-national analysis of mental toughness and hardiness in elite university rugby league teams. *Perceptual and Motor Skills, 109,* 213–215. PubMed doi:10.2466/pms.109.1.213-223

Sheard, M. (2009). Hardiness, commitment, gender and age differentiate university academic performance. *British Journal of Educational Psychology*, 79, 189-204.

Sheard., M. (2010). *Mental toughness: The mindset behind sporting achievement*. New York: Routledge.

Sheard, M., Golby, J., & van Wersch, A. (2009). Progress toward construct validation of the Sport Mental Toughness Questionnaire (SMTQ). *European Journal of Psychological Assessment, 25,* 186–193 10.1027/1015-5759.25.3.186. doi:10.1027/1015-5759.25.3.186

Simpson, G. G. (1961). *Principles of animal taxonomy*. New York, NY: Columbia University Press.

Smith, J. A. (1996). Beyond the divide between cognition and discourse: Using interpretive phenomenological analysis in health psychology. *Psychology and Health, 11,* 261–271.

Smith, J. A. (2003). Validity and qualitative psychology. In J. A. Smith (Ed.), *Qualitative psychology: A practical guide to research methods* (pp. 232–235). London: Sage.

Spector, P.E. (1994). Using self-report questionnaires in OB research: A comment on the use of a controversial method. *Journal of Organizational Behavior, 15,* 385-392.

Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly*, 13(2), 147-169.

Straub, D. W., Boudreau, M-C, & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the AIS*, (13), 380-427.

Strauss, A. L., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage.

Steiger, J.H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research, 25,* 173–180. doi:10.1207/ s15327906mbr2502_4

Stewart, C., Smith, B., & Sparkes, A. C. (2011). Sporting autobiographies of illness and the role of metaphor. *Sport in Society*, 14, 581-597. http://dx.doi.org/10.1080/ 17430437.2011.574358.

Stern, J. M., & Simes, R. J. (1997). Publication bias: Evidence of delayed publication in a cohort study of clinical research projects. *British Medical Journal*, 315, 640-645.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th edition). Boston: Allyn & Bacon.

Tapp, J. (1991). Mental toughness. *Referee*, 16, 44-48.

Thelwell, R., Weston, N., & Greenlees, I. (2005). Defining and under- standing mental toughness within soccer. *Journal of Applied Sport Psychology, 17,* 326–332, doi:10.1080/10413200500313636

Thelwell, R. C., Weston, N. J., & Greenless, I. A. (2005). Defining and understanding mental toughness within soccer. *Journal of Applied Sport Psychology*, 17, 326-332.

Thelwell, R. C., Such, B. A., Weston, N. J., Such, J. D., & Greenlees, I. A. (2007). Developing mental toughness: Perceptions of elite female gymnasts, *International Journal of Sport and Exercise Psychology*, 8, 170-188.

Thelwell, R. C., Such, B. A., Weston, N., Such, J., & Greenlees, I. A. (2010). Developing mental toughness: perceptions of elite female gymnasts. *International Journal of Sport and Exercise Psychology*, 8, 170–189.

Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology, 8,* 45–55. PubMed doi:10.1186/1471-2288-8-45.

Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2005). Research methods in physical activity (5th Ed.). Chapaign, IL: Human Kinetics.

Tranfield, D., & Denyer, D. (2002). *Towards a methodology for developing evidence-informed management knowledge by means of systematic review.* Report to the ESRC (grant no. IMRC19). UK:.Cranfield Business School.

Tufford, L., & Newman, P. (2010). Bracketing in qualitative research. *Qualitative Social Work*, 11(1), 80-96, doi: 10.1177/1473325010368316

Tunney, J. (1987). Thoughts on the line, mental toughness: Biceps for the mind. *Soccer Journal,* 32, 49-50.

Tutko, T. A., & Richards, J. W. (1971). Psychology of coaching. Boston, MA: Allen and Bacon, Inc.

Walker, B. M., & Winter, D. A. (2007). The elaboration of personal construct psychology. *Annual Review of Psychology*, 58, 453-477.

Walsh, D., & Downe, S. (2005). Meta-synthesis method for qualitative research: A literature review. Journal of Advanced Nursing, 50(2), 204-211.

Waltz, C. F., Strickland, O. L., & Lenz, E. R. (2005). *Measurement in nursing and health research* (3rd ed.) New York: Springer.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect. The PANAS Scales. *Journal of Personality and Social Psychology*, 47, 1063-1070.

Watts, G. (1978). 'Mental toughness for disadvantaged track teams', *Scholastic Coach*, 47, 100-102.

Weed, M. (2005). Meta-Interpretation: A method for the interpretive synthesis of qualitative research. *Forum Qualitative Sozial Forschung, 6,* 1–17.

Weed, M. (2006). Interpretive qualitative synthesis in the sport and exercise sciences: The meta-interpretation approach. *European Journal of Sport Science, 6,* 127–139. doi:10.1080/17461390500528576

Weed, M. (2008). A potential method for the interpretive synthesis of qualitative research: Issues in the development of meta-interpretation. *International Journal of Social Research Methodology, 11,* 13–28. doi:10.1080/13645570701401222

Weinberg, R., Butt, J., & Culp, B. (2011). Coaches' views of mental toughness and how it is built. *International Journal of Sport and Exercise Psychology, 9,* 156–172, doi:10.1080/1612197X.2011.567106

Werner, A. C., & Gottheil, E. (1966). Personality development and participation in collegiate athletics. *Research Quarterly, 37,* 126-131.

West. S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables. Problems and remedies. In R. H. Hoyle (Ed.), *Structural equation modelling: Concepts, issues and applications* (pp. 56-75). Newbury Park, CA: Sage.

Williams, M. H. (1998). *The ergonomics edge: Pushing the limits of sports performance.* Champaign, IL: Human Kinetics.

Williams, J. M. (2001). *Applied sport psychology: Personal growth to peak performance*. New York: McGraw-Hill.

Williams, A. M., Hardy, L., & Mutrie, N. (2008). Twenty-five years of psychology in the Journal of Sports Sciences: A historical overview. *Journal of Sports Sciences*, 26, 401-412.

Wylleman, P., & Lavallee, D. (2004). A developmental perspective on transitions faced by athletes. In M. Weiss (Ed.), *Developmental sport and exercise psychology: a lifespan perspective* (pp. 507-527). Morgantown. FIT.

Wynd, C. A., Schmidt, B., & Schaefer, M. A. (2003). Two quantitative approaches for estimating content validity. *Western Journal of Nursing Research*, 25, 508-518.

Xu, Y. (2008). Methodological issues and challenges in data collection and analysis of qualitative meta-synthesis. *Asian Nursing Research, 2,* 173–183. doi:10.1016/S1976-1317(08)60041-9

Yin, R. K. (1989). *Case study research, design and methods.* Newbury Park, CA: Sage.

Appendices

Appendix 2.1 Studies included in the Systematic Review

No	*Author(s)*	*Date*	*Title*	*Reference*
1	Dennis, P. W.	1978	Mental toughness and performance success and failure. ***Perceptual and Motor Skills***	46, 385-396.
2	Lee, K. H., Shin, D. S., Han, M. W., & Lee, E.	1994	Developing the norm of Korean table tennis players' mental toughness. ***Korean Journal of Sport Science***	6, 103-120.
3	Shin, D. S. & Lee, K. H.	1994	A comparative study of mental toughness between elite and non-elite female athletes. ***Korean Journal of Sport Science***	6, 85-102.
4	Fourie, S., & Potgieter, J. R.	2001	The nature of mental toughness in sport. ***South African Journal for Research in Sport, Physical Education and Recreation***	23, 63-72.
5	Jones, G., Hanton, S., & Connaughton, D.	2002	What is thing called mental toughness? An investigation of elite sport performers. ***Journal of Applied Sport Psychology***	14(3), 20-28.
6	Golby, J., Sheard, M., & Lavellee, D.	2003	A cognitive-behavioural analysis of mental toughness in national league rugby teams. ***Perceptual and Motor Skills***	96, 455-462.
7	Golby, J., Sheard, M., & Lavellee, D.	2004	Mental toughness and hardiness at different levels of rugby league. ***Personality and Individual Differences***	37(5), 933-942.
8	Middleton, S. C., Marsh, H. W., Martin, A. J., Richards, G. E., & Perry, C.	2004	Mental Toughness: Is the mental toughness test tough enough? ***International Journal of Sport Psychology***	35(2), 91-108.
9	Bhambri, E., Dhillon, P. K., & Sahni, S. P.	2005	Effect of psychological interventions in enhancing mental toughness dimensions of sports persons. ***Journal of the Indian Academy of Applied Psychology***	31(1-2), 63-68.
10	Bull, S. J., Shambrook, C. J., James, W., & Brookes, J. E.	2005	Towards an understanding of mental toughness in elite English cricketers. ***Journal of Applied Sport Psychology***	17(3), 209-227.
11	Crust, L., & Clough, P. J.	2005	Relationship between mental toughness and physical endurance. ***Perceptual and Motor Skills***	100, 192-194.
12	Thelwell, R., Weston, N., & Greenless, I.	2005	Defining and understanding mental toughness within soccer. ***Journal of Applied Sport Psychology***	17(4), 326-332.
13	Golby, J., & Sheard, M.	2006	The relationship between genotype and positive psychological development in national-level swimmers. ***European Psychologist***	11(2), 143-148.
14	Levy, A., Polman, R. C. J., Clough, P. J., Marchant, D., & Earle, K.	2006	Mental toughness as a determinant of beliefs, pain and adherence in sport injury rehabilitation. ***Journal of Sport Rehabilitation***	15(3), 246-254.
15	Crust, L.	2007	Mental toughness in sport: A review. ***International Journal of Sport and Exercise Psychology.***	5(3), 270-290.
16	Golby, J., Sheard, M., & van Wersch, A.	2007	Evaluating the factor structure of the Psychological Performance Inventory. ***Perceptual and Motor Skills***	105, 309-325.

17	Jones, G., Hanton, S., & Connaughton, D.	2007	A framework of mental toughness in the world's best performers. ***The Sport Psychologist***	21, 243-264.
18	Kuan, G., & Roy, J.	2007	Goal profiles, mental toughness and its influence on performance outcomes among Wushu athletes. ***Journal of Sport Science and Medicine***	***6, 28-33.***
19	Mack, M.G., & Ragan, B. G.	2008	Development of the Mental, Emotional, and Bodily Toughness Inventory in collegiate athletesand nonathletes. ***Journal of Athletic Training***	43(2), 125-132.
20	Connaughton, D., Hanton, S., Jones, G., & Wadey, R.	2008	Mental toughness research: Key issues in this area. ***International Journal of Sport Psychology***	39(3), 192-204.
21	Connaughton, D., Wadey, R., Hanton, S., & Jones, G.	2008	The development and maintenance of mental toughness: perceptions of elite performers. ***Journal of Sports Sciences***	26(1), 83-95.
22	Crust, L.	2008	A review and conceptual re-examination of mental toughness: Implications for future researchers. ***Personality and Individual Differences***	45(7), 576-583.
23	Gucciardi, D. F., Gordon, S., & Dimmock, J. A.	2008	Towards an understanding of mental toughness in Australian football. ***Journal of Applied Sport Psychology***	20(3), 261-281.
24	Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H.	2008	Mental toughness, optimism, pessimism and coping among athletes. ***Personality and Individual Differences***	44(5), 1182-1192.
25	Crust, L.	2009	The relationship between mental toughness and affect intensity. ***Personality and Individual Differences***	47(8), 959-963.
26	Crust, L. & Azadi, K.	2009	Leadership preferences of mentally tough athletes. ***Personality and Individual Differences***	47(4), 326-330.
27	Gucciardi, D. F.	2009	Do developmental differences in mental toughness exist between specialized and invested Australian footballers? ***Personality and Individual Differences***	47(8), 985-989.
28	Gucciardi, D. F., & Gordon, S.	2009	Development and preliminary validation of the Cricket Mental Toughness Inventory (CMTI). ***Journal of Sports Sciences***	27 (12), 1293-1310.
29	Gucciardi, D. F., Gordon, S., & Dimmock, J. A.	2009a	Advancing mental toughness research and theory using personal construct psychology. ***International Review of Sport and Exercise Psychology***	2(1), 54-72.
30	Gucciardi, D. F., Gordon, S., & Dimmock, J. A.	2009b	Development and preliminary validation of a mental toughness inventory for Australian football. ***Psychology of Sport and Exercise***	10(1), 201-209.
31	Gucciardi, D. F., Gordon, S., & Dimmock, J. A.	2009c	Evaluation of a mental toughness training program for youth-aged Australian footballers: I. A quantitative analysis. ***Journal of Applied Sport Psychology***	21(3), 307-323.
32	Gucciardi, D. F., Gordon, S., & Dimmock, J. A.	2009d	Evaluation of a mental toughness training program for youth-aged Australian footballers: II. A qualitative analysis. ***Journal of Applied Sport Psychology***	21(3), 324-339.
33	Gucciardi, D. F., Gordon, S., Dimmock, J. A. & Mallett, C. J.	2009	Understanding the coach's role in the development of mental toughness: Perspectives of elite Australian football coaches. ***Journal of Sports Sciences***	27(13), 1483-1496.
34	Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A.	2009	A behavioural genetic study of mental toughness and personality. ***Personality and Individual Differences***	46(2), 100-105.

35	Kaisler, M., Polman, R. C. J., & Nicholls, A. R.	2009	Mental toughness, stress, stress appraisal, coping and coping effectiveness in sport. ***Personality and Individual Differences***	47(7), 728-733.
36	Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H.	2009	Mental toughness in sport: Achievement level, gender, age, experience, and sport type differences. ***Personality and Individual Differences***	47(1), 73-75.
37	Ryba, T. V., Stambulova, N. B., & Wrisberg, C. A.	2009	Forward to the past: Puni's model of volitional preparation in sport. ***International Journal of Sport and Exercise Psychology***	7 (3), 275-291.
38	Sheard, M.	2009	A cross-national analysis of mental toughness and hardiness in elite university rugby league teams. ***Perceptual and Motor Skills***	109, 213-223.
39	Sheard, M., Golby, J., & van Wersch, A.	2009	Progress toward construct validation of the Sports Mental Toughness Questionnaire (SMTQ). ***European Journal of Psychological Assessment***	25, 186-193.
40	Connaughton, D., Hanton, S., & Jones, G.	2010	The development and maintenance of mental toughness in the world's best performers. ***The Sport Psychologist***	24(2), 168-193.
41	Coulter, T. J., Mallett, C. J., & Gucciardi, D. F.	2010	Understanding mental toughness in Australian soccer: Perceptions of players, parents and coaches. ***Journal of Sports Sciences***	28(7), 699-716.
42	Crust, L. & Azadi, K.	2010	Mental toughness and athletes' use of psychology strategies. ***European Journal of Sport Science***	10(1), 43-51.
43	Crust, L., & Keegan, R.	2010	Mental toughness and attitudes to risk-taking. ***Personality and Individual Differences***	49(3), 164-168.
44	Crust, L., & Swann, C.	2010	Comparing two measures of mental toughness. ***Personality and Individual Differences***	50(2), 217-221
45	Gucciardi, D. F.	2010	Mental toughness profiles and their relations with achievement goals and sport motivation in adolescent Australian footballers. ***Journal of Sports Sciences***	28(6), 615-625.
46	Thelwell. R. C., Such, B. A., Weston, N, J. V, Such, J. D, & Greenless, I. A	2010	Developing mental toughness: Perceptions of elite gymnasts. ***International Journal of Sport and Exercise Psychology***	8(2), 170-188

Appendix 2.2 Overview of sample demographics

Reference	Source	Sample					Age					
		Total	Male	%	Female	%	Age range	Total M	s.d	Male M	sd	Female M	sd
Dennis (1978) Mental toughness and performance success and failure	238 undergraduate physical education students, those scoring highest and lowest (N = 40 in each) on the mental toughness subscale were selected	80											
Lee, Shin, Han & Lee (1994) Developing the norm of Korean table tennis players' mental toughness	519 students; 182 middle school students (M = 87, F = 95), 199 high school students (M = 92, F = 107) and 138 college students/adults (M = 50, F = 88)	519	229	44.12	290	55.88							
Shin & Lee (1994) A comparative study of mental toughness between elite and non-elite female athletes	223 female athletes (elite = 107, non-elite = 116) from volleyball, table tennis, badminton, shooting, and archery	223			223	100							
Fourie & Potgieter (2001) The nature of mental toughness in sport	131 elite South African coaches from 30 different sport bodies and 160 athletes from 31 disciplines, from university to international level	131 coaches	93	70.99	38	29.01	22-85	42.7					
		160 athletes	87	54.38	73	45.63	14-35	21					
Jones, Hanton & Connaughton (2002) What is thing called mental toughness? An investigation of elite sport performers	10 International sport performers from swimming, sprinting, artistic and rhythmic gymnastics, trampolining, middle-distance running, triathlon, golf, rugby union and netball	10	7	70	3	30		31.2	5.28				
Golby, Sheard & Lavellee (2003)	70 International rugby league footballer who represented four national teams; Wales (n = 15), France (n = 21), Ireland (n = 13) and England (n = 21)	70	70	100									
Golby & Sheard (2004) Mental toughness and hardiness at different levels of rugby league	115 male professional rugby league players from International (n=70)/Super League (n=22)/Division 1 (n=23)	115	115	100			18-35	25.5	3.3	25.5	3.3		
Middleton, Marsh, Martin, Richards, & Perry (2004) The psychological performance inventory: Is the mental toughness test tough enough?	263 student elite-athletes from a specialised sports high school in Sydney, Australia, who played a variety of sports, including basketball, softball, rugby league, soccer, baseball, swimming, track and fields, dance aerobics, cricket and netball	263	163	62	100	38		13.8	1.6				
Bhambri, Dhillon & Sahni (2005) Effect of psychological interventions in enhancing mental	32 State level table-tennis players	32	20		12		12-17						

toughness dimensions of sports persons												
Bull, Shambrook, James & Brookes (2005) Towards an understanding of mental toughness in elite English cricketers	A list of the mentally toughest cricketers was compiled by 101 cricket coaches. 12 of the Top 15 rated players were recruited	12	12	100%								
Crust & Clough (2005) Relationship between mental toughness and physical endurance	41 male undergraduate Sports & Exercise students	41	41	100%				21.0	2.7	21.0	2.7	
Thelwell, Weston & Greenlees (2005) Defining and understanding mental toughness within soccer	6 male professional soccer players with full-honour international experience. Four were past internationals and two were still competing at international level	6	6	100				28.8	4.8	28.8	4.8	
	43 male professional soccer players	43	43	100				25.2	6.2	25.2	6.2	
Golby & Sheard (2006) The relationship between genotype and positive psychological development in national-level swimmers	31 UK national level swimmers from an outstanding club in the northeast of England	31	13	41.94	18	58.06	10-24 years	13.48	2.93			
Levy, Polman, Clough, Marchant & Earle (2006) Mental toughness as a determinant of beliefs, pain and adherence in sport injury rehabilitation	70 patients undertaking a sport injury rehabilitation program, 31% competitive athletes and 69% recreational athletes	70	44	62.86	26	37.14		32.5	10.2			
Golby, Sheard & van Wersch (2007) Evaluating the factor structure of the Psychological Performance Inventory	408 UK sport performers, 303M and 105F ranging in age from 12-63 years from roller skating, basketball, canoeing, golf, rugby league, rugby union, soccer and swimming. Ranged from club and regional to international level	408	303	74.26	105	25.74	12-63 years	24.2	6.7			
Jones, Hanton & Connaughton (2007) A framework of mental toughness in the world's best performers	8 "super-elite" performers, 3 male coaches, and 4 male sport psychologists. Sports represented were boxing, swimming, athletics, judo, triathlon, rowing, pentathlon, squash, cricket and rugby union from Australia, England, Canada, and Wales	15	12	80%	3	20%	25-60 years					
Kuan & Roy (2007) Goal profiles, mental toughness and its influence on performance outcomes among Wushu athletes	40 Malaysian university Wushu athletes	40	21	52.5	19	47.5		21	1.66			

Mack & Ragan (2008) Development of the Mental, Emotional, and Bodily Toughness Inventory in collegiate athletes and non-athletes	261 undergraduate students, 29% (n = 76) athletes and 71% (n = 186) non-athletes	261	165	63.22	96	36.78							
Connaughton, Wadey, Hanton & Jones (2008) The development and maintenance of mental toughness: perceptions of elite performers	7 Elite International athletes (from artistic and rhythmic gymnastics, swimming, trampolining, triathlon and rugby union. Sampled from Jones et al. (2002) study	7	5	71.43	2	28.57		33	5.3				
Gucciardi, Gordon & Dimmock (2008) Towards an understanding of mental toughness in Australian football	11 M elite coaches from Western Australian and Australian Football Leagues	11	11	100				42	9.62				
Nicholls, Polman, Levy & Backhouse (2008) Mental toughness, optimism, pessimism and coping among athletes	677 athletes competing at International (60), National(99),County (198), Club/University (289) and Beginner (31) levels	677	454	67.06	223	32.94	15-58 years	22.66	7.20				
Crust (2009) The relationship between mental toughness and affect intensity	112 sport participants (55M, 57F) from basketball, association football, hockey, gymnastics, netball, badminton, golf, long-distance running and triathlon, who ranged from recreational to national level participation.	112	55	49.12	57	50.88	18-51 years			30.1	11.6	28.6	8.9
Crust & Azadi (2009) Leadership preferences of mentally tough athletes	103 UK athletes of club/university to county standard from a variety of team sports in the north of England, 36 were club/university athletes and 67 were county standard	103	66	64.08	37	35.92				22.58	4.99	21.11	2.80
Gucciardi (2009) Do developmental differences in mental toughness exist between specialized and invested Australian footballers?	350 male Australian footballers, "Specialisers" (n = 144) played a secondary sport, whereas "Investors" (n =206) engaged solely in Australian football	350	350	100			13-18 years	15.88	1.71	15.88	1.71		
Gucciardi & Gordon (2009) Development and preliminary validation of the Cricket Mental Toughness Inventory (CMTI)	11 Indian and 5 Australian elite male international cricketers (5 currently playing, 11 in admin or coaching roles)	16	16	100									
	9 male Australian first-class cricketers	9	9	100			21-28 years	24.67	2.28	24.67	2.28		
	International sample – 570 male first-class cricketers from various cricket playing countries, Australian sample – 433 Australian cricketers,	570 (Int)	570	100			14-39 years	23.7	7.5				

	male and female from U17 to National level	433 (Aus)	355	81.99	78	18.01		23.35	7.48		
	Australian sample of cricketers (n = 433) from Study 3	433	355	81.99	78	18.01		23.35	7.48		
Gucciardi, Gordon & Dimmock (2009) Development and preliminary validation of a mental toughness inventory for Australian football	Study 1: 418 M elite and sub-elite Australian footballers	418	418	100			15-30 years	18.97	3.71	18.97	3.71
	Study 2: 120 players, 5 coaches, 120 parents from 5 youth-aged football teams	120 (Players) 5 (Coaches) 120 (Parents)	120				15-16 years	15.45	0.36		
Gucciardi, Gordon & Dimmock (2009) Evaluation of a mental toughness training program for youth-aged Australian footballers: I. A quantitative analysis	3 under 15's youth aged male football teams, a parent of each player and coaching staff . Three groups, i) Control Group, ii) Psychological Skills Training Group, iii) Mental Toughness Training Group	i) 24 ii) 26 iii) 25						14.46 14.29 14.58	0.36 0.48 0.32		
Gucciardi, Gordon & Dimmock (2009) Evaluation of a mental toughness training program for youth-aged Australian footballers: II. A qualitative analysis	Players, parents and coaches from the MTT program (Gucciardi et al., 2009) were invited. 10 players (i), one of their parents (ii), and 3 coaches (iii)	i) 10 ii) 10 iii) 3	5		5			14.43	0.53		
Gucciardi, Gordon, Dimmock & Mallett (2009) Understanding the coach's role in the development of mental toughness: Perspectives of elite Australian football coaches	Each of the 11 male coaches from Gucciardi et al., (2008) were re-sampled	11	11	100				42.0	9.6		
Horsburgh, Schermer, Veselka & Vernon (2009) A behavioural genetic study of mental toughness and personality	152 pairs of adult monozygotic and 67 pairs dizygotic twins, 438 participants in total,	438	76	17.35	362	82.65	18-82 years	23.88	6.22		
Kaiseler, Polman & Nicholls (2009) Mental toughness, stress, stress appraisal, coping and coping effectiveness in sport	482 UK based athletes, competing at international (15), national (60), county (220) and club/university (175) level	482	305	63.28	177	36.72	16-45 years	20.44	3.98		

Nicholls, Polman, Levy & Backhouse (2009) Mental toughness in sport: Achievement level, gender, age, experience and sport type differences	677 athletes, competing at International (60), National (99), County (198), Club/University (289) and Beginner (31) levels. 482 consisted of team-sport and 195 individual-sport athletes, 311 from contact and 366 non-contact sports	677	454	67.06	223	32.94	15-58 years	22.66	7.20					
Sheard (2009) A cross-national analysis of mental toughness and hardiness in elite university rugby league teams	49 male elite university student rugby league footballers representing Australia (n= 25) and Great Britain (n = 24)	49	49	100			18-26 years	21.7	2.3					
Sheard, Golby & van Wersch (2009) Progress toward construct validation of the Sports Mental Toughness Questionnaire (SMTQ)	Study 1: 633 UK athletes drawn from 25 sport classifications competing from club to international standard	633	427	67.46	206	32.54	16-63 years	21.5	5.48					
	Study 2: 509 UK athletes, drawn from 26 sport classifications competing from club to international standard	509	351	68.96	158	31.04	18-48 years	20.2	3.35					
Connaughton, Hanton & Jones (2010) The development and maintenance of mental toughness in the world's best performers	11 of the 15 of Jones et al.'s (2007) original sample. 7 Super-Elite performers, 2 coaches and 2 sport psychologists. Sports represented were swimming, athletics, judo, rowing, pentathlon, squash and rugby union, while nationalities included Australia, England, Canada and Wales	7 (Athletes)	4	57.14	3	42.86	25-48 years							
		2 (Coaches)	2	100			40 & 62 years	51	12.56					
		2 (Sport Psych)	2	100			40 & 47 years	43.5	4.95					
Coulter,Mallett & Gucciardi (2010) Understanding mental toughness in Australian soccer: Perceptions of players, parents and coaches	4 male coaches, who all held National A Licenses (highest coaching award in Australia), 6 male professional players, all with 3 years min International experience and 5 parents	4 (Coaches)	4	100			40-47 years	44.3	3.4	44.3	3.4			
		6 (Athletes)	6	100			25-34 years	29.3	3.8	29.3	3.8			
		5 (Parents)	2	40	3	60	57-64 years	59.4	3.3					
Crust & Azadi (2010) Mental toughness and athletes' use of psychology strategies	107 athletes, from a variety of team and individual sports, 36 were club/university athletes and 71 were competing at county standard or higher	107	67	62.62	40	37.38				22.6	5.0	21.1	2.8	
Crust & Keegan (2010) Mental toughness and attitudes to risk-taking	105 student athletes, from a variety of sports including football, badminton, basketball, boxing, cricket, distance running, field hockey, golf, martial arts, netball, rugby, tennis, trampolining and triathlon. The sample included recreational (n = 32), club/university (n = 55), and county level athletes and above (n = 18).	105	69	65.71	36	34.29				22.2	5.3	24.6	7.7	
Crust & Swann (2010) Comparing	110 male club and university athletes who were mostly team sport players and represented 10	110	110	100				20.81	2.76	20.81	2.76			

two measures of mental toughness	sports													
Gucciardi (2010) Mental toughness profiles and their relations with achievement goals and sport motivation in adolescent Australian footballers	214 non-elite, local junior level, male Australian footballers	214	214	100			16-18 years			16.8	0.7			
Thelwell, Such, Weston, Such & Greenlees (2010) Developing mental toughness: Perceptions of elite gymnasts	10 female gymnasts, 5 from Great Britain and 5 from the United States	10			10	100	15-22 years (GB, N = 5)	18	2.90			18	2.90
							17-20 years (US, N = 5)	18.4	1.00			18.4	1.00

Table 2.2 *Detailed analysis of papers*

	Dennis (1978)	Lee et al (1994)	Shin & Lee (1994)	Fourie & Potgieter (2001)	Jones et al. (2002)	Golby et al. (2003)	Golby & Sheard (2004)	Middleton et al. (2004)	Bhambri et al. (2005)	Bull etal. (2005)	Cruct & Clough (2005)	Thelwell et al. (2005)	Golby & Sheard (2006)	Levy et al. (2006)	Crust (2007)	Golby et al. (2007)	Jones etal. (2007)	Kuan & Roy (2007)	Connaughton et al. (2008)	Connaughton et al. (2008)	Cruct (2008)	Gucciardi et al. (2008)	Mack & Ragan (2008)
Sample Size	238	519	223	C131 A160	10	70	115	263	32	12	41	C6 A43	31	70		408	15	40		7	n/a	11	261
Sample	S	S	A	C A	A	A	A	A	A	A	S	A	A	A		A	A C SP	A		A		C	A NA
Gender	NI	M & F	F	M & F	M & F	M	M	M & F	M & F	M	M	M	M & F	M & F		M & F	M & F	M & F		M & F		M	M & F
Age	NI	-	-	22/14-85/35,	31.2	18-35	18-35	13.8	12-17	-	21.0	28.2/25.2	10-24	32.5		12-63	25-60	21		M33 sd5.3		42	-
Country	USA	Korea	Korea	SA	Mix	Mix	UK	AUS	India	UK	UK	UK	UK	UK		UK	Mix	Malaysia		Mix		AUS	USA
Type of sport																							
Sport-general			X	X	X			X		X						X	X			X			
Sport-specific		X				X	X		X			X	X					X				X	
Team only						X	X			X		X										X	
Individual only		X											X					X					
Combination			X	X	X			X								X	X			X			
Not identified	X										X			X									X
Data Collection																							
Questionnaire	X	X	X	X		X	X	X	X		X		X	X		X		X					X
PPI		X	X			X	X	X	X				X			X		X					
MTQ48											X												
SMTQ																							
Other	MRS													MT18									MeBT
Interview					X					X		X					X			X		X	
Focus group					X					X							X						
Mixed-method				X	X							X					X						
Design																							
Correlational	X	X	X			X	X	X					X	X				X					
Experimental	X										X												
Quantitative	X	X	X	X	X	X	x	x	X		X	X	X	X		X	X	X					X
Qualitative				X	X					X		X					X			X		X	
Review															X				X		X		
Intervention									X														
Q dev & validation								X			X					X							X

Note: Sample – A = athlete, NA = Non-athlete, C = Coach, P = Parent, SP = Sport Psychologist, S = Students; Gender – M = male, F = female

	Nicholls et al. (2008)	Crust (2009)	Crust & Azadi (2009)	Gucciardi (2009)	Gucciardi & Gordon (2009)	Gucciardi et al. (2009a)	Gucciardi et al. (2009b)	Gucciardi et al. (2009c)	Gucciardi et al. (2009d)	Gucciardi et al. (2009)	Horsburgh et al. (2009)	Kaisler et al. (2009)	Nicholls et al. (2009)	Ryba et al. (2009)	Sheard (2009)	Sheard et al. (2009)	Connaughton et al. (2010)	Coulter et al. (2010)	Crust & Azadi (2010)	Crust & Keegan (2010)	Crust & Swann (2100)	Gucciardi (2010)	Thelwell et al. (2010)
Sample Size	677	112	103	350	16/ 9/ 570/ 433		418/ 120	75	23	11	438	482	677		49	1142	11	10	107	105	110	214	10
Sample	A	A	A	A	A C		A C P	A	A P C	C	NA	A	A		A	A	A C P	A C	A	A	A	A	A
Gender	M & F	M & F	M & F	M	M & F		M	M	M & F	M	M & F	M & F	M & F		M	M & F	M & F	M	M & F	M & F	M	M	F
Age		15-51	22.58/ 21.11	13-18	21-28, 14-39		15-30	<15		42.0	18-82	16-45	15-58		18-26	16-63	25-62	25-34, 40-47	22.6/ 22.1	22.2/ 24.6	20.81	16-18	15-22
Country	UK	UK	UK	AUS	Mix		AUS	AUS	AUS	AUS	USA	UK	UK	.	Mix	UK	Mix	AUS	UK	UK	UK	AUS	Mix
Type of sport																							
Sport-general		X	X									X				X	X		X	X	X	X	
Sport-specific				X	X		X	X	X	X					X			X					X
Team only			X	X	X		X	X	X	X					X			X			X	X	
Individual only																							X
Combination		X										X	X			X	X		X	X			
Not identified	X																						
Data Collection																							
Questionnaire	X	X		X	X		X	X			X	X	X		X	X			X		X	X	
PPI																							
MTQ48	X	X	X								X	X	X						X	X	X		
SMTQ																X					X		
Other				AfMTI	CMTI		AfMTI	AfMTI							PPI-A							AfMTI	
Interview					X				X	X							X	X					X
Focus group					X																		
Mixed-method					X																		
Design																							
Correlational	X	X	X	X	X		X	X			X	X	X		X	X			X	X	X	X	
Experimental																							
Quantitative	X	X	X	X	X		X	X			X	X	X		X	X			X	X	X	X	
Qualitative					X				X	X							X	X					X
Review						X								X									
Intervention								X															
Q dev & validation					X		X				X					X							

Note: Sample – A = athlete, NA = Non-athlete, C = Coach, P = Parent, SP = Sport Psychologist, S = Students; Gender – M = male, F = female

Appendix 3.1

RESEARCH PARTICIPANT CONSENT FORM

"When the going gets tough…"

This project is the first in a series of studies researching the way in which we cope when faced with stressors, pressures, challenges and adversities. The general expectation is that attitudes towards problems, appraisals of situations and the ways we try to cope with them can influence our well-being. Consequently, we invite adult (**minimum age 18 years**) volunteers to take part in a research study at the School of Human and Life Sciences, Roehampton University. This project, approved by Roehampton University's Ethics Board, will be performed by the principle investigator Simon Crampton, under the supervision of Professor Changiz Mohiyeddini at the School of Human and Life Sciences, Roehampton University. This study is part of a research protocol, and is not intended to provide a clinical examination of your body or a clinical evaluation in any respect.

Brief description of research project

In this study you will be asked to complete some questionnaires which are designed simply to look at normal variation in aspects of mood and personality within the population; not as tools to diagnose mental illness. All this information will be available only to the research team and treated in the strictest confidence. You will need no more than 30 minutes to complete the questionnaire.

Anonymity

In order to ensure all answers are anonymous and uphold your right to withdraw, we will ask you to write an 8-digit ID code (you can create a combination of letters and numbers as you want i.e. A1B2C3D4) on the questionnaire. Please keep this number safe (i.e. saved in your mobile) because if you later wish to withdraw from the study you will need to refer to this code when contacting the principle investigator and your data will be removed from our files although the data may still be used but in aggregate form only.

Please read the consent statement below and sign if you are willing to participate.

Consent Statement:

a. I have read and received a copy of this consent form and have been given the opportunity to ask questions. You have given me: (a) an explanation of the procedures to be followed in the project and (b) answers to enquiries I have made.

b. I understand that there may be no direct benefit to me from my participation in this study as described above.

c. I understand that my participation will not cost me anything other than the time and effort involved.

d. I understand that all personal data relating to volunteers are held and processed in the strictest confidence, in accordance with the Data Protection Act (1998). All data will be held securely in password protected computer files and locked filing cabinets.

e. I understand that I am free to withdraw from the study at any time without needing to justify my decision. I understand that this will not adversely affects my studies in anyway.

f. I understand that this study is entirely anonymous. My identity will not be recorded or passed on to anyone not involved in this study, and will be protected in the publication of any findings. Researchers involved in the study will be unaware of any links between my identity and the data collected and accordingly no individual feedback will be given.

g. I understand that it is envisaged that the results – which will be entirely anonymous – will be submitted for publication or conference presentations.

h. I confirm that I have read and understood the above and freely consent to participating in this study. I have been given adequate time to consider my participation and agree to comply with the instructions and restrictions of the study.

Name …….

Signature……

Email: ……

Date……

If you require advice, information or reassurance about a technical or health related matter, or have a concern about any other aspect of your participation, please raise this with the principal investigator Simon Crampton (email: s.crampton@roehampton.ac.uk, Telephone: 020-8392 3587), the Director of Studies Professor Changiz Mohiyeddini (email: c.mohiyeddini@roehampton.ac.uk, Telephone: 020-8392 3616) or Dean of the School of Human and Life Sciences, Mr Michael Barham (email: m.barham@roehampton.ac.uk, Telephone: 020-8392 3617) School of Human and Life Sciences, Roehampton University, Whitelands College, Holybourne Avenue, London, SW15 4JD.

PLEASE RETURN ONE CONSENT FORM WITH YOUR COMPLETED QUESTIONNIARE AND RETAIN THE OTHER FOR YOUR RECORDS

Appendix 3.2

Mental Toughness Questionniare-48

Please indicate your response to the following statements by **circling one** of the numbers, which have the following meaning;

SD = Strongly Disagree; **D** = Disagree; **N** = Neither agree nor disagree; **A** = Agree; **SA** = Strongly Agree

Please answer these items carefully, **thinking about how you are generally**. Do not spend too much time on any one item.

		Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly Agree
1	I usually find something to motivate me	SD	D	N	A	SA
2	I generally feel in control	SD	D	N	A	SA
3	I generally feel that I am a worthwhile person	SD	D	N	A	SA
4	Challenges usually bring out the best in me	SD	D	N	A	SA
5	When working with other people I am usually quite influential	SD	D	N	A	SA
6	Unexpected changes to my schedule generally throw me	SD	D	N	A	SA
7	I don't usually give up under pressure	SD	D	N	A	SA
8	I am generally confident in my own abilities	SD	D	N	A	SA
9	I usually find myself just going through the motions	SD	D	N	A	SA
10	At times I expect things to go wrong	SD	D	N	A	SA
11	"I just don't know where to begin" is a feeling I usually have when presented with several things to do at once	SD	D	N	A	SA
12	I generally feel that I am in control of what happens in my life	SD	D	N	A	SA
13	However bad things are, I usually feel they will work out positively in the end	SD	D	N	A	SA
14	I often wish my life was more predictable	SD	D	N	A	SA
15	Whenever I try to plan something, unforeseen factors usually seem to wreck it	SD	D	N	A	SA
16	I generally look on the bright side of life	SD	D	N	A	SA
17	I usually speak my mind when I have something to say	SD	D	N	A	SA
18	At times I feel completely useless	SD	D	N	A	SA
19	I can generally be relied upon to complete the tasks I am given	SD	D	N	A	SA
20	I usually take charge of a situation when I feel it is appropriate	SD	D	N	A	SA
21	I generally find it hard to relax	SD	D	N	A	SA
22	I am easily distracted from tasks that I am involved with	SD	D	N	A	SA
23	I generally cope well with any problems that occur	SD	D	N	A	SA
24	I do not usually criticise myself even when things go wrong	SD	D	N	A	SA
25	I generally try to give 100%	SD	D	N	A	SA
26	When I am upset or annoyed I usually let others know	SD	D	N	A	SA

27	I tend to worry about things well before they actually happen		SD	D	N	A	SA
28	I often feel intimidated in social gatherings		SD	D	N	A	SA
29	When faced with difficulties I usually give up		SD	D	N	A	SA
30	I am generally able to react quickly when something unexpected happens		SD	D	N	A	SA
31	Even when under considerable pressure I usually remain calm		SD	D	N	A	SA
32	If something can go wrong, it usually will		SD	D	N	A	SA
33	Things just usually happen to me		SD	D	N	A	SA
34	I generally hide my emotions from others		SD	D	N	A	SA
35	I usually find it difficult to make a mental effort when I am tired		SD	D	N	A	SA
36	When I make mistakes I usually let it worry me for days after		SD	D	N	A	SA
37	When I am feeling tired I find it difficult to get going		SD	D	N	A	SA
38	I am comfortable telling people what to do		SD	D	N	A	SA
39	I can normally sustain high levels of mental effort for long periods		SD	D	N	A	SA
40	I usually look forward to changes in my routine		SD	D	N	A	SA
41	I feel that what I do tends to make no difference		SD	D	N	A	SA
42	I usually find it hard to summon enthusiasm for the tasks I have to do		SD	D	N	A	SA
43	If I feel somebody is wrong, I am not afraid to argue with them		SD	D	N	A	SA
44	I usually enjoy a challenge		SD	D	N	A	SA
45	I can usually control my nervousness		SD	D	N	A	SA
46	In discussions, I tend to back-down even when I feel strongly about something		SD	D	N	A	SA
47	When I face setbacks I am often unable to persist with my goal		SD	D	N	A	SA
48	I can usually adapt myself to challenges that come my way		SD	D	N	A	SA

Appendix 3.3 Inter-item correlations among items of the MTQ48, means and standard deviations

Item	MT 4	MT 6	MT 14	MT 23	MT 30	MT 40	MT 44	MT 48	MT 1	MT 7	MT 11	MT 19	MT 22	MT 25	MT 29	MT 35	M 39	MT 42	MT 47	MT 21	MT 26	MT 27	MT 31	MT 34
MT4		.01	.10	.19	.19	.09	.43	.32	.22	.27	.13	.18	.09	.30	.33	.08	.22	.14	.16	.06	.05	.16	.19	-.05
MT6			.13	.14	.11	.25	.08	.15	-.05	-.01	.13	-.02	.07	.02	.11	.11	.05	.08	.09	.22	.18	.26	.12	-.01
MT14				.16	.18	.11	.12	.10	.06	.10	.13	.11	.10	.03	.14	.10	.04	.17	.22	.20	.12	.17	.12	-.03
MT23					.29	.13	.20	.30	.16	.24	.14	.15	.13	.19	.20	.14	.17	.12	.17	.16	.15	.16	.33	-.02
MT30						.17	.27	.40	.12	.23	.19	.26	.13	.23	.23	.16	.18	.15	.16	.14	-.02	.10	.35	-.03
MT40							.20	.20	.03	.02	.03	.00	-.01	.00	.10	.13	.10	-.05	.01	.11	.05	.07	.08	.05
MT44								.38	.16	.30	.12	.16	.08	.30	.36	.20	.28	.14	.12	.07	-.01	.14	.26	-.04
MT48									.18	.25	.17	.24	.10	.30	.31	.17	.25	.16	.20	.10	.01	.17	.32	.00
MT1										.19	.08	.14	.14	.25	.20	.15	.23	.21	.14	-.06	-.01	-.06	.05	-.11
MT7											.09	.17	.09	.30	.40	.17	.23	.14	.19	.02	.05	.16	.26	-.01
MT11												.11	.34	.09	.16	.23	.23	.26	.21	.21	.07	.22	.14	-.10
MT19													.19	.26	.22	.16	.16	.19	.13	-.06	-.01	.01	.15	-.04
MT22														.24	.16	.25	.20	.26	.15	.07	.03	.04	.08	-.04
MT25															.30	.16	.30	.25	.21	-.02	.00	.03	.14	-.10
MT29																.22	.23	.29	.33	.12	.10	.19	.24	-.07
MT35																	.30	.20	.20	-.03	.06	.13	.11	-.09
MT39																		.14	.14	-.01	.01	.09	.25	-.05
MT42																			.30	.11	.04	.11	.05	-.10
MT47																				.10	.04	.16	.13	-.17
MT21																					.07	.37	.24	-.08
MT26																						.17	.12	.33
MT27																							.34	.03
MT31																								.11
MT34																								
MT37																								
MT45																								
MT2																								
MT5																								
MT9																								
MT12																								
MT15																								
MT33																								
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MT16																								
MT18																								
MT24																								
MT32																								
MT36																								
MT17																								
MT20																								
MT28																								
MT38																								
MT43																								
MT46																								
M	4.08	3.12	3.35	3.59	3.68	3.32	4.15	3.89	4.03	3.98	3.04	4.04	3.06	4.20	4.08	2.69	3.36	3.48	3.49	3.48	2.94	2.69	3.52	3.18
SD	.77	.98	1.03	.71	.69	.91	.66	.60	.63	.87	1.09	.67	1.03	.81	.81	.98	.92	.88	.92	1.15	1.12	1.13	.87	1.09

(Continued)

Item	MT 37	MT 45	MT 2	MT 5	MT 9	MT 12	MT 15	MT 33	MT 41	MT 3	MT 8	MT 10	MT 13	MT 16	MT 18	MT 24	M 32	MT 36	MT 17	MT 20	MT 28	MT 38	MT 43	MT 46
MT4	.08	.19	.27	.28	.11	.22	.13	.09	.18	.25	.24	.18	.22	.21	.19	-.02	.16	.17	.11	.22	.11	.25	.10	.14
MT6	.08	.10	.11	.04	.04	.11	.18	.10	.06	.08	.11	.10	.07	.11	.16	.05	.14	.26	.04	-.01	.13	-.00	.01	.12
MT14	.06	.09	.16	.09	.16	.20	.38	.15	.20	.13	.12	.15	.13	.20	.27	-.01	.25	.24	.15	.06	.16	.11	.13	.25
MT23	.08	.29	.26	.09	.07	.28	.14	.06	.20	.20	.34	.17	.28	.32	.26	.07	.17	.23	.13	.21	.11	.18	.08	.15
MT30	.14	.25	.20	.18	.09	.22	.12	.06	.16	.09	.28	.10	.23	.23	.15	.03	.07	.17	.17	.19	.13	.18	.16	.15
MT40	.06	.09	.08	.06	-.07	.15	.01	-.11	-.05	.09	.15	-.01	.09	.14	-.01	.08	-.01	.12	.09	.08	.09	.07	.10	.00
MT44	.15	.28	.24	.24	.09	.19	.08	.05	.16	.22	.24	.18	.19	.29	.13	-.04	.16	.17	.19	.17	.16	.21	.24	.17
MT48	.18	.18	.27	.23	.16	.31	.15	.01	.19	.25	.33	.15	.30	.29	.13	.04	.10	.16	.17	.25	.16	.22	.18	.17
MT1	.09	.05	.26	.09	.10	.23	.16	.08	.12	.17	.15	.06	.16	.19	.12	-.05	.15	.05	.09	.08	.03	.05	.02	.02
MT7	.18	.24	.20	.20	.15	.17	.05	.07	.17	.20	.26	.11	.16	.25	.21	-.01	.07	.18	.17	.17	.14	.22	.09	.10
MT11	.25	.12	.16	.09	.26	.20	.23	.13	.19	.06	.14	.26	.07	.15	.29	.01	.24	.19	.05	.07	.15	.04	.05	.19
MT19	.09	.05	.18	.11	.12	.6	.05	.04	.12	.14	.07	-.01	.10	.09	.10	-.04	.06	.02	.08	.30	.07	.08	.02	.06
MT22	.17	.01	.12	.02	.14	.12	.20	.10	.15	.08	.06	.13	.01	.06	.20	-.07	.23	.15	-.00	.07	.00	-.03	-.03	.06
MT25	.17	.11	.18	.11	.13	.19	.05	.04	.19	.13	.21	.15	.13	.23	.16	-.10	.13	.10	.06	.14	-.00	.10	.01	.06
MT29	.21	.21	.22	.17	.10	.17	.11	.16	.20	.23	.24	.12	.19	.20	.22	-.05	.21	.18	.09	.14	.22	.11	.12	.18
MT35	.51	.18	.08	.10	.08	.12	.11	.03	.13	.06	.13	.15	.07	.09	.16	.00	.11	.19	.07	.11	.07	.09	.06	.07
MT39	.28	.20	.27	.12	.12	.23	.14	.09	.14	.24	.25	.18	.15	.20	.22	.08	.20	.14	.15	.13	.07	.17	.04	.01
MT42	.22	.12	.13	.10	.23	.18	.20	.20	.39	.13	.11	.18	.18	.19	.22	-.02	.27	.17	.05	.12	.16	.05	-.03	.13
MT47	.16	.13	.12	.16	.19	.14	.19	.23	.28	.13	.18	.21	.15	.16	.22	-.03	.25	.14	.05	.13	.17	.11	.12	.24
MT21	.03	.18	.18	.03	.06	.21	.20	.15	.18	.19	.20	.14	.10	.21	.20	.05	.27	.31	.02	.01	.27	.03	.09	.14
MT26	.04	.10	.04	-.07	.00	.03	.13	.07	.01	-.05	-.02	.08	.02	.02	.08	.01	.09	.17	-.19	-.06	.01	-.11	-.23	-.00
MT27	.19	.29	.17	.13	.06	.18	.19	.14	.15	.17	.26	.26	.18	.16	.33	.17	.27	.50	.12	.08	.33	.06	.11	.18
MT31	.17	.41	.32	.12	.08	.21	.06	-.01	.10	.26	.33	.14	.26	.25	.18	.09	.17	.27	.15	.11	.17	.12	.11	.15
MT34	-.03	-.02	-.06	-.15	-.11	-.11	-.12	-.16	-.14	-.05	-.03	-.15	-.06	-.09	-.13	.06	-.14	-.04	-.16	-.07	-.13	-.13	-.10	-.13
MT37		.24	.18	.09	.06	.14	.10	.04	.12	.14	.14	.14	.12	.12	.18	.03	.15	.23	.03	.07	.11	.06	.03	.06
MT45			.28	.13	.12	.18	.10	.14	.14	.20	.39	.24	.21	.21	.26	.05	.19	.28	.15	.12	.27	.29	.19	.13
MT2				.19	.16	.35	.22	.12	.27	.47	.38	.17	.25	.26	.24	.07	.24	.27	.21	.16	.19	.19	.07	.18
MT5					.07	.14	.13	.03	.16	.22	.16	.13	.13	.22	.11	.07	.14	.13	.25	.29	.22	.40	.15	.23
MT9						.13	.25	.25	.20	.12	.14	.21	.10	.10	.18	-.08	.15	.08	.09	.06	.02	.09	.11	.18
MT12							.22	.14	.25	.33	.31	.18	.31	.33	.23	.02	.26	.23	.19	.18	.17	.16	.13	.20
MT15								.35	.28	.10	.10	.25	.05	.14	.31	-.01	.39	.23	.12	.12	.20	.09	.06	.20
MT33									.21	.10	.13	.19	.14	.11	.24	.03	.38	.20	.05	-.04	.17	.06	.05	.12
MT41										.28	.23	.21	.20	.24	.36	.00	.30	.22	.16	.19	.23	.19	.16	.29
MT3											.40	.21	.29	.26	.27	.13	.22	.22	.18	.17	.21	.22	.14	.17
MT8												.23	.31	.29	.28	.07	.20	.32	.24	.18	.20	.25	.20	.16
MT10													.11	.16	.29	.07	.34	.26	.12	.12	.21	.16	.07	.20
MT13														.44	.15	.13	.18	.22	.14	.09	.08	.04	.03	.08
MT16															.23	.12	.22	.22	.19	.10	.17	.10	.12	.15
MT18																.10	.32	.32	.15	.15	.29	.18	.13	.19
MT24																	.02	.18	.07	.03	.0	.04	-.01	-.03
MT32																		.33	.11	.09	.21	.11	.07	.26
MT36																			.11	.07	.26	.08	.09	.19
MT17																				.28	.27	.28	.41	.34
MT20																					.19	.36	.21	.22
MT28																						.30	.29	.33
MT38																							.38	.31
MT43																								.35
MT46																								
M	2.59	3.37	3.93	3.57	3.06	3.83	3.26	3.21	3.62	4.05	3.87	2.71	3.80	3.94	3.43	2.46	3.35	2.97	3.67	3.87	3.56	3.50	3.56	3.57
SD	.97	.98	.65	.79	.90	.80	.93	.89	.81	.69	.81	.95	.84	.79	1.02	1.01	.92	1.15	.97	.77	1.07	.95	.99	1.07

Appendix 4.1 *The Researchers Stance*

The Researchers Stance

Personal History

My personal perspectives on mental toughness began to take shape early in my adolescent years. Throughout my life, my parents have always been immensely supportive and from an early age instilled solid principles in my approach to any of my endeavours. Throughout this upbringing they would always emphasise the importance of disciplined hard work and perseverance. When it came to trying new things or facing new challenges, whether in the form of physical confrontations, scholastic endeavours or experiencing setbacks or disappointments, my parents discouraged avoidance behaviours of any kind and actively encouraged a continued pursuit, which fuelled a determination to succeed.

During my early childhood years, I recall being driven on by a burning desire to be the best in everything that I did and frequently demonstrated my ascendancy in a variety of academic disciplines in school and in various sports, notably cricket where I frequently played above my peer group. Nevertheless, I would often believe that I lacked the necessary pre-requisites or “skills” needed to achieve my goals and overcome various challenges. Inherent in many of my endeavours was an underlying belief of inadequacy, nevertheless one coupled with a desire to improve. Influential in these years was the observation of my sister who appeared to face similar challenges with significant ease, almost dismissive of the tasks in hand. In comparison, where I believed I had to expend maximal effort, time and concentration from start to finish to achieve a seemingly ‘acceptable’ result, she would expend no obvious time, effort or care to her work and would always deliver exceptionally. Subsequently, I felt I was often unable to fulfil my parents, teachers and coaches expectations. These insecurities were met with an inherent fear of failure, timid nervousness around uncertainty and a sense of worry of letting my family and those around me (i.e. teammates) down.

My consequential attempts to deal with the childhood insecurities resulted in me exerting every effort and attention to a task, be it sporting, academic or social, in order not to appear lacking in competence or demonstrate any obvious signs of inferiority. Whilst these maladaptive perceptions may have created some undue tension and apprehension, they did assist in

developing a meticulous approach to preparation, a thirst for knowledge and understanding, a competitive nature, as well as a strong desire and determination to succeed and make the most of my abilities. I also began to appreciate that there are more ways than one to be successful in the pursuit of goals and that success was potential more to do with character and attitude than just skill or ability.

As I grew older and began to develop physically, so too did my passions for sport and my confidence in my ability to deliver performances and results on a consistent basis. My growing understanding of myself became apparent in my advanced maturity in relation to my peers which allowed me to focus closely on my aspirations without fear of judgement and ridicule. Whilst there were common social pressures around me in the guise of friends, relationships and other distractions away from my sport, I was able to rebuff their advances and remained focused on my sport and academic aspirations, striking what I believe was a health balance of the two. This early identification of my passions, my aspirations and the growing sense of self-belief and self-confidence, in turn provided me with a greater sense of significance, self-esteem and self-worth.

In this period, my parents were highly active in providing me with the exposure to additional opportunities in the form of training and playing experiences and encouraging me to move to a school with a combined focus on academic and sporting excellence. In general, this provided a backdrop to new challenges in the sense that the school was academically challenging and sport was an important vehicle for personal development. As a result I would be stretched in both domains but felt I had the necessary support and environment in which to not only manage the demands, but also to thrive. More specifically, my parents were highly instrumental in providing me with the cognitive and affective strategies that I needed to withstand such demands and difficult challenges. If it wasn't for the experiences and resources provided by my parents, my struggle with self-consciousness and wavering confidence may have continued to dominate my developmental years.

Accompanying the increased confidence and passion for my endeavours, came with them the increased sense of independence and responsibility. Early into my teenage years I began working part-time as a coach. This soon became a valuable vehicle for me to continue my pursuit in sport, giving me an increased insight into my game and the requirements at the elite level. Once

more, it presented the opportunity to part-fund a season abroad following my A-levels. The experience of living abroad was a significant influence on my personal development as it was the culmination of two years of hard work and dedication, and provided the exposure to a tough climate, culture and experience that enabled me to mature in a number of ways. Along with the cognitive and affective skills I had developed as a result of my parental influence, this experience facilitated the development of a toughness from a physical and social perspective. The rigors of looking after myself in a new country and culture, the increased independence and self-reliance, along with the personal responsibility, social interactions and sporting challenges I faced, were all instrumental in developing a more robust and deeper rooted sense of self-esteem. Living abroad brought with it an unavoidable need for added maturity given the challenges of fending for oneself in a foreign country, over a days' travel away from home. What is more, the exposure to a tough cultural environment whereby as the overseas professional there were considerable expectations and pressures to perform, I had to develop a robust and tougher outlook to my sport as well as my own personal character and upkeep.

As a result of my prior experiences, I have developed a personal opinion that a number of factors are important to the development of mental toughness which include but are not limited to; a person's attitude, the presence of a high work ethic, and the exposure to both physically and mentally demanding challenges. My early childhood experiences suggest the significant influence of attitudes and mindset and the resultant behaviour that is demonstrated in relation to a task. My teenage experiences implicate the importance of maturity and independence in further developing a desire to achieve ones goals as well as the operation of efforts to achieve such goals. Without disregarding the importance of the previous experiences and influences, the most significant aspect of the toughening process was however expressed as the exposure to, and experience of, physical and mental challenges and adversities with the emphasis placed on the development of cognitive, affective and behaviour strategies to overcome such challenges.

From a researchers standpoint, my childhood experience may influence me to more readily identify with attributes such as a high work ethic, perseverance and resilience, or processes such as the exposure to tough challenges and adversity, as being central to the phenomenon of mental toughness. In this instance, it is possible that this viewpoint may influence my interpretation and

understanding of the literature and the results. Consequently, I must ensure not make the assumption that attributes, are or are not, related to mental toughness based on the outcomes of my own personal experiences. Instead, I must use direct sources and seek to employ strategies to provide greater clarification through the triangulation of data, and interpretation of my resulting conceptualisation using external validations such as other psychologists (research and applied focused), coaches and athletes for which it is intended.

Demographics

Various demographical categories are relevant to this investigation. I am a 26-year-old male from Mexborough, South Yorkshire, who has grown up in the south-west suburbs of Outer-London. My parents are retired teachers, who taught at a local state school throughout my primary, secondary and Higher Education (Undergraduate) years. As an infant, I attended a Church of England school at primary level, moved to the local state school for my secondary school years (11-16 years) before attending a state Grammar school for the sixth form (16-18 years). These demographic traits define an upbringing that has been exposed to traditional teaching and middle-class social influences and one that has experienced a rapid mobilisation of technology and increased availability of everyday commodities akin with 21st century commercialisation.

Whilst my upbringing was built on the basic principles that anything worthwhile is worth working and waiting for, I now find myself immersed in a super-sonic, instant access generation whereby services and information are disseminated worldwide in fractions of a second. An era now dominated by social networking, media invasion and cash flow monopoly. This holds relevance to the nature in which I perceive mental toughness to develop and the services the findings of this study may provide. With speed and outcome delivery such an everyday necessity, there may be the influence for the outcome of the study to reflect these tendencies whereby the accuracy of a measure needs to be all encompassing and definitive and for development programs or strategies to be fast acting and notably effective. Currently there is a longing from athletes, coaches and practitioners alike, for assessment protocols to assist in the identification of potentially talented and ‘at-risk’ groups, likewise there is a growing demand for effective development strategies to enhance these levels of mental toughness. Whilst considered a much sought after commodity in sport, it is important to acknowledge these pressures and convey that the development of

conceptualisations, assessment methods and development strategies must remain distinct from these external influences.

My education is undoubtedly an influence on the manner in which I perceive the underlying constructs of mental toughness attributes. It may also determine how I perceive the importance of various attributes and persuade the argument for the inclusion of one over the other in a conceptualisation. My preconceptions have the potential to guide the way I identify factors as well as influence the interpretation of results. Based on my academic studies of sport psychology at undergraduate and postgraduate levels for example, I believe mental toughness to be associated with the attainment of elite performance and is responsible, in some part, for why individuals are successful at the highest level and others are not. When two individuals or teams are evenly matched in terms of physical, technical and tactical expertise, it is the mentally tougher of the two that is most likely to return victorious. This outcome perspective on mental toughness as a construct may influence the way in which the concept proposed is framed. Whilst current perspectives my share this outlook (Jones et al., 2002), others would suggest otherwise (Gucciardi et al., 2008) therefore it is important to remain non-judgmental in the evaluation of resources elicited in the development of a new conceptual model. My overall understanding of the construct is that it is multidimensional in nature, comprised of attributes that broadly fall into the following categories; confidence, motivation, focus, and coping. These assertions present a potential bias towards the literature and must be acknowledged in the development of theory or interpretations of results.

Alongside this research programme, I am also pursuing Accreditation through the British Association of Sport and Exercise Science (BASES) which may hold some influence over my perceptions of mental toughness. Here I am undergoing a period of Supervised Experience whereby I am providing psychological support services to a variety of athletes across a number of sports. My applied practice is supervised by Dr Wil James, a co-author of a study into mental toughness in cricket (Bull et al., 2005) who is employed by Lane4, the company founded by a key author in the mental toughness literature, Professor Graham Jones (Jones et al., 2002; 2007; Connaughton et al., 2008, 2010). These experiences and interactions also present a potential influence on the lens through which I analyse and present my findings and thus are acknowledged.

Whilst this dual role may appear to be a conflict of interests, it may also be a strength to the research programme with the overarching aim being to produce theoretically driven research to provide a guide for measurement development and future applied practice.

Personal beliefs

As cognitive behavioural psychologists would suggest, we all have rules by which we live our lives. Although they aren't specifically taught rules, we learn them through our early life experiences and from observing other people who influence us. With this in mind, I may have a number of rules or personal beliefs that may influence my position on mental toughness that are worthy of bringing to the readers attention. These include but are not limited to the beliefs; that we should constantly strive to improve, that it is good to be successful in what you do, that failure is part of the learning process, that rules are there to be followed, that standards are there to be upheld and nothing good ever came easy.

In my opinion, our personalities, personal values and core beliefs shape the kind of people that we are and therefore influence the way in which we operate in our day-to-day lives. Our rules, values and beliefs therefore may serve to either facilitate or impede the growth of an individual's level of mental toughness. From my personal experiences I feel that the environment in which we live in plays a crucial role in the development of these values and beliefs. As a result I consider that mental toughness can be developed or inhibited by the type of environment we live in, the social interactions we have and the exposures and experiences we are exposed to throughout our lives. For example, I see that the people that surround us, influence us and act as important role models to us shape the way in which we interpret events, approach situations and manage the challenges and obstacles we face. Importantly however, I believe that it is the exposure to these challenges, adversities and setbacks, which are so fundamental to the development of these key characteristics such as perseverance, commitment, the determination to succeed, and the insatiable desire to achieve ones goals., commonly associated with mental toughness.

Appendix 4.2 Key components identified in meta-interpretation procedure

Attribute	Definition	Category	Source	Open Coding	Axial Coding	Selective Coding
Motivational level	The ability of the athlete to show perseverance, determination, desire, responsibility and commitment		Fourie & Potgieter (2001)	perseverance, determination, desire, responsibility, commitment	Motivation, Discipline	Desire, Discipline
Coping skills	the ability of the athlete to reveal his/her coping ability, demonstrate composure, acceptance, activation control and adaptability		Fourie & Potgieter (2001)	coping ability, composure, acceptance, activation control, adaptability	Coping skills	Affective Intelligence
Confidence maintenance	the ability to reveal competence, self-confidence and attitude		Fourie & Potgieter (2001)	Competence, self-confidence, attitude	Confidence	Self-belief
Cognitive skill	the ability to concentrate, focus and think, make decisions and analyse		Fourie & Potgieter (2001)	Concentration, focus, decision making	Focus, Decision-making	Attention Control
Discipline and goal-directedness	the ability of the athlete to display discipline, a goal-orientation and idealism.		Fourie & Potgieter (2001)	Discipline, goal orientation, idealism	Discipline, Motivation	Discipline
Competitiveness	the ability to display the appearance of a winner, maintain consistent performance, reveal a high competitive level and big match temperament		Fourie & Potgieter (2001)	Winner, Consistent performance, high competitive level, temperament	Competitiveness, Temperament	Challenge Mindset
Possession of prerequisite physical and mental requirements	the ability of the athlete to display strong physical and mental conditioning, an ability to cope with pain and to demonstrate self-sacrifice		Fourie & Potgieter (2001)	Conditioning, cope with pain, sacrifice	Physical toughness, Coping, Sacrifice	Physical Toughness
Team unity	the ability of the athlete to reveal respect, team cohesion and relationship skills.		Fourie & Potgieter (2001)	Respect, Cohesion, Relationship skills	Team unity	
Preparation skills	the ability of the athlete to display balance, balanced preparation and visualisation.		Fourie & Potgieter (2001)	Balance, Preparation, Visualisation	Preparation	Discipline
Psychological hardiness	the ability of the athlete to reveal a strong personality, emotional and psychological well-being to take charge and show autonomy.		Fourie & Potgieter (2001)	Strong personality, Well-being, take charge, autonomy	Attitude, well-being, leadership	Discipline
Religious convictions	the religious beliefs of the athlete.		Fourie & Potgieter (2001)	Religious beliefs	Values	Discipline
Ethics	the athlete's sense of righteousness.		Fourie & Potgieter (2001)	Righteousness	Values	Discipline
Self-belief	*Having an unshakable self belief in your ability to achieve your competition goals*		Jones, Connaughton & Hanton (2002)	Self-belief in abilities	Self-belief	Self-belief

Bouncing back	*Bouncing back from performance set-backs as a result of increased determination to succeed*		Jones, Connaughton & Hanton (2002)	Bounce back from setbacks, determination	Bouncing back	Resilience
Self-belief in abilities	*Having an unshakable self-belief that you possess unique qualities and abilities that make you better than your opponents*		Jones, Connaughton & Hanton (2002)	Self-belief in unique qualities	Self-belief	Self-belief
Desire	*Having an insatiable desire and internalized motives to succeed.*		Jones, Connaughton & Hanton (2002)	Desire, internal motives	Motivation	Desire
Focused - task	*Remaining fully focused on the task at hand in the face of competition specific distractions*		Jones, Connaughton & Hanton (2002)	Focused on task	Focus	Attention Control
Regain control	*Regaining psychological control following unexpected, uncontrollable events*		Jones, Connaughton & Hanton (2002)	Psychological control	Control, Coping	Affective Intelligence
Toughness	*Pushing back the boundaries of physical and emotional pain, while still maintaining technique and effort under distress in training and competition.*		Jones, Connaughton & Hanton (2002)	Cope with pain, technique and effort	Physical toughness, Coping	Physical Toughness
Accept anxiety	*Accepting that competition anxiety is inevitable and knowing that you can cope with it*		Jones, Connaughton & Hanton (2002)	Accept anxiety	Attitude - appraisal, Coping, Control	Affective Intelligence
Focused - comp	*Not being adversely affected by others' good and bad performances*		Jones, Connaughton & Hanton (2002)	Not affected by others	Focus, Control	Attention Control / Affective Intelligence
Thrive on pressure	*Thriving on the pressure of competition*		Jones, Connaughton & Hanton (2002)	Thrive on pressure	Challenge	Challenge Mindset
Focused - life	*Remaining fully-focused in the face of personal life distractions*		Jones, Connaughton & Hanton (2002)	Focused - life distractions	Focus	Attention Control
Switch on/off	*Switching a sport focus on and off as required*		Jones, Connaughton & Hanton (2002)	Switch on/off	Balance, Focus,	Attention Control
(Tough Character)	*Independence*	Personal Responsibility	Bull, Shambrook, James & Brooks (2005)	Independence	Discipline	Discipline
(Tough Character)	*Self-reflection*	Personal Responsibility	Bull, Shambrook, James & Brooks (2005)	Reflection	Self & sport/game awareness,	Sport Intelligence
(Tough Character)	*Competitiveness with self as well as others*	Personal Responsibility	Bull, Shambrook, James & Brooks (2005)	Competitiveness	Competitiveness	Challenge Mindset
(Tough Attitudes)	*Exploiting learning opportunities*	Personal Responsibility	Bull, Shambrook, James & Brooks (2005)	Exploit learning	Discipline, Resilience, Sport Intelligence	Sport Intelligence

(Tough Attitudes)	*Belief in quality preparation*	Personal Responsibility	Bull, Shambrook, James & Brooks (2005)	Preparation	Values, Discipline	Discipline
(Tough Attitudes)	*Self-set challenging targets*	Personal Responsibility	Bull, Shambrook, James & Brooks (2005)	Set-set target	Discipline, Challenge	Discipline
(Tough Attitudes)	*"Never say die" mindset*	Dedication and commitment	Bull, Shambrook, James & Brooks (2005)	Relentless mindset	Challenge	Challenge Mindset
(Tough Attitudes)	*"Go the extra mile" mindset*	Dedication and commitment	Bull, Shambrook, James & Brooks (2005)	Dedication, Commitment,	Commitment, Discipline	Discipline
(Tough Attitudes)	*Determination to make the most of ability*	Dedication and commitment	Bull, Shambrook, James & Brooks (2005)	Determination	Determination	Desire
(Tough Character)	*Resilient confidence*	Belief	Bull, Shambrook, James & Brooks (2005)	Resilient confidence	Confidence	Self-belief
(Tough Attitudes)	*Belief in making the difference*	Belief	Bull, Shambrook, James & Brooks (2005)	Belief	Belief, Influential	Self-belief
(Tough Thinking)	*Robust self-confidence - overcoming self-doubt*	Belief	Bull, Shambrook, James & Brooks (2005)	Self-belief to achieve	Self-confidence, resilience	Resilience
(Tough Thinking)	*Robust self-confidence* - feeding off physical condition	Belief	Bull, Shambrook, James & Brooks (2005)	Self belief in abilities		Self-belief
(Tough Thinking)	*Robust self-confidence* - maintain self-focus	Belief	Bull, Shambrook, James & Brooks (2005)	Focused on self	Focus	Attention Control
(Tough Attitudes)	*Thriving on competition*	Coping with pressure	Bull, Shambrook, James & Brooks (2005)	Thrive on competition	Challenge	Challenge Mindset
(Tough Attitudes)	*Willing to take risks*	Coping with pressure	Bull, Shambrook, James & Brooks (2005)	Risk	Challenge, Sport/game intelligence	Challenge Mindset
(Tough Thinking)	*Thinking clearly - Good decision making*	Coping with pressure	Bull, Shambrook, James & Brooks (2005)	Clear thinking, decision making	Decision making	Affective Intelligence

(Tough Thinking)	*Thinking clearly - Keeping perspective*	Coping with pressure	Bull, Shambrook, James & Brooks (2005)	Perspective	Control	Sport intelligence
(Tough Thinking)	*Thinking clearly - Honest self-appraisal*	Coping with pressure	Bull, Shambrook, James & Brooks (2005)	Appraisal	Discipline	Discipline
	Having total self-belief at all times that you will achieve success		Thelwell, Weston & Greenlees (2005)	Self-belief to achieve	Self-belief	Self-belief
	Wanting the ball at all times (when playing well and not so well).		Thelwell, Weston & Greenlees (2005)	Wanting the ball	Challenge	Challenge Mindset
	Having the ability to react to situations positively.		Thelwell, Weston & Greenlees (2005)	React positively	Coping, Resilience	Resilience
	Having the ability to hang on and be calm under pressure.		Thelwell, Weston & Greenlees (2005)	Calm under pressure	Coping, Control	Affective Intelligence
	Knowing what it takes to grind yourself out of trouble.		Thelwell, Weston & Greenlees (2005)	Knowing what it takes	Game/Sport Intelligence	Sport Intelligence
	Having the ability to ignore distractions and remain focused.		Thelwell, Weston & Greenlees (2005)	Ignore distractions, remain focused	Focus, Control	Attention Control
	Controlling emotions throughout performance.		Thelwell, Weston & Greenlees (2005)	Control emotions	Control, regulate emotion	Affective Intelligence
	Having a presence that affects opponents		Thelwell, Weston & Greenlees (2005)	Presence	Belief, Influential	Self-belief
	Having everything outside of the game in control		Thelwell, Weston & Greenlees (2005)	Control of lifestyle	Lifestyle balance, control	Discipline
	Enjoying the pressure associated with performance		Thelwell, Weston & Greenlees (2005)	Enjoy performance pressure	Challenge	Challenge Mindset
Belief	*Having an unshakable self-belief as a result of total awareness of how you got to where you are now*		Jones, Connaughton & Hanton (2007)	self-belief, awareness	Self-belief, sport/game awareness	Self-belief
	Having an inner arrogance that makes you believe that you can achieve anything you set your mind to		Jones, Connaughton & Hanton (2007)	Inner arrogance, believe can achieve	Belief, Influential	Self-belief
	Having the belief that you can punch through any obstacle people put in your way		Jones, Connaughton & Hanton (2007)	Belief, overcome obstacles	Belief, Resilience	Self-belief
	Believing that your desire or hunger will ultimately result in you fulfilling your potential		Jones, Connaughton & Hanton (2007)	Belief in desire	Belief, desire	Self-belief, Desire
Focus	*Refusing to be swayed by short-term gains (financial, performance) that will jeopardize the achievement of long-term goals*		Jones, Connaughton & Hanton (2007)	Long term goals	Focus, Discipline	Discipline

	Ensuring that achievement of your sport's goal is the number-one priority in your life		Jones, Connaughton & Hanton (2007)	number one priority	Desire, Discipline, Focus	Discipline
	Recognise the importance of knowing when to switch on and off from your sport		Jones, Connaughton & Hanton (2007)	Switch on/off	Game/Sport Intelligence, Balance, Focus	Attention Control
Using long term goals as the source of motivation	*When training gets tough (physically and mentally) because things are not going your way, keeping yourself going by reminding yourself of your goals and aspirations and why you're putting yourself through it*	Training	Jones, Connaughton & Hanton (2007)	Keep yourself going, reminder of goals and aspirations	Resilience, desire	Resilience
	Having the patience, discipline and self-control with the required training for each specific developmental stage to allow you to reach your full potential		Jones, Connaughton & Hanton (2007)	Patience, disciplines, self-control	Discipline, control	Discipline
Controlling the environment	*Remaining in control and not controlled*		Jones, Connaughton & Hanton (2007)	Control	Control	Affective Intelligence
	Using all aspects of a very difficult training environment to your advantage		Jones, Connaughton & Hanton (2007)	Using training environment	Sport/Game intelligence	Sport Intelligence
Pushing yourself to the limit	*Loving the bits of training that hurt*		Jones, Connaughton & Hanton (2007)	Loving training,	Pushing to limits, Training ethic	Discipline
	Thriving on opportunities to beat other people in training		Jones, Connaughton & Hanton (2007)	Thriving in training	pushing to limits, Challenge	Challenge Mindset
Handling pressure	*Loving the pressure of competition*	Competition	Jones, Connaughton & Hanton (2007)	Enjoy competition pressure	Challenge	Challenge Mindset
	Adapting to and coping with any change/distraction/threat under pressure		Jones, Connaughton & Hanton (2007)	Adaption, coping under pressure	Control of focus, Coping	Attention Control
	Making the correct decisions and choosing the right options that secure optimal performance under conditions of extreme pressure and ambiguity		Jones, Connaughton & Hanton (2007)	Correct decisions, right options,	Decision-making,	Sport Intelligence
	Coping with and channelling anxiety in pressure situations		Jones, Connaughton & Hanton (2007)	Coping with anxiety, Channelling anxiety	Coping, Control	Affective Intelligence
Belief	*Total commitment to your performance goal until every possible opportunity of success has passed*		Jones, Connaughton & Hanton (2007)	Total commitment	Desire, Discipline, Focus	Discipline
	Not being fazed by making mistakes and then coming back from then		Jones, Connaughton & Hanton (2007)	Not fazed by mistakes, coming back from mistakes	Challenge, Resilience	Challenge Mindset / Resilience
Regulating performance	*Having a killer instinct to capitalise on the moment when you know you can win*		Jones, Connaughton & Hanton (2007)	Killer instinct	Belief, Influential, game awareness	Sport Intelligence
	Raising your performance "up a gear" when it matters most		Jones, Connaughton & Hanton (2007)	Raising performance	Regulate performance	Sport Intelligence
Staying focused	*Totally focusing on the job at hand in the face of distraction*		Jones, Connaughton & Hanton (2007)	Totally focused	Focus	Attention Control

	Remaining committed to a self-absorbed focus despite external distractions		Jones, Connaughton & Hanton (2007)	Committed, self absorbed focus	Commitment, Focused	Discipline, Attention Control
	In certain performances, remaining focused on processes and not solely outcomes		Jones, Connaughton & Hanton (2007)	Process focused	Focus	Attention Control
Awareness and control of thoughts and feelings	*Being acutely aware of any inappropriate thoughts and feelings and changing them to help perform optimally*		Jones, Connaughton & Hanton (2007)	Aware of thoughts and feelings, changing thoughts and feelings to facilitate performance	Affective awareness, Affective control	Affective Intelligence
Controlling the environment	*Using all aspects of a very difficult competition environment to your advantage*		Jones, Connaughton & Hanton (2007)	Using training environment	Sport/Game intelligence	Sport Intelligence
Handling failure	*Recognising and rationalising failure and picking out the learning points to take forward*	Post-competition	Jones, Connaughton & Hanton (2007)	Recognising and rationalising failure, taking forward learning points	Handling and rationalise failure, Learning from mistakes	Resilience
	Using failure to drive yourself to further success		Jones, Connaughton & Hanton (2007)	Using failure to drive success	Handling failure, Resilience, Challenge	Challenge Mindset, Resilience
Handling success	*Knowing when to celebrate success and then stop and focus on the next challenge*		Jones, Connaughton & Hanton (2007)	Celebrate success, Focus on next challenge	Handling success, Discipline	Discipline
	Knowing how to rationally handle success		Jones, Connaughton & Hanton (2007)	Rationally handle success	Handling success, Discipline	Discipline
1. Self-belief	*Self-belief in your mental and physical ability under pressure and in your ability to persevere and overcome any obstacle and/or challenge that you may face during your football career*		Gucciardi, Gordon & Dimmock (2008)	Self-belief in ability, persevere, overcome obstacle and challenge	Self-belief, Challenge	Self-belief
2. Worth ethic	*A philosophy characterised by always working hard and pushing yourself through (physically and mentally) demanding situations in competition, training and preparation to achieve your goals and vision*		Gucciardi, Gordon & Dimmock (2008)	Working hard, pushing yourself, philosophy, vision	work ethic, pushing yourself, discipline	Discipline
a. Determination	*An unbelievable determination to succeed, never giving up and endeavouring to be the best you can be*		Gucciardi, Gordon & Dimmock (2008)	Determination to succeed, never giving up, endeavouring	Drive, Determination, Discipline	Discipline
b. Perseverance	*The ability to persevere when faced with adversities and challenges both on and off the field to achieve your goals*		Gucciardi, Gordon & Dimmock (2008)	Perseverance	Perseverance	Discipline
c. Goals	*Identifying your goals, what needs to be done to achieve those goals and adjusting (re-shaping) those goals when faced with an obstacle or adversity*		Gucciardi, Gordon & Dimmock (2008)	Identifying goals, adjusting goals	Drive, Determination, Discipline	Desire

d. Meticulous preparation	*Doing everything in your preparation and leaving no stone unturned to ensure that you are prepared mentally and physically*		Gucciardi, Gordon & Dimmock (2008)	Preparation	Preparation, Discipline	Discipline
e. Time-management	*Managing your time efficiently to balance he many demands associated with elite football to get the very best out of yourself*		Gucciardi, Gordon & Dimmock (2008)	Time management, balance	Self-management, commitment, discipline	Discipline
f. Inspirational	*Having the ability to let your actions speak louder than words and inspire your teammates*		Gucciardi, Gordon & Dimmock (2008)	Inspirational	Inspirational, Influence others	Discipline
3. Personal Values	*Placing great importance and significance on personal values relevant to one becoming a better person and athlete*		Gucciardi, Gordon & Dimmock (2008)	Strong personal values	Strong personal values	Discipline
a. Honesty	*Taking an honest stance when self-appraising your own performances and not making excuses when you do perform poorly*		Gucciardi, Gordon & Dimmock (2008)	Honest self-appraisal, No excuses	Strong personal values	Discipline
b. Pride in performance	*Personal pride in your preparation, and training and competitive performances*		Gucciardi, Gordon & Dimmock (2008)	Pride in preparation and performance	Strong personal values	Discipline
c. Accountability	*Taking ownership and responsibility for your behaviour and not making excuses for poor performances*		Gucciardi, Gordon & Dimmock (2008)	Ownership, Accountability, no excuses	Strong personal values	Discipline
4. Self-motivated	*A internal motivation and desire for competitive challenges and team success, and also having the desire to put the necessary things into practice to achieve your vision of success*		Gucciardi, Gordon & Dimmock (2008)	Internal motivation, desire for challenge, desire for success, vision	Motivation, desire, vision	Desire
a. Competitive Desire	*Having a competitive desire and looking forward to the challenge of testing your skills against the best*		Gucciardi, Gordon & Dimmock (2008)	Competitive desire, enjoy challenge, want to be tested	Desire, Thrive in challenge	Desire
b. Team success	*Having the desire to be part of a successful team and putting the team's objectives before individual goals, knowing that you have to do certain things, which you may not enjoy if you are to help your team achieve success*		Gucciardi, Gordon & Dimmock (2008)	Team first attitude, team player	Team values	
c. Vision	*The desire to have an accurate vision of what it takes to succeed, what it takes to achieve that, and the desire to put that into practice*		Gucciardi, Gordon & Dimmock (2008)	Accurate vision, desire to implement vision	Vision, desire to achieve	Desire
5. Tough attitude	*An unshakeable, tough attitude directed towards becoming a champion of the game*		Gucciardi, Gordon & Dimmock (2008)	Tough attitude	Tough attitude	Discipline
a. Discipline	*An enduring discipline of the mind in all situations to do everything in your life that needs to be done to achieve your goals*		Gucciardi, Gordon & Dimmock (2008)	Discipline	Discipline	Discipline
b. Commitment	*Having an enduring physical and mental commitment to doing over and above what is required to set yourself apart from the rest*		Gucciardi, Gordon & Dimmock (2008)	Commitment, push yourself	Commitment	Discipline
c. Positivity	*Maintaining a positive attitude despite the circumstances and focusing on what can be done rather than what has happened*		Gucciardi, Gordon & Dimmock (2008)	Positive attitude, positive focus	Positive attitude in adversity	Resilience
d. Professionalism	*Having a professional attitude in every sense of the word - in particular, towards your diet, training, leadership, rehabilitation and competition*		Gucciardi, Gordon & Dimmock (2008)	Professional attitude	Attitude, Discipline	Discipline

e. Sacrifices	*Acknowledge that sacrifices (on and off the field) are inevitable if you want to achieve both individual and team success and understand what the potential sacrifices you might have to make are*		Gucciardi, Gordon & Dimmock (2008)	Acknowledge and understand sacrifice	Sacrifice	Discipline
6. Concentration & Focus	*Having that single-mindedness to focus and concentrate on the job at hand and what you want to achieve despite internal or external pressures, obstacles or adversities*		Gucciardi, Gordon & Dimmock (2008)	Single-mindedness to focus,	Single-mindedness, focus, concentration	Attention Control
7. Resilience	*The ability to overcome adversities with an exceptional work ethic and persevering determination to showcase your mental and physical ability*		Gucciardi, Gordon & Dimmock (2008)	overcome adversities, exceptional work ethic, persevering determination	Resilience, work ethic, determination	Resilience
8. Handling Pressure	*Being able to execute skills and procedures under pressure and stress, and accepting these pressures as challenges to test yourself against*		Gucciardi, Gordon & Dimmock (2008)	Execute under pressure, accept pressure as challenges	Handle pressure, Challenge	Challenge Mindset
a. Override negative thoughts	*The ability to override and block out negative thoughts and self-doubts concerning your mental and physical state*		Gucciardi, Gordon & Dimmock (2008)	Override negative thoughts and self-doubt	Coping, Control	Affective Intelligence
9. Emotional Intelligence	*An honest and accurate self-awareness and understanding of your emotions when under pressure or facing an obstacle, and the ability to manage your emotions to enhance performance across all situations*		Gucciardi, Gordon & Dimmock (2008)	Self-awareness and understanding of emotions, ability to manage emotions	Emotional intelligence, emotional awareness, emotion regulation	Affective Intelligence
a. Self-awareness	*Being able to recognise and understand the obstacles, challenges and pressures involved and accurately self-assessing your individual performances*		Gucciardi, Gordon & Dimmock (2008)	Recognise and understand obstacles and challenges, accurate self assessment	Sport/Game awareness and understanding, self-appraisal, self-awareness	Sport Intelligence
10. Sport Intelligence	*Having the ability to perceive and understand both the training and competitive environment, and having the self-awareness to identify and understand your role within the team and any potential adversities that you may face*		Gucciardi, Gordon & Dimmock (2008)	Perceive and understanding training and performance environment, self-awareness, identify and understand role	Environment intelligence, role intelligence, self-awareness	Sport Intelligence
a. Team role responsibility	*Understanding and accepting responsibility for your role in the team, which entails putting team success before individual success*		Gucciardi, Gordon & Dimmock (2008)	understand and accept role responsibility, team first attitude	Responsibility, Attitude, Discipline	Sport Intelligence, Discipline
b. Understanding the game	*Understanding and knowing every aspect of the game and the responsibilities of every player on the ground and off the field*		Gucciardi, Gordon & Dimmock (2008)	Understand and know the game	Sport Intelligence	Sport Intelligence

11. Physical Toughness	*Playing to the best of your ability whist carrying an injury, consciously making the decision to attack the ball in a physically threatening situation and pushing your body through extreme fatigue experienced during competition and training*		Gucciardi, Gordon & Dimmock (2008)	Playing well with injury, attack despite threatening situation, pushing body through fatigue	Physical toughness, pushing to limits	Physical Toughness
Affective intelligence	the ability to regulate one's emotions and moods in any circumstance to facilitate performance		Gucciardi & Gordon (2009)	Regulate emotions and mood to facilitate performance	Emotion regulation	Affective intelligence
Desire to achieve	An internalised, insatiable desire and commitment to consistently improve one's performance levels and achieve success		Gucciardi & Gordon (2009)	internalised insatiable desire, commitment to improve and achieve	Desire, motivation, commitment	Desire
Resilience	The ability to withstand and bounce back from situations in which negative outcomes are experienced (i.e. pressure, adversity, challenge)		Gucciardi & Gordon (2009)	bounce back from negative outcomes	Resilience	Resilience
Attentional control	The ability to manage one's attention and focus over extended periods of play involving various distractions		Gucciardi & Gordon (2009)	manage attention and focus	Focus, Control	Attention Control
Self-belief	An unshakeable self-belief in your physical ability to perform in any circumstance		Gucciardi & Gordon (2009)	Self-belief in ability to perform	Self-belief	Self-belief
Cricket smarts	An awareness and understanding of the game and the processes required to perform well		Gucciardi & Gordon (2009)	Game awareness and understanding	Game/Sport awareness	Sport Intelligence
1. Winning mentality and desire	*Having a winning desire that drives you to overcome challenge and adversity both on and off the pitch to succeed/win*		Coulter, Mallett & Gucciardi (2010)	Winning desire, overcome challenge	Winning mentality, desire	Desire
2. Self-belief	*Possessing self-belief in physical and mental ability under pressure to overcome all challenging situations*		Coulter, Mallett & Gucciardi (2010)	Self-belief in ability	Self-belief,	Self-belief
3. Physical toughness	*Pushing through the pain barrier to remain focused on the game, and maintaining a high level of performance while carrying an injury, fatigued or hurting*		Coulter, Mallett & Gucciardi (2010)	Pushing through pain, remain focused, maintain performance despite injury, pain or fatigue	Pushing to limits, physical toughness	Physical Toughness
4. Work ethic	*Hard work and pushing yourself (physically and mentally) to achieve your goals in all areas of the game (e.g. preparation, training, matches)*		Coulter, Mallett & Gucciardi (2010)	Hard work, pushing yourself to achieve	work ethic, pushing yourself, discipline	Discipline
5. Resilience	*Persevering through adversity both in and out of soccer with ''bullet proof'' determination to stay focused and to maintain a consistently high level of performance*		Coulter, Mallett & Gucciardi (2010)	Perseverance, determination, stay focused	Perseverance, resilience, focus	Resilience, Attention Control
6. Personal values	*Placing meaning on personal values and living by personal standards to being a better person and player*		Coulter, Mallett & Gucciardi (2010)	Personal values, personal standards	Strong personal values	Discipline
7. Concentration and Focus	*Having a single-mindedness to focus on the job at hand in the face of internal or external pressures, obstacles or adversities*		Coulter, Mallett & Gucciardi (2010)	Single-mindedness to focus,	Single-mindedness, focus, concentration	Attention Control

8. Performance awareness	*Having the ability to accurately self assess your performances*		Coulter, Mallett & Gucciardi (2010)	Accurately self-assess performance	Self-awareness, game awareness	Sport Intelligence
9. Sport intelligence	*Having an ability to read the game, having strong tactical awareness, and understanding your role on the pitch to execute decisions at critical moments*		Coulter, Mallett & Gucciardi (2010)	Read the game, tactical awareness, understand role, execute decisions	Decision-making, game/sport awareness, role understanding	Sport Intelligence
10. Tough attitude	*Having an incessant mind-set focused on being the best you can be*		Coulter, Mallett & Gucciardi (2010)	incessant mindset, focused to be the best	Tough attitude	Discipline
11. Coping under pressure	*Maintaining a high level of performance under pressure and viewing obstacles as challenges*		Coulter, Mallett & Gucciardi (2010)	Handle pressure, view obstacles as challenge	Handle pressure, Challenge	Challenge Mindset
12. Competitive effort	*Sustaining a high level of competitiveness on the pitch regardless of the situation*		Coulter, Mallett & Gucciardi (2010)	Competitiveness	Competitiveness, Desire	Desire
13. Risk taker	*A willingness to take risks both on the pitch and in one's life/career to increase the opportunity of success*		Coulter, Mallett & Gucciardi (2010)	Willingness to take risk	Risk, Decision making	Sport Intelligence
14. Emotional intelligence and control	*Possessing self-awareness when facing challenges to control and manage your emotions*		Coulter, Mallett & Gucciardi (2010)	Self-awareness and understanding of emotions, ability to manage emotions	Emotional intelligence, emotional awareness, emotion regulation	Affective Intelligence
A winning mentality and desire	The ''will to win'' drives players to extreme levels of competitiveness regardless of the scenario they find themselves in. Specifically, a winning mentality allows mentally tough players to think in a way that not only motivates them to never give up and succeed, but also to overcome fatigue or pain to become victorious		Coulter, Mallett & Gucciardi (2010)	"will to win", extreme competitiveness, motivated to never give up	motivation, desire to achieve	Desire
Optimism	Optimism was perceived to be influential in allowing players to focus on the positives from demanding circumstances and to have a hopeful outlook that the future will be positive and will present with it opportunity		Coulter, Mallett & Gucciardi (2010)	Optimism, focus on positives, hopeful outlook	optimism, belief	Self-belief
A personal pride	Mentally tough individuals have a strong personal pride to not only do things professionally and correctly (e.g. with preparation, training, rehabilitation) but also to ensure that they have regularly justified their efforts to increase their chances of success. This quality, therefore, enables players to think in a way that motivates them to live by the highest personal standards		Coulter, Mallett & Gucciardi (2010)	Strong personal pride, justified their efforts, live by high personal standard	Pride, Strong personal values and standards	Discipline
An honest and realistic view of achievements	This quality influences the perspective of mentally tough players when coping with excessive praise or criticism relating to their performances. The quality allows players to distinguish that their achievements are often neither as good nor bad to the extremes that other individuals make them out to be, thus enabling them to maintain a level (and realistic) outlook of their actions on the pitch		Coulter, Mallett & Gucciardi (2010)	maintain level outlook to cope with criticism	coping, perspective,	Resilience

A down to earth perspective	Having a ‘‘down-to-earth’’ attitude allows mentally tough players to cope with adversity both on and off the pitch. In particular, these players were depicted as people who understand that (1) sometimes unhelpful things naturally happen which have to be dealt with, and (2) in the grand scheme of life the testing times as a professional player are often insignificant to priorities/experiences that life throws at them or others close to them		Coulter, Mallett & Gucciardi (2010)	"down to earth" attitude, cope with adversity, perspective	coping, perspective,	Resilience
An acknowledgement of others' sacrifices	This quality was believed to contribute to mentally tough players having the respect for the efforts others have made on their behalf to allow them to play the sport they love as a job. This drove these players to think in a way that they must never let these individuals down by wasting the opportunity on offer in becoming, and living the life of, a professional player		Coulter, Mallett & Gucciardi (2010)	respect for others	Strong personal values, acknowledgement of others	Discipline
Valuing personal opportunities	Valuing personal opportunities allowed players to continually recognize that their position within the team/squad is often dispensable if they do not sustain a reliable work ethic to continually improve and fight for their place		Coulter, Mallett & Gucciardi (2010)	Valuing personal opportunities, reliable work ethic	Value opportunity, work ethic,	Discipline
Having an immense love to play soccer	Having an immense love to play soccer allowed for players to justify the sacrifice and discipline required to (1) put in the training hours to make it as a professional and also to cope with the peer pressure from others as a young player, and (2) to assist these players when faced with long-term injuries, some of which at times were judged as career threatening		Coulter, Mallett & Gucciardi (2010)	Immense love of game, justify sacrifice and discipline,	Internal drive, coping, sacrifice, discipline	Desire, Discipline
Acknowledging self responsibility	Mentally tough players reported that they were able to accept they needed to take responsibility for themselves and their future if they were to become professional soccer players. This mature attitude seemed to allow these players to overcome particular hardships (e.g. homesickness, travelling away) when stepping up to the professional level as a young player		Coulter, Mallett & Gucciardi (2010)	Accept responsibility, attitude to overcome hardships	Attitude, responsibility,	Discipline
A will to win	Cognitions that help a player to fight and motivate oneself to compete stronger in the pursuit of success	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Will to win, fight and motivated in pursuit of success	Desire, motivation	Desire
Self-belief and confidence	Thoughts that reinforce a player's ability and reminding them of past success in overcoming similar obstacles and setbacks	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Reinforcing thoughts about ability	Self-confidence	Self-belief
Concentration on simple play	Thoughts that control a player's emotions and direct simple actions by concentrating on task relevant cues following mistakes, playing under pressure or during important matches (e.g. Grand Final) to do one's job/what is expected of one	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Emotion controlling thoughts , concentrating on task	Focus and refocus, Emotional control	Attention Control / Affective Intelligence
Inspirational action	Cognitions to change one's physical behaviour and actions to focus on those things that will demonstrate competitiveness, belief, and effort to inspire others to do the same	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Inspirational thoughts,	Thought regulation, influence others	Affective Intelligence
Tactical awareness and adaptability	Tactical-related thinking that instructs for changes to be made in one's play to respond to situational and oppositional formation adjustments	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Tactical thinking, change game	Regulate performance, game awareness	Sport Intelligence

Positive body language	Psychological processes that focus on evading the potential for opposition players to feed off negative body language when fatigued, injured or emotionally flustered (e.g. following errors).	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Regulate body language	Regulate body language	Affective Intelligence
Judged only by performances	Thoughts that allow a player to come to terms with the fact that if they put themselves on the pitch and play they will be judged purely by their performance regardless of other/personal issues (e.g. injury, hardships off the pitch)	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Judged on performance		
Physical toughness	Motivating cognitions focused on the outcome to win to override physical pain and fatigue, and to prove to oneself that you are not weak minded	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Motivated by the outcome, demonstrate strength	Motivation	Desire
Perseverance and determination	Thoughts that sustain motivation, belief, drive, and concentration to the end	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Motivation, belief, drive and concentration	Perseverance and determination	Desire
Staying positive	Positive cognitions that counter negative thoughts and distractions to help focus on what constructive actions are necessary to take next in the pursuit of one's goals	Self-talk cognitions	Coulter, Mallett & Gucciardi (2010)	Counter negative thoughts, help focus	Positivity, focus	Attention Control
Self-Efficacy	The athlete's judgment or belief in his or her own ability to succeed in reaching a specific goal	*MT Orientation (Self-Belief)*	Middleton (2007)	Belief in ability	Belief	Self-Belief
Mental Self-concept	Viewing one's self as being mentally strong in relation to dealing with adversity	*MT Orientation (Self-Belief)*	Middleton (2007)	Belief in being mentally strong	Belief	Self-belief
Potential	Believing that you have the inherent ability or capacity for growth, development or coming into being	*MT Orientation (Self-Belief)*	Middleton (2007)	Belief in ability or capacity for growth	Belief in potential	Self-belief
Task Specific Attention	The unshakeable concentration of mental processes on a task whilst excluding other distractions from concentration	*MT Strategy*	Middleton (2007)	unshakeable task concentration	Strong task focus	Attention Control
Perseverance	Persisting in or remaining constant to a purpose, idea or task in the face of obstacles, discouragement or adversity	*MT Strategy*	Middleton (2007)	Persistence, constant to a purpose	Perseverance	Discipline
Task Familiarity	Having a good understanding and being well acquainted with the task or adversity	*MT Orientation*	Middleton (2007)	Task understanding	Game/Sport awareness	Sport Intelligence
Personal Bests	An internal motivation or drive to pursue personal best performances	*MT Orientation (Motivation)*	Middleton (2007)	Internal motivation, drive for best performance	Internal drive, motivation	Desire
Task Value	The quality of importance or the significance the successful completion of the task holds for the individual	*MT Orientation (Motivation)*	Middleton (2007)	Task importance	Task Motivation	Desire
Goal Commitment	The act of binding oneself (intellectually and emotionally) to a goal or a course of action	*MT Orientation*	Middleton (2007)	binding to course of action	Goal commitment	Discipline

Positivity	The process of being positive and remaining positive in the face of adversity or challenge	*MT Strategy (Emotion Management)*	Middleton (2007)	Positive attitude	Positivity	Affective Intelligence
Stress Minimisation	The process of reducing ones emotional reaction to adversity	*MT Strategy (Emotion Management)*	Middleton (2007)	Reduced emotion reaction	Emotion regulation / suppression	Affective Intelligence
Positive Comparisons	Sensing that you're coping better with adversity and thus have a psychological and competitive advantage over your opponent	*MT Strategy (Emotion Management)*	Middleton (2007)	Coping with adversity, Positive comparison	Affective Coping, Resilience	Affective Intelligence
Confidence	*The athletes belief in their own abilities to achieve goals and be better than their opponents*		Sheard, Golby & van Wersch (2009)	Belief in abilities, positive comparison	Belief	Self-belief
Constancy	*Determination, personal responsibility, an unyielding attitude and ability to concentrate*		Sheard, Golby & van Wersch (2009)	Determination, responsibility, unyielding attitude, concentration	Determination, responsibility, Strong attitude, Focus/ Concentration	Discipline
Control	*The perception that one is personally influential and can bring about desired outcomes with particular reference to controlling emotions*		Sheard, Golby & van Wersch (2009)	Belief in being influential, control over emotions	Influential, Self-belief, Emotional Control	Affective Intelligence
Effective planning and goal setting	*Froward planning, being realistic, correct perception of challenge, taking the challenge, personal challenge, seeing the big picture, having a sense of perspective, having a sense of purpose, the need to be adaptable and flexible when planning, having ambition, hitting your target*	*Safety and survival*	Fawcett (2006)	Ambition, planning, challenge seeking, sense of purpose and direction	Ambition, goal seeking	Desire
Coping with anxiety	*Lack of fear, dealing with negative consequences, combating worry about oneself, combating worry about others, dealing with negative self-talk, control thoughts about negative consequence, coping dealing with death*	*Coping with stress and anxiety*	Fawcett (2006)	No fear, dealing with negative consequences	Coping with anxiety	Affective Intelligence
Effective decision making	*Effective decision making, making decisions under pressure, wisdom from experience, making joint decisions under pressure, patience in decision making*	*Safety and survival*	Fawcett (2006)	Effective decision making, patience	Decision-making	Sport Intelligence
Self-confidence and Self-belief	*Self-confidence, positive self-talk, having self-belief*	*Knowing oneself*	Fawcett (2006)	Self-confidence, Self-belief	Self-confidence, Self-belief	Self-belief
Coping with stress situations	*Composure under pressure, dealing with prolonged pressure, tolerance of others, mental preparation, dealing with pressure form colleagues, using humour to reduce pressure, chunking to lessen the burden*	*Coping with stress and anxiety*	Fawcett (2006)	Composure, dealing with pressure, humour	Coping with anxiety	Affective Intelligence
Self-control	*Self-control, patience, emotional control, dealing with death, dealing with ego, being unemotional, dealing with anger, coping with elation, emotional drive*	*Knowing oneself*	Fawcett (2006)	Self-control, emotional control, emotional drive	Self-awareness, emotion regulation	Affective Intelligence
Physical fitness	*Supreme fitness/physical state, physical/mental link*	*Physical Coping Ability*	Fawcett (2006)	Physical fitness	Physical conditioning	Physical Toughness

Coping with negative low arousal	*Handling complacency, combating boredom*	*Coping with stress and anxiety*	Fawcett (2006)	Handling complacency, boredom	Discipline	Discipline
Ability to suffer	*Ability to suffer, mental reserve, ability to recharge, combating mental drainage, ability to handle sleep deprivation*	*Physical Coping Ability / Coping with stress and anxiety*	Fawcett (2006)	Ability to suffer	Physical Toughness, Resilience	Resilience
Risk assessment	*Necessary risk taking, avoiding mental slips, knowing your limits, risk assessment, handling uncertainty, common sense*	*Safety and survival*	Fawcett (2006)	Risk assessment, knowing limits	Decision-making, self-awareness	Sport Intelligence
Physical coping	*Coping with physical discomfort, coping with altitude effects, fighting spirit*	*Physical Coping Ability*	Fawcett (2006)	Coping with discomfort	Physical Toughness, Resilience	Physical Toughness
Independence & Personal responsibility	*Being alone, personal responsibility, independence, being assertive, being self-sufficient, being single minded*	*Knowing oneself*	Fawcett (2006)	Responsibility, independence, self-sufficient, single-mindedness	Single-mindedness, responsibility	Discipline
Self-awareness	*Being balanced, knowing oneself, inner awareness*	*Knowing oneself*	Fawcett (2006)	Balanced, knowing self, awareness	Self-awareness	Affective Intelligence
Coping with success	*Handling success*	*Coping with success & failure*	Fawcett (2006)	Handling success	Handle success, Discipline	Discipline
Dealing with failure	*Accepting failure, experiencing failure, perceived failure*	*Coping with success & failure*	Fawcett (2006)	Handling failure	Handling failure, Discipline, Resilience	Discipline, Resilience
Dealing with external distractions	*Coping with external distraction, combating homesickness*	*Undivided Attention*	Fawcett (2006)	Distraction control	Dealing with external distractions	Attention Control
Full attention on task	*Having full attention, mental readiness, dealing with the present*	*Undivided Attention*	Fawcett (2006)	Full attention, in the present	Task focus	Attention Control
Self-confidence	*Self-confidence, perception of ability, confidence in ability, confidence in training programme, confidence in coach, winning confidence, technical confidence, specific confidence*	*Self-confidence and belief*	Fawcett (2006)	Self-confidence, belief in ability	Self-confidence	Self-belief
Self-belief	*Self-belief*	*Self-confidence and belief*	Fawcett (2006)	Self-belief	Self-belief	Self-belief
Dedication and commitment	*Dedication, commitment, self-discipline*	*Motivation and commitment*	Fawcett (2006)	*Dedication, commitment, self-discipline*	*Dedication, commitment, self-discipline*	Discipline

Motivation and desire	*Self-motivation, drive and desire, having the incentive, determine nature, wanting it badly enough, will to win, independent & responsible, staying motivated*	*Motivation and commitment*	Fawcett (2006)	*Self-motivation, drive and desire, incentive, determine nature, wanting it, will to win, independent & responsible, staying motivated*	Motivation, Desire, Responsible	Desire
Absolute focus	*Absolute focus, maintaining focus, having vision, consistent focus, staying clear headed, staying in the present, auto-pilot, seeing the big picture*	*Effective mental application / Handling pressure*	Fawcett (2006)	Absolute focus, clear head, present focused	Focus, Clear mind	Attention Control
Use of mental skills	*Use of positive self-talk, use of powerful imagery, goal setting, dealing with external distractions, effective decision making*	*Effective mental application*	Fawcett (2006)	Self-talk, imagery, goals, focus, decision-making	use of mental skills - coping	Affective Intelligence
Gaining the mental edge	*Rising to the occasion, big occasion toughness, not giving anything away, being single minded, doing the job, being ruthless, killer instinct, hates losing, having a professional attitude, having maturity, living close to the edge, looking after oneself, wining mentality, not making excuses, courage and conviction, being consistent, showing conceit for the opposition, loving the competition*	*Dealing with event pressure*	Fawcett (2006)	Winning mentality, discipline, raising your game, thrive on competition	Winning mentality, gaining the mental edge	Challenge Mindset, Discipline
Dealing with setbacks	*Dealing with set-backs, dealing with form lapses in form, losing face, dealing with losing*	*Handling pressure*	Fawcett (2006)	Dealing with setbacks	Resilience	Resilience
Dealing with mistakes	*Dealing with external distractions, being able to block out*	*Handling pressure*	Fawcett (2006)	Dealing with distractions	Focus, Distractions	Attention Control
Handling pressure	*Handling pressure, being smart under pressure, handling event pressure, not feeling over awed on the day*	*Handling pressure / Dealing with event pressure*	Fawcett (2006)	Handling pressure, sport smart	Handling pressure - coping, Sport intelligence	Affective Intelligence / Sport Intelligence
Self-control	*Self-control, technical control. Being patient, control of ego, emotional control*	*Self-confidence and belief*	Fawcett (2006)	*Self-control, technical control. Being patient, control of ego, emotional control*	Discipline, Emotional control	Affective Intelligence
Handling success	*Dealing with success, not fearing success*	*Dealing with event pressure*	Fawcett (2006)	Handling success	Handle success, Discipline	Discipline
Previous experience	*Previous experience*	*Handling pressure*	Fawcett (2006)	Experience	Experience	Sport Intelligence
Physical fitness	*Physical toughness, extreme fitness, natural toughness*	*Physical coping ability*	Fawcett (2006)	Physical fitness, Physical toughness	Physical Toughness	Physical Toughness
Physical coping ability	*Coping with pain, coping with discomfort, perform when exhausted, dealing with fatigue*	*Physical coping ability*	Fawcett (2006)	Pain discomfort tolerance, deal with fatigue	Physical Toughness, Coping	Physical Toughness

Training situations	*Being away from home, training methods, smart training, tough training, training culture, competitive training environment*	*Training and situational demands*	Fawcett (2006)	Training methods, competitive training environment	Training discipline, Sport Intelligence	Discipline, Sport Intelligence
Situational demands	*Discipline requirements, situation issues*	*Training and situational demands*	Fawcett (2006)	Situational demands	Sport Intelligence	Sport Intelligence
Lifestyle management	*Lifestyle demands, adaptation to environment*	*Training and situational demands*	Fawcett (2006)	Lifestyle demands	Discipline	Discipline
Extending oneself beyond the comfort zone	*Extending oneself, pushing oneself, leaving the comfort zone, making sacrifices, raising the bar*	*Dealing with event pressure / Training and situational demands*	Fawcett (2006)	Pushing oneself, out of comfort zone, sacrifice	Pushing to limits, sacrifice	Discipline
Dealing with stress and anxiety	*Controlling the nerves, dealing with worry about performance, dealing with worry about selection, absence of negatives, dealing with fear, controlling anxiety & holding it together, staying relaxed*	*Handling pressure*	Fawcett (2006)	Control of nerves, dealing with worry, fear, controlling anxiety	Emotional Control, Anxiety control	Affective Intelligence
Self-belief	*Self-belief*	*Self confidence and belief*	Fawcett (2006)	Sell-belief	Sell-belief	Sell-belief
Self-confidence	*Self-confidence, self-confidence in ability, self-belief, respect from others, knowing your tough, state confidence, on the day confidence, in training programme*	*Self confidence and belief*	Fawcett (2006)	Self-confidence, confidence in abilities, in training	Self-confidence, confidence in abilities	Sell-belief
Dealing with mistakes and setbacks	*Dealing with mistakes, dealing with setbacks, dealing with failure, coping with adversity, proving people wrong, getting through a difficult phase,*	*Dealing with event pressure*	Fawcett (2006)	Dealing with setbacks, mistakes, failure	Setbacks, coping	Resilience
Absolute focus	*Being focused, ability to focus, mental parking, unconscious quality, staying in the present, in the zone, not thinking too much, mental intensity*	*Effective mental application / Dealing with event pressure*	Fawcett (2006)	Focused, staying in the present, in the zone, clear thinking	Focus control	Attention Control
Anxiety control	*Dealing with anxiety, controlling the nerves, dealing with worry, worrying about others, avoiding negative thoughts, avoiding complacency, re-interpreting anxiety, feeling overawed, staying relaxed, not thinking too much*	*Effective mental application*	Fawcett (2006)	Control of nerves, dealing with worry, controlling and reinterpreting anxiety	Emotional Control, Anxiety control	Affective Intelligence
Dealing with situational issues	*Media exposure, non-selection, team pressures, having the opportunity to medal, dealing with a life threat, dealing with captaincy, dealing with team mates, dealing with different conditions, travelling lifestyle, lifestyle demands, dealing with a circus environment at the Games, competitive selection, lifestyle issues*	*Training and situational toughness*	Fawcett (2006)	Handling situational issues - media, team, competition, lifestyle issues	Handling distractions, situational pressures	Discipline, Attention Control
Self-control	*Self-control, big point control, control of ego, self-demanding, refusing to be intimidated, making it happen, avoid feeling sorry for oneself*	*Self control & Discipline*	Fawcett (2006)	Self-control, responsibility	Discipline	Discipline
Dealing with expectations	*Achieving the unexpected, dealing with expectations, winning when expected to win*	*Dealing with event pressure*	Fawcett (2006)	Dealing with expectations	Dealing with expectations	Discipline, Challenge Mindset

Dealing with personal pressure	*Being self critical, imposing exacting standards, internal pressure*	*Dealing with event pressure*	Fawcett (2006)	Self-critical, standards	Personal standards	Discipline
Dealing with distraction	*Dealing with distractions, blocking out, keeping it all in perspective, not thinking too much about it all*	*Dealing with event pressure*	Fawcett (2006)	Dealing with distractions, perspective, not thinking too much	Dealing with distractions, perspective, Single-mindedness	Attention Control
The winning mentality	*Higher level mental skills, knowing how to win, the winning mentality, ability to seize the opportunity, showing resilience, having the killer touch, making it happen, doing it when it matters, grinding a result, not showing a weakness, being single minded, being ruthless, making effective decisions*	*Dealing with event pressure*	Fawcett (2006)	Mental skills, winning mentality, ruthless, decision making, seize the opportunity	Winning Mentality	Self-belief
Determination	*Determined, making sure you get what you want, reaching the intensity level, inner strength, inner fight, channelling your desire, heart v head*	*Commitment & determination*	Fawcett (2006)	Inner drive, challenged desire	Desire, Determination	Desire
No fear	*Not feeling over-awed, not having excuses, no fear at all*	*Dealing with event pressure*	Fawcett (2006)	No excuses, no fear	No fear	Challenge Mindset
Critical moments	*Dealing with immediate situations-one off chances, big point situations, ready room mentality*	*Dealing with event pressure*	Fawcett (2006)	Dealing with big match moments	Critical moments	Sport Intelligence
Reaction to others	*Handling feedback, proving people wrong*	*Self control & Discipline*	Fawcett (2006)	Handling feedback, proving them wrong	Resilience, Discipline	Resilience, Discipline
Extending beyond the comfort zone	*Extending oneself, pushing oneself, going beyond where never been before, team application beyond comfort zone*	*?Training and situational toughness*	Fawcett (2006)	Pushing oneself, beyond the comfort zone	Pushing to limits	Discipline
Previous experience	*Previous experience o being there before, athletic maturity*	*Dealing with event pressure*	Fawcett (2006)	Experience, athletic maturity	Experience, Sport Intelligence	Sport Intelligence
Goal setting	*Setting personal targets, being flexible, being patient, using ego orientation positively*	*Effective mental application*	Fawcett (2006)	Setting targets, patience	Desire, Goal setting	Desire
Positive self-talk	*Using positive self-talk effectively*	*Effective mental application*	Fawcett (2006)	Positive self talk	Self-talk	Affective Intelligence
Commitment	*Total commitment& being totally dedicated*	*Commitment & determination*	Fawcett (2006)	Total commitment, dedicated	Commitment, dedication	Discipline
Driving ambition	*Driving ambition, wanting it badly enough*	*Commitment & determination*	Fawcett (2006)	Driving ambition, wanting it	Desire	Desire
Mental preparation	*Using mental skills to prepare well*	*Effective mental application*	Fawcett (2006)	Mental skills to prepare	Preparation	Discipline

Appendix 5.1 Content Validity Activity I

Purpose:

The purpose of this task is to provide preliminary feedback on the content of the pool of proposed items developed to assess a new conceptual model of mental toughness. The feedback collected will be used to develop a self-report inventory designed to assess mental toughness in athletes which is accessible across a variety of different individual and team sports.

Activity:

Please take a moment of read through and familiarise yourself with the proposed conceptual definition of mental toughness.

Proposed conceptual definition:

"Mental Toughness is the term given to an collection of attributes and abilities that determines, in some part, how an individual cognitively, emotionally, and behaviourally responds to pressures, stressors, challenges and adversities with optimal perseverance and conviction in the pursuit of a goal. More specifically mental toughness is a combination of interrelated protective (i.e. resilience) and enabling factors (i.e. self-belief, challenge mindset) that allow performers to not only cope with the various demands, pressure, challenges and adversities of sport, but also to thrive and produce consistently optimal performances relative to skill level."

Please read each of the items carefully and provide feedback in relation to its **appropriateness in relation to YOUR sport** and **clarity of wording** by following the steps detailed below.

- Firstly, please tick whether the item is **applicable** or **not applicable** to ***YOUR*** *sport*.
- Secondly, please rate by circling on the clarity scale provided the extent to which you feel the item is **clear** in its wording. For example;

Not clear at all						**Totally Clear**
1	**2**	**3**	**4**	**5**	**(6)**	**7**

- If you make a mistake, simply cross through the wrong answer and circle the correct rating.
- Finally, if you have **any comments** (i.e. revisions) or questions regarding the item please do so in the comments box provided.

The exercise should take you no longer 20 minutes to complete.

Thank you in advance for your participation in this process.

For more information regarding the development of the conceptualisation and the associated inventory please contact

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Content validity task

Name: _____ **Age:** _____ **Sport:** _____ **Competitive Level:** _____

Contact Details: (@) _____

Role: Athlete / Coach / Practitioner (please circle) **Years Experience:** _____

Please answer all questions in relation to the application of the item to athletes in **your sport** and the clarity of the wording. There are no right or wrong answers. Your honest feedback is vital for the development of a new valid inventory which is accessible across a variety of sports.

	Item	Applicable	Not Applicable	Not at all clear — **Clarity Rating** — Totally Clear							Any comments
				1	2	3	4	5	6	7	
1	I believe I can achieve anything I set my mind to			1	2	3	4	5	6	7	
2	I approach challenges in a positive way			1	2	3	4	5	6	7	
3	I remain positive in my approach no matter how badly things are going			1	2	3	4	5	6	7	
4	I possess a strong desire to achieve my goals			1	2	3	4	5	6	7	
5	I possess a strong work ethic in training in search for my performance edge			1	2	3	4	5	6	7	
6	When under pressure I have doubts in my ability			1	2	3	4	5	6	7	
7	I embrace situations that challenge me			1	2	3	4	5	6	7	
8	I am determined to achieve my goals			1	2	3	4	5	6	7	
9	I am committed to doing all that it takes to achieve my goals			1	2	3	4	5	6	7	
10	I lack motivation to achieve my goals			1	2	3	4	5	6	7	
11	I believe in my ability to produce consistent performances under pressure			1	2	3	4	5	6	7	
12	I avoid situations that challenge me			1	2	3	4	5	6	7	
13	When under pressure, I believe in my ability to perform well			1	2	3	4	5	6	7	
14	I tend to give up easily on my goals			1	2	3	4	5	6	7	
15	When under pressure, I doubt my ability to produce consistently good performance			1	2	3	4	5	6	7	
16	I do just what I need to in training to get by			1	2	3	4	5	6	7	

17	I do not enjoy performing when things get tough			1	2	3	4	5	6	7	
18	I have a strong desire to improve			1	2	3	4	5	6	7	
19	I accept the pressure of competition as an opportunity to challenge myself			1	2	3	4	5	6	7	
20	I prefer to only work on the aspects of my game that I am good at			1	2	3	4	5	6	7	
21	I possess a strong desire to pursue personal best performances			1	2	3	4	5	6	7	
22	I am willing to make the necessary sacrifices to achieve my goals			1	2	3	4	5	6	7	
23	When under pressure I begin to doubt myself			1	2	3	4	5	6	7	
24	I believe challenges are an opportunity to test myself			1	2	3	4	5	6	7	
25	My performance is all about what happens on the day			1	2	3	4	5	6	7	
26	There are just some things that I am not willing to give up to improve my performance			1	2	3	4	5	6	7	
27	I am content with my level of performance			1	2	3	4	5	6	7	
28	I see challenge as an opportunity to expose my weaknesses			1	2	3	4	5	6	7	
29	I believe I have what it takes to achieve my goals			1	2	3	4	5	6	7	
30	I don't believe that I have what it takes to achieve success in my goals			1	2	3	4	5	6	7	
31	Under pressure, I think about what I might lose if I fail			1	2	3	4	5	6	7	
32	I am willing to make the inevitable sacrifices needed in order to achieve success			1	2	3	4	5	6	7	
33	Under pressure I feel controlled by the challenge of the competition			1	2	3	4	5	6	7	
34	I have little desire to improve			1	2	3	4	5	6	7	
35	There are just some things I am not willing to sacrifice to achieve my goals			1	2	3	4	5	6	7	
36	I have doubts in my ability to handle pressure			1	2	3	4	5	6	7	
37	Challenges bring out the best in me			1	2	3	4	5	6	7	
38	I want to test myself against the toughest of opposition			1	2	3	4	5	6	7	
39	I back myself to deliver under pressure			1	2	3	4	5	6	7	
40	I thrive on the pressure of performing			1	2	3	4	5	6	7	
41	I take 100% responsibility for my performance			1	2	3	4	5	6	7	
42	When challenged under pressure, I feel my performance is			1	2	3	4	5	6	7	

	out of my control										
43	When things get tough, I tend to give up easily			1	2	3	4	5	6	7	
44	I have strong belief in my ability			1	2	3	4	5	6	7	
45	When confronted with challenge, my performance suffers			1	2	3	4	5	6	7	
46	I am professional in my approach to my performance			1	2	3	4	5	6	7	
47	When faced with adversity, I am determined to overcome it			1	2	3	4	5	6	7	
48	I am happy to compete just at my level			1	2	3	4	5	6	7	
49	When challenged under pressure, I still feel I am in control of my performance			1	2	3	4	5	6	7	
50	It is beyond my control whether I achieve my goals			1	2	3	4	5	6	7	
51	I do not like to be tested against tough opposition			1	2	3	4	5	6	7	
52	I am able to remain in total control of my performance under pressure			1	2	3	4	5	6	7	
53	I doubt my ability			1	2	3	4	5	6	7	

Appendix 5.2 Content Validity Activity II

Content Validity Activity II

Purpose:

The purpose of this task is to provide feedback on the content validity of the pool of proposed items developed to assess a new conceptual model of mental toughness. The feedback collected will be used to develop a self-report inventory designed to assess mental toughness in athletes.

Activity:

Please take a moment of read through and familiarise yourself with the proposed conceptual definition of mental toughness and its sub-dimensions.

Proposed conceptual definition:

"Mental Toughness is the term given to an collection of attributes and abilities that determines, in some part, how an individual cognitively, emotionally, and behaviourally responds to pressures, stressors, challenges and adversities with optimal perseverance and conviction in the pursuit of a goal. More specifically mental toughness is an amalgam of interrelated protective (i.e. emotional control, resilience) and enabling factors (i.e. self-belief, challenge mindset) that allow performers to not only cope with the various demands, pressure, challenges and adversities of sport, but also to thrive and produce consistently optimal performances relative to skill level."

Sub-dimension definitions:

Dimension	***Definition***
Self-Belief	*the belief in one's abilities to achieve one's goals*
Desire	*the internal drive to achieve one's goals*
Discipline	*the strong personal standards that influence one's approach towards one's goals*
Challenge Mindset	*the tendency to appraise and respond to tough situations as opportunities for development*

Please read each of the items carefully. Based on the written definitions of each scale, please rate the extent to which you believe the items relate to the respective subscale definition which it is assigned using the 4-point scale below. Please give you answer by marking the box with an X. For a more detailed description of each of the components of mental toughness, please see pages 5 & 6.

Not relevant **Somewhat relevant** **Quite relevant** **Highly relevant**

The exercise should take you no longer 15 minutes to complete.

Content Validity Task II

Please read each item carefully and rate the extent to which you believe the item is an accurate match to the definition provided using the scale provided. There are no right or wrong answers.

Self-belief *– the belief in one's abilities to achieve one's goals*					
	Item	Not relevant	Somewhat relevant	Quite relevant	Highly relevant
1	I believe I have what it takes to achieve my goals	☐	☐	☐	☐
2	I have doubts in my ability to consistently produce good performance s (R)	☐	☐	☐	☐
3	I have doubts in my ability to achieve my goals (R)	☐	☐	☐	☐
4	When faced with a setback, I doubt my ability to overcome it (R)	☐	☐	☐	☐
5	I believe in my ability to overcome setbacks	☐	☐	☐	☐
6	I believe in my ability to deliver under pressure	☐	☐	☐	☐
7	When under pressure, I begin to doubt my ability to deliver (R)	☐	☐	☐	☐
8	I believe in my ability to consistently produce good performances	☐	☐	☐	☐

Drive *– the internal desire to achieve one's goals*					
	Item	Not relevant	Somewhat relevant	Quite relevant	Highly relevant
1	I am determined to achieve my goals	☐	☐	☐	☐
2	I have little desire to improve (R)	☐	☐	☐	☐
3	When faced with a setback, I am determined to overcome it	☐	☐	☐	☐
4	I do not like to be tested against the toughest of opposition (R)	☐	☐	☐	☐
5	I want to test myself against the toughest of opposition	☐	☐	☐	☐
6	I lack the motivation to achieve my goals (R)	☐	☐	☐	☐
7	When face with a setback, I tend to give up easily (R)	☐	☐	☐	☐
8	I possess a strong desire to improve	☐	☐	☐	☐

Discipline *– the strong personal standards that influence one's approach towards one's goals*					
	Item	Not relevant	Somewhat relevant	Quite relevant	Highly relevant
1	I take responsibility for my performance	☐	☐	☐	☐
2	I have a strong work ethic in training	☐	☐	☐	☐
3	I do just what I need to in training to get by (R)	☐	☐	☐	☐
4	I am committed to doing all that it takes to achieve my goals	☐	☐	☐	☐
5	There are just some things I'm not willing to sacrifice to achieve my goals (R)	☐	☐	☐	☐
6	I need motivating by others to work on my performance (R)	☐	☐	☐	☐
7	I prefer to only work on the aspects of my performance that I am good at (R)	☐	☐	☐	☐
8	I make the sacrifices needed to achieve success in my goals	☐	☐	☐	☐

Challenge Mindset *– the tendency to appraise and respond to tough situations as opportunities for development*					
	Item	Not relevant	Somewhat relevant	Quite relevant	Highly relevant
1	I thrive on the pressure of competition	☐	☐	☐	☐
2	For me, challenges are an opportunity to test myself	☐	☐	☐	☐
3	Under pressure, I think about what I might lose if I fail (R)	☐	☐	☐	☐
4	I see the pressure of competition as an opportunity to challenge myself	☐	☐	☐	☐
5	I see tough challenges as situations where I could embarrass myself (R)	☐	☐	☐	☐
6	I do not enjoy the pressure of competition (R)	☐	☐	☐	☐
7	When under pressure, my performance begins to suffer (R)	☐	☐	☐	☐
8	When under pressure, I remain in control of my performance	☐	☐	☐	☐

Any comments:

Thank you for your participation in this process.

For more information regarding the development of the conceptualisation and the associated inventory please contact **Simon Crampton** (m) +44(0) 7718 990 926 **(@)** simoncrampton@hotmail.co.uk

Appendix 5.3 Preliminary Sport Mental Toughness Profiler

Demographics

Age: ..... Sex: Male / Female Nationality: …… ID Code: ……

Sport involvement:

What is ***your current main*** sport? .....

Name of current team (if applicable):
.....

Are you competing at as an: (please circle) Amateur Semi-Professional Professional

Length of time competing in your sport (years): ……..

What level do you ***currently compete*** in this sport:
.....

Inter-mural	University	Club	County	National	International

*****

Instructions

Please read each of these carefully before answering any of the questions to each section. Please answer ALL questions <u>honestly</u> and as accurately as possible. This is not a test therefore there are no right or wrong answers. Try not to take too much time on each question, but if you do not understand please ask the research assistant for help.

Using the scale below (1= 'Almost never', 6 = 'Almost always'), please rate how **consistently** you demonstrated each of the following in your sport. Answer each question in relation to how you typically think, feel and behave as an athlete in your current sport. Remember this is not a test, there are *no right or wrong answers* so be as honest as possible and give <u>your own views</u> about yourself only.

1	I believe I have what it takes to achieve my goals	1	2	3	4	5	5	6
2	I take responsibility for my performances	1	2	3	4	5	5	6
3	I am determined to achieve my goals	1	2	3	4	5	5	6
4	I thrive on the pressure of competition	1	2	3	4	5	5	6
5	I have doubts in my ability to consistently produce good performance s (R)	1	2	3	4	5	5	6
6	I struggle to push myself towards higher goals (R)	1	2	3	4	5	5	6
7	I have a strong work ethic in training	1	2	3	4	5	5	6
8	I have a strong desire to succeed	1	2	3	4	5	5	6
9	I have doubts in my ability to achieve my goals (R)	1	2	3	4	5	5	6
10	I do just what I need to in training to get by (R)	1	2	3	4	5	5	6
11	For me, challenges are an opportunity to test myself	1	2	3	4	5	5	6
12	I don't mind if I don't achieve my goals (R)	1	2	3	4	5	5	6
13	I lose belief in my ability to be successful (R)	1	2	3	4	5	5	6
14	I value being committed to doing all that it takes to achieve my goals	1	2	3	4	5	5	6
15	Under pressure, I think about what I might lose if I fail (R)	1	2	3	4	5	5	6
16	My belief in my ability to succeed is hard to undermine	1	2	3	4	5	5	6
17	I am determined to reach my potential	1	2	3	4	5	5	6
18	I see the pressure of competition as an opportunity to challenge myself	1	2	3	4	5	5	6
19	I find myself making excuses for my performance (R)	1	2	3	4	5	5	6
20	I lack the motivation to achieve my goals (R)	1	2	3	4	5	5	6
21	I believe in my ability to deliver under pressure	1	2	3	4	5	5	6
22	I see tough challenges as situations where I could embarrass myself (R)	1	2	3	4	5	5	6
23	It is important to me to persist until I achieve success in my goals	1	2	3	4	5	5	6
24	I do not enjoy the pressure of competition (R)	1	2	3	4	5	5	6
25	When under pressure, I begin to doubt my ability to deliver (R)	1	2	3	4	5	5	6
26	I make the sacrifices needed to achieve success in my goals	1	2	3	4	5	5	6
27	I tend to lose motivation easily (R)	1	2	3	4	5	5	6
28	I believe in my ability to consistently produce good performances	1	2	3	4	5	5	6
29	I do not like to be tested against the toughest of opposition (R)	1	2	3	4	5	5	6
30	I possess a strong desire to improve	1	2	3	4	5	5	6
31	There are just some things I'm not willing to sacrifice to achieve my goals (R)	1	2	3	4	5	5	6
32	I want to test myself against the toughest of opposition	1	2	3	4	5	5	6

Appendix 5.4 Sport Mental Toughness Questionnaire

This is not a test. Please answer each question by circling the letter that best describes how you are generally. Thank you.

		NOT AT ALL TRUE	A LITTLE TRUE	MOSTLY TRUE	VERY TRUE
1	I have an unshakeable confidence in my ability	A	B	C	D
2	I get anxious by events I did not expect or cannot control	A	B	C	D
3	I am committed to completing the tasks I have to do	A	B	C	D
4	I worry about performing poorly	A	B	C	D
5	I have what it takes to perform well while under pressure	A	B	C	D
6	I interpret potential threats as positive opportunities	A	B	C	D
7	I get angry and frustrated when things do not go my way	A	B	C	D
8	I take responsibility for setting myself challenging targets	A	B	C	D
9	I am overcome by self-doubt	A	B	C	D
10	I get distracted easily and lose my concentration	A	B	C	D
11	I have qualities that set me apart from other competitors	A	B	C	D
12	I give up in difficult situations	A	B	C	D
13	Under pressure, I am able to make decisions with confidence and commitment	A	B	C	D
14	I can regain my composure if I have momentarily lost it	A	B	C	D