Mental Toughness:
Conceptualisation and Measurement

By

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Dedicated to my grandfather, John Read, who instilled in me a passion for performance and wisdom. Thank you!
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Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.

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(Signature)
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ABSTRACT

Major challenges facing sport psychology researchers, practitioners, coaches, and athletes include understanding mental toughness and knowing how to train for it. Athletes and coaches have long identified mental toughness as an important attribute for performance. Practitioners have devised training approaches for mental toughness—often based on anecdotal notions of what mental toughness is and how it should be developed. The research available on mental toughness is scarce, with only a few recent but limited advances. Fundamental to the challenge of understanding and training mental toughness, there is a critical need for research to develop a model of mental toughness that is not based on anecdote, but rather on sound research methods and theoretical underpinnings. Following on from conceptualisation, there is a need to develop an instrument to measure mental toughness. Taken together, a conceptual model and a measurement approach are the tools needed by researchers to develop and test mental toughness training programs.

The purpose of this thesis was to address some of these issues by capitalising on the strengths of both qualitative and quantitative methods to: (a) critically examine a popular test of mental toughness; (b) determine specific characteristics of mental toughness and understand the interrelationship between those characteristics; (c) develop a model of mental toughness that draws together specific characteristics; (d) produce a mental toughness definition; (e) develop the Mental Toughness Inventory, a robust and valid instrument that demonstrates a sound factor structure, strong reliabilities, and invariance across gender, age, and level of competition (i.e., demonstrating within-network validity); and (f) determine the relative congruence between scores on the Mental Toughness Inventory and theoretically related constructs (i.e., demonstrating between-network validity).

In line with these aims, Study 1 evaluated the psychometric properties of an existing, popular, and yet unsubstantiated test of mental toughness—the Psychological Performance Inventory (PPI). Given the breadth and depth of mental toughness as evidenced by the literature, the PPI was not expected to provide a reasonable model. Instead, the study was intended to inform the researcher on the psychometric strengths of the PPI and guide the development of a new measure of mental toughness throughout the remainder of the thesis. The PPI was examined
using both within-network and between-network validity checks and responses from 263 student-athletes in Years 7–12 (12 to 19 years of age). Study 2 was a qualitative study that examined the interview data of over 30 elite sportspeople to determine the characteristics of mental toughness. The purpose of this study was to develop a conceptual model and definition of mental toughness that draws together all the characteristics in a way that adds meaning and clarity to the concept. The purpose of Studies 3 and 4 was to construct, refine, and validate the Mental Toughness Inventory (MTI)—a measure of mental toughness emanating from the findings of Studies 1 and 2. Studies 3 and 4 critically examined the construct validity of the MTI using both within-network and between-network validation on the basis of responses from institution-based athletes (from sports programs such as those run by the Australian Institute of Sport) and school-based athletes (from a selective sports high school). Furthermore, Studies 3 and 4 provided the scope to examine invariance of the mental toughness factor structure across groups, group mean-level differences, and interaction effects.

The results of Study 1 provided a number of insights into the status of the PPI, raised an interesting conundrum regarding the interface between conceptualisation and instrumentation, and provided guidance for instrument development that would become the empirical basis of subsequent quantitative studies. The qualitative results of Study 2 unearthed a multidimensional model of mental toughness, containing 12 first-order factors each of which contribute to a higher order (or Global) mental toughness factor. The 12 mental toughness characteristics identified are: self-efficacy, potential, mental self-concept, value, personal bests, commitment, stress minimisation, perseverance, positive comparisons, positivity, task familiarity, and task focus. Study 3 involved the construction of the Mental Toughness Inventory (MTI), with results revealing excellent validity from a within-network perspective (including confirmatory factor analysis, goodness of fit, internal reliability, and invariance across groups). Study 4 results revealed that MTI factors correlated more strongly with theoretically-related concepts and less strongly with unrelated concepts—thus demonstrating between-network validity (convergent and discriminant). Study 4 also revealed a number of significant main effects of age (favouring older athletes), gender (favouring male athletes) and group (a contextual effect where institution-based athletes rate themselves more “rigorously” relative to school-based athletes at their level)
mental toughness. Study 4 also showed some non-linear effects which broadly show that institution-based athletes decrease in mental toughness from 12 to 16 years of age (as do school-based athletes) before making significant improvements on several characteristics of mental toughness from 17 years and older (school-based athletes continue to decrease in mental toughness through to adulthood)—a series of findings attesting to the role of context in the assessment of mental toughness.

These findings have important implications for researchers, sports psychologists, coaches, and athletes. For sport psychologists, coaches and athletes, this research presents some clear characteristics of mental toughness that may be beneficial for training and development. Furthermore, the mental toughness model provides a more fine-grained view of mental toughness, one that is both easier to understand and which lends itself more readily to further development. These results demonstrate strong contextual effects, which need to be carefully considered when assessing and developing mental toughness. For sporting organisations, this research points to a number of things that can be done at an institutional level—particularly in relation to creating an environment that is most likely to facilitate the positive development of various components of mental toughness. Finally, for research and continued theorising about mental toughness, the findings from this thesis support viewing mental toughness as a combination of cognitive, behavioural, and emotive processes that work together in combating adversity or pressure.

Taken together, the conceptualising and empirical work conducted in this study are proposed to advance the field of research—creating opportunities to study the effectiveness of interventions designed to enhance mental toughness. Furthermore, the results provide practitioners, coaches, and athletes with a concrete understanding of mental toughness such that they are better equipped to devise training approaches and to handle pressure and adversity en route to athletic success.
CHAPTER 1

INTRODUCTION

The rise of a champion athlete is a fascinating and complex process. This process is often marked by significant and determining moments or turning points—moments that provide new wisdom and provoke change, growth and learning. Yet, initially these moments are unappreciated, recognised only in hindsight, possibly because they often arrive in the company of adversity. It is not unreasonable to suggest that once overcome, adversity in many cases provides the significant turning points in the sporting careers of elite athletes. If, therefore, we accept that adversity is an unavoidable factor in sporting achievement, and that ultimately, success requires adversity as much as it requires triumph over adversity, then it is the varying capacity to endure that separates the champion athletes from the rest. In the chapters to follow, the capacity to endure and triumph over adversity is explored through the eyes of some of Australia’s most prominent sporting achievers.

A number of Australia’s most prominent sporting achievers were interviewed over a one-year period and during this time common and consistent threads were interwoven into our discussions. Taking into consideration their diverse personalities and the range of surveyed sports, the following observations are worth noting—not least the fact that each of these people started from a point of total belief in themselves. They were each prepared to work hard and remained committed to their goals, regardless of who or what came up against them. They were disciplined and focused, accepting the challenge and the journey with gratitude. However, there was something more—something that became clearer with every interview, something needed to be understood and taught to future generations of athletes. These are people who have learned to endure through adversity. Somewhere in their past, a friend, a mentor, a parent, instilled in them the qualities that they needed, to achieve the heights that many others might only ever dream of—tenacity, self-belief, work ethic, talent—but before all this, a positive and mentally tough mindset that believes that dreams can be achieved through perseverance and patience.
It is this positive and mentally tough mindset that makes the road less arduous, the work more tolerable, the victory irresistible. It is this positive mindset that urges athletes on and gives them a future. Each of these outstanding sportspeople possesses knowledge of this truth and unwavering mental toughness. To them, adversity is at worst a temporary setback and at best a time of learning and enrichment. Clearly, however, mental toughness is an attribute that is taught, by word or example, and is the essence of any winner.

Despite growing interest, large-scale empirical studies on the makeup of mental toughness are rare and the studies that have been conducted lack rigorous scientific evaluation. Loehr (1986), in his classic book on mental toughness training for sports, presented the Psychological Performance Inventory as a test of mental toughness. Unfortunately, he presented no psychometric data to support its use, nor any theoretical offerings in relation to the development of the concept. Most recently Jones, Hanton, and Connaughton (2002) completed a qualitative study of elite athletes identifying multiple facets of mental toughness. Although their research was strong in the identification of several characteristics of mental toughness, the study had a number of significant limitations, including a small sample size and limited data analysis in relation to established sporting concepts. Therefore, mental toughness remains largely undefined and misunderstood. The lack of understanding about mental toughness undermines any interventions aiming to increase mental toughness in athletes. Thus, there is a need to operationalise the concept of mental toughness and to develop appropriate and valid measurement of it.

The following issues, therefore, remain to be answered. What is mental toughness? What are the characteristics of mental toughness? What separates athletes who thrive on elite competition and challenge from those who buckle under pressure? Why do some athletes succeed in the face of adversity whereas others fail? Why do some athletes experience unproductive negative affect in competition and adverse circumstances while others do not? Why do some athletes bounce back from failure whereas others are overwhelmed by it? Taken together, the answers to these questions and more will provide timely information of practical use to athletes and coaches.

The present thesis addresses the issues first by evaluating a popular yet unsubstantiated test of mental toughness—Loehr’s Psychological Performance Inventory (1986). The researcher then explores the mental toughness characteristics
of some of Australia’s most prominent sporting personalities. These characteristics are drawn together into a model of mental toughness, and the Mental Toughness Inventory is developed and validated to provide a robust measure of mental toughness in athletes. The primary aims of the present investigation are to extend theory, research, and practice by:

(a) critically examining a popular test of mental toughness;
(b) determining specific characteristics of mental toughness and understanding the interrelationship between those characteristics;
(c) developing a model of mental toughness that draws together specific characteristics;
(d) producing a definition of mental toughness; and,
(e) developing the Mental Toughness Inventory to be a robust and valid instrument that demonstrates a sound factor structure, strong reliabilities, and invariance across age, time, and level of competition.

Overall, this thesis provides the scope to learn about mental toughness from Australia’s great sporting heroes, and for future athletes to profit from the sharing of these experiences. Some of the significant outcomes of this research include: a conceptually-informed mental toughness factor structure comprising constructs hypothesised comprise mental toughness; the development of a valid and reliable measurement instrument—the Mental Toughness Inventory (MTI); confirmatory measurement data on mental toughness and the factors that underlie it; and understanding of the differences in mental toughness across school-based and institute-based athletes, across males and females, and across younger and older athletes. Findings arising from this thesis hold a number of implications for interventions designed to address mental toughness in elite sport settings.

Taken together, the conceptualising and empirical work conducted in this study is proposed to benefit researchers and practitioners by providing clarity on mental toughness in athletes—including the characteristics that contribute to it and how those characteristics fit together into a conceptual model. With this knowledge in hand researchers will be in a better position to study predictors and consequences of mental toughness.
CHAPTER TWO

LITERATURE REVIEW AND A CONSTRUCT VALIDATION APPROACH

Introduction

Performance pressures faced by elite athletes have increased over the last few decades, due to higher quality competition and increased corporate expectations (Hong, 1997; Warneminde, 1991). These pressures have led to a greater interest in how to use the “powers” of the mind to achieve superior athletic performance. In attempting to reach their athletic potential, athletes have been complementing physical training with psychological training tools such as goal setting, visualisation and relaxation (Hardy, Jones, & Gould, 1996; Weinberg, 1992).

In the last decade or so, researchers have become increasingly interested in how psychological factors such as personality, group dynamics, and individual cognitions affect sporting performance (e.g., Jones, 1993, Thomas, Schlinker, & Over, 1996). An emerging area of interest is the role of mental toughness. Sport psychologists (researchers and practitioners), coaches, sports commentators, sports fans, and athletes acknowledge the importance of mental toughness in sporting performance (see Goldberg, 1998; Hodge, 1994; Tunney, 1987; Williams, 1988). In early work on the issue, Loehr (1982, 1986) emphasised that athletes and coaches felt that at least 50% of success is due to psychological factors that reflect mental toughness. Goldberg (http://www.competitivedge.com/intro.html) argued that a lack of mental toughness is the reason some athletes suffer from slumps, “choke”, and experience runaway emotions; why they perform better in practice than in competition; and, why they underachieve. He claims that learning about mental toughness will assist coaches to be better motivators, develop winning teams, prepare teams for big games, develop winning concentration, snap losing streaks and end slumps, and teach athletes to stay “cool in the clutch”. Similarly, Gould, Hodge, Peterson and Petlichkoff (1987) emphasised that although coaches feel that mental
toughness is important in achieving success, it is difficult for athletes to achieve. Clough, Earle, and Sewell (2002) estimated that as much as 75% of sport psychology first consultations with athletes and coaches involve requests for procedures to develop mental toughness. In research on the psychology-injury relationship, it was shown that tough-minded athletes are less likely to sustain an injury (Jackson, Jarrett, Barely, Kausch, Swanson, & Powel, 1978). Norris (1999) also emphasised the importance of mental toughness, based on extensive interviews with champion athletes. Learning about mental toughness, according to Norris, will help athletes get more out of practice, use failures as springboards to success, and use mental skills to produce winning efforts.

However, despite widespread agreement on the importance and benefits of mental toughness and calls to identify psychological attributes that create champions, high quality research into mental toughness is limited. The literature contains widely differing mental toughness definitions, including:

- An ability to cope with or handle pressure, stress, and adversity (Goldberg, 1998; Gould et al., 1987; Williams, 1988);
- An ability to overcome or rebound from failures (Dennis, 1981; Goldberg, 1998; Gould et al., 1987; Taylor, 1989; Tutko & Richards, 1976; Woods, Hocton, & Desmond, 1995);
- An ability to persist or a refusal to quit (Dennis, 1981; Goldberg, 1998; Gould et al., 1987);
- An insensitivity or resilience (Alderman, 1974; Goldberg, 1998; Tutko & Richards, 1976); and,
- The possession of superior mental skills (Jones, Hanton & Connaughton, 2002; Bull, Albinson, & Shambrook, 1996; Loehr, 1982, 1995).

At an applied level, mental toughness is described (Brennan 1998, p.3) as: *The ability to handle situations. It’s somebody who doesn’t choke, doesn’t go into shock, and who can stand up for what he believes. It’s what someone has who handles pressures, distractions and people trying to break their concentration. It involves focusing, discipline, self-confidence, patience, persistence, accepting responsibility without whining or excuses, visualising, tolerating pain and a positive approach.*
A quick glance at the available literature reveals that there is considerable variation in the way mental toughness is described and characterised. The general lack of clarity surrounding the term is perhaps due to a lack of scientific rigour having been applied in addressing mental toughness. This lack of clarity is unfortunate, as mental toughness has such a significant impact on athletic achievement (Clough & Earle, 2002; Goldberg, 1998; Gould et al., 1987; Loehr, 1982, 1995; Williams, 1988). Researchers have yet to produce valid assessment and training methods for mental toughness.

This thesis aims to review mental toughness research with the goal of developing a conceptual model and a measurement instrument to assess mental toughness in athletes. Consistent with the overarching aim, the thesis begins with a critical review of research on mental toughness theory and measurement. Typically, reviewing such works would provide the foundation from which to build and enhance theory and measurement. Given the dearth of research on mental toughness, however, reviewing related concepts such as resilience, coping, self-concept, and flow, rounds out a theoretical base from which research can extend.

The development of mental toughness theory and measurement in this thesis is carried out against the backdrop of a construct validity approach to theory development and measurement. Broadly, a construct validity approach to theory development includes investigations of the internal structure of a concept before placing the concept within the context of a broader group of related and unrelated concepts. The construct validation approach is presented in more depth at the conclusion of the literature review.

**In Search of Mental Toughness**

Until recently, Loehr’s popular books on mental toughness remained the most influential work for professional practice (1982, 1995). Loehr published a model of mental toughness that included seven characteristics: self-confidence, negative energy, attention control, visual and imagery control, motivation, positive energy, and attitude control. Although this model is conceptually appealing, Loehr offered little rationale for the selection of the seven mental toughness factors. Rather, the model appears to be a collection of psychological skills based on Loehr’s personal and clinical experience and thoughts about attributes that relate to superior performance under pressure.
After Loehr’s early work, researchers identified the need to move beyond heuristic notions of mental toughness, towards a scientifically based understanding. In particular, researchers of mental toughness jointly agreed that qualitative methods were, and still are, the keys to unlocking the mysteries surrounding the concept (Bull, Shambrook, James, & Brooks, 2005; Fourie & Potgieter, 2001; Gordon, 2005; Jones et al., 2002). Qualitative methods enable researchers to learn about a concept without being affected by any pre-determined ideas about that concept. This was an important step forward for theory, as it meant that models of mental toughness were no longer simply a collection of sport psychology concepts. Instead, qualitative methods allowed researchers to develop a rationale for the inclusion of certain characteristics into a model of mental toughness.

In a pioneering qualitative study of mental toughness, Fourie and Potgieter (2001) analysed written responses from 131 expert coaches and 160 elite athletes. Coaches and elite athletes responded to a series of open-ended questions requiring them to provide their best definitions and descriptions of mental toughness. Fourie and Potgieter’s analyses of these written responses identified twelve 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. Drawing from these results and Loehr’s earlier work, what emerges is a multidimensional model of mental toughness, whereby a range of important skills or capacities relate to the construct of mental toughness. Fourie and Potgieter recognised wide variation in the way coaches and athletes described characteristics of mental toughness. For this reason, the researchers concluded by suggesting that further work was needed to finalise a working definition and model of mental toughness.

In 2002, Jones et al. published the results of a qualitative study examining mental toughness in very elite athletes. Their research aimed to define mental toughness and to determine the essential attributes required to be a mentally tough performer. The definition that emerged from their analysis was that:

Mental toughness is 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).

They also identified twelve attributes as keys to mental toughness such as self-belief, an unshakeable focus, high levels of desire and determination (especially at times of distress), and overall consistency of effort and technique despite life and sport stresses. The strength of their research is that, consistent with Fourie and Potgieter (2001), multiple components of mental toughness are identified—thus reinforcing the notion that mental toughness is multidimensional. The definition presented, however, remains inadequate in that it describes outcomes of mental toughness, rather than defining mental toughness itself. Furthermore, little attempt was made to establish or draw upon a theoretical tradition in understanding and interpreting these mental toughness attributes. When qualitative data are presented in this way, what results is more a description of what participants said, with little attempt to integrate established theory and to develop a theoretically derived conceptual model. Probably the most significant gap in the area of mental toughness research is the dearth of information establishing any kind of theoretical background. For this reason, although the current thesis draws knowledge from the participants, it is guided by established theory. This approach can be considered to signify the initiation of mental toughness theory.

Also in 2002, Clough et al. attempted to incorporate athlete and coach experiences with some guiding theories drawn from hardiness research and one prominent study on physiological adaptations to stress. Although their effort to marry theory and experience is to be commended, the authors made no significant attempt to quantitatively validate the model of mental toughness that resulted from their theoretical reasoning. Instead, they tackled conceptual questions of definition and measurement. The use of untested models is a significant weakness in the mental toughness research domain. Future research needs to resolve conceptual issues before moving too quickly towards measurement. Nonetheless, the authors proposed a 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 control their own destiny, these individuals can remain relatively unaffected by competition or adversity.

This definition is somewhat superficial, in the face of such positive steps to integrate theory and practice, the authors experienced the same limitations as others attempting to define mental toughness. That is, the definition simply describes what mental toughness “looks like” and not the characteristics that constitute mental toughness. Their proposed model of mental toughness simply combined a model of hardiness (see Kobasa, 1979) with one study that established confidence as important for managing stress. The resulting model included control, commitment, challenge and confidence. For mental toughness theory to advance, care must be taken with the way that a model of mental toughness is developed. It is proposed here that a model of mental toughness cannot be a simple combination of existing models. Mental toughness needs to be investigated in depth, understanding the intricacies of the concept and how it comes about, and then, that understanding should be integrated with theory.

Most recently, Bull et al. (2005) focused specifically on mental toughness in cricket. They addressed two main objectives: to obtain a better understanding of what mental toughness is within cricket, and to identify how existing mentally tough English cricketers developed their mental toughness. They used qualitative procedures to interview 12 mentally tough cricketers (101 English cricket coaches having identified the most mentally tough cricketers of the previous 20 years). From their results they presented a complex model of mental toughness that included four structural categories, each containing a number of themes related to overall mental toughness. These include environmental influence: parents, childhood, the need to earn success, opportunities to survive early setbacks, exposure to foreign cricket; tough character: resilient confidence, independence, self-reflection, competitiveness with self as well as others; tough attitudes: never-say-die mindset, go-the-extra-mile mindset, thrive on competition, belief in making a difference, exploit learning opportunities, willing to take risks, belief in quality preparation, determination to make the most of ability, self-set challenging targets; and tough thinking: thinking clearly—making good decisions, keeping perspective, honest self-appraisal and robust self-confidence—overcoming self-doubts, feeding off physical conditioning, maintaining self-focus.
The strength of Bull et al.’s (2005) research is the identification of multiple dimensions of mental toughness. The multidimensionality of mental toughness is a central theme for all who have researched and reported on the concept (i.e., Clough et al., 2002; Fourie & Potgieter, 2001; Jones et al., 2002). Although the characteristics that constitute the multidimensional models do vary from researcher to researcher, all agree that multiple factors are a part of mental toughness. A further strength of Bull et al.’s research is that for the most part their model identifies factors that are a part of mental toughness, not outcomes of being mentally tough (in contrast to the research effort by Jones et al, 2002). For example, the basic structure of their model includes the influencing roles of the environment, tough character, tough attitudes and tough thinking. A limitation of their research is that they did not explicitly link their model of mental toughness to theory. Until such models are linked to theory and subsequently tested, they are more an interpretation of qualitative research data than theoretically grounded constructs which subsequently are empirically validated—even if those interpretations are based on the collective experience of participants and the researcher. Taking that extra step of relating the model to theory, closely followed by the quantitative testing of that model, is important for future mental toughness research and is the focus of the present study. These strengths and limitations provide important lessons for this thesis in the quest to pursue a valid model and measurement tool for mental toughness.

**Current State of Mental Toughness Conceptualisation**

Researchers have not come to an agreement on the conceptualisation of mental toughness. Recent efforts have attempted to define the concept, but even those efforts have shown variation in the way mental toughness is characterised and in the way those characteristics are brought together into a model of mental toughness. Some of the characteristics said to be indicative of mental toughness include:

- Willpower, control, motivation, thriving, competitiveness and courage (Bull et al., 1996; Bull et al., 2005; Favert & Benzel, 1997; Fourie & Potgieter, 2001; Gould et al., 1987; Graham & Yocom, 1990; Hodge, 1994; Jones et al., 2002; Loehr, 1982; Tunney, 1987; Tutko & Richards, 1976; Woods et al., 1995);
- Focus and concentration (Finch, Gould, Smethurst, & Steffen, 1996; Fourie & Potgieter, 2001; Goldberg, 1998; Graham & Yocom, 1990; Jones, 1982; Jones et al., 2002; Loehr, 1982; Luszki, 1982; Tunney, 1987);

- Desire, determination and commitment (Bull et al., 1996; Bull et al., 2005; Fourie & Potgieter, 2001; Goldberg, 1998; Hodge, 1994; Jones et al., 2002; Loehr, 1982; Luszki, 1982; Tunney, 1987; Williams, 1988);

- Achieving consistency (Gould et al., 1987; Graham & Yocom, 1990; Loehr, 1982; Williams, 1988);

- High levels of optimism, confidence, self-belief, and self-esteem (Bull et al., 1996; Favret & Benzel, 1997; Finch et al., 1996; Goldberg, 1998; Gould et al., 1987; Graham & Yocom, 1990; Hodge, 1994; Jones et al., 2002; Loehr, 1982, 1995; Luszki, 1982; Pankey, 1993; Taylor, 1989; Woods et al., 1995);

- Coping with performance pressures (Bull et al., 2005; Fourie & Potgieter, 2001; Jones et al., 2002); and,

- Resilient confidence (Bull et al., 2005; Fourie & Potgieter, 2001).

Gordon (2005), in his address to the International Society of Sport Psychology Congress, presented a review of the current state of research into mental toughness. Gordon identified that although early qualitative efforts had been made to characterise mental toughness, little had been done to explicitly link the concept to theory. Similarly, Clough et al. (2002) suggested that for mental toughness theory to progress, the definition process for mental toughness requires two separate avenues: (a) obtaining the views of practitioners, players, and coaches on mental toughness, and (b) reviewing and drawing from established academic research findings. They proposed that in general, sport psychology construct development has been hampered by a separation between researchers and practitioners. This separation has made it difficult at times for conceptualisation to influence practice and vice versa. Ideally, conceptualisation and practice are intertwined such that athletes can benefit from the interaction of ideas, experience and feedback.
Substantive Issues to be Resolved

The present research attempts to address a major gap in the sport psychology literature. Researchers and practitioners alike are appealing for a validated understanding of mental toughness. The sport psychology literature routinely discusses such topics as anxiety control, concentration, motivation, confidence, visualisation and imagery, body image, and overcoming injury. Nonetheless, mental toughness, a key attribute seen by many as ‘making the difference’ in sporting achievement, has not received such direct attention. What is emerging from the literature is a multidimensional model of mental toughness. Such a model may subsume a range of sport psychology concepts (such as confidence, anxiety control) in a way that explains how athletes perform at high levels despite difficult circumstances. The present research aims to combine the best of qualitative methods with guiding influences from the literature, and then employ quantitative methods to develop a valid measure of mental toughness.

In terms of mental toughness measurement, the literature presents no suitable measure of the construct. Both Loehr (1995) and Clough et al. (2002) have produced questionnaire assessment tools. In both instances, the lack of a theoretical basis in the design of these instruments significantly undermines any attempt to demonstrate the validity of these instruments. Loehr’s instrument, however, was the most widely recognised and used at the time the current study commenced. Prior to the development of further instrumentation, this research conducts a psychometric evaluation of Loehr’s Psychological Performance Inventory. Evaluation of the PPI will also present important lessons for this researcher as the investigation moves towards developing a new measure of mental toughness.

Surrounding the central issues of conceptualisation and measurement, there are a number of related issues to be resolved. Specifically, is mental toughness different from any other experience of adversity? For example, both resilience and hardiness have received some attention over time as descriptive terms that define people who deal with challenging circumstances well. In what way, if any, does mental toughness differ from resilience or hardiness? What can research on mental toughness learn from hardiness and resilience theory? Also, how do such concepts as flow and self-concept relate to mental toughness? Self-concept is reported to have
significant positive influences on numerous human conditions. So, how does it affect mental toughness? Likewise, flow is described as a key concept relating to superior athletic performance. Do flow and mental toughness have similarities and differences? These questions remain to be answered and will be examined closely in the course of this research.

Taking together the different research on mental toughness, the concept remains inadequately defined and conceptualised. Furthermore, given the lack of an operational definition, a suitable measure of mental toughness is yet to be developed. This is important because such measures will assist researchers to unravel the critical role of mental toughness and thereby facilitate early talent identification, and early intervention strategies. This thesis aims to characterise mental toughness explicitly, locating it within the broader context of theory and other established constructs.

Unravelling Theories Related to Mental Toughness

Given the identified gaps in the available mental toughness literature, it is worthwhile considering some well-established sources of theory that can guide the present investigation. Both “resilience” and “hardiness” have been extensively researched as concepts that help explain positive outcomes in the face of stressful circumstances. Reviewing these concepts provided the researcher with perhaps the strongest source of guidance, as both hardiness and resilience are akin (but not identical) to mental toughness.

Self-concept is also included in this review. Self-concept captures the complexities of how people perceive and think about themselves. Researchers have related those self-perceptions to a myriad of outcomes. The field has a strong research history, which includes the recently identified “elite athlete self-concept”. The present research seeks to gain an understanding of the potential role of self-concept and how it relates to mental toughness.

Finally, the concept Flow is reviewed. Flow describes a state of mind that is believed to bring about superior athletic performance. Although the review of such concepts as resilience, hardiness and self-concept addresses the ‘hanging in there’ factor, flow on the other hand, reviews the real “performance experience” aspect of elite sport. Flow has received some research attention and is widely accepted in practice. The foreshadowed yields of the review of flow literature include an
understanding of how athletes achieve optimal performance, identification of factors associated with achieving flow, and potentially, guidance in the successful development of a performance concept in the sport psychology domain.

Taken together, hardiness, resilience, self-concept and flow offer a wide-ranging base of theory to draw from. Collectively these research domains identify characteristics that are critical, from both a ‘hanging in there’ perspective and a ‘performance experience’ perspective. Importantly, all of these concepts are immersed in a sound base of theory and research, thereby offering the current investigation theoretical guidance.

Resilience

The literature on resilience offers a significant source of theoretical guidance for mental toughness research. Resilience is generally seen as a quality or ability to regain functioning after some adversity or challenge. Resilience has, over time, been used to describe people who effectively cope with crisis, overcome pain and suffering, and flourish in spite of adversity. Researchers have been interested in resilience for over 70 years, with this interest intensifying over the last 25 to 30 years.

Historical Roots

For some years psychologists have been interested in psychological predictors of illness or psychopathology. There has been an abundance of investigations into the effects of psychological stress on various conditions such as heart attacks, cancer, schizophrenia, depression, anxiety disorders and more. As a consequence of this line of research, people became aware of and interested in resilient individuals who were capable and successful despite experiencing risk and adversity. Some of the earliest studies examined resilient people during the Depression (Angell, 1936; Cavan & Ranck, 1938) and World War II (Hill, 1949; Koos, 1946). These studies focused on the strengths in personality, family dynamics, and social support from families of people who successfully coped with such crises.

Norman Garmezy (1971, 1974a, 1974b) sparked the ensuing interest in resilience when he took a leading role in his early investigations concerning the role of “risk” in the development of schizophrenia. His research involved examining a
large sample of high-risk children who, in spite of adverse backgrounds, appeared to have normal development. The presence of competence in these children and adolescents led to ideas of invulnerability, stress resistance, and resilience. Garmezy continued to study successful adaptation despite risk by researching children who: were exposed to a stressful life event (Garmezy, 1981); were handicapped (O’Doughery, Wright, Garmezy, Lowenson & Torres, 1983); had mothers with mental illness; had maladaptive behaviours (Rolf, 1972); and were psychologically disadvantaged (Garmezy & Nuechterlein, 1972). Subsequent studies described “invulnerable”, “odds defying” children and “superkids” who were able to survive and flourish in spite of adversity (Anthony, 1987; Anthony & Cohler, 1987; Kauffman, Grunebaum, Cohler & Gamer, 1979).

Following Garmezy, research into resilience proliferated during the 1980s and 1990s. The majority of researchers continued to make observations about the characteristics of people who successfully coped with risk and adversity (e.g., Baldwin, Baldwin, & Cole, 1990; Elder & Clip, 1989; Jew & Green, 1998; Masten & Coatsworth, 1998). In more recent years, more sophisticated views of resilience have emerged in the form of proposed models that aid understanding of resilience and associated factors (see Carver, 1998). In the domain of sport, resilience has received little attention, with only a few papers presented recently on resilience and various aspects of performance (Crawford, Schofield, & Mummery, 1999; Mummery, Schofield, Perry, Crawford, 1998; Schofield, Kelly, & Mummery, 2000). Most recently, Martin and Marsh (2006) used a unidimensional measure of resilience to show how resilience predicted academic performance outcomes such as enjoyment of school, class attendance, and general self-esteem. They also presented a 5 factor mode of academic resilience, including: self-efficacy, planning, control, low anxiety, and persistence.
Identifying Resilience

Many researchers identify resilience by the presence or absence of psychological impairment after experiencing stress, trauma, or some kind of adversity. For example, individuals are identified as possessing resilience when they have survived childhood cancer (Beardslee, 1989), survived heart defects (O’Doughery et al., 1983), escaped psychiatric illness after hardship and misfortune (Bebbington, Sturt, Tennant, & Hurry, 1984), lived with good emotional health after combat experience (Aldwin, Levenson, & Spiro, 1994; Elder & Clip, 1989), had success despite poverty (Garmezy, 1993), remained united with their families after war, separation and reunion (Hill, 1949), survived over a long period with the AIDS disease and yet remained positive and psychologically well adjusted (Rabkin, Remien, Katoff, & Williams, 1993), and lived without dysfunction despite being brought up in troubled families (Koos, 1946; Wolin & Wolin, 1993). In these cases, resilience is seen as the absence of psychological impairment despite experiencing some kind of hardship or adversity.

Similarly, others determine resilience by the presence or absence of competence and normal psychological adjustment despite being at high risk of maladjustment. For example, a great deal of research looks at youngsters who achieve competence despite being at risk due to a parent’s mental disorder, such as schizophrenia, depression, alcoholism and suicide (Anthony, 1987; Baldwin, Baldwin, & Cole, 1990; Beardslee, 1989; Garmezy, 1981; Garmezy, 1974a; Garmezy, 1974b; Garmezy, 1971; Kauffman et al., 1979; Masten & Coatsworth, 1998; O’Grady & Metz, 1987; Rolf, 1972; Rutter, 1985). These researchers defined someone as resilient because they have been at high risk of psychopathology and yet have shown competence, and in some cases exceptional success.

Descriptions of Resilience

People who demonstrate resilience have been described as:

- “Stress resistant” (Baldwin et al., 1990; Garmezy, Masten & Tellegen, 1984; Garmezy & Masten, 1986);
• “Invulnerable” (Anthony, 1987; Cohler, 1987; Cowen & Work, 1988; Garmezy & Neuchterlin, 1972; Hauser, Vieyra, Jacobson & Wertlieb, 1985);

• “Capable” (Glaser, Butler & Pryor, 1998);

• “Competent” or “adaptive behaviour” (Emery & Kitzmann, 1995; Fine, 1991; Worland, Weeks & Janes, 1987);

• “Unusually good adaptation” (Beardslee, 1989);

• “Successful adaptation” (Moen, 1997; Wagnild & Young, 1990);

• “Resourceful adaptation” (Elder & Clip, 1989);

• “Thriving” (Carver, 1998).

• “Superkids” (Kauffman et al., 1979);

• “Relatively good outcome despite major risk of the development of psychopathology” (Rutter, 1999);

• Having “enormous human capacity” (Felsman & Vaillant, 1987); and,

• “Children who will not break” (Segal & Yahraes, 1978).

Again, as seen above, descriptions of resilience are what the end product looks like—people successfully overcoming adversity. What these descriptions fail to describe is the process of resilience, the process of overcoming adversity. How do these people do it? It must also be noted here that one limitation of reviewing these studies is that most of these definitions have arisen from investigations in children and adolescents, and their applications to adult populations is uncertain.

Luthar (1991) described childhood resilience as observed behavioural success at developmental tasks despite the experience of stressors and possible underlying emotional distress. In this description, resilience is viewed as competence despite risk, not necessarily emotional health. Luthar also found competence among highly stressed but resilient adolescents to be accompanied by increased levels of depression, anxiety and self-criticism (Luthar, 1991). Although competence and behavioural problems are more obvious examples of someone not coping well, the effects of internal suffering should not be underestimated or ignored. Resilience needs to be considered in terms of both external and internal difficulties.
An important truth common to all those who have described resilience is that in order for persons to be defined as resilient, it must be demonstrated that they have actually been placed in adverse situations and have withstood them (Masten & Coatsworth, 1998). That is, resilience becomes apparent or develops in the context of some kind of challenge, trauma or adversity. What does this mean for researchers who want to understand this human ability to overcome adversity? Firstly, resilience only exists in the presence of some adversity or potential stressor. To best understand resilience, then, one should consider the interaction of the adversity or challenge factors with the resilience factors (similar to work done by Kaplan, 1999). This holistic perspective acknowledges that what constitutes effective protective factors can vary significantly, depending on both the level and form of adversity or challenge.

Definitions of Resilience

Resilience has been defined as:

The ability to recover quickly from illness, change, or misfortune; The act of resiling, springing back, or rebounding. (www.dictionary.reference.com)

Researchers also use similar terms in their definitions of resilience (e.g., Carver, 1998; Dyer & McGuiness, 1996; O’Grady & Metz, 1987; Rak & Patterson, 1996; Walsh, 1996; Wolin & Wolin, 1993). A resilient person is defined as:

One who regains functioning following adversity. ‘To spring back’ does not suggest that one is incapable of being wounded or injured. Metaphorically, it is descriptively appropriate to consider that under adversity, an individual can bend, or lose some of his or her power and capability, yet subsequently recover to the prior level of adaptation. (Garmezy, 1993, p. 129)

Garmezy provided a useful definition of resilience. The limitation though, is that the definition, like many of the descriptions of resilience, only identifies resilience as the outcome (i.e., recovering to a prior level of adaptation after experiencing adversity). A more useful definition might indicate the dimensionality of resilience.

The following section reviews factors that are said to be dimensions of resilience. The twin perspectives of personality and social psychology bring to bear
two distinct angles that are useful in understanding the dimensions of resilience. From personality psychology, many individual difference variables have conceptual links to general themes of perseverance, resilience, and thriving. From social psychology come discussions of situational or contextual variables that may serve similar functions. These all would seem to represent variables worth examining more closely in relation to resilience and mental toughness.

**Individual Differences as Dimensions of Resilience**

**Self-belief and motivation**

Carver’s (1998) suggests that whether a person shows resilience or thriving depends on the personality traits of mastery (i.e., the sense that one has mastered a specific skill) of and confidence (i.e., the belief in oneself to perform the necessary task). As the importance of an event increases for people, those with high confidence/mastery will tend to increase their efforts whereas low confidence people will give up. This pattern is self-perpetuating and self-intensifying. If one starts from a position of low confidence then it takes a larger increase in confidence for them to start trying than for the high confidence people to keep trying. In a situation where recovery from adversity is important, those starting from a position of high confidence will find it easier to cope. The strength of Carver’s contribution for mental toughness is that it identifies both “mastery” and “confidence” as significant dimensions of resilience. These factors have also been commonly reported by others studying resilience (Garmezy, 1981; Garmezy & Neuchterlein, 1972; Kauffman et al., 1979; Schofield et al., 2000). Also implicit in Carver’s work is the ‘importance of the event’ in determining the likelihood of resilience.

Self-belief is commonly reported as a factor of resilience. Mummery et al. (1998) identified a positive physical self-concept as an important dimension of performance resilience in adolescent competitive swimmers. Beardslee (1989) reported that resilient people believe themselves to be good problem solvers. Kauffman et al. (1979) suggested that a healthy self-esteem is a significant protective characteristic of “superkids”—competent children of mentally ill mothers. Furthermore, the belief in oneself and one’s capabilities is seen as a factor of resilience by others (Glaser et al., 1998; Masten & Coatsworth, 1998; Moen, 1997;
Segal & Yahraes, 1978; Wagnild & Young, 1990; Wolff, 1995). As identified earlier, self-belief or confidence is also a commonly reported component of mental toughness.

**Intelligence and achievement**

Many researchers stress the importance of intelligence as a dimension of resilience. Intelligence is a concept that has been developed to describe why people vary in their abilities to overcome problems that require learning, thinking, and solving. In general terms, most researchers view intelligence as “a person’s capacity for goal-directed and adaptive behavior; and involves the ability to profit from experience, solve problems, and reason effectively” (Myers, 1998, p. 337). In retrospective studies of people who experienced adversity and risk, intelligence (IQ) was found to be a significant discriminating variable between those who coped successfully and those who did not (Baldwin et al., 1990; Garmezy et al., 1984; Kauffman et al., 1979; Masten & Coatsworth, 1998; Rabkin et al., 1993; Schissel, 1993; Werner & Smith, 1982; Wolff, 1995). Some researchers identified the intelligence of the parent as a significant determinant of the resilience of the child (Baldwin et al., 1990; Kauffman et al., 1979).

Rather than there being a unidimensional intelligence, it would seem that multiple intelligences exist (Gardner, 1983, cited in Berk, 1998; Myers, 1998). For example, Salovey and Mayer (1990) identified emotional intelligence as distinct from academic or cognitive intelligence. Of particular relevance to the present study, emotional intelligence in essence suggests that to remain goal-directed and adaptive requires a capacity to:

1. Appraise and express emotions in self and others;
2. Regulate emotions in self and others;
3. Use emotions adaptively (in thought, reason, and problem solving).

(Salovey, 1998)

Already implicitly linked in the work of some researchers, emotional intelligence and mental toughness seem destined to be drawn together in some capacity. In the work of Gordon (2002), the development of emotional intelligence in elite sport is encouraged through coaching athletes on “tough” situations. Smith
(1998) described mentally skilled athletes (which he interchanges readily with emotionally intelligent) as having “emotional toughness in the face of challenges or adversity” (p. 13). For the current study, it is important to consider the skills of emotional intelligence as they relate to mental toughness.

**Coping**

It is not surprising that researchers report good coping strategies as a characteristic of resilience (Beardslee, 1989; Carver, 1998; Garmezy, 1981; Garmezy & Neuchterlein, 1972; Glasser et al., 1998; Mummery et al., 1998; Murphy & Moriarty, 1976; Schofield et al., 2000; Wagnild & Young, 1990; Wolf, 1995). Coping style attributes considered to be dimensions of resilience include: self-regulation—the regulation of impulsive drives (including attentional, emotional, and behavioural drives) and the ability to delay gratification (Masten & Coatsworth, 1998; Murphy & Moriarty, 1976; O’Grady & Metz, 1987; Segal & Yahraes, 1978; Werner & Smith, 1982), the tendency to maintain a positive future orientation (Segal & Yahraes, 1978; Werner & Smith, 1982), good attention or concentration skills (Kauffman et al., 1979; Werner & Smith, 1982), the tendency for perseverance (Wagnild & Young, 1990), and adaptive personalities (Elder & Clipp, 1989; Rabkin et al., 1993; Wagnild & Young, 1990; Werner & Smith, 1982). Collectively these are all reasonable factors to consider in any conceptualisation of mental toughness.

**Physiology**

What of the relevance of physiological differences between resilient and less resilient people? Dienstbier (1991) completed a review of the literature on the physiological arousal of humans relative to some associated acute or chronic stressors. In drawing together the various research findings on the topic, Dienstbier developed a physiological toughness model. The underlying premise of the model is that “within genetic limits of adaptability, all physiological systems are strengthened through use and tend to become less able and efficient through disuse” (pp. 849). It was suggested that when humans experience various forms of stress, the body is ‘toughened’ such that a further exposure to a similar stress should produce an attenuated response. The model developed suggests that toughened individuals have more adaptive physiological responses.
Although a physiological basis for mental toughness is worthy of consideration, it is beyond the scope of this study, which focuses on the psychological dimensions of mental toughness.

**Situational or Contextual Dimensions of Resilience**

**Social support**

There is a striking consistency in the findings of studies of resilience in multiple populations across multiple time periods; social support of various kinds is consistently reported as an important dimension of resilience (Carver, 1998; Garmezy, 1981; Garmezy & Neuchterlein, 1972; Glaser et al., 1998; Hill, 1949; Kauffman et al., 1979; Masten & Coatsworth, 1998; O’Grady & Metz, 1987; Rabkin et al. 1993; Schissel, 1993; Segal & Yahraes, 1978; Werner & Smith, 1982). Many report the importance of a close and positive relationship with a parent in the first few years of life. Others suggest that the social support of the extended family is an important factor in resilience. Carver (1998) reported that having a close attachment as an adult gives one a secure basis from which to explore. Segal and Yahraes (1978) reported the presence of an inspirational person in the lives of the resilient, along with parents who recognise the validity of their personal interests and goals. Other significant sources of social support include: peers, older friends, grandparents, siblings, teachers, and ministers. In a study of the influence of social support and coping skills on resilience in competitive swimmers, no direct effect of social support on resilience was found (Crawford, et al. 1999). Rather, social support was mediated by coping skills, and coping skills had a direct influence on resilience.

In mental toughness, some might suggest that if athletes need the support of others then they are not mentally tough. Certainly, if they rely heavily on support every step of the way then that would not demonstrate personal strength. At the same time, however, having the knowledge that there are people who support what they are doing and who would help if needed, can give them a sense of strength from which they feel free to explore and challenge the world without fear of failing. The role of social support in mental toughness is therefore worth considering, and particularly the way in which mentally tough athletes use their social support.
Summary of Resilience

Overall, resilience is a complex phenomenon. Resilience is the ability to bounce back after adversity. A number of factors from within the person, from outside the person, and from the adversity itself affect resilience. A number of characteristics from within the person were identified—these characteristics fall into the broad categories of: self-belief, motivation, coping skills, emotional intelligence, and physiological adaptations to stress. External to the person, social support has been shown to be a significant contributor to resilience. These findings are informative for the current investigation into mental toughness and the development of its theory and measurement.

However, there are some limitations to how this quality of resilience can be used in the conceptualisation of mental toughness. Since the term has origins in populations largely at risk of psychopathology, this means that resilience has been seen somewhat from a psychiatric perspective. Although much can be learned about mental toughness from the resilience research, one must also be cautious about uncritically applying findings from one population to another. The population of interest for mental toughness is not necessarily suffering from the same types of risk (e.g., psychopathology), and therefore the conditions of mental toughness may differ to the experience of resilience. Another limitation of the above-mentioned works is that a significant proportion of the research reviewed examined resilience during childhood. One must be careful not to overgeneralise findings from one population to another. Mental toughness is also different to resilience in that mental toughness specifically occurs in the context of performance. Furthermore, mental toughness is more than merely returning to ‘normal’ functioning—mental toughness is about thriving on the experience and excelling despite the adversity. Hence, it is proposed here that mental toughness, although consistent with resilience in a number of ways, is not the same as resilience.

Notwithstanding this, there are a number of key points raised in this review of resilience that have relevance for the current study into mental toughness. First, research efforts need to identify the experience itself (and dimensions of that experience) rather than what it looks like retrospectively. Second, there appear to be multiple dimensions of resilience (and mental toughness), and therefore a model should identify the multiple factors that constitute mental toughness. Third, as for
resilience, researchers into mental toughness need to consider contextual elements of an individual interacting with a stressor. Finally, resilience points out factors such as self-belief, coping skills, motivation, and emotional intelligence as important for overcoming adversity. These variables need to be considered in the conceptualisation of mental toughness.

**Hardiness**

Hardiness was first identified (Kobasa, 1979) as a set of beliefs about the self and the world, involving a sense of control, commitment, and challenge. Kobasa hypothesised that hardiness protects physical health despite stressful circumstances. According to Maddi and Kobasa (1984), a hardy person views potentially stressful situations as meaningful and interesting (commitment), sees stressors as changeable (control), sees change as a normal aspect of life rather than as a threat, and views change as an opportunity for growth (challenge). When confronted with disruptions, changes or problems, hardy individuals are more likely to cope by transforming them mentally and in action into something less stressful (Allred & Smith, 1989; Hull, Van Treuren and Virnelli, 1987).

Hardiness has more recently been applied in the sports-performance domain. For example, researchers have demonstrated positive relationships between hardiness and performance, athlete mood states, and injury recovery times (Ford, Eklund, & Gordon, 2000; Goss, 1994; Maddi & Hess, 1992). Maddi and Hess presented results that demonstrated a moderate positive relationship between hardiness and basketball performance throughout a season. Goss (1994) published a study on hardiness and mood disturbances in swimmers while training. Their results revealed that hardy swimmers experienced fewer mood disturbances during the season than non-hardy swimmers. Specifically, hardy swimmers had lower feelings of tension, depression, anger, fatigue, confusion, and higher feelings of vigour. They also found that hardy swimmers possessed more adaptive coping behaviours. Ford et al. (2000) likewise reported that hardy individuals cope more effectively with life change stress, resulting in reduced injury vulnerability and faster recovery rates. Andersen and Williams (1988) also included hardiness as a predictor in their model of stress and athletic injury. Research efforts clearly link hardiness with overcoming stressors in the sporting domain.
In their review of the state of theory and research on hardiness, Funk (1992) concluded that hardiness research had been hampered by several fundamental shortcomings, including measurement problems, the failure to test hardiness theory adequately, and the failure to find predicted results. Funk suggested that these shortcomings are products of poor operationalisation of the construct. Furthermore, researchers have tended to adopt convenient, simple, and familiar research strategies at the expense of scientific rigor. This trend is exemplified by researchers using pre-existing scales to measure hardiness, as opposed to constructing scales to fit hardiness theory (e.g., Personal Views Survey; Hardiness Institute, 1985).

As with resilience, it is proposed here that hardiness is distinct from mental toughness. Hardiness is a mindset that combines beliefs about control, commitment and challenge to effectively counter potentially negative affect resulting from adversity. Mental toughness is different to hardiness in that mental toughness is more than merely resisting yielding to potentially debilitating experiences—mental toughness is about thriving on the experience and excelling despite the adversity. Notwithstanding this, a number of key points raised in this review of hardiness inform the current study into mental toughness. Specifically, the three components of hardiness—control, commitment, and challenge—are worthy characteristics to consider in the conceptualisation of mental toughness. Poorly operationalised conceptual models have been shown to be the root of inconsistent findings for hardiness theory and research. Mental toughness researchers need to be mindful of adequately conceptualising mental toughness before moving towards issues of measurement. The current investigation also needs to consider the most appropriate research methods, whereby mental toughness models are explicitly tested.
Self-Concept

Self-concept is a construct related to success, achievement, and other desired outcomes. In the area of sport and exercise, researchers have identified self-concept as a significant predictor of achievement (Marsh, Hey, Johnson, & Perry, 1997; Marsh, Hey, Roche, & Perry, 1997; Marsh & Peart, 1988). Self-concept, and other related topics such as self-efficacy, self-belief, and confidence, have been central issues in sport psychology and performance. Self-concept is examined in relation to mental toughness due to the large amounts of literature on mental toughness making either general or direct connections with the notion of self-belief/confidence. For this reason, there is value in reviewing self-concept as a possible component of mental toughness.

Physical Self-Concept

For years, self-concept research was plagued by inconsistent findings and a general failure to measure the concept accurately. More recently, however, considerable advancement in self-concept research has been achieved through adopting stronger theoretical models, better methodology, and stronger analytical tools (e.g., Marsh, 1990a, 1993a; Marsh, Byrne, & Shavelson, 1988). One of the most significant outcomes of these advancements is the finding that self-concept is multidimensional. On this point, researchers have identified that one aspect of someone’s overall self-concept is their physical self-concept (Marsh, 1993b; Marsh et al., 1997). Most recently, researchers have identified the self-concepts of elite athletes.

Elite Athlete Self-Concept

In 1995, Marsh suggested that new instruments should be developed specifically to measure the self-concept of elite athletes. Many researchers claim that the most useful self-concept instruments are those that measure specific components that are particularly relevant to a specific population.

Marsh et al. (1997) developed the Elite Athlete Self-Description Questionnaire. Forming the basis of this instrument was the hypothesis that overall performance by elite athletes was a function of: skill levels, body suitability, physiological (aerobic and anaerobic) competence, and mental competence.
Consistent with the construct validity approach, instrument development followed the path of item development, piloting, refinement, and finally testing the instrument in an elite athlete sample. The final instrument was found to be psychometrically sound across an elite athlete sample.

In searching for the composition of mental toughness, the elite athlete self-concept has a lot to offer. One of the most commonly reported ingredients to mental toughness is self-belief. Drawing from theory on the self-concepts of elite athletes is likely to provide the current investigation with guidance in ways athletes think about themselves, and how those self-perceptions play out to affect performance and health outcomes.

**Flow in Sport**

The above reviews on resilience and hardiness address the “hanging in there” element of mental toughness. However, it is proposed here that there is also a “performance experience” aspect of mental toughness. Jackson and Roberts (1992) hypothesised that an important psychological dimension underlying peak performance is the experience of flow. The researchers found support for this idea through examining athletes’ descriptions of optimal performances and scores on measures of flow. Flow in sport is described as:

“an optimal psychological state whereby a person becomes totally absorbed in the activity and undergoes a number of positive experiences, including freedom from self-consciousness, great enjoyment of the process, clarity of goals and knowledge of performance, complete concentration, feelings of control, and a sense of being totally *in tune with the performance*” (Marsh & Jackson, 1999, p. 344).

The foreseen yield of flow in the context of mental toughness is the identification of a range of psychological variables that have been explicitly linked with the achievement of peak athletic performance. Mental toughness, too, is centrally relevant to peak performance, with perhaps more of an emphasis on overcoming the obstacles to achieving that level of performance.

The nine-factor model of flow was first developed by Csikszentmihalyi (1990, 1993; Csikszentmihalyi & Csikszentmihalyi, 1988). Subsequent support for
the model came from Jackson’s qualitative content analysis of elite athletes’ flow descriptions (1992, 1995). The nine dimensions are: challenge-skill balance (a feeling of balance between the demands of the situation and perceived skills); action-awareness merging (involvement is so deep that it becomes almost automatic); clear goals (a feeling of certainty about what one is going to do); unambiguous feedback (immediate and clear feedback to one’s actions); concentration on task at hand (a feeling of being totally focused); sense of control (a sense of exercising control); loss of self-consciousness (lack of concern for or worry about the self); transformation of time (a perceptual altering of the way time passes); and autotelic experience (the end result of being in flow, a feeling of doing something for its own sake, with no expectation of future reward or benefit).

A number of the flow factors are conceptually related to mental toughness. For example, factors such as control, concentration, challenge-skill (in essence, a form of self-belief) are routinely reported in the limited work on mental toughness, but also more broadly in resilience and hardiness studies. This body of research will inform the current investigation as to important characteristics that are related to mental toughness. Flow addresses an area of mental toughness not specifically captured in hardiness and resilience constructs. It is proposed that hardiness and resilience are concepts that describe “hanging in there” despite stressors. Flow, on the other hand, addresses the athletic “performance experience”. In sum, then, as mental toughness is developed through the present study, it is worthwhile considering the relevance of flow.

**Drawing Sources of Theory Together to Understand Mental Toughness**

Mental toughness has received limited conceptual work and theory development. Commonalities in describing mental toughness revolve around the four central themes of self-belief, motivation, coping skills, and focus or concentration. Reviews of resilience indicate a number of individual (e.g., specific styles of motivation, self-belief, effective coping methods) and situational (social support) elements that constitute resilience. Hardiness also contains variables that influence positive outcomes in relation to stressors—namely control, commitment, and challenge. Self-concept research suggests that athletes’ self-concepts influence performance. Flow also provides a perspective on the range of variables that are associated with actual performance experience.
The task, then, is to integrate these diverse perspectives to propose core
dimensions of mental toughness. Those characteristics are then to be synthesised into
a model that captures the breadth and multidimensionality of mental toughness. The
above reviewed theory interweaves the fabric of the results of this thesis, thereby
helping to extend established work, theory, and measurement in mental toughness.

Mental Toughness Measurement

Loehr’s Psychological Performance Inventory (PPI—1986) remains the most
influential mental toughness instrument. Loehr published the PPI in his book on
mental toughness (1986) and claimed that the instrument measured the seven most
important psychological factors that reflect mental toughness: self-confidence,
negative energy, attention control, visual and imagery control, motivation, positive
energy, and attitude control. Although Loehr offered an intuitively and conceptually
appealing discussion of the instrument, he presented no psychometric support for its
use. Surprisingly, given the ongoing impact of Loehr’s research and despite the PPI
being used in practice, there apparently have been no rigorous and formal evaluations
of the PPI’s psychometric properties. Murphy and Tammen (1998) pointed out that it
should not be used because it lacks norms, validity, and reliability data and, more
generally, a clear rationale in construction/selection of items. The following
questions remain to be pursued. Is the PPI reliable? Does the PPI demonstrate
convergent and discriminant validity? Does the a priori factor structure provide a
reasonable fit to the data (based on athlete responses)? Do the PPI factors proposed
by Loehr relate in a meaningful way to established and conceptually-related
constructs? Taken together, the answers to these questions will provide evidence to
either support or reject the model of mental toughness presented by Loehr, and the
subsequent use of the PPI as a test of mental toughness. Answering these questions is
the focus of Study 1. It is anticipated that a thorough examination of the PPI can
guide the development of a new model and measure of mental toughness.

Clough et al. (2002) presented the development of the MT48—a 48-item
questionnaire measuring four components of mental toughness (i.e., control,
commitment, challenge, and confidence). The MT48 was based substantially on the
hardiness model (i.e., control, commitment, and challenge). The authors of the MT48
deduced that because the instrument was based substantially on the hardiness model,
content validity was established. Adopting a model from one area and applying it to a
cognate (but still distinct) area is not an acceptable method for demonstrating validity
(i.e., the validity of each new construct needs to be independently assessed). For the
current research, validity requires that mental toughness measurement be based on an
adequately developed conceptualisation of mental toughness.

Clough et al. (2002) administered the MT48 to more than 600 athletes from a
range of sports. The results revealed a reliability coefficient of .90 for the instrument.
Clough et al. then attempted to demonstrate the construct validity of the MT48
(which they describe as ‘does it relate to other measures?’) by observing how overall
mental toughness (i.e., overall mental toughness obtained by combining MT48 scale
scores) relates to a number of other constructs, including optimism (r = .48, p < .01),
self-image (r = .42, p < .05), life satisfaction (r = .56, p < .01), self-efficacy (r =
.68, p < .01) and stability (r = .57, p < .01). A significant flaw in their method,
however, is that for the validity of the instrument one needs to examine how
individual MT48 scales (i.e., not overall mental toughness) relate to other constructs.
The researchers’ attempts to establish validity are to be commended, but due to some
methodological and analytical shortfalls in their validation procedures, the validity of
the MT48 remains undetermined.

There are a number of important deductions from this work on mental
toughness measurement. First, care must be taken that the researcher does not
progress too quickly towards measurement before more substantiative issues such as
definition and conceptualisation have been resolved. In the case of the MT48, which
started with impressive intentions to integrate theory and practice, the resulting
model of mental toughness was unsatisfactory, and this subsequently undermined the
development of a potentially good instrument. Second, researchers must employ
adequate methods to demonstrate validity. Later in this chapter, the construct validity
approach is presented as a method for validating a measure of mental toughness.

The development of suitable measurement for mental toughness holds many
benefits for researchers, practitioners, and athletes. There are two existing measures
of mental toughness. Unfortunately, both instruments have shortcomings. Given that
the PPI is widely recognised as a mental toughness measure, has a significant history,
and was, at the time of commencement of the present study, the most current
measure, the PPI is psychometrically tested as a component of this study.
Notwithstanding this, it is recognised that further work will be needed to examine the MT48 in the same way as the PPI.

Given the lack of theoretical foundation in the PPI’s development, it is not predicted that the instrument will be psychometrically sound. However, it is envisaged that reviewing the strengths and weaknesses of the PPI will provide a sound basis for subsequent instrument development. The research plan for the entire thesis was to:

- Evaluate the PPI to assess its suitability as a mental toughness measure;
- Begin a program of qualitative and quantitative research aimed ultimately at developing a valid mental toughness instrument to develop a grounded theory of mental toughness;
- Conduct a qualitative study of mental toughness comprising in-depth interviews with world champions and elite coaches;
- Develop and conduct preliminary testing and refinement of the Mental Toughness Inventory;
- Fully test the final version of the Mental Toughness Inventory across a wide sample of athletes differing in age, gender, and contextual environments; and,
- Utilise strong research methods to validate both the model of mental toughness and the Mental Toughness Inventory.

Taken together, these methods bring into consideration the need for a construct validation approach, the focus of the following section.

**Providing the Solution: A Construct Validation Approach**

The construct validation approach is considered a highly suitable method for pursuing mental toughness definition, concept structure, and measurement. There is now general agreement among sport and exercise psychology researchers on the need to develop and evaluate sports psychology instruments within a construct validity framework (Ostrow, 1996). More specifically, Gill, Dzewaltowski, and Deeter (1988) have concluded that “within sport psychology the most promising work on individual differences involves the development and use of sport-specific constructs and measures” (p. 139-140). They argued for a construct validation approach to the
development of multidimensional instruments based on theory, followed by item and reliability analysis, exploratory and confirmatory factor analyses, tests of convergent and discriminant validity, validation in relation to external criteria, and application in research and practice. The number of measures in sport and exercise research that meet these ideals is limited. In an intensive effort to catalogue measures used over a 25-year period, Ostrow (1996) developed the Directory of Psychological Tests in the Sport and Exercise Sciences. He included all instruments from the published sport/exercise literature with reliability or validity information, but only one third had items based on a conceptual or theoretical framework, less than one in four reported factor analyses, and less than 10% showed evidence of extensive reference support.

Although there has been progress in the last decade (Marsh, 1996), there is still need for: (a) more carefully developed instruments, (b) better articulation of the links between instrument design, theory, and practice, and (c) improved application of methodological and statistical techniques. These issues are important to resolve because weak measures undermine research and theory evaluation, thereby limiting contributions to practice.

Construct validity investigations can be classified as within-network or between-network studies:

- Within-network studies explore the internal structure of a construct. They begin with a logical analysis of internal consistency of the construct definition, measurement instruments, and generation of predictions. This is followed by studies that typically employ empirical techniques such as factor analysis; and,

- Between-network studies attempt to establish a logical, theoretically consistent pattern of relations between measures of a construct and other constructs. Between-network research is often based on correlational procedures.

In psychological research, there is a tendency to move too quickly from within-network studies that focus on good measurement to between-network studies that relate the construct to other applied outcomes—particularly for researchers with an applied orientation. For example, in their classic review of self-concept research,
theory, and measurement, Shavelson, Hubner and Stanton (1976) noted that “it appears that self-concept research has addressed itself to substantive problems before problems of definition, measurement, and interpretation have been resolved” (p. 470). After nearly a century of contradictory findings, the systematic development of self-concept measures from a construct validation perspective provided the basis for quantum leaps in our conceptual understandings of the structure, nature, development, enhancement, and impact of self-concept on other desirable outcomes (Marsh & Craven, 1997). These advances were only possible with the development of multidimensional measurement tools with demonstrated reliability and validity. These methodological issues are evident in many areas of psychological research, including mental toughness.

In the present mental toughness investigation, an important first step was to develop a good conceptual understanding of the construct (i.e., within–network approach). That is, what is mental toughness, what are the characteristics that underlie it, and in what way do these characteristics interrelate? The structure of mental toughness is determined by integrating established theory (stemming from the above review of mental toughness, resilience, hardiness, self-concept, and flow) with an in-depth qualitative study of mental toughness in elite athletes. What follows then is the development of a measurement instrument to assess mental toughness and its internal qualities. In line with the within-network approach, the internal properties of this instrument were critically examined and refined. As a final validity check, the between-network construct validity approach was used to determine how well the mental toughness construct and its internal qualities related to a selection of established sport psychology constructs. Once definition, conceptualisation, and measurement were established, more applied issues, such as examining differences in mental toughness across a range of athletes differing in age, experience and gender, were pursued.
Between-Network Sport Psychology Constructs

Consistent with the construct validity approach, it is not only important to address validity within an instrument (within-network validity) but it is also necessary to explore possible differential relationships between the characteristics of mental toughness and a set of theoretically relevant measures (between-network validity). Here it is proposed that three between-network constructs provide a theoretically relevant basis for examining the validity of the mental toughness construct: self-concept, flow, and life effectiveness.

In terms of self-concept, several researchers have become interested in the positive associations between self-concept and elite sports performance (Marsh et al., 1997; Marsh & Perry, 2005; Marsh, Perry, Horsely, & Roche, 1995; Marsh & Redmayne, 1994). In addition to self-concept, flow is deemed a feasible between-network construct. Flow is described as the psychological process underlying peak performance (Jackson, 1992; Jackson & Roberts, 1992; Marsh & Jackson, 1999). Constructs such as coping, self-efficacy, motivational drives, and control are also feasible between-network constructs – and are identified routinely in resilience and hardiness research. Taken together, the constructs of self-concept, flow, coping, motivation, self-efficacy and control provide a theoretically relevant basis for examining between-network validity of the mental toughness construct.

Overall Summary and Research Direction

Mental toughness is recognised by many as a highly important characteristic contributing to elite athletic performance (Clough et al., 2002; Gould, Dieffenbach, & Moffett, 2002; Jones et al., 2002; Loehr, 1982, 1995). Although mental toughness is commonly discussed in athletic performance circles, it has escaped adequate definition and conceptualisation. Recently, there have been positive steps in this direction. However, a number of significant limitations and gaps in the research remain. Research in the cognate areas of hardiness and resilience proves informative for the present study. However, both hardiness and resilience are different from mental toughness and are not targeted to the performance domain. Mental toughness research has been fraught with methodological difficulties (i.e., lack of a conceptual model, employment of weak statistical methods). This gives rise to the need for
thorough research specifically targeting the development of a conceptual model of mental toughness. In view of this, three salient issues form the impetus for the present study:

1. The need for scientific rigour in establishing a model and definition of mental toughness;
2. The need for a valid mental toughness measurement instrument; and,
3. A tendency for researchers to move too quickly to applied outcomes before issues of conceptualisation and measurement are adequately addressed—thereby establishing the need for strong preliminary measurement work.

The thesis began by examining the psychometric properties of the PPI with a view to informing the conceptualisation and measurement approaches developed in this study. Then, the study located characteristics of mental toughness through qualitative research, drawing together meaningful data to develop a conceptual model. Following on from these developments, an instrument is constructed and validated to measure mental toughness in athletes.

The products of this research include: a conceptually-informed mental toughness factor structure comprising constructs hypothesised to reflect the attainment of mental toughness; the development of a valid and reliable measurement instrument—the Mental Toughness Inventory (MTI); confirmatory measurement data on mental toughness and the factors that underlie it; and an understanding of the differences in mental toughness across different groups of athletes. Findings arising from this thesis hold a number of implications for interventions designed to address mental toughness in elite sport settings.
CHAPTER THREE

HYPOTHESES AND RESEARCH QUESTIONS

Introduction

Although mental toughness is widely recognised as a most important characteristic for sporting success, little is known about what the concept is, how to measure it, and how to train it in athletes. This thesis addresses the issues of conceptualisation and measurement by targeting two primary research objectives. The first objective sets the scene by identifying specific characteristics of mental toughness and understanding the interrelationship between those characteristics. These characteristics of mental toughness are drawn together to produce a conceptual model and definition of mental toughness. This major development provides the platform from which to develop and validate a mental toughness measurement tool.

The second research objective is to develop a reliable and valid measurement tool to assess the characteristics of mental toughness using as a starting point, data derived from the first objective. The Mental Toughness Inventory (MTI) therefore is constructed to measure the specific components identified in the mental toughness model. Rigorous quantitative testing is performed on the questionnaire, in line with the construct validation approach.

Taken together, the research advances the field by offering clarity to present understanding of mental toughness. The yields of this research include the development of a conceptually-informed mental toughness factor structure comprising constructs hypothesised to reflect the attainment of mental toughness. This is followed by the development of a valid and reliable measurement instrument—the Mental Toughness Inventory (MTI). Confirmatory measurement data is then provided on mental toughness and the factors that underlie it. Finally, the research provides key understandings about the differences in mental toughness across sub-elite and elite athletes, across males and females, and across younger and
older athletes. Findings arising from this thesis hold a number of implications for interventions designed to address mental toughness in elite sport settings.

The purpose of the current chapter is to present separately for each of the four studies that comprise this thesis: (a) the overarching aims of the study, (b) the nature of the problem, (c) specific hypotheses, (d) research questions posed, and (e) the rationale for such questions. Hypotheses are developed based on the overarching goals of the study, previous theory, and research. Where past research and theory provide little direction for clear predictions, research questions are formulated.

**Study 1: The Psychological Performance Inventory: The Psychometric Properties of an Existing Mental Toughness Measurement Tool**

**The Problem**

Is the Psychological Performance Inventory (PPI) a valid and reliable measurement tool for mental toughness? The PPI was presented by Loehr (1986) as a test of the characteristics of mental toughness. Loehr presented little rationale for the development of the instrument and for the selection of the factors that comprise it. Nor is psychometric data available to support the use of the test. Despite the lack of any supporting validity information, the test remains the most significant assessment instrument for mental toughness. This is of some concern, given that we do not know the strength of the instrument. Therefore, the problem is that the PPI remains untested and requires urgent examination.

Given that Loehr’s rationale for the development of the PPI is not substantial, and that limited scientific rigor has been adhered to in the development of the instrument, it is not anticipated that the PPI will be an appropriate test of mental toughness. Rather, this thesis intends to start with the analysis of this instrument in the hope that it can contribute towards the development of a valid assessment tool for measuring mental toughness in elite athletes. Given the genesis of the PPI, its validity is likely to be limited and therefore this thesis intends to go beyond the PPI towards a broader understanding of mental toughness.

**Aims**

The objective for Study 1 is to evaluate the psychometric properties of a popularised test of mental toughness—the Psychological Performance Inventory (PPI). In this
context, the following questions are pursued in this study. Is the PPI reliable? Does the PPI demonstrate convergent and discriminant validity? Does the a priori factor structure provide a reasonable fit to the data (based on athlete responses)? Do the PPI factors proposed by Loehr relate in a meaningful way to established and conceptually-related constructs? Taken together, the answers to these questions will provide timely data to either support or reject the use of the PPI as a test of mental toughness.

**Statement of Research Questions**

The psychometric properties of the PPI have not previously undergone any rigorous testing and evaluation. Furthermore, inadequate rationale has been presented for the selection of the PPI factors and the development of the instrument. Therefore, it is not possible to advance specific hypotheses about the reliability and validity of the PPI for this study. Accordingly, the following research questions are advanced.

- **Research Question 1.1:** How reliable are the PPI scales?
- **Research Question 1.2:** To what extent does Confirmatory Factor Analysis of the PPI demonstrate the a priori factor structure presented by Loehr (1986)?

A number of existing psychometrically proven questionnaires are used in this study to evaluate the between-network validity of the PPI. These questionnaires include the Global Mental Toughness Measure (GMTM), the Elite Athlete Self-Description Questionnaire (EASDQ), the Physical Self-Description Questionnaire (PSDQ), the Perceptions of Success Questionnaire (POS) and the Flow Trait Scale (FLOW). These questionnaires are used to examine the between-network validity of the pattern of relationships formed between the PPI factors and established sport psychology constructs. In regard to between-network validity, the following research question is advanced.

- **Research Question 1.3:** To what extent do the PPI factors relate in a meaningful way to established sport psychology constructs such as specific aspects of self-concept, motivation, and flow?
Rationale for Research Questions

Rationale for Research Questions 1.1 to 1.3: The availability of measures in sport and exercise research that meet even basic psychometric ideals is limited. Although there has been progress in the last decade (Marsh, 1996), there is still need for: (a) more carefully developed instruments, (b) better articulation of the links between instrument design, theory, and practice, and (c) improved application of methodological and statistical techniques. Weak measures undermine research and theory evaluation, thereby limiting their contribution to practice. For the present study, a popularised yet unsubstantiated test of mental toughness—the Psychological Performance Inventory—is rigorously evaluated to determine whether it is a valid and psychometrically sound measure of mental toughness. Loehr (1986) presented the PPI in his classic book on mental toughness. The PPI was presented as a test of mental toughness. Although intuitively appealing, Loehr presents no rationale for the development of the instrument and the selection of the factors. Furthermore, the PPI remains untested in regards to its psychometric properties. Therefore, the reliability and validity of the instrument form research questions to be answered.

Locating this Study in the Thesis

The research questions posed here for Study 1 are examined and discussed in Chapter 5. These results contribute to the overall thesis by allowing us to assess an existing but unsubstantiated test of mental toughness, providing valuable learnings about the PPI’s strengths and weaknesses that are useful when the thesis pushes further towards the development of a psychometrically sound mental toughness assessment piece.
Study 2: Mental Toughness Unearthed: A Qualitative Investigation of Mental Toughness in Elite Athletes

The Problem

What is mental toughness and what are the characteristics that define it? Despite the recent preoccupation with mental toughness in sporting circles, little is actually understood about the topic. Large-scale empirical studies on the makeup of mental toughness are scarce. Many identify mental toughness as a characteristic that separates the champion athletes from the rest, and so the concept is worthy of further enquiry. The following questions remain unanswered. What characteristics separate mentally tough athletes from others who are not mentally tough? How does mental toughness unfold in the day-to-day life of an elite athlete? What thoughts, feelings and behaviours are involved in an experience of mental toughness? What are the key ingredients that lead one to be mentally tough? How does one demonstrate mental toughness?

Taken together, these questions are aimed at understanding the specific characteristics of mental toughness, their inter-relationship, the broad domains within which they fall, and the relative salience of MT characteristics in individual athletes’ lives. Answers to each of these provide critical data for informing the development of a model of mental toughness. The model of mental toughness that emerges here is then tested in a subsequent quantitative phase.

Aims

The aims of Study 2 are to produce a definition of mental toughness, determine the specific characteristics of mental toughness and to understand the interrelationship between those characteristics. Central to this aim is the need to identify a model of mental toughness from a grounded perspective, that is, a model unbiased by existing thoughts, theories or opinions. The outcomes expected included the development of a model of mental toughness that draws together specific characteristics of mental toughness. This model of mental toughness provides a basis for the development and validation of the Mental Toughness Inventory (MTI) in subsequent studies.
Statement of Research Questions

Importantly, given the qualitative and grounded theoretical approach adopted, no hypotheses are made in relation to specific characteristics of mental toughness. Notwithstanding this, a number of research questions are advanced.

- Research Question 2.1: How do elite athletes and coaches describe mental toughness?
- Research Question 2.2: What are the characteristics of mental toughness in elite athletes?
- Research Question 2.3: How do the characteristics of mental toughness integrate to form a model of mental toughness?
- Research Question 2.4: What role does adversity play in mental toughness?

Rationale for Research Questions

Rationale for Research Question 2.1 and 2.2: The very nature of qualitative research is to identify best case examples and to study those examples in depth. This thesis is interested in understanding mental toughness in elite sport. This research is about finding out how elite athletes perform exceptionally well under extraordinary pressures. To study mental toughness from a qualitative perspective requires a close examination of best case examples of the construct. In this case, best case examples of mental toughness are elite athletes and elite sporting coaches who are familiar with performing at the highest level under all sorts of pressures and challenging situations. In line with the grounded theory approach, this study attempts to draw out the elite athletes’ and coaches’ experiences and interpretations of mental toughness.

Rationale for Research Question 2.3: To understand the characteristics of mental toughness alone is not enough. The building blocks of mental toughness are only part of the mystery to be unlocked. A complete model of mental toughness that firstly encapsulates all of the characteristics, but secondly explains how mental toughness unfolds in the life of an athlete, is the ultimate goal. To reach this mark, one not only needs to know the dimensions of mental toughness but also the interrelationships between those characteristics. For the present study, a model of mental toughness is pursued through qualitative interview and data analysis techniques.
Rationale for Research Question 2.4: Although the literature provides little agreement on what mental toughness is, what does emerge is the commonality of describing mental toughness in relation to overcoming some form of adversity. The way in which mental toughness is continually linked to overcoming adversity creates the impression that this role is an accepted given. It seems to be an underlying assumption that is implicit in descriptions of mental toughness but never explicitly stated. The relationship between adversity and mental toughness has never been questioned or researched. Therefore, the nature of this relationship presents itself as a central research question.

**Locating this Study in the Thesis**

The research questions posed here for Study 2 are examined and discussed in Chapter 6. These results contribute to the overall thesis by establishing a multidimensional conceptual model of mental toughness which is then used later in the thesis as a basis for the development of the mental toughness assessment piece. This results chapter produces some of the most significant yields of this thesis, namely, a definition and a conceptual model of mental toughness that have been developed following sound scientific practice.

**Study 3: Development of the Mental Toughness Inventory (MTI)**

**The Problem**

Perhaps the most substantial component of this research program is the development and validation of a mental toughness measurement tool—the Mental Toughness Inventory (MTI). Such a test has great practical use for those wanting to assess and develop their level of mental toughness. The development of a valid test of mental toughness also allows future research to evaluate the effectiveness of mental toughness intervention programs. The problem to be resolved in this study, however, is first, to develop an instrument based on the qualitative results derived from Study 2, and second, to determine whether the MTI is a valid measurement tool for assessing mental toughness across a range of athletes.
Aims

The objective for Study 3 is to develop the MTI as a robust instrument that demonstrates a sound factor structure, strong reliabilities and invariance across age, and school- and institute-based athlete groups. The focus of Study 3 is on examining the within-network validity of the newly developed Mental Toughness Inventory (MTI).

Statement of Hypotheses

- Hypothesis 3.1: Tests of reliability will demonstrate high reliability scores for each MTI scale measured.
- Hypothesis 3.2: Confirmatory Factor Analysis (CFA) will demonstrate the a priori factor structure of the MTI.
- Hypothesis 3.3: The MTI factor structure will be consistent for school- and institute-based athletes as demonstrated by confirmatory factor analysis tests of invariance.
- Hypothesis 3.4: The MTI factor structure will be consistent for male and female athletes, as demonstrated by confirmatory factor analysis tests of invariance.

Rationale for Hypotheses

Rationale for Hypotheses 3.1 to 3.2: The use of psychometrically weak measures undermines assessment and interventions. Therefore, in the development of a test of mental toughness, it is of prime importance that the instrument be psychometrically proven. For this reason, the newly developed Mental Toughness Inventory (MTI) is rigorously evaluated following the construct validity approach. The instrument has been developed following sound instrument development practice. That is, content and structure were defined through the fusion of qualitative inquiry with established lines of research. Items were then developed to capture the content of the theoretical model of mental toughness. These items were then piloted and refined. Given the thorough development path of the MTI, it is predicted that the resulting instrument will be a reliable and valid measure of mental toughness for a range of athletes.
Rationale for Hypotheses 3.3 and 3.4: The aim is to develop a mental toughness measure suitable for testing a range of athletes. It is not appropriate to develop instruments in one population and then to generalise that instrument beyond the confines of a narrowly defined sample. Rather, the instrument needs to be tested to evaluate its generalisability across different types of athletes. This study evaluates the generalisability of the MTI across both males and females, and across school- and institute-based athletes. Furthermore, this study examines the generalisability of the MTI when the instrument is used on the same athletes at two time points, 12 months apart.

Locating this Study in the Thesis
The hypotheses posed here for Study 3 are examined and the results are presented in Chapter 7. These results contribute to the overall thesis in several ways. Firstly, the results provide data that confirm the conceptual model of mental toughness. Secondly, an instrument is developed that measures the conceptual model—the Mental Toughness Inventory (MTI). Thirdly, the MTI is assessed from a within-network perspective to demonstrate sound reliabilities, strong factor loadings, and acceptable goodness of fit statistics. Finally, the MTI is refined whilst maintaining psychometric strength.

Study 4: Between-Network Validity of the Mental Toughness Inventory (MTI)

The Problem
Study 3 produced the Mental Toughness Inventory (MTI) and demonstrated its validity from a within-network perspective. Within-network validity is necessary, but not sufficient in demonstrating construct validity. What is needed now is an examination of the between-network properties of the MTI. Between-network validity checks are the focus of Study 4.

Aims
The aims for Study 4 are to determine the relative congruence (or lack thereof) between theoretically related MTI and key correlates scales—thus demonstrating between-network validity. A further aim for Study 4 is to examine relative mean-
level differences on the various dimensions of mental toughness across age, gender, and athlete context (i.e., school- or institute-based athletes).

**Statement of Research Questions**

- Research Question 4.1: Do the MTI factors relate in a systematic and theoretically meaningful way to a selection of associated constructs? On examining the pattern of relationships it is foreshadowed that “like” constructs will be more highly correlated than “less alike” constructs. For example, the MTI factor “Task Focus”, which assesses the ability to keep one’s focus on the task without becoming distracted, will be strongly related to FLOW factor “Concentration” and EASDQ factor “Mental Competence”.
- Research Question 4.2: How do mental toughness scales scores vary according to age, gender and between school- and institute-based athletes?

**Rationale for Research Questions**

Rationale for Research Question 4.1: The aim for this study is to develop a valid instrument to measure mental toughness in athletes. One way to examine construct validity is to examine the pattern of relationships created when the construct under consideration is correlated with an array of related constructs (i.e., between-network validity—see chapter 2 for discussion of between-network validity). To demonstrate validity, the researcher looks to see that the construct relates in a systematic way that is congruent with respect to theory. Therefore, in accordance with the aim to develop a valid measure, it is important that the MTI factors are more strongly related with theoretically related factors than non-related factors.

Three between-network constructs (including their sub-scales) provide a theoretically relevant basis for examining the validity of the mental toughness construct: self-concept, flow, and life effectiveness. Rather than working through making predictions on the hundreds of correlations conducted in the between-network approach, it is suggested that posing between-network validity as a research question is a more parsimonious and intuitively appealing means of examining validity.

Overall, the aim of this study was to develop a valid instrument of mental toughness. The MTI has been developed in adherence to strict psychometric criteria. The instrument was developed through a process which started with
conceptualisation and was then followed by item development, analysis and refinement. Therefore, it is expected that the mental toughness instrument and the factors within it will relate in a systematic and meaningful way. That is, the MTI factors will relate more strongly with theoretically related factors than non-related factors.

Rationale for Research Question 4.2: In learning about mental toughness, it is of interest to observe mean-level differences on mental toughness between males and females, younger and older, and school- and institute-based athletes. Stereotypes might suggest that males are more mentally tough than females. The results will be of interest in resolving this debate. Are older athletes more mentally tough than their younger counterparts? Does mental toughness differ between school- and institute-based athletes? These research questions will be answered by this study.

Locating this Study in the Thesis
The research questions posed here for Study 4 are examined and results presented in Chapter 8. These results contribute to the overall thesis by demonstrating the between-network validity of the MTI, thereby completing the construct validity approach to instrument construction. Study 4 results (chapter 8) also provide a first look at differences in mental toughness according to age, gender and context (i.e., school- or institute-based contexts).

Summary
Overall, this thesis begins with the evaluation of a popularised, yet psychometrically unsubstantiated, test of mental toughness. The research then progresses through the identification of a set of characteristics of mental toughness. The interrelationships between those characteristics are examined and then developed into a mental toughness model. A construct definition is also developed at this point. The mental toughness model is measured and evaluated through the development of the Mental Toughness Inventory (MTI). The MTI is rigorously tested with a view to demonstrating that it is a psychometrically robust instrument suitable for testing mental toughness across a wide range of athletes including males, females, school- and institute-based athletes. Finally, differences on key dimensions of mental toughness are examined across age, gender and context (i.e., school- or institute-
based athletes). Taken together, these processes are aimed at deriving the following major yields:

- A mental toughness construct definition;
- A mental toughness conceptual model that is grounded in qualitative research data and real life experience;
- A psychometrically strong and valid mental toughness measurement instrument—the Mental Toughness Inventory (MTI);
- Tests of the construct validity of responses to the MTI in relation to generalisability of the factor structure across gender and athlete context (school- or institute-based athletes); and,
- Tests of construct validity in relation to other related constructs and coaches’ ratings.

Other subsequent yields emanating from this research will include:

- Insights into how mental toughness is developed in athletes from 12 years through to senior elite;
- Understanding differences in mental toughness between males and females, younger and older athletes, and between school- and institute-based sports; and,
- Insight into how mental toughness plays out in the life of an athlete.

Taken together, these yields of this research thesis contribute significantly to the area by providing a firm platform from which subsequent and further study of mental toughness can be launched. The next chapter presents the methods which this research thesis will utilise and follow in pursuing the aforementioned hypotheses and research questions.
CHAPTER FOUR

METHODOLOGY

Introduction
The present chapter details the methodology employed throughout this research thesis. Four separate studies are developed to address the aims, hypotheses and research questions of the current research (see Chapter 3). These studies are characterised by the completion of key research tasks, the achievement of critical understandings, and the identification of specific pieces of the mental toughness puzzle that, when taken together, result in a reliable and valid measurement tool of mental toughness. These four studies progress from within-network approaches to between-network approaches. That is, the project starts by investigating the internal structure of mental toughness (a within-network approach) before branching out and establishing the construct within the field of sport psychology (a between-network approach).

Study 1 involves testing the reliability and validity of a popularised yet unsubstantiated test of mental toughness— the Psychological Performance Inventory (PPI). Study 2 utilises qualitative methods to uncover the characteristics of mental toughness, leading to the development of a model and definition of mental toughness. For Study 3, the Mental Toughness Inventory (MTI) is developed and used to assess mental toughness characteristics across a range of athletes including school-based and institute-based, male and females. Study 4 rounds out this thesis by taking a between-network look at how mental toughness relates to selected key correlates. Study 4 also examines the effect of various criteria (such as age, gender, and training/competition context) on the characteristics of mental toughness.

The methodology employed in each of the four studies is presented in this Methodology Chapter. This includes a detailed presentation of the characteristics of the participants, the qualitative interview and data analytic approach, the survey
procedure relating to the quantitative analyses, the materials used in the
questionnaire, and an outline of the research designs for each distinct study
component. An orientation to the statistical procedures used to analyse the data is
also presented. Where a study utilises specific statistical techniques, those are
described in more detail in the write-up of the results for that study.

Study 1: Examining the Psychometric Properties of an Existing yet
Unsubstantiated Test of Mental Toughness—The
Psychological Performance Inventory
This study encompasses a review of an existing but unsubstantiated test of mental
toughness—Loehr’s 1986 Psychological Performance Inventory (PPI). Given that
little research has been completed on the PPI, and the likelihood that a broader range
of factors contributes towards the attainment of mental toughness (see literature
review), it is not anticipated that the PPI will be psychometrically appropriate for
assessing mental toughness in athletes. Rather, this thesis intends to start with the
analysis of this instrument in the hope that it can contribute towards the development
of a valid assessment tool for measuring mental toughness in elite athletes.

Study 2: Using Qualitative Methods to Unearth the Conceptual
Structure of Mental Toughness
Given the predictions regarding the PPI and the need to develop a more thorough
measure of mental toughness, this study presents the unearthing of a conceptual
model of mental toughness, the results of an in-depth qualitative study tied with
relevant and established sources of theory. The qualitative study involves
interviewing highly experienced elite athletes and coaches—people familiar with
mental toughness in the elite sporting domain. These interviews provide first hand
experience that is then combined with findings from established theory. The foreseen
outcome is the identification of key mental toughness characteristics. Furthermore, a
preliminary understanding of the interrelationships between these characteristics
leads to the development of a conceptual model of mental toughness.

The development of a conceptual model of mental toughness is a significant
contribution to the field. To date an organically-based model (i.e., based on in-depth
insights of athletes and coaches) of mental toughness does not exist. For the project,
the mental toughness model developed here provides the basis of the to-be-constructed “Mental Toughness Inventory” and also the basis on which investigations of mental toughness are carried out. An additional yield of this stage of the project is gained from learning about real life examples of mental toughness that improve our understanding of how mental toughness plays out in the life of an athlete.

**Study 3: Development of the Mental Toughness Inventory (MTI)**

**Constructing the Mental Toughness Inventory (MTI)**

This stage of the research sees the construction of the major yield of this project—the Mental Toughness Inventory (MTI). The MTI is constructed based on the mental toughness model developed earlier through the qualitative study (Study 2). Instrument construction follows the path of item development, then q-sort and talk aloud responses to examine initial validity and reliability, followed by a pilot administration of the instrument such that statistical analysis of the MTI is carried out, allowing the refinement of the final version of the instrument. The development of an instrument based on theory and stakeholders’ perspectives, and specifically designed to measure multidimensional mental toughness, is a significant yield to the mental toughness research domain.

**Examining the Validity of the Mental Toughness Inventory (MTI) from a Within-Network Perspective**

Study 3 then examines the validity of the MTI by administering the instrument to a large group of athletes and then empirically testing its psychometric properties. In line with the construct validity approach detailed earlier, this study focuses on the within-network validity of the MTI by examining such things as factor structure, reliability, variance and invariance between groups.

**Study 4: Between-Network Validity of the Mental Toughness Inventory**

The objective for Study 4 is to complete the construct validation approach by examining the between-network validity of the Mental Toughness Inventory. This includes an examination of correlations between theoretically related constructs and the characteristics within the MTI. To be valid, the pattern of relationships must
reveal higher correlations between theoretically related constructs than correlations with less-related constructs.

This project uses a number of key constructs to validate the mental toughness model. A key correlate is a construct that the researcher posits to be theoretically related to the construct under examination; in this case, mental toughness. Key correlates provide a powerful source of validating information—whereby the researcher observes how well the construct in question, relates as would be expected to a select group of related constructs (key correlates). The constructs selected as key correlates for this study include athletic self-concept, motivation, focus/attention, coping, and control. These constructs were selected on the basis of their conceptual relatedness to mental toughness either as correlates or outcomes of individuals’ mental toughness. Hence, they are deemed to be feasible constructs with which to validate the Mental Toughness Inventory. If the mental toughness factors are to be presented as valid factors, it should be shown that they relate as would be expected to significant constructs.

The key correlates are measured by the following instruments: Elite Athlete Self Description Questionnaire (athletic self concept), Flow Trait Scale (flow), and the Review of Personal Effectiveness and Locus of Control (ROPELOC—variety of coping and performance factors). A complete review of these instruments is presented below in the materials section.

Following on from the examination of between-network correlations, Study 4 examines the effect of age, gender and context (i.e., school or institution-based) on mean level scores for mental toughness. These factors are also classified as between-network factors as they provide information on how mental toughness relates to "external" factors.

**Participants**

A variety of participant samples were included in this research project. Volunteer athlete participants were recruited through state institutes and academies of sport, including the Australian Institute of Sport and Westfield Sports High School. The research required adequate numbers of participants to represent the different participant variables of interest (age, level of elite sport involvement, gender, sport, etc.) related to the construct of mental toughness.
Study 1: Examining the Properties of the Psychological Performance Inventory

Respondents were 263 aspiring elite athletes (62% male, 38% female) attending a specialised sports high school in Sydney, Australia. The school is one of the most prestigious sports high schools in Australia. Each year, student athletes from across the state compete for enrolment in major sports, including basketball, softball, rugby league, soccer, baseball, swimming, track and field, dance aerobics, cricket and netball. The mean age of respondents was 13.8 years (SD = 1.6 years). Respondents were drawn from Year 7 (19%), Year 8 (22%), Year 9 (22%), Year 10 (20%), Year 11 (10%), and Year 12 (7%).

Study 2: Qualitative Research to Conceptualise Mental Toughness

Purposive and snowball sampling techniques were used to select research participants for this study. Purposive sampling involves the researcher targeting participants most closely related to the topic of research—in this case, selection of participants involved the meeting of two requirements, a) being identified as mentally tough by elite sporting peers, and b) representative duties for their country as an athlete or in other sport-related pursuits. Snowball sampling involves the researcher gaining additional participants related to the research through the referral of existing participants. In seeking referrals, participants were asked to identify elite athletes whom they would say exhibit mental toughness. These are frequently used qualitative approaches to gathering participants (Miles & Huberman, 1994; Morse & Richards, 2002) as these techniques allow the selection of optimal examples of the phenomenon under study, and also ensure that experts in the area of investigation are included in the sample.

The sample comprised a total of 33 participants ranging between 25 and 70 years of age (Mean = 37.68; SD = 13.36). In total there were 21 males and 12 females. The participants included 25 current or former elite athletes (16 and 9 respectively), 15 of them being Gold Medallists or World Champions in their respective sports (8 multiple world champions). The sports represented were: track and field, swimming, boxing, hockey, rowing, archery, basketball, mountain running, mountain climbing, marathon, rugby union, rugby league, Australian rules football, baseball, cricket, cycling, waterpolo, squash, netball, triathlon, power lifting and physically disabled track and field. Of the 25 athletes, six were also currently
employed as an elite coach or in elite sports management. A further eight participants were non-athletes who had previous extensive elite level sporting experience through positions such as sports scientist, coach, psychologist or management positions.

**Study 3 Assessing the Validity of the Mental Toughness Inventory**

Multiple participant samples were researched in the development and validation of the Mental Toughness Inventory (MTI). The pilot version of the MTI was first administered at Time 1 to student-athletes from Westfield Sports High School. The results from that administration were used to refine the instrument. The revised MTI was administered a second time to student-athletes from Westfield Sports High School (Time 2) and also to institute-based athletes on scholarship at various sporting institutes around Australia. Overall, the development of the MTI utilised three participant samples: school-based athletes from Westfield Sports High School at Time 1 and Time 2, and an institute-based athlete sample (at Time 2 only).

**Time 1 Westfield Sports High School**

The Time 1 school-based athlete sample consisted of 479 junior-elite athletes who attended a specialised sports high school in Sydney, Australia. As indicated above, the school is one of the most prestigious sports high schools in Australia. The sample included 279 males (58%) and 200 females (42%). The participants ranged in age from 12 to 19 years of age (mean = 14.29 years, SD = 1.54 years).

**Time 2 Westfield Sports High School**

The Time 2 school-based athlete sample consisted of 438 aspiring elite athletes who attend a specialised sports high school in Sydney, Australia. The sample included 274 males (63%) and 164 females (37%). The participants ranged in age from 12 to 18 years of age (mean = 14.34 years, SD = 1.50 years).

**Time 2 Institutes of Sport (Note: no Time 1 for institutes of sport)**

The institute-based athlete sample comprised 392 elite athletes from various institutes of sport around Australia (including the Australian Institute of Sport, New South Wales Institute of Sport, Western Australia Institute of Sport, ACT Academy of Sport, Australian Rugby Union Wallabies, and Australian Cricket). The athlete sample consisted of 202 males (51%) and 190 females (49%). The institute-based
athlete participants ranged in age from 11 to 38 years of age (mean = 18.55, SD = 4.48 years).

**Study 4 Between-Network Validity of the Mental Toughness Inventory**

Study 4 utilised the athlete responses obtained from Study 3 to explore between-network validity. Therefore, the Study 4 participant sample is the same as reported above in Study 3. Time 2 data from Westfield Sports High School and from the Institutes of Sport were used.

**Quantitative Measures**

**Psychological Performance Inventory**

In professional practice, Loehr’s Psychological Performance Inventory (PPI) remains the most influential mental toughness instrument, and historically is the most important. Loehr published the PPI in his classic book on mental toughness (1986) and claimed that the instrument measured the seven most important psychological factors that reflect mental toughness: self-confidence, negative energy, attention control, visual and imagery control, motivation, positive energy, and attitude control. Although Loehr offered an intuitively and conceptually appealing discussion of the instrument, he presented no psychometric support for its use. Surprisingly, given the ongoing impact of Loehr’s research and despite the fact that the PPI continues to be used in practice, there apparently have been no rigorous and formal evaluations of PPI responses. The PPI is a 42-item self-report instrument designed to measure factors that reflect mental toughness (see Table 4.1 for example items). All questions in the PPI were answered using a 8-point Likert type scale, ranging from “1” (False) to “8” (True). Psychometric evaluation of this popularised yet unsubstantiated test of mental toughness is the focus of Study 1 in the present research program.
Table 4.1
Summary description of the PPI scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Example Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-confidence</td>
<td>I believe in myself as a player.</td>
</tr>
<tr>
<td>Negative Energy</td>
<td>I get angry and frustrated during competition.</td>
</tr>
<tr>
<td>Attention Control</td>
<td>I can clear interfering emotions quickly and regain focus.</td>
</tr>
<tr>
<td>Visual and Imagery Control</td>
<td>Before competition, I picture myself performing perfectly.</td>
</tr>
<tr>
<td>Motivation Level</td>
<td>I am highly motivated to play my best.</td>
</tr>
<tr>
<td>Positive Energy</td>
<td>I can keep positive emotion flowing during competition.</td>
</tr>
<tr>
<td>Attitude Control</td>
<td>I am a positive thinker during competition.</td>
</tr>
</tbody>
</table>

Global Mental Toughness Measure

The Global Mental Toughness Measure (GMTM) is a brief unidimensional scale designed by the researcher for the purposes of this research program. The GMTM is a 6-item scale designed to obtain a self-report global rating of mental toughness (see Table 4.2 for items). All questions are answered using an 8-point Likert type scale, ranging from “1” (False) to “8” (True). The psychometric properties of this scale are evaluated at various points throughout the present research program.

Table 4.2
The GMTM items

<table>
<thead>
<tr>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am mentally tough in training and in preparation.</td>
</tr>
<tr>
<td>I am mentally tough when I am in competition.</td>
</tr>
<tr>
<td>I am mentally tough when there is a chance that I might fail.</td>
</tr>
<tr>
<td>I am mentally tough when overcoming a setback.</td>
</tr>
<tr>
<td>I am mentally tough when I face particularly demanding challenges.</td>
</tr>
<tr>
<td>Overall I am mentally tough.</td>
</tr>
</tbody>
</table>

Key Correlates

A number of key correlates were used throughout this research. These key correlates were selected on the basis of being well established measures in the sports psychology literature that were hypothesised a priori to be subsequently correlated to mental toughness. The relationships between the key correlates and mental toughness are predicted on the basis of their conceptual relatedness to mental toughness, either
as correlates or as outcomes of individuals’ mental toughness. Hence, they are deemed to be feasible constructs with which to validate the mental toughness structure.

**Elite Athlete Self-Concept**

The Elite Athlete Self-Description Questionnaire (EASDQ) was selected for the present research to measure athletes’ self-concept: This recently developed instrument is based on a multidimensional and hierarchical model of self-concept. The EASDQ is designed for use with adolescents aged 12-18 as well with adults. The EASDQ is a 28-item self-report instrument designed by Marsh, Hey, Johnson and Perry (1997; also see Marsh, Hey, Roche, & Perry, 1997; Marsh, 1997) to measure six components of elite athletes’ self-concept: Skills, Body, Aerobic, Anaerobic, Mental, and Overall Performance (see Table 4.3 for example items). Participants responded to the items using an 8-point Likert response scale (1 = False; 8 = True). Research (Marsh, Hey, Johnson & Perry, 1997; Marsh, Hey, Roche, & Perry, 1997; also see Marsh, 1997) demonstrates that EASDQ responses are reliable and have a well-defined factor structure as shown by confirmatory factor analysis. Marsh and Perry (2005) reported that EASDQ responses by elite swimmers were strongly correlated with performances in 16 different events and contributed to prediction of subsequent performance in international championships beyond what could be explained in terms of previous performances.

Table 4.3

**Summary description of the EASDQ scales**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Example Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills</td>
<td>I am a most skillful athlete in my best sport/event.</td>
</tr>
<tr>
<td>Body</td>
<td>I excel in my best sport/event because of the suitability of my body shape.</td>
</tr>
<tr>
<td>Aerobic</td>
<td>Compared to others at my level I am aerobically (long periods of high endurance activity) superior in my best sport/event.</td>
</tr>
<tr>
<td>Anaerobic</td>
<td>My capacity for short bursts of high intensity activity makes me a good performer in my best sport/event.</td>
</tr>
<tr>
<td>Mental</td>
<td>I am mentally able to motivate myself appropriately to the situation when necessary in my best sport/event.</td>
</tr>
<tr>
<td>Performance</td>
<td>I excel at my best sport/event because I am able to give a peak performance when necessary.</td>
</tr>
</tbody>
</table>
Physical Self-Description Questionnaire

The Physical Self Description Questionnaire (PSDQ; Marsh, Richards, Johnson, Roche, & Tremayne, 1994; Marsh, 1997) is a 70-item test that measures 11 components of physical self-concept. Although selected PSDQ scales measure self-concept, they are different from the scales included in the EASDQ (described above). Research summarised by Marsh (1997) demonstrates that the PSDQ responses are reliable (Median coefficient alpha = .92 across the 11 scales), are stable over the short term (median r = .83, 3 months) and long term (median r = .69, 14 months), have a well defined factor structure as shown by confirmatory factor analysis, and provide support for convergent and discriminant validity in relation to a variety of external criteria (Marsh, 1996; 1997). For the purposes of the current investigation, only three of the PSDQ scales were administered: Sports Competence, Global Physical, and Global Esteem (20 items in total—See Table 4.4 for example items). Each PSDQ item is a simple declarative statement to which participants respond using a 6-point true-false rating scale.

Table 4.4
Summary description of the PSDQ scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Example Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sports Competence</td>
<td>I am good at most sports.</td>
</tr>
<tr>
<td>Global Physical</td>
<td>I am satisfied with the kind of person I am physically.</td>
</tr>
<tr>
<td>Global Esteem</td>
<td>I feel that my life is not very useful.</td>
</tr>
</tbody>
</table>

Flow Scale

Flow is an optimal psychological state whereby a person becomes totally involved in the activity of engagement, and experiences a number of positive experiential characteristics, including freedom from self-consciousness and great enjoyment of the process. The 36-item FLOW instrument is based on Csikszentmihalyi’s theory of flow as applied to a sport setting (see Jackson & Csikszentmihalyi, 1999). The instrument, developed by Jackson and colleagues (Jackson, 1994; Jackson & Marsh, 1996; Marsh & Jackson, 1999), measures nine flow experiences in sport: challenge-skill, action-awareness merging, clear goals, unambiguous feedback, concentration, sense of control, loss of self-consciousness, transformation of time, and autotelic (intrinsically rewarding) experience (see Table
4.5 for example items). Research (Jackson, 1994; Jackson & Marsh, 1996; Marsh & Jackson, 1999) demonstrates that the Flow responses are reliable (reliability coefficients varied between .80 and .92) and have a well-defined factor structure, as shown by confirmatory factor analysis. Each FLOW item is a simple declarative statement to which participants respond using an 8-point true-false rating scale.

Table 4.5
Summary description of the FLOW scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Example Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge-Skill</td>
<td>The challenge and my skills are at an equally high level.</td>
</tr>
<tr>
<td>Action-Awareness</td>
<td>I made the correct movements without thinking about trying to do so.</td>
</tr>
<tr>
<td>Clear Goals</td>
<td>I know clearly what I want to do.</td>
</tr>
<tr>
<td>Unambiguous Feedback</td>
<td>I had a good idea while I was performing about how well I was doing.</td>
</tr>
<tr>
<td>Concentration</td>
<td>My concentration is focused entirely on what I am doing.</td>
</tr>
<tr>
<td>Sense of Control</td>
<td>I have a sense of control over what I am doing.</td>
</tr>
<tr>
<td>Loss of Self</td>
<td>I was not concerned with what others may have been thinking of me.</td>
</tr>
<tr>
<td>Consciousness</td>
<td>The way time passed seemed to be different to normal.</td>
</tr>
<tr>
<td>Transformation of</td>
<td>Auto telic Experience</td>
</tr>
<tr>
<td>Time</td>
<td>I love the feeling of the performance and want to capture it again.</td>
</tr>
</tbody>
</table>

**Personal Effectiveness**

The Review of Personal Effectiveness and Locus of Control instrument (ROPELOC; Richards & Neill, 2002) was developed to tap into key psychological and behavioural aspects of human functioning that indicate a person’s effectiveness in a variety of areas. The ROPELOC measures 12 areas of personal effectiveness, including personal abilities and beliefs (Self-Confidence, Self-Efficacy, Stress Management, Open Thinking), social abilities (Social Effectiveness, Cooperative Teamwork, Leadership Ability), organisational skills (Time Management, Quality Seeking, Coping with Change) an “energy” scale called Active Involvement and a measure of overall effectiveness in all aspects of life. The ROPELOC also measures Internal and External Locus of Control (i.e., ROPELOC consists of 14 scales in total). The instrument consists of 45 items, all of which are rated on a scale of 1-“False, Not like me” to 8-“True, Like me” (See Table 4.6 for example items).

Research demonstrates that the ROPELOC is psychometrically sound in terms of reliability and factor structure (Richards, Ellis & Neill, 2002). Richards et
al. (2002) reported high reliabilities for each of the ROPELOC factors (range = .79 to .90), as well as substantial factor loadings (range=.65 to .86).

Table 4.6

Summary description of the ROPELOC scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Example Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Confidence</td>
<td>I am confident in my ability to be successful.</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>No matter what the situation is I can handle it.</td>
</tr>
<tr>
<td>Stress Management</td>
<td>I am calm when things go wrong.</td>
</tr>
<tr>
<td>Open Thinking</td>
<td>I am open to new thoughts and ideas.</td>
</tr>
<tr>
<td>Social</td>
<td>I communicate effectively in social situations.</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>I am good at cooperating with team members.</td>
</tr>
<tr>
<td>Cooperative Teamwork</td>
<td>I am seen as a capable leader.</td>
</tr>
<tr>
<td>Leadership Ability</td>
<td>I am efficient and do not waste time.</td>
</tr>
<tr>
<td>Time Efficiency</td>
<td>I try to get the best possible results when I do things.</td>
</tr>
<tr>
<td>Quality Seeking</td>
<td>I cope well with changing situations.</td>
</tr>
<tr>
<td>Coping with Change</td>
<td>I like being active and energetic.</td>
</tr>
<tr>
<td>Active Involvement</td>
<td>Overall, in my life I am an effective person.</td>
</tr>
<tr>
<td>Overall Effectiveness</td>
<td>What I do and how I do it will determine my successes in life.</td>
</tr>
<tr>
<td>Internal Locus of Control</td>
<td>My life is mostly controlled by external things.</td>
</tr>
<tr>
<td>External Locus of Control</td>
<td>What I do and how I do it will determine my successes in life.</td>
</tr>
</tbody>
</table>

Perceptions of Success Questionnaire

The Perceptions of Success Questionnaire developed by Roberts and Balague (1991; Roberts, Treasure & Balague, 1998; also see Marsh, 1994; 1997) is one of the major motivational goal orientation instruments used in the sports area. Participants respond to the 14-item questionnaire that measures task and ego motivation orientations that are specific to sport. Research (Roberts & Balague, 1991; Roberts, Treasure & Balague, 1998; also see Marsh, 1994; 1997) demonstrates that POS responses are reliable and have a well-defined factor structure, as shown by confirmatory factor analysis.

Quantitative Procedure

Consent to conduct the current study was obtained from the University of Western Sydney Ethics Review Committee (Human Subjects) as well as the New South Wales Department of Education and Training, and the Australian Institute of Sport. Participants under the age of 18 years were required by the committee to have
written parental or guardian permission to participate. This procedure was completed by all participants prior to the administration of the questionnaire. Participants with parental/guardian permission were invited to volunteer to participate in the study based on informed consent.

**Quantitative Questionnaire Procedure**

Questionnaires were administered in Studies 1, 3 and 4. For consistency, the same administration procedures were used across each study. Anonymity was guaranteed in that participants were assured that the data would be used for research purposes only and not for athlete selection purposes. Each testing session began with a brief set of instructions on how to use the rating scale in the questionnaire. All participants were encouraged to seek assistance from a member of the research group if they were experiencing any difficulties in responding to an item. Participants were then asked to work through the questionnaire on their own and submit the completed form to the researcher when they had finished.

During the first year of the research program (2002), Study 1 participants from Westfield Sports High School were asked to complete a questionnaire package including the Psychological Performance Inventory as well as questionnaires on self-concept, flow, and motivation (goal-orientation).

During the second year of the study (2003), Study 3 participants from Westfield High School were invited to complete a questionnaire package including the Pilot Mental Toughness Inventory (constructed as a component of this research program), the Elite Athlete Self-Description Questionnaire, the Physical Self Description Questionnaire, the Flow State Scale, and the Perceptions of Success Questionnaire.

Study 4 was completed in the third year of the study (2004). Here the Mental Toughness Inventory and the package of correlates were administered to athlete-participants from Westfield Sports High School, the Australian Institute of Sport, the ACT Academy of Sport, New South Wales Institute of Sport, Western Australia Institute of Sport, South West Sydney Academy of Sport, Triathlon Australia, Australian Rugby, and Australian Cricket.

The same testing procedures were followed for all testing administrations.
Quantitative Data Analysis

Brief Orientation to Confirmatory Factor Analysis

Many of the above procedures rely on confirmatory factor analysis (CFA). Hence, a series of CFAs are used in this research to assess the factor structure of the measurement instruments. The raw data was used as input to PRELIS (Jöreskog & Sörbom, 2004), where a covariance matrix was produced and subsequently analysed using LISREL 8.72 (Jöreskog & Sörbom, 2005).

In CFA, the researcher postulates relations between the observed measures and the underlying a priori factors, based on theory and/or empirical research, and then tests the hypothesised structure statistically (Byrne, 1998). In the present study, CFA tests the ability of a solution based on the a priori structure to fit the data by demonstrating that: (a) the solution is well defined; (b) parameter estimates are consistent with theory and a priori predictions; and (c) the $\chi^2$ and subjective indices of fit are reasonable (Marsh, Bala, & McDonald, 1988; McDonald & Marsh, 1990; Marsh, in press). In the CFAs performed in the present study, it was hypothesised that: (a) each measured variable would have a non-zero loading on the factor it was designed to measure and a zero loading on all other factors, (b) the factors in all cases would be correlated, and (c) the error terms (referred to as uniquenesses) for each measured variable would be uncorrelated (unless stated otherwise). The maximum likelihood method of estimation was used for each of the models; it is robust in relation to violations of assumptions of normality, particularly in relation to parameter estimates (factor loadings, factor correlations, path coefficients, etc.) which are of primary concern in this thesis (Hu, Bentler, & Kano, 1992; Jöreskog & Sörbom, 1993; Marsh, in press).

The LISREL program produces a range of goodness of fit indices. The chi-square value is a likelihood ratio test statistic that evaluates the fit between the restricted hypothesised model and the unrestricted sample data. The model may be rejected if the chi-square value is large relative to the degrees of freedom and accepted if the value is non-significant or small. However, for very large sample sizes, there is a risk of relatively good-fitting models being rejected on the basis of the chi-square test (Bentler, 1990; Marsh, 1994; Marsh, Balla, & McDonald, 1988; Marsh, in press). Following Marsh, Balla, & Hau (1996) and Marsh et al. (1988) the
Non-Normed Fit Index (NNFI; also known as the Tucker-Lewis Index, TLI), the Comparative Fit Index (CFI; also known as the Relative Noncentrality Index, RNI), and root mean square error of approximation (RMSEA) were emphasised to evaluate goodness of fit, as they provide a relatively nonbiased indication of fit for large sample sizes. However, the chi-square test statistic is also presented, as well as an evaluation of parameter estimates. The NNFI and CFI vary along a 0-to-1 continuum in which values greater than .90 and .95 are typically taken to reflect acceptable and excellent fits to the data respectively (McDonald & Marsh, 1990). For RMSEAs, values less than .05 indicate good fit, and values as high as .08 represent reasonable errors of approximation in the population (Browne & Cudeck, 1993; Jöreskog & Sörbom, 1993). The CFI contains no penalty for a lack of parsimony so that improved fit due to the introduction of additional parameters may reflect capitalisation on chance, whereas the NNFI and RMSEA contain penalties for a lack of parsimony. Whereas tests of statistical significance and indices of fit aid in the evaluation of the fit, there is ultimately a degree of subjectivity and professional judgment in the selection of a “best” model.

The majority of the analyses for this research use various forms of confirmatory factor analysis (CFA). CFA analysis was a large component of the analysis for both Study 1 (PPI) and Study 3 (MTI). CFAs were conducted separately for each instrument included in the test battery.

**Mental Toughness Instrument Development: Refining the Number of Items**

Ensuring that the Mental Toughness Inventory was brief and concise, yet maintained psychometric soundness, required that an acceptable level of reliability (e.g., at least .8) should be achieved, based on scales having a relatively small number of items. As a guide, the aim was to: (a) reduce the length of the MTI; (b) measure and maintain the content of all 13 factors in the MTI; (c) maintain reliability estimates of at least .80; and (d) provide a factor structure in which goodness of fit indexes met acceptable standards. Thus the first task in data analysis was to work through the MTI subscale-by-subscale with a view to removing items that were not loading particularly well on hypothesised subscales. This process involved examining results from: (a) a series of one-factor congeneric CFA models, (b) a full model CFA, and (c) Cronbach’s alpha coefficients given the removal of each item from the subscale.
Item strength was considered in relation to multiple criteria. Items were selected using the following guidelines:

(a) Items that best measured the intended construct as inferred on the basis of corrected item-total correlations and the size of standardised factor loadings in CFA;

(b) Items that had minimal cross-loadings as evidenced by LISREL’s modification indexes, indicating the extent to which the fit would be improved if an item were allowed to load on a factor other than the one it was intended to measure and the expected size of the cross-loading;

(c) Items that had minimal correlated uniquenesses, particularly with other items within the same scale. In the case where two items within the same scale had substantial correlated uniquenesses, only one of the two items was retained;

(d) The number of times that an item was left blank (although the proportion of missing responses was very small—less than 1%);

(e) A subjective evaluation of the content of each item in order to maintain the breadth of content of the original construct;

(f) Sufficiently parsimonious items in each scale in order to maintain a coefficient alpha estimate of reliability of at least .80.

**Multiple-Indicator-Multiple-Cause (MIMIC) Models**

Study 4 utilises MIMIC models to determine the “effect” of certain variables on characteristics of mental toughness. Kaplan (2000; see also Grayson, Mackinnon, Jorm, Creasey & Broe, 2000) suggested the MIMIC approach, which is similar to a regression model in which latent variables (e.g., multiple dimensions of athlete mental toughness) are “caused” by discrete grouping variables (e.g., gender, age, gender x age) that are represented by a single indicator. One advantage of the MIMIC approach over the standard approach is that it can handle cases in which sample size in a given group may be too small to ensure stable estimates of variances and covariances. Moreover, by representing group membership in appropriate ways, the MIMIC approach allows the researcher to consider more familiar models of main effects and interactions. This type of model also has the important advantage that the dependent variables are latent variables based on multiple indicators.

The MIMIC models included in Study 4 include the effects of gender, context (i.e., school and institution-based athletes), age (treated as a continuous variable),
gender x age interaction, gender x context interaction, age x context interaction, and gender x age x context interaction. Consistently with recommendations by Aiken and West (1991), age was zero-centred (put in deviation score form so that the mean is zero) so as to reduce the multicollinearity between age and the corresponding interaction term. Very high levels of multicollinearity can introduce technical problems in estimating regression coefficients, and centering variables often minimises these potential problems. The interaction term was calculated by multiplying gender and the zero-centered age variable. To further reduce collinearity between the interaction term and its composite main effects, a series of preliminary linear regressions where main effects predicted the interaction term and residuals saved thereby developing a “pure” interaction term with the collinearity of main effects removed.

**Missing Data**

Missing data is an unavoidable problem for large-scale longitudinal studies such as the present investigation. The inevitability of missing data is a potentially important problem, particularly when the amount of missing data exceeds 5% (e.g., Graham & Hoffer, 2000; Marsh, in press). A growing body of research has emphasised potential problems with traditional pairwise, listwise, and mean substitution approaches to missing data (e.g., Brown, 1994; Graham & Hoffer, 2000; Little & Rubin, 1987), leading to the implementation of the Expectation Maximisation Algorithm, the most widely recommended approach to imputation for missing data, as operationalised using missing value analysis in LISREL. All missing data in the present study were subsequently handled with the EM Algorithm. In the present study there was little missing data present. For Study 1 (psychometric evaluation of the Psychological Performance Inventory), only 0.35% of 7,364 data points were missing from the 263 students. For Study 3 (school-based athletes Time 1) only 0.61% of 11,496 data points were missing from the 479 school-based athletes. For Study 3 (school-based athletes Time 2) only 0.42% of 17,082 data points were missing from the 438 school-based athletes. Also for Study 3, (institute-based athletes Time 2) only 0.39% of 15,288 data points were missing from the 392 institute-based athletes. Study 4 utilised the Time 2 data for school- and institute-based athletes from Study 3, and therefore, has the same missing data statistics as for Study 3.
Qualitative Measure

Qualitative Research Methods

Sport psychology researchers have identified the need for qualitative research methods to be adequately defined (Krane, Andersen, & Strean, 1997; Sparkes, 1998). Therefore it is important to describe in detail the methods employed here. Study 2 implemented the grounded theory approach to data collection and analysis. The grounded theory approach involves allowing themes and understandings to emerge or originate from data sources. Quantitative research is generally deductive; that is, it begins with an hypothesis and data are gathered which lead to either accepting or rejecting the hypothesis (Bolwing, 1997; Silverman, 2000). In qualitative research, and particularly when adopting the grounded theory approach to qualitative research, it is common to use inductive logic, which involves the generation of theories from analysis of data (Bowling, 1997; Mile & Huberman, 1994). In this way, theory is generated “in intimate relationship with the data, with the researchers fully aware of themselves as instruments for developing that grounded theory” (Strauss, 1987, p.6).

A grounded theory approach to studying mental toughness was adopted for this investigation because this approach is considered the appropriate method for the researcher wishing to learn from the participants how to understand a process or situation (Miles & Huberman, 1994; Morse & Richards, 2002). Allowing the factors of mental toughness to emerge from the data in this way is a major strength of this project.

Qualitative Interview Framework

Qualitative data for this project were derived through semi-structured interviews (see Appendix A and B). Given the grounded theoretical approach taken with these interviews, the researcher was careful to try not to influence the answers of the participant being interviewed. Interviews started with general questions about mental toughness, thus allowing the participant to share their thoughts and experiences about mental toughness—unbiased by the style of questioning adopted by the researcher. An example of this line of question is “Can you tell me what you think mental toughness is?” Once the participants’ views about mental toughness had been explored, the researcher used a cognitive behavioural model to help the participant explore mental toughness further (i.e., asking questions about the thoughts, feelings
and behaviours related to mental toughness). A few example questions following the cognitive-behavioural model include:

- Can you describe the thoughts associated with being mentally tough?
- Can you describe the feelings associated with being mentally tough?
- Can you describe the act of being mentally tough?

The interview concluded by gaining an introspective view of mental toughness. That is, the final aim of the interview was to have the participant share a personal experience of acting or behaving in a mentally tough way. The participant was asked to think of a time that they were particularly mentally tough. They then shared their experience, prompted along the way by the researcher to share thoughts, feelings and behaviours associated with their mental toughness experience. In this way, the cognitive-behavioural model was explored in relation to specific situations (i.e., from the participant’s experience).

**Qualitative Interview Procedure**

Data were collected using the semi-structured interview schedule described in the qualitative materials section above. The aim of the interview was to draw out the participants’ experience or explanation of mental toughness. Before each interview commenced, the participants were briefed on the study’s broad aims (without leading their responses) and methods before giving signed consent to participate. Participants understood that they could terminate the interview at any time, or skip any question, and that independent counselling was available if needed.

When rapport had been established, the interviewer began exploring the participant’s experience of mental toughness. The duration of each interview ranged between 45 and 90 minutes. The interview was audiotaped and transcribed verbatim. These transcripts were used for the data analysis. Finally, participants were asked to suggest names of mentally tough athletes who could be approached for further interviews (the snowball sampling component).

**Qualitative Data Analysis**

The data for this research was in the form of qualitative interview transcripts. N-Vivo software (Qualitative Solutions & Research, 1999) was utilised to assist in managing and analysing the data. NVIVO is designed to integrate a number of documents (i.e., interview transcripts) for analysis and to index components of text (i.e., interview
Coding, Categorising and Abstraction

The interview transcripts were analysed through a process of coding, categorisation and abstraction. In documenting the coding and categorisation process, Constas (1992) suggests researchers outline the components of categorisation and the temporal aspects of category development. The components of categorisation used in this study are origination, verification, and temporal designation.

Origination refers to the major influence for categorisation. In this study, origination stems from three sources: (a) Participants: the participants’ responses primarily guide category formation; (b) Investigative: the researcher’s thoughts and theoretical influences assist in category formation; and (c) Literature: an array of established research findings (e.g., elite athlete self-concept research) also provides some influence on category formation. In verifying the categories formed in this study, two strategies are employed: (a) Rational: the categories formed have face value and logically connect the data to the category label; and (b) Referential: category formation is supported by established research findings. Temporal designation refers to whether the categories were formed a priori or during data analysis. In this study, the majority of categories are formed a priori, in that they are based on established research literature. However, a number of categories in this study do not fit predetermined categories, and thus are developed through a combination of the participants’ responses and the researcher’s interpretations. Taken together, these strategies are the basis upon which the data are interpreted, categorised, and then presented in this chapter to develop a model of mental toughness and the factors that comprise it.

To move beyond the data codes and categories to concepts and theories that help explain phenomena requires the researcher to employ some level of abstract thinking (Morse & Richards, 2002). Although grounded theory describes gaining understanding from the data, in practice it is not a passive process. The researcher directs the process, making informed decisions about the data, thinking, linking and abstracting (Morse & Richards, 2002). In interpreting the interviews in this study, the researchers made informed decisions about the data based on abstract thinking about
the data in relation to established theory. It is important to recognize that some level of subjectivity is required in the data analysis. Qualitative results reflect the researcher’s interpretation, based in part on theories reviewed, but also on the researcher’s own judgement. Results that arise from qualitative research are not quantitatively derived, nor statistically testable. Rather, they reflect patterns or themes in the data that are derived through the interface of the data collected from respondents and the researcher’s analysis of that data.

**Summary of Methods**

Overall, the project aims to enhance understanding of mental toughness. The area is in need of conclusive research capable of providing a definition of mental toughness, a model to understand the concept, as well as the factors of mental toughness. This research strives to deliver on all three counts. The thesis begins with the testing of an existing mental toughness assessment instrument—the Psychological Performance Inventory. Those results then inform Study 2, an in-depth qualitative study that illuminates the nature of mental toughness. This qualitative data is comprehensively integrated with other research in the area, to provide sound insights into the mental toughness factors. From this point, quantitative research integrates these factors into a model of mental toughness, and also develops the first psychometrically sound measure of mental toughness. The yields of this study are mental toughness definition, conceptualisation, and a psychometrically proven measurement instrument. These represent important first steps in progressing mental toughness research and pave the way for research into the training and development of the concept in athletes and in others.
CHAPTER FIVE

STUDY 1 RESULTS:
PSYCHOMETRIC PROPERTIES OF THE
PSYCHOLOGICAL PERFORMANCE INVENTORY

Introduction

Study 1 represents the first stage of the project into the construct definition and validation of mental toughness. The study evaluates the construct validity of responses to Loehr’s (1986) mental toughness test, the Psychological Performance Inventory (PPI), by 263 student-athletes from an elite sports high school. Loehr presented the PPI as an assessment tool for mental toughness, without providing substantial theoretical rationale for the inclusion of the scales within the instrument. Given the unknown structure of mental toughness, it is not anticipated that the PPI will not be psychometrically appropriate for assessing mental toughness in athletes. The analysis of the PPI will however, provide an important source of input to the broader context of this thesis (i.e., illuminating mental toughness factors that appear to work well in terms of validity checks).

A number of questions are pursued in Study 1. To what extent is the PPI reliable? To what extent does the PPI demonstrate convergent and discriminant validity? Does the a priori factor structure provide a reasonable fit to the data (based on athlete responses)? To what extent do the PPI factors proposed by Loehr relate in a meaningful way to established and conceptually-related constructs? Taken together, the answers to these questions will provide timely data to either support or reject the use of the PPI as a test of mental toughness.

Overview of Analyses

A popularised yet unsubstantiated test of mental toughness—the Psychological Performance Inventory—is rigorously evaluated to determine whether it is a valid and psychometrically sound measure of mental toughness. The psychometric
properties of the PPI have not previously undergone rigorous testing and evaluation. Furthermore, Loehr offers little theoretical rationale for the selection of the PPI factors and the development of the instrument. Therefore, examining the psychometric properties of this instrument involves:

a) Within-Network Validity Approaches (see Chapter 2 for review)
   - Examining the internal consistency of the PPI scales on the basis of Cronbach’s alpha (Research Question 1);
   - Evaluating the PPI’s factor structure using confirmatory factor analysis (CFA; Research Question 2), and;

b) Between-Network Validity Approaches (see Chapter 2 for a review)
   - Evaluating between-network validity by looking at how the PPI subscales relate to a range of established sport psychology constructs. Between-network validity is assessed by examining the correlations between the PPI subscales and a range of sports psychology constructs that are predicted to be meaningfully related to mental toughness. (Research Question 3)

This study involved administering the PPI to a large sample of aspiring elite athletes from a specialised sports high school in Sydney (N = 263; Age Range = 12-19 years, Mean Age = 13.8 years, SD = 1.6 years). Responses were collected and analysed using confirmatory factor analysis (CFA) and tests of internal reliability. For a more detailed outline of the methods, please refer to the methodology chapter (Chapter Four).

The results for this chapter are organised so that the within-network validity checks (i.e., internal consistency and CFA) are presented first. This chapter then progresses from within-network to between-network as correlations between both the PPI original model, an alternative PPI model, and a range of theoretically related constructs are then discussed.

Assessing Within-Network Properties of the Psychological Performance Inventory

Within-network studies explore the internal structure of a construct. The within-network assessment approach adopted here begins with a logical analysis of internal consistency of the measurement instruments. This is followed by the investigation of
the internal structure of the instrument—using CFA to determine the goodness of fit between the data collected and the model of mental toughness posited by Loehr (1986).

**Internal Consistency Estimates (Research Question 1.1)**

Internal consistency estimates (Cronbach’s alphas) for the seven PPI subscales are presented in Table 5.1. For the total sample of participants, internal consistency estimates ranged between .63 and .77 with a median alpha coefficient of .74. The negative energy scale yielded the lowest internal consistency estimate (.63). Taken together, the reliability estimates do not provide strong consistent within-network support for the PPI subscales.

**Testing the Factor Structure of the PPI (Research Question 1.2)**

CFA was then conducted on the PPI. The first-order factor structure underlying the seven components of the PPI was not well defined, with the CFA yielding a $\chi^2$ of 2297.44 (df = 798), a NNFI of .70, CFI of .73, and RMSEA of .085. The factor loadings, factor correlations, and reliabilities (Cronbach’s alphas) are presented in Table 5.1 illustrating the highest loading on any factor as .73 and the lowest as .22. In addition to the poor model fit—and even more problematic—the solution was improper as indicated by factor correlations greater than 1.0. Using CFA, a series of post-hoc models was then explored in which the original seven factors were retained, but poor fitting items were eliminated. Whereas deletion of numerous items resulted in substantially better fit, all solutions remained improper in that a number of factor correlations approached or exceeded 1.0. Taken together, the poor model fit and the improper correlations suggest the PPI model as originally formulated was not strong. It was therefore deemed appropriate to explore alternative models, using exploratory factor analysis (principal components analysis) rather than CFA.

**Exploratory Factor Analysis of the PPI (Research Question 1.2)**

Principal components analysis with oblique rotation (as factors were expected to be correlated) was performed on the 42 PPI items. A variety of solutions were explored with a view to generating conceptually compelling factors that explained substantial variance, comprised high target loadings, and yielded few cross-loadings. This was accomplished through a process of deleting items that yielded substantial cross-
loadings or did not load substantially on any factors and through examining a range of factor solutions (three- through to ten-factor solutions). A five-factor model based on responses to 16 items was deemed to be the most appealing, with the highest target loadings, fewest cross loadings, substantial explained variance, and factors that appeared to be conceptually meaningful. When CFA was used to test this five-factor model, the data fitted the model well ($\chi^2 = 142.17$ df = 94, NNFI = .94, CFI = .96, RMSEA = .044). Table 5.1 presents factor loadings derived from the CFA as well as correlations between factors and reliabilities.
Table 5.1. Original and alternative confirmatory factor analysis structures for the PPI

<table>
<thead>
<tr>
<th>Items</th>
<th>Original PPI Factor Structure</th>
<th>Alternative PPI Factor Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC—1</td>
<td>Factor Loadings</td>
<td>Factor Loadings</td>
</tr>
<tr>
<td>SC—8</td>
<td>.33</td>
<td>.65</td>
</tr>
<tr>
<td>SC—15</td>
<td>.62</td>
<td>.65</td>
</tr>
<tr>
<td>SC—22</td>
<td>.65</td>
<td>.70</td>
</tr>
<tr>
<td>SC—29</td>
<td>.73</td>
<td>.70</td>
</tr>
<tr>
<td>SC—36</td>
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<tr>
<td>NE—2</td>
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<td>NE—9</td>
<td>.65</td>
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<td>.53</td>
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<td>.58</td>
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<td>.56</td>
<td>.63</td>
</tr>
<tr>
<td>VIC—18</td>
<td>.61</td>
<td>.54</td>
</tr>
<tr>
<td>VIC—25</td>
<td>.58</td>
<td>-.01</td>
</tr>
<tr>
<td>VIC—31</td>
<td>.69</td>
<td>.30</td>
</tr>
<tr>
<td>VIC—39</td>
<td>.87</td>
<td>.31</td>
</tr>
<tr>
<td>ML—5</td>
<td>.65</td>
<td>.68</td>
</tr>
<tr>
<td>ML—12</td>
<td>.72</td>
<td>.34</td>
</tr>
<tr>
<td>ML—19</td>
<td>.56</td>
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Original PPI factors (Loehr, 1986): SC = Self-Confidence; NE = Negative Energy; AtteC = Attention Control; VIC = Visual and Imagery Control; ML = Motivation Level; PE = Positive Energy; AttiC = Attitude Control. Alternative structure: CP = Competition Positivity; CA = Competition Anxiety; IM = Internal Motivation; EC = Emotional Control; V = Visualisation.
In the alternative PPI factor structure factor 1 comprises four items and has been assigned the label “Competition Positivity”. Competition Positivity describes the athlete’s ability to maintain positive thinking during competition and draws items from four different PPI factors (Attitude Control, Positive Energy, Motivational Level and Self-Confidence). Factor 2 comprises two items from two different PPI factors (Negative Energy and Attention Control) and has been labelled “Anxiety Control”. Anxiety Control describes anxiety-related reactions to performance pressures. Factor 3 comprises three items (two from the Motivational Level scale and one from the Positive Energy scale) and has been labelled “Internal Motivation”. Internal Motivation describes the athlete’s sense of fulfilment and satisfaction gained from playing or practising in their sport. Factor 4 comprises three items (two from the Negative Energy scale and one from the Attention Control scale) and has been labelled “Emotional Control”. Emotional Control describes the athlete’s ability to control his or her emotional response to the pressures of competition. Factor 5 comprises four items (all from the Visual and Imagery Control scale) and has been labelled “Visualisation”. Visualisation describes the athlete’s ability to use positive visualisation skills in training and competition.

**Relationships between Original PPI Factors and Alternative Model PPI Structure**

Subscale scores for the seven PPI factors and the five factors in the alternative model were computed by generating the mean of component items. Pearson product moment correlations between the PPI factors and the five alternative factors were carried out, and are presented in Table 5.2. Competition Positivity correlated substantially with the PPI’s Self-confidence (r = .78), Positive Energy (r = .78), and Attitude Control (r = .81) factors despite having only one of the PPI’s original scale items appearing in each of these alternative model factors. Internal Motivation correlated substantially (r = .85) with the PPI’s Motivation Level, having two-thirds of its items from the original PPI scale. Emotional Control shared substantial variance with the PPI’s Negative Energy (r = .77), as did Visualisation with the PPI’s Visualisation and Imagery Control (r = .94)—not unexpectedly, as the alternative factor comprised four of the PPI’s Visualisation items. Taken together, these data suggest that constructs in the alternative model that are conceptually akin to those in the PPI share greater variance than they do with constructs that are not so
conceptually congruent. Anxiety—the factor that departs most from Loehr’s conceptualisation—does not share substantial variance with any PPI factors (e.g., it shares 25% variance with the PPI’s Attention Control).

Table 5.2
Correlation matrix between PPI factors and the alternative five factors

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<td>Attitude Control</td>
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* Correlation is significant at p < .05
** Correlation is significant at p < .01

**Between-Network Properties of the Psychological Performance Inventory**

The analysis detailed above suggests a psychometrically sound alternative factor structure—that is, a structure with sound within-network properties. Construct validation requires the demonstration of appropriate relationships between the constructs being validated and other known constructs—that is, sound between-network properties. Therefore, the next task is to explore the patterns of relationships between both models and other key correlates described above.

**Relating both Models to Key Correlates (Research Question 1.3)**

A battery of between-network measures was also included in the study. These related to physical and athletic self-concept, goal orientation, flow, and a global mental toughness measure. These measures were selected on the basis of their conceptual relatedness to mental toughness either as correlates or outcomes (see Methodology Chapter—Chapter 4, for rationale for selection of key correlates) of individuals’ mental toughness. Hence, they are deemed to be feasible constructs with which to
validate the alternative structure and also how this compares with the performance of the original PPI factors in relation to these measures. In addition to these key correlates, a mean scale score for all PPI items was computed.

Analysis of the correlations was multifaceted. First, the correlations between the original PPI factors and the key correlates were examined, and were then compared to the correlations between the alternative factors and the key correlates. Second, the correlations between the total PPI scale score and each of the key correlates was examined. Third, correlations were examined between the total PPI scale score and each of the key correlates relative to correlations between the specific (original PPI and alternative structure) subscale scores and the key correlates. The examination concluded with the correlations between the global mental toughness measure (GMTM) and each of the key correlates and compared these with the correlations between the total PPI scale score and each of the key correlates. Table 5.3 presents findings.

The first observation was that—in general—the PPI factors were more strongly correlated with the key correlates than our alternative factors are with these same measures. Second, in all but two cases, the PPI total score correlates more strongly with the key correlates than do the subscales based on the alternative structure. Third, in all cases the PPI total score correlates more strongly with the key correlates than does the global mental toughness measure with the same correlates (PPI mean r = .52; GMTM mean r = .45). In terms of between-network validation, then, the original PPI performs better than the alternative structure and the global measure of mental toughness.
Table 5.3
Correlations between factors in both models and key correlates

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CP = Competition Positivity; CA = Competition Anxiety; IM = Internal Motivation; EC = Emotional Control; V = Visualisation; SC = Self-Confidence; NE = Negative Energy; AtteC = Attention Control; VIC = Visual and Imagery Control; ML = Motivation Level; PE = Positive Energy; AttiC = Attitude Control; GMTM = Global Mental Toughness Measure; POS = Perceptions of Success; PSDQ = Physical Self Description Questionnaire; EASDQ = Elite Athlete Self Description Questionnaire; PPI = Psychological Performance Inventory (mean score of all PPI items). All correlations greater than .11 are statistically significant (p < 0.05, two-tailed).
Summary and Implications for the Thesis

The present chapter provides a number of insights into the status of the PPI, introduces an interesting conundrum regarding the interface between conceptualisation and instrumentation, and offers directions to guide future instrument development. Although the fit of the PPI was poor, its conceptualisation and validity were sound. Although an alternative model fitted the data well, support for its conceptual underpinning and validity was not as strong. A number of important insights have been identified that inform the development of a mental toughness assessment piece in the following chapters:

- This study highlights the need for a strong conceptual/theoretical rationale for the selection of mental toughness factors and the items that measure them;
- This study highlights the need for adequate relatedness between mental toughness component factors and key correlates; and,
- This study highlights the importance of taking care in the area of item development—such that the resulting mental toughness assessment instrument is strong on theoretical/conceptual grounds as well as having a sound factor structure.

Taken together, these data suggest that there currently exists no comprehensively sound measure of mental toughness and that vital further work is required to develop a multifaceted mental toughness measure that is strong on conceptual, within-network, and between-network grounds. This is the focus of subsequent chapters.
CHAPTER SIX

STUDY 2 RESULTS:
MENTAL TOUGHNESS UNEARTHED:
A QUALITATIVE STUDY OF MENTAL TOUGHNESS
IN ELITE ATHLETES

She just had this ability to overcome adversity, she always did... and she would just find ways to push herself through whatever she needs to push through... I think her mother had died of cancer five or six years ago, and her brother got killed this year and she’s somebody who always seems to emerge from beyond whatever she’s dealing with, to get through it and surpass what anybody would think you could do. She’s tough, she’ll go that extra yard, that extra hard yard that most people won’t.

Introduction

The above quote from an elite sportsperson in this study is highly representative of how coaches and athletes alike can readily identify someone in terms of their mental toughness. Given the PPI is not a valid measure of mental toughness, and given that previous qualitative research is not definitive, we are still left with the question “what exactly does it mean to be mentally tough?” Therefore, the broad aims of Study 2 were to draw upon qualitative data to uncover factors of mental toughness. The constructs were taken together to develop a conceptual model of mental toughness that subsumes the factors of mental toughness in a way that lends clarity to the construct but is also useful to athletes and coaches from a practical perspective. The specific yields of Study 2, then, are to define and conceptualise a mental toughness model (including the factors that comprise it). This significant work provides the platform needed to pursue measurement approaches further into the thesis.
Overview of Analyses

This section provides an overview of the general methods used for this study. Broadly, this study involved interviewing very elite athletes and coaches with the goal of learning from their experiences, and uncovering characteristics of mental toughness from those experiences. This is a qualitative study, whereby strict methodology is employed that gathers themes and constructs from rich data such as text. For full details on the qualitative methods employed here, please refer to the methodology chapter of this thesis.

Grounded theory was the qualitative method employed for this study. The grounded theory approach involves allowing themes and understandings to emerge or originate from the qualitative data. The grounded theory approach is the most appropriate method to be used when the researcher wishes to learn from the participants how to understand a concept (Miles & Huberman, 1994; Morse & Richards, 2002). Grounded theory uses inductive logic, where theories are generated in close relationship with the data, with the researcher mindful of themselves as instruments in interpreting data and developing theory (Strauss, 1987).

The sample comprised a total of 33 participants (mostly elite athletes, but also elite coaches and sport psychologists) ranging between 25 and 70 years of age (Mean = 37.68; SD = 13.36). In total, there were 21 males and 12 females. The participants included 25 current or former elite athletes (16 and 9 respectively), 15 of them being Gold Medallists or World Champions in their respective sports (8 being multiple world champions on multiple occasions). Data were collected using a semi-structured interview schedule.

The data for this research was in the form of qualitative interview transcripts (i.e., each interview was transcribed verbatim). The interview transcripts were analysed through a process of coding, categorisation and abstraction. This involved breaking the text down into categories (e.g., text grouped into categories such as task focus, or coping, or self-efficacy), and making informed decisions about those categories. To move beyond the data codes and categories to concepts and theories that help explain target phenomena requires the researcher to employ some level of abstract thinking.
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(Morse & Richards, 2002). Although grounded theory describes gaining understanding from the data, in practice it is not a passive process. The researcher directs the process, making informed decisions about the data, thinking, linking and abstracting (Morse & Richards, 2002). In interpreting the interviews in this study, the researcher made informed decisions about the data based on abstract thinking about the data in relation to established theory. It is important to recognise that some level of subjectivity is required in the data analysis. Qualitative results reflect the researcher’s interpretation, based in part on theories reviewed, but also on the researcher’s own judgement. Results that arise from qualitative research are not quantitatively derived, nor statistically testable. Rather, they reflect patterns or themes in the data that are derived through the interface of the data collected from respondents and the researcher’s analysis of that data. Notwithstanding this, a number of the concepts developed in this qualitative phase are examined in later quantitative methods.

**Mental Toughness and Adversity (Research Question 2.4)**

A dominant finding that emerged when interviewing participants, and also later when reviewing and analysing the interview statements, is that mental toughness seems to exist in the presence of or response to adversity. The types of adversity reported ranged greatly and included things such as: something going awry in a competition, high levels of performance pressure, physical pain associated with high level physical effort, competing through an injury, falling behind in a competition, and performing under bad conditions. Although the type of adversity can take different forms, the common thread in relation to mental toughness is the notion of overcoming the adversity. Mental toughness primarily exists in relation to overcoming adversity.

In searching for the underpinnings of mental toughness, it is important then to understand each factor of mental toughness in the context of how it assists in overcoming adversity. It is recognised that reactions to adversity will differ from individual to individual, and the results do suggest that there are a number of ways in which athletes interpret and respond to adversity. Notwithstanding this, there are some common features and characteristics associated with mental toughness, and what develops below is a list of factors that comprise a proposed mental toughness model.
Mental Toughness Characteristics (Research Questions 2.1 and 2.2)

Twelve mental toughness characteristics evolved through this qualitative research. These factors include: self-efficacy, mental self-concept, potential, task focus, perseverance, task familiarity, personal bests, task value, goal commitment, positivity, stress minimisation, and positive comparisons. Table 6.1 presents an overview of each factor—including a definition and quote that represents the central theme of the factor.

Before launching from this factor overview into a more detailed look at each of the factors, it is useful to demonstrate how the qualitative method of data analysis worked in practice—drawing 12 factors from the data. To demonstrate this process, the development path for one mental toughness factor—Task Focus—is illuminated next.

Example of How Factors were Drawn from the Data

Each interview was transcribed verbatim; this formed the “data” for this research. As the researcher read through qualitative interview transcripts, he used the program N-Vivo (a data management program/tool) to highlight sentences within the text and attach a code to that text (data). Coding is where the researcher examined a sentence from an interview, and labelled that piece of text as being about “X, Y or Z”. As an example, the researcher coded the following sentences as being about Task Focus: “The ability to focus on the right thing at the right time, under pressure. The ability to maintain whatever focus is appropriate, whether it’s a focus on technical execution or strategic decision making or whatever, when they are under pressure.”

All interview transcripts were read and coded as described above. The researcher then analysed the data further, by looking for trends and patterns in the coded groups of data. For Task Focus, the data indicated a very specific focus, locking the athlete’s attention down onto a specific task—to the exclusion of surrounding pressures. Moreover, the sentences contained in this grouping could not be disaggregated into smaller groupings (as was the case with some other mental toughness factors such as “coping”, which was subsequently disaggregated into specific types of coping).

In working through the qualitative data (and presenting it here), it has been important to be mindful of the need for confidentiality. It is important that participant
quotes remain anonymous. These participants are public figures, well known to an international audience, and could easily be identified by some of their comments. While it would add to the appeal of reading through this data, including names, gender and sport information would compromise the anonymity that was promised to each of the participants. To divulge certain comments or details might led to identification, which could result in participants losing a competitive edge.
Table 6.1. Mental Toughness factors, definitions and quotes

<table>
<thead>
<tr>
<th>Factor</th>
<th>Definition</th>
<th>Representative Quote</th>
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<tr>
<td><strong>Self-Efficacy</strong></td>
<td>The athlete’s judgment or belief in his or her own ability to succeed in reaching a specific goal</td>
<td>“You believe in your heart that you can go and do it…I was just following my heart, believing in myself that I could do it and come back.”</td>
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<tr>
<td><strong>Mental Self-Concept</strong></td>
<td>Viewing one’s self as being mentally strong in relation to dealing with adversity</td>
<td>“I have the attitude that mentally I am superior, mentally I am stronger and mentally I am capable of hanging in there for longer”</td>
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<tr>
<td><strong>Potential</strong></td>
<td>Believing that one has the inherent ability or capacity for growth, development or coming into being</td>
<td>“The driving thing for me at the moment is the fact that I haven’t achieved everything I think I’m capable of, and I still think I can.”</td>
</tr>
<tr>
<td><strong>Task Focus</strong></td>
<td>The unshakeable concentration of mental processes on a task whilst excluding other distractions from concentration</td>
<td>“The ability to remain focused in extreme situations…you are constantly trying to redirect your focus back into what you are doing that moment.”</td>
</tr>
<tr>
<td><strong>Perseverance</strong></td>
<td>Persisting in or remaining constant to a purpose, idea, or task in the face of obstacles, discouragement or adversity</td>
<td>“When all hell’s breaking loose around you, you just keep going…you just knuckle down to what you are doing and you just keep grinding away.”</td>
</tr>
<tr>
<td><strong>Task Familiarity</strong></td>
<td>Having a good understanding and being well acquainted with the task or adversity</td>
<td>“Being familiar with your environment and with the competition just makes you relaxed.”</td>
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<tr>
<td><strong>Personal Bests</strong></td>
<td>An internal motivation or drive to pursue personal best performances</td>
<td>“I enjoy exploring my physical and mental limits…seeing how much pain and adversity I can overcome…seeing what my best is.”</td>
</tr>
<tr>
<td><strong>Task Value</strong></td>
<td>The quality of importance or the significance the successful completion of the task holds for the individual</td>
<td>“The value of what you are going after is very critical. How significant is that to you? If it’s not important, why would you put yourself through it?”</td>
</tr>
<tr>
<td><strong>Goal Commitment</strong></td>
<td>The act of binding oneself (intellectually and emotionally) to a goal or a course of action</td>
<td>“There was no way I would ever have given up after making that commitment to myself. I had to follow it through, no matter what, just for me.”</td>
</tr>
<tr>
<td><strong>Positivity</strong></td>
<td>The process of being positive and remaining positive in the face of adversity or challenge</td>
<td>“I always try to see the positive, no matter what I’m faced with.”</td>
</tr>
<tr>
<td><strong>Stress Minimisation</strong></td>
<td>The process of reducing one’s emotional reaction to adversity</td>
<td>“I think he can see and dismiss small failures for what they are, where the others get focused on small failures and blow them out of proportion.”</td>
</tr>
<tr>
<td><strong>Positive Comparisons</strong></td>
<td>Sensing that one is coping better with adversity and thus has a psychological and competitive advantage over one’s opponent</td>
<td>“I remember looking across at her and I could see her eyes widening and I thought—she’s shitting herself. So I kept going.”</td>
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Self-Efficacy

I think believing in yourself is the main thing, because when you start to doubt yourself, when you don’t think you are capable of achieving something, I suppose you get a little bit soft, you are soft on yourself and you take the easy options, the ones you know that you probably shouldn’t. So believing that you can do something I think is really important in mental toughness.

The above quote represents a common view of the participants in this study—that self-efficacy is a key ingredient that orients an athlete towards being mentally tough. Self-efficacy is defined as the athlete’s judgment or belief in his or her own ability to succeed in reaching a specific goal. It is this self-efficacy that helps keep them committed to the goal despite adversity and pressure.

A range of participant quotes about self-efficacy and mental toughness is presented here:

- “I think people who are mentally tough can quite genuinely look at themselves in the mirror and feel pretty comfortable with what they see, and that’s a pretty good thing to have, rather than be questioning oneself all the time or doubting oneself or planning ways to avoid certain situations because we don’t believe we can back ourselves to be successful”;

- “I’m the best at what I do. I have this enormous belief in my own athletic ability, I have a power and a skill, which I work very hard at and it’s almost like an artist, they believe the work that they do is magnificent, it’s beautiful, it’s worthy. We believe the same thing, we believe we have worked our bodies as hard as we can… you have no fear and you are very calm… It’s a very powerful feeling and you actually feel very strong, so it’s not a feeling that people on the outside can tell, it’s something I think that people that do show their mental toughness exteriorly rather than hold it in, they’re not mentally tough, they’re already showing their fear by putting it on the outside because they have to convince everybody else. I don’t need to convince anybody else that I’m the best,
I just prove it in my sport, you’ll see it in my results and I think mentally tough people have that sort of very calm soothing confidence about themselves”;

- “I’d prepare so well for games…you know training, eating, sleeping whatever, so I didn’t have to question what I did on the court, of course you always do you have your moments but in a tough situation at the end of a game I would never question, I’d feel like, yeah get me the ball. I want the ball, I know I can get it done.”

These quotes demonstrate a remarkable quality common to mentally tough athletes. That data indicated that mentally tough athletes have an unquestionable self-belief in their ability. Participants report that this self-belief is not something they go about ‘advertising’. Rather, participants describe it as more a quiet confidence—built on the knowledge that they have done the work and they are as prepared as they can be.

**Mental Self-Concept**

I have the attitude that mentally I am superior, mentally I am stronger and mentally I am capable of hanging in there for a longer period.

The above quote indicates that mentally tough athletes have a belief that they are mentally strong—a specific belief about their own mental strength. Below are a number of participant quotes that demonstrate this mental toughness characteristic:

- “My attitude always is that I’m going into this mentally stronger than anyone else. That’s my belief even though it’s not necessarily correct but that’s how I will go into a race… I think that knowing that you are stronger on the day mentally is almost like knowing that you are physically stronger on the day”;
- “In the last few weeks, my form had gone off a little bit, and I knew that, however I was still able to keep myself mentally strong”;
- “[Mentally tough athletes] understand that the battle is not physical; rather it’s in the mind… All athletes who have that mental edge or appear to be sharper than other athletes, they really understand that there is a real benefit from having that
mental toughness and they know to focus more on the mental side than the physical side.”

This factor captures a unique component of an athlete’s self-concept—mental self-concept. Marsh, Hey, Johnson, and Perry’s (1997) identified six parts to an elite athlete’s self-concept. Some of those parts relate to how the athlete views himself or herself physically (i.e., body, aerobic, anaerobic). The authors also identified that a significant part of an elite athlete’s self-concept is how they view their ‘mental competence’—their ability to stay mentally strong through the challenges of their sport. This concept, too, is identified in the data as important for elite athletes aspiring to mental toughness.

**Potential**

*I believe I have been blessed with the ability and it’s just a matter of me fulfilling it... I feel as though I haven’t reached what I’m capable of, so for me it’s a challenge to keep improving, keep getting better, keep being as good as what I think I can be.*

Potential is defined as having the self-belief that you have the inherent ability or capacity for growth, development or coming into being. The data indicated that potential represents a specific self-belief or feeling within a person that they know their future will be bright, they know they will achieve more in their area.

A range of participant quotes about these self-beliefs to do with potential and mental toughness is presented here.

- “The sensation of potential within yourself, not knowing how much but thinking there is some potential there and I’d like to see what it is”;
- “I believe I can be the world’s best athlete, I haven’t had the opportunity to do that, or I haven’t been able to fulfil my full potential yet, but there is no doubt in my mind I will be the world’s best”;
- “I had a belief that I could be successful in sport... so this was an opportunity for me to see if I could take it to the heights that I thought I
could... I had a strong belief that I could be successful and I had a strong expectation of myself to be”;

- “When I got dropped from the Australian team in ‘98 and the coach, he pretty much said to me, “Look mate your career’s done, you are not really the type of player that we’re looking for any more with the Australian team, we’re more athletic, the players are bigger stronger”. At that time, I thought to myself, “No I’m not done, I’m not ready”. Oh, it probably took six months or eight months to make my decision but I said, “No, I’m going to give it my best shot to make the 2000 Olympics”, and I made it. I believed that I was still good enough. Initially I was shocked that I got dropped, like I was devastated! I knew it was getting tougher getting older and stuff, but I thought that my time wasn’t up. It took me a while but then I said, “No, I want this. I think I’m good enough to make it’ and I wanted to prove to myself that that I could do it”;

- “I feel as though for me I haven’t reached what I’m capable of. I think it’s a challenge to keep improving, keep getting better, keep being as good as what I think I can be… the driving thing for me at the moment is the fact I haven’t achieved everything I’ve wanted to achieve and I still think I can, I can do better than what I have and if I was to walk away from it now I wouldn’t be satisfied with myself… the satisfaction comes from beating myself and improving and trying to get to where I think I can be.”

What these data demonstrate is that despite adversity, mentally tough athletes continue to see the potential in themselves to do well, and are continually driven to fulfil this potential. The data suggests that as mentally tough athletes encounter adversity, they remain committed and driven to achieving their self-perceived potential, despite the obstacles.
Task Focus

The really mentally tough ones were ready, focused, locked in, nothing was going to shake them, immovable.

Task Focus is the act of concentrating on a task whilst excluding other distractions from one’s concentration. In terms of mental toughness, this task focus appears to be unshakeable (i.e., one’s concentration is not easily distracted from the task). Below are a number of participant quotes demonstrating this mental toughness characteristic:

- “the ability to focus on the right thing at the right time, under pressure… the ability to maintain whatever focus is appropriate, whether it’s a focus on technical execution or strategic decision making or whatever, when they are under pressure”;
- “The ability to remain focused when you are in extreme situations, so you are not distracted, you don’t start thinking about the actual pain that you are feeling … You are focused on what you are doing … you are focused on the moment and what you are trying to achieve in that moment, you are not focused on the outcome … I would always be trying to re-direct my focus if I was doing something that was mentally tough … you do feel the pain, but you are constantly trying to redirect your focus back into what you are doing that moment… mental toughness comes down to having that ability to focus”;
- “I remember the first time I ran twenty-five 400s, it was like “Uhuh, I don’t know if I can do this”. But you start doing it and you just focus on each part of it and take it one step at a time … you try not to be overwhelmed so much by the enormity of the whole thing … you just take on the challenge step by step and just work your way through it and don’t give up until it’s complete, no matter what. And fight the fact that hey, I’m feeling bad right now, I’m feeling tired, but you’ve got to focus and concentrate on what you’ve got to do to keep going. I know with running and endurance sports like that you tend to focus on the technical aspects, you know, if you really start to feel fatigued and really start to think it’s too much and I can’t continue, I can’t push through at this pace then
you’ll concentrate on relaxing and feeling the pace and staying in a rhythm, which you find you can do if you focus on that sort of thing, the technique.”

On review of the data, the essence of this factor appears to be the ability to maintain whatever focus is needed despite the presence of pressure, potential distractions, or adversity. The data suggests a focus on execution of the task rather than the outcome. These are athletes who execute the task with excellence because of their elite level focus on the process of task execution.

Perseverance
Perseverance is the act of persisting in or remaining constant to a purpose, idea, or task in the face of obstacles, discouragement or adversity. Participant quotes about perseverance are presented here.

- “When all hell’s breaking loose around you, you just keep going, you just dig deeper, bite the bullet … you just knuckle down to what you are doing and you just keep grinding away until you get the results. Because until you get the results that you want then there’s not even a question of stopping or easing or giving in. You just keep driving and driving and driving”;  
- “When you are mentally tough you always stick it out and fight like a dog ‘til the end. So, even when you are playing absolute crap and having a really bad day, if you are mentally tough you’ll still fight ‘til the last point… it’s like you say “I will do absolutely anything possible here to keep getting the ball back and stay in the rally and win the rally”. But it’s not losing control it’s just fighting like a dog.”

The data highlights the dogged perseverance that many mentally tough athletes live their lives by. The data suggests that perseverance is not just a strategy applied when things are getting tough, but rather, it is the way they live their lives. That is, these athletes are perseverant as a way of coping through all of life’s challenges. Beyond the interview data collected here, perseverance is also representative of the common view of
mental toughness—continued effort and pursuit of some goal despite pressure or adversity.

**Task Familiarity**

Being familiar with your environment and with the competition just makes you relaxed and the little things that can really get on top of you don’t, once you are really familiar with the process.

Task familiarity involves having a good understanding and being well acquainted with the task or a particular adversity. Athletes gain this sense of familiarity through previous experience. Below are a few examples of this characteristic from participants in this study:

- “Once you’ve done it once, it is a lot easier… I think that mental toughness has a lot to do with familiarity and the confidence that you gain from [being familiar];”
- “I remember there was one stage at the [Olympic] games where the timer’s clock malfunctioned… it took 4 or 5 minutes before they got it fixed and that would have been a perfect opportunity to have lost my focus and stuffed up. But when we had been training for shooting matches before the games, we had a lot of trouble with our own timing clock stuffing up and we got used to them, having to just wait around and then start again with the next shot being a scoring arrow. Knowing from experience in that situation. Knowing to switch off, just not think about the match any more, sort of just vegetate for a while and then switch back on rather than trying to stay focused that entire time or switching off and staying switched off”;
- “I would expect some degree of familiarisation with the task, they know the journey or what will happen in the next 40 minutes, and they’re familiar with that and they probably understand the ebbs and the flows. They are familiar with how a game unfolds. In the first couple of minutes, the game starts in quite a hurried fashion, you run up and down and in the first couple of minutes your body is hurting, [you] think two minutes is
about all I can give, but an experienced player is perhaps familiar with the journey and knows that at two minutes after you [have] run up and back flat out, everybody else is in the same scenario, everybody else is feeling that pain, but your body will adjust. So I think that perhaps the familiarity with the task, [familiarity with] the journey, previous experience, being there before and knowing the fluctuations that are going to happen in the journey to achieve this goal.”

The above quotes demonstrate how experience provides athletes with a familiarity that helps them to get through tough times. The data indicated that experience, or task familiarity, serves a number of purposes for mentally tough athletes. Firstly, experience gives the athlete greater self-belief in their ability to do whatever it is they have to do. Secondly, experience can give athletes the knowledge of how to successfully execute a particularly challenging task, through the experience of what has worked in the past. Thirdly, feeling more experienced than one’s opponents can be a source of positive comparison that leaves the athlete feeling stronger and better equipped to succeed. Taken together, the reports of athletes indicated that there are clear benefits to the mentally tough athlete in having experience and task familiarity.

A Personal Best

Even though I have achieved the results I want in my sport, I still find I have those reactions, I still want to push it as far as I can, so my competitiveness and my aggression for achieving an extreme result are something that interests me, it’s still there... I still have that habit of wanting to push, after 15 years of pushing.

A personal best performance is achieved when an athlete’s level of performance is better than or equal to their previous best performance. The internal drive and determination to pursue personal best performances was commonly reported by the mentally tough athletes of this study. In the participant interviews, a range of personal best motivations were disclosed. These included the following:
• The need to feel that they have achieved their best;
• The desire to explore their physical and mental limits;
• The desire to see how far they can take the talent with which they have been blessed;
• The desire to see how much pain and adversity they can overcome;
• The satisfaction of achieving a personal best performance;
• The desire to set and break records;
• The love of challenging their bodies to see what their best is;
• The drive to be the best they can be.

The following are a few examples of participants talking about this motivation for achieving a personal best:

• “For me it’s about seeing how hard I can push myself and seeing how far I can take the talent I have been blessed with. I don’t know why I am good at athletics, but I’m going to see how far I can push my body, how far I can take it”;
• “[Sport] provides me with a chance to push myself as hard as I can, to see what my physical limits are, how hard can I push myself physically, how far will that take me”;
• “They love the pursuit of excellence and they love to challenge their bodies with these tasks and they make it a point, it’s like a game for them to see “what adversity can I overcome, what goal can I pick, how far can I push myself, what can I possibly achieve?”.

The above quotes demonstrate how mentally tough athletes explore their best performance with curiosity. What is my best? What can I do? How fast? How high? How accurate? From interviewing a number of champions as part of this study, champions at different stages of their lives, it is clear that this is a quality about them that does not end with sport. These mentally tough people are curious about their capabilities in many ways (e.g., one athlete described that after 15 years of pushing himself in sport, he continues to push himself to see what he can achieve in his
newfound pursuit—jewellery design)—and with a great sense of passion and enjoyment. The data indicates that this motivation for personal bests is important for mental toughness because athletes become driven for excellence and less concerned about outcomes (i.e., a known source of anxiety and underperformance in sport).

**Task Value: How Important is it to You?**

I think the value of what you are going after is very critical. How significant is that to you? I think the biggest factor is the significance of *where you are going*. ‘Right, how significant is it for me?’ It’s the significance of what they’re doing. If it’s not important, they’re not going to do it.

As captured in the above sentiments expressed by one participant, the value of what one is pursuing is critical for mental toughness. In his statement he suggests that for elite athletes, the importance or the significance of what they are doing is a key factor in whether or not they will persevere through challenge and adversity. In mental toughness terms, Task Value is defined as the quality of importance or the significance the task holds for the individual. The data indicate that different things are important for different people.

Participants reported a range of things that were significantly important to them, including:

- Proving a critic wrong;
- Achieving unfulfilled potential;
- Winning an event one had not won before;
- Being successful at an event in which one’s parent was successful;
- Proving to one’s self that they can beat a particular opponent or win a particular event;
- Continuing to be successful in their sport (particularly if it is the main focus of their life).
Speaking specifically about Task Value, participants reported:

- “I think in general, if you describe somebody as being mentally tough you could identify what it is that they’re mentally tough about or in regards to. I think one of the initial components of mental toughness is to have a task, an identified task which that person demonstrates their mental toughness in relation to”;
- “Anyone who is driven hard enough to really achieve at the top level in a sport has some major thing they want to prove to someone. Otherwise why would you do it? Especially in a sport as most of them are, where you don’t get those financial rewards, why else would you single mindedly and doggedly keep at the grindstone to get the results if it wasn’t to prove something that really means something to you?”;
- “To prove your critics wrong, that’s a big one that drives me, to be able to go out and do an event and prove people wrong is something that I love to do, and by going out and winning races and performing well in races achieves that.”

The data here suggest that the greater the value or significance of the task, the more mentally tough someone will be towards that task when adversity is encountered. The data clearly suggest that athletes direct their mental toughness towards goals that are significant to them. This is an important observation as it suggests that mental toughness is more likely to be a situational phenomenon (i.e., related to tasks the individual sees as important or valuable) rather than a trait that applies across various domains in a person’s life. The data demonstrate that task value is important for mental toughness as it, at least in part, determines the level of drive towards the task through adversity.

**Commitment to Goals**

They are just going to do whatever it takes, they are so committed to the task and they will do whatever it takes.

Commitment is defined as the act of binding oneself (cognitively and emotionally) to a goal or a course of action. What is implicit in this definition is the idea that once one has
become cognitively and emotionally connected to a goal one develops a greater resistance to any adversities or challenges.

The following are a few examples of participants talking about commitment.

- “They are the ones who are willing to take the extra step at any time as far as what they have to put into it. They are self-directed. They don’t have to be told about it. If you’ve got to take an athlete and say “look you really need to come back and do that sprint again or that hill climb again or you need to get up half an hour earlier and do a bit more work”, I don’t think they have that mental toughness that takes them on to win”;

- “I think that was a lot about just being absolutely committed to something, just every possible thing I could do to make that team I did… just knowing that I wanted it, there was no way I would ever have given up after making that commitment to myself. I think it was like, I have to follow it through anyway, no matter what, just for me”;

- “He decided from the very beginning that he was going to do everything that he needed to do, and he wasn’t just going to do it, he was going to do it to the absolute best of his ability and take himself to the maximum effort every time. He never does anything by halves, everything is full on.”

What is deduced from the above statements is that becoming attached intellectually and emotionally (i.e., being committed) to working towards a given goal, increases determination to complete that course of action. Mental toughness is seen as a genuine commitment to a task—a commitment that is not affected by obstacles, adversity or distraction.
Positivity

*We didn’t have that far to go in the race. However, I still kept positive,*
*that was the key, I still kept positive.*

In participant interviews, mentally tough athletes were described as people who were positive in the face of adversity. Positivity is defined as the process of being positive and remaining positive in the face of adversity or challenge.

Examples of participants and their positivity in relation to mental toughness include:

- “I guess I do a lot of talking to myself, I look at situations and I always try to see the positive in it, no matter what I’m faced with… [mental toughness] is the power to see potential in every situation and change negatives into positives at all times”;
- “I kept a diary and my whole aim with the diary was to write in it every day and to turn things into positives everyday. So for example, that bike and run session I talked about, my whole aim was to turn things into positives. So in this diary for that particular day I started off by saying it was a negative, it was tough and then I turned it around and I made it positive. And I did this everyday. Sometimes I start off saying “I felt shit today but the good thing about it was this, this and this”, so even if there were negatives I’d try to find the positives in them and turn them around straight away.”;
- “I think being positive is certainly an important part of being tough. I mean you can’t be negative and overcome the mental hurdles and take things to that step where you are getting into real mental toughness. I mean you’ve got to fight off the negatives and that’s what mental toughness is about.”

Participants describe being positive as an integral part of mental toughness. Throughout the interviews for this study, participants spoke of how positive mentally tough athletes are in the face of adversity—interpreting adversity at worst as a temporary setback and at best a time for learning and enrichment. This positive mindset is likely to
improve mental toughness in several ways. Firstly, positivity as a strategy controls for negative affect such that athletes can remain focused on the steps towards goal completion. Secondly, positive perceptions of potentially stressful events can serve as an emotion-charged source of motivation and determination. Whereas, when negative self-talk exists one is more likely to withdraw from an activity. Finally, by looking for the positives in adverse situations, athletes give themselves more chances to discover the keys to succeeding at their goals. On the other hand, negativity seems to blind one from these discoveries. Positivity, then, is an important style of coping for mental toughness.

**Stress Minimisation**

*At the end of the day it’s not that hard in comparison to the everyday life that normal people endure.*

Minimisation refers to the strategy of reducing one’s emotional reaction to adversity; keeping the emotional reaction to a minimum; making the situation seem small or less significant; making the adversity less significant or less important. Essentially, then, “stress minimisation” is a strategy that puts the challenge into perspective and in so doing, downplays the significance of the potentially negative affect. Examples of stress minimisation include:

- “Ultimately when I get in some situations I just try and look at the big picture… I’m able to put things in the right perspective and still do the job”;
- “He has a certain amount of patience with himself in the right areas, I can see he gets frustrated when he shoots a bad shot, but he doesn’t lose his “rag” ever, I think he can see and dismiss small failures for what they are, where the others get focused on small failures and blow them out of proportion”;
- “Seeing the big picture, you can see the light in the tunnel. The mentally tough ones still experience problems, but they just keep working towards and staying focused on their longer term goals, where [non-mentally tough athletes] are looking at the here and now and they’re going—“God I’m an idiot, I keep stuffing this up”, and it’s as far as they’re seeing and as far as they’ll go. They get caught in the moment”;
“At first it’s quite daunting and you are reasonably nervous about it or concerned, but then it’s a case of just accepting that and saying, “righto, well it’s only going to last six minutes, it’s a hell of a small period of time in the scheme of things, so I’ll be a bit uncomfortable for ten minutes and then it’s over”.

The data indicates that this strategy is one of perception. Mentally tough athletes do not overreact and become overwhelmed with emotion in response to pressure. Rather, the data indicates that these mentally tough athletes are more likely to stay “cool headed,” “cool, calm, and collected”, and to keep the big picture in mind when presented with a challenge. In effect, this dampening of negative affect leads to mentally tough athletes who have fewer problems with anxiety, thus having the emotional stability to make good decisions and to deliver well-measured responses in the face of adversity and pressure. Some athletes find the pressure of a situation debilitating.

Positive Comparison

Out of the corner of my eye I see the top Yank go down and get into the crouching position and instantaneously the statement was ‘take your mark’. And it went through my mind he’s more nervous than I am.

Positive comparison refers to a strategy athletes use where their sense of mental strength is gained through making a positive comparison with their opponent. At crucial points in their performance, often at the peak experience of adversity, the athlete makes a personally favourable comparison between themselves and their opponent on how well they are coping with the situation. For example, in the quote above, they reported feeling that the American athlete was more nervous than he was (i.e., the American was not coping as well). This positive comparison leaves the athlete feeling mentally stronger and more ready to perform.

Other examples of the use of this ‘Positive Comparison’ strategy by mentally tough athletes include:

- “I just remember standing there, waiting to receive the ball and I’m thinking, “shit, here goes my Worlds”. And I remember standing there, and I looked across
at her and I could see her eyes widening and I thought,—“she’s shitting herself”. So I kept going, kept saying the same thing over and over. I just stuck to my game plan and I didn’t get cocky or confident… It was the most awesome match. They reckon it was one of the best women’s matches on record”; • “I was expecting to be a bit further up the field. However, I kept faith, I kept positive, I hung in there, I gritted my teeth and continued and before long I picked up a position, and I went past that athlete at a good rate of knots and I thought if I’m struggling and I’m going past them at that rate of knots imagine what they’re feeling like. So I kept faith that I could still pick up more places… I picked up those two athletes and I actually managed to overtake them without too much effort, which was a good sign because it just goes to show that they would have been struggling because if they’re going that much slower than I was, obviously they were hurting more than I was.”

The data suggests that Positive Comparison is another factor of perception. The mentally tough athlete perceives that they are coping with the adversity better than others. Through interview and subsequent data analyses, it was clear that these athletes drew strength from knowing they were coping better than their opponent. It seems to be a strategy used at the peak experience of adversity. So as the athlete begins to feel the pressure, they develop a positive comparison, thereby giving them a boost in confidence and strength to push a little harder to overcome the final stages of the task.

**Summarising 12 Factors Derived from the Data**

Twelve characteristics of mental toughness were drawn from the analysis of over 30 in-depth interview transcripts. These factors include: self-efficacy, mental self-concept, potential, task focus, perseverance, task familiarity, personal bests, task value, goal commitment, positivity, stress minimisation, and positive comparisons. It is recognised that there is a degree of subjectivity in assigning different quotes to different factors. Notwithstanding this, decisions were based on a systematic process (Constas, 1992) and on the researcher’s prior experience in working with elite athletes.
Integrating the Factors into a Multidimensional Structure (Research Question 3)

One aim of this investigation was to move beyond description towards a conceptual model of mental toughness. Supporting a multidimensional model of mental toughness, one participant reports,

I sort of see it a bit like a pyramid I guess, with mental toughness being the final outcome sitting at the top of the pyramid and at the base a number of quite broad platform factors if you like, and then skills being built upon those to the extent that the outcome at the end of the day is an athlete that’s mentally tough under pressure.

Here the participant describes a series of ‘broad platform factors’ from which mental toughness originates. This multidimensional view of mental toughness is also supported by the research of Jones et al. (2002) and Fourie and Potgieter (2001), and by Loehr’s (1986) heuristically appealing, although empirically problematic model of mental toughness. Taken together, mental toughness should, at a minimum, be considered to be a multidimensional construct.

The components underpinning mental toughness provide the basis for a model of mental toughness that reflects the complexity of the concept. Figure 6.1 displays a visual representation of the model that was developed as a component of this study. This model is a preliminary representation of mental toughness as guided by the qualitative study and requires further quantitative testing to validate and perhaps refine it—the focus of Studies 3 and 4. The model was developed with guidance from the data, which suggested that a number of factors affect the overall display of mental toughness. Therefore, the model presented here includes the 12 factors of mental toughness all contributing to global mental toughness (as the data suggests).
Figure 6.1

Structure of the proposed model of mental toughness
The model of mental toughness presented here is a description rather than a prescription. The factors were derived via participant description, and the model integrates these descriptions into an overall model of mental toughness. This research does not prescribe a set way to be mentally tough. Athletes do not necessarily require all of these factors to be considered mentally tough. Instead, it is hypothesised that athletes can be mentally tough using different combinations of these factors presented in the model. It is most likely, however, that there will be a core group of factors that are essential for mental toughness. Determining the contribution of each component to overall mental toughness remains an important investigation for the future.

**Mental Toughness Definition**

After determining a theoretical model of mental toughness, including a range of factors that comprise it, the development of a preliminary definition of mental toughness is now possible. This definition may be confirmed or further refined in the process of later quantitative study.

The preliminary definition is as follows:

Mental toughness is defined as an unshakeable perseverance and conviction towards some goal despite pressure or adversity. Moreover, attaining mental toughness as so defined requires the presence of some or all of the twelve mental toughness components: self-efficacy, mental self-concept, potential, value, personal bests, commitment, positive comparisons, stress minimisation, perseverance, positivity, task familiarity, and task focus.

The strength of this definition is that it does not limit itself to what may be seen as the outcomes of mental toughness. One accusation that has been levelled at others who have attempted to define mental toughness, is a tendency to confuse what mental toughness allows one to do (i.e., outcomes of mental toughness) with what it actually is (e.g., Jones et al., 2002). The definition presented here looks not only at what mental toughness is but also includes the characteristics that help an individual achieve a mentally tough orientation: for example, stress management, perseverance, task focus and commitment.
Examining the definition more closely, the word “unshakeable” broadly captures the notion there is a quality of resistance to pressures, or overcoming of pressure. The words “unshakeable perseverance and conviction” describes how the actions of perseverance, and the motivation and determination, remain largely unaffected by pressures or challenges. The definition also highlights an important finding of this study, that mental toughness exists in the context of some pressure or adversity. Overall, the definition captures the multidimensionality of mental toughness with a strong emphasis on “how” it is achieved and not just the outcome characteristics. This provisional definition and the model of mental toughness developed here, provide some direction for instrument development in later chapters.

The Yields of this Qualitative Study and Implications for the Thesis

The model of mental toughness presented in this research provides an appealing way of considering mental toughness. The model has strengths for both theory development and application. For theory, the model draws together a series of hypothesised interrelationships between the factors of mental toughness and represents these in a multidimensional model, similarly to the approach adopted by Shavelson et al. (1985) in progressing self-concept research. Further quantitative research is needed to provide support for this multidimensional model—the aims of Studies 3 and 4.

The model also has strengths for the applied setting. Firstly, by drawing together a set of constructs, the model provides a parsimonious way of considering mental toughness. Although the model integrates a complex set of constructs and concepts, it still provides a readily identifiable and understandable way for athletes to think about their mental toughness and for coaches and others to explain it to them. The model also holds potential applied benefits in the area of measurement and training. Firstly, the development of a model, however preliminary, draws the field closer to effective measurement of mental toughness. Secondly, once effective measurement is possible, insights into the success and nature of interventions designed to develop and sustain mental toughness, are enhanced.

Overall, the present study advances our understanding of the concept by presenting a more fine-grained view of the components of mental toughness. This was, in part, achieved through methodological changes employed by the researcher.
In Fourie and Potgeiter’s (2001) study, the qualitative study employed the use of an open-ended written response format. This method has its limitations in that participants’ comments cannot be probed for further expansion and development. Jones et al. (2002) utilised individual (N = 10) and group interviews. While this method of data collection was a progression in the field, the data interpretation lacked more fine-grained analysis. Instead, the authors adopted a presentation style that was a description of what was said, without a great deal of further development. The present study provides an important development on the former two studies in that it extends the method and results to utilise more complex and fine-grained data collection, data analysis, and presentation methods. The present study utilised in-depth qualitative interviews (N = 33) of world-class athletes and coaches, presented a descriptive view of what emerged from the interviews, and then developed these ideas into a multidimensional and hierarchical mental toughness model and supported by theory.

Taken together, then, the findings of the present qualitative investigation not only hold substantive and methodological implications for researchers studying mental toughness, but are also relevant to practitioners operating in contexts in which athletes are required to deal effectively with setbacks, adversity, and challenge in the sporting setting.

**Summary**

This study provides what has been lacking in the area of mental toughness — definition and multidimensional conceptualisation. With an understanding of mental toughness in hand, investigations of measurement, development across a lifespan, and training methods become viable. The theoretical model of mental toughness developed here, and the factors that comprise it, form the basis for the development of the Mental Toughness Inventory (MTI)—the focus of subsequent studies in this thesis.
CHAPTER SEVEN

STUDY 3 RESULTS:
DEVELOPMENT OF THE
MENTAL TOUGHNESS INVENTORY (MTI)

Introduction
This represents the third study of this thesis—and focuses on the development and refinement of the major yield of this thesis—the Mental Toughness Inventory (MTI). The development of a test of mental toughness follows on from the proposed model of mental toughness presented in the previous study (i.e., Chapter 6—qualitative investigation of mental toughness). What the current study offers is the chance to quantitatively test the qualitatively derived multidimensional model. In addition to testing the proposed model of mental toughness, this study aims to develop the first psychometrically sound instrument that is appropriate for assessing the multidimensional nature of mental toughness in athletes from a wide variety of settings.

Using the qualitatively derived model of mental toughness as the foundation for the present study, a large pool of items was developed to assess the 12 characteristics of mental toughness—forming the basis of the Mental Toughness Inventory (MTI). This chapter uses athlete responses to the MTI to refine the total number of items and the design of the instrument. Instrument refinement is guided by the following of strict psychometric criteria. In this context, the following questions are pursued in this study. To what extent is the MTI reliable? To what extent does the MTI demonstrate convergent and discriminant validity? Does the a priori factor structure provide a reasonable fit to the data (based on athlete responses)? Does the removal of weaker fitting items substantially improve the validity of the instrument? The answers to these questions will provide timely data to either support or reject the use of the MTI as a test of mental toughness.

To what extent do the PPI factors proposed by Loehr relate in a meaningful way to established and conceptually-related constructs?
Overview of Analyses

Study 3 begins with a qualitatively derived multidimensional model of mental toughness. The study built a questionnaire to assess that model, items having been developed relating to each of the 12 factors of mental toughness in the hypothesised model and the instrument having been compiled into a form for administration. The instrument was then administered to groups of athlete participants, with the resulting data being used to refine the instrument. The data was also used to assess the validity of both the hypothesised model and the instrument itself as a valid test of mental toughness.

The results for this chapter are organised so that the construction and refinement of the instrument are presented first. The chapter then presents the within-network validity checks (i.e., internal consistency and CFA), before demonstrating the invariance of the model across different participant samples.

A Model of Mental Toughness Provides the “Blueprint” for the Development of the Mental Toughness Inventory

The qualitative results of Study 2 indicated that there are 12 characteristics of mental toughness. These characteristics were integrated into a multidimensional model of mental toughness. The development of a test of mental toughness based on this qualitatively derived hypothesised model provides the opportunity to formally evaluate the model from a quantitative perspective. Therefore, the hypothesised model (see Figure 7.1) acts as the foundation for the construction of the Mental Toughness Inventory (MTI).
Figure 7.1

Structure of the proposed model of mental toughness
Development of Items

In the development of instruments, it is common to start with a large pool of items, thereby allowing sufficient scope to refine the instrument in the light of subsequent testing and analysis. In this study, pools of items were specifically developed to best capture the content of the intended factors. Where possible, items were developed from the statements about mental toughness gathered from the qualitative studies of Study 2. Furthermore, the range of items developed for each factor aimed to capture the breadth and depth of that factor. One sample item for each of the 12 factors of mental toughness in the model is presented in Table 7.1. Thus, the design of the instrument—twelve specific scales along with the items intended to measure each of the scales—provides an a priori model that is the basis of subsequent analyses.

Table 7.1
MTI factors and representative items

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<thead>
<tr>
<th>Factor</th>
<th>Representative Item</th>
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<tr>
<td>Self-efficacy</td>
<td>“No matter what the pressure, I still believe in myself.”</td>
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<tr>
<td>Task Value</td>
<td>“This activity is one of the most valuable parts of my life.”</td>
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<tr>
<td>Potential</td>
<td>“I feel my future in this area will be good.”</td>
</tr>
<tr>
<td>Task Familiarity</td>
<td>“My experience makes me stronger when performing.”</td>
</tr>
<tr>
<td>Personal Bests</td>
<td>“To have done my best is the most important thing to me.”</td>
</tr>
<tr>
<td>Stress Minimisation</td>
<td>“I am good at minimising the effects of stress.”</td>
</tr>
<tr>
<td>Mental Self-concept</td>
<td>“I excel because of my mental strength.”</td>
</tr>
<tr>
<td>Positivity</td>
<td>“When things are bad I try to turn it around into something positive.”</td>
</tr>
<tr>
<td>Perseverance</td>
<td>“I keep working at things until I overcome them.”</td>
</tr>
<tr>
<td>Positive Comparison</td>
<td>“Seeing the opposition feeling the pressure builds my confidence.”</td>
</tr>
<tr>
<td>Task Focus</td>
<td>“I get absolutely focused on the task, nothing distracts me.”</td>
</tr>
<tr>
<td>Goal Commitment</td>
<td>“No matter what, I remain committed to my goals.”</td>
</tr>
</tbody>
</table>
Administering the MTI

There were two rounds of administration using the MTI. The first was a pilot administration of the MTI intended to refine the number of items in the instrument. The Pilot version of the MTI was a 108-item questionnaire—12 factors each measured by 9-items. The pilot MTI was administered to 479 athletes from an elite sports high school (age range = 12 to 19 years, mean age = 14.29, SD age = 1.54 years, males = 58%, females = 42%). Test results were used to refine the instrument (see below for description of this procedure) which yielded a 5 item per factor instrument.

This 5-item version of the MTI was then administered in the second round to a wide sample of institute and school-based athletes (school-based athlete number = 438, age range = 12-18 years, mean age = 14.34 years, SD age = 1.5 years, males = 62.6%, females = 37.4%; and institute-based athlete number = 392; age range = 11 to 38 years, mean age = 18.55 years, SD age = 4.48, males = 51%, females = 49%). Tests of within-network validity were used to demonstrate the psychometric properties of the instrument. Also, a further refined version containing 3-items per factor (designed for ready and time-efficient use by practitioners) was also assessed.

Refining the Number of Items

One aim for the development of the MTI was that it be a brief and concise instrument that maintains psychometric soundness. This requires that an acceptable level of reliability (e.g., at least .8) be achieved, based on scales having a relatively small number of items. Thus, the aim is to: (a) reduce the length of the MTI; (b) measure and maintain the content of all 12 factors in the MTI; (c) maintain reliability estimates of at least .80; and (d) provide a factor structure in which goodness of fit indices meet acceptable standards. Working through the MTI subscale-by-subscale, items that do not load particularly well on the hypothesised scale are removed. Multiple criteria are used (see Methods) to select items. This process involves examining results from (a) a series of one-factor congeneric CFA models, (b) a full model CFA, and (c) Cronbach’s alpha coefficients, given the removal of each item from the subscale.

A series of models are explored in which the original twelve mental toughness factors are retained, but poorer fitting items are eliminated.
Confirmatory Factor Analyses

A series of confirmatory factor analyses (CFA) were used in this research to assess the factor structure of the MTI. Broadly, CFA tests the ability of a solution based on the a priori model to fit the data by showing that: (a) the solution is well defined; (b) parameter estimates are consistent with theory and a priori predictions; and (c) the $\chi^2$ and subjective indices of fit are reasonable (Marsh, in press; Marsh, Balla, & McDonald, 1988; McDonald & Marsh, 1990). Refer to the methodology chapter for more details on CFA.

MTI Refinement Using a Within-Network Construct Validity Approach

Confirmatory factor analysis of the pilot version of the MTI (i.e., 12 factors measured by 9 items each) revealed a good match to the data (see Table 7.1 for goodness of fit indices). With the goal of reducing the size of the MTI, a series of models were explored in which the original 12 factors were retained, but poorer fitting items were eliminated (see previous section on the criteria used to achieve this). This process resulted in the development of a refined version of the MTI, containing 12 factors measured by 5-items each (see Appendix C for item wording and statistics).

In the development of instruments, it is important to be clear and transparent about how the instrument is developed. Therefore, to demonstrate how the Mental Toughness Inventory was refined from 9-items per factor to 5-items per factor, the researcher will demonstrate how the process unfolded for one factor—“Task Focus”. Refining the task focus factor (as for each of the mental toughness factors) involved a series of stages. Firstly, the nine items that measured task focus were tested for scale reliability. The reliability for the scale was good ($r = .93$). Reliability would be marginally improved by the removal of item 1. The removal of any of the other items did not substantially affect the overall reliability (i.e., reliability would remain over .91). The overall model of mental toughness (i.e., 12 factors measured by 9-items each) was then tested for the fit to the data using CFA. The fit was good (CFI = .99, NNFI = .98, RMSEA = .056). For Task Focus, the factor loadings were all quite strong. The weaker of the factor loadings were for Items 1 and 5. Examinations of cross-loadings revealed Items 1, 3, 5, and 9 related strongly with other scales (specifically personal bests, perseverance and commitment). Furthermore,
modification indices revealed large expected change by removing items 1, 3, 5, and 9. Based on these multiple criteria, decisions were made and the factor task focus was reduced from 9-items to 5-items. Similar processes and decisions were made in reducing the item set for each of the other 11 MTI factors. Every effort was made to try to retain the breadth and depth of the factor content whilst selecting the strongest items for this questionnaire.

The refined version of the MTI (see Appendix D) was then tested across school- and institute-based athlete samples. Reliability estimates for each of the factors, across both samples, were well above the acceptable level of .8 (mean alpha coefficient = .89, range = .83 to .92; see Table 7.3). Confirmatory factor analyses demonstrated that solutions based on the qualitatively derived model of mental toughness fitted the data well (see Table 7.2 for goodness of fit indices for school-based and institute-based athlete samples). From a within-network perspective, then, the data demonstrate that the MTI is psychometrically sound.

The researcher recognises that practitioners would value a slimmer version of this instrument. A shorter MTI would provide the opportunity to test athletes closer in time to competition and training without being overly demanding on the athlete. Reducing the size of the instrument from 5- to 3-items per factor maintained a very good fit of responses to the model (see Table 7.2 for fit statistics for both school- and institute-based). Although the 3-item per factor version of the MTI performs very well against psychometric criteria, it cannot be used for the remainder of this research as it has only been tested using data obtained from the 5-item version testing data. Further research is needed to confirm the validity of the shortened 3-item per factor version—by administering: (a) only the 3-item version and (b) both the 5-item and 3-item versions in the one survey and then assessing comparative findings. Therefore, notwithstanding the practitioner benefits of the shorter scale, the 5-item-per-factor version of the MTI is used for the remainder of this thesis.
Confirmatory factor analysis of the Mental Toughness Inventory

<table>
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<tr>
<th>Model</th>
<th>$X^2$</th>
<th>DF</th>
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<th>CFI</th>
<th>RMSEA</th>
<th>Description</th>
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<td>1a</td>
<td>16418.45</td>
<td>6591</td>
<td>.99</td>
<td>.99</td>
<td>.056</td>
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<tr>
<td>1b</td>
<td>4580.27</td>
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<td>.98</td>
<td>.063</td>
<td>School Sample: 5 items 12 factors</td>
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<tr>
<td>1c</td>
<td>1275.15</td>
<td>528</td>
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<td>.99</td>
<td>.057</td>
<td>School Sample: 3 items 12 factors</td>
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<td>1d</td>
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<td>.98</td>
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<td>Institute Sample: 5 items 12 factors</td>
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<tr>
<td>1e</td>
<td>926.75</td>
<td>528</td>
<td>.99</td>
<td>.99</td>
<td>.044</td>
<td>Institute Sample: 3 items 12 factors</td>
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</tbody>
</table>

**Confirmatory Factor Analysis of the MTI by Group (Hypotheses 3.1 and 3.2)**

Having excluded poorer fitting items, the resulting MTI contained 12 factors comprising 5 items each (60 items in total). CFA was used to test the a priori model behind the MTI. CFA results are presented by looking at the CFA fit indices for school-based athletes first, then for institute-based athletes, and then for the multigroup CFA models, formally comparing the fit of both samples with respective elements of the factor structure constrained to be equal.

**MTI CFA on School-Based Athlete Sample:** The factor structure underlying the twelve components of the MTI was well defined for the school-based athlete sample (Hypothesis 3.2), with the CFA yielding a $\chi^2$ of 4515.78 (df = 1644), a NNFI of .98, RNI of .98, and RMSEA of .063. The factor loadings, factor correlations, and reliabilities (Cronbach’s alphas) are presented in Table 7.3. Reliabilities for this group were strong and ranged from .83 to .91 (Hypothesis 3.1).

**MTI CFA on Institute-Based Athlete Sample:** The factor structure underlying the twelve components of the MTI was also well defined for the institute-based athlete sample (Hypothesis 3.2), with the CFA yielding a $\chi^2$ of 4201.87 (df = 1644), a NNFI of .98, RNI of .98, and RMSEA of .062. The factor loadings, factor correlations, and reliabilities (Cronbach’s alphas) are presented in Table 7.3. Reliabilities for this group were strong and ranged from .85 to .93 (Hypothesis 3.1).

**MTI CFA on Male Sample:** The factor structure underlying the twelve components of the MTI was well defined for the male sample (Hypothesis 3.2), with the CFA yielding a $\chi^2$ of 4728.38 (df = 1644), a NNFI of .98, RNI of .98, and RMSEA of .062. The factor loadings, factor correlations, and reliabilities (Cronbach’s alphas) are presented in Table 7.4. Reliabilities for this group were strong and ranged from .83 to .91 (Hypothesis 3.1).
MTI CFA on Female Sample: The factor structure underlying the twelve components of the MTI was well defined (Hypothesis 3.2), with the CFA yielding a $\chi^2$ of 4037.43 (df = 1644), a NNFI of .98, RNI of .98, and RMSEA of .064. The factor loadings, factor correlations, and reliabilities (Cronbach’s alphas) are presented in Table 7.4. Reliabilities for this group were strong and ranged from .85 to .94 (Hypothesis 3.1).
Table 7.3.
Factor analysis structure for the MTI (5 item version) using both the institute and school-based athlete samples

<table>
<thead>
<tr>
<th>Item Number</th>
<th>SEFF</th>
<th>PCOM</th>
<th>VAL</th>
<th>POT</th>
<th>TFAM</th>
<th>PB</th>
<th>MIN</th>
<th>MSC</th>
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The Mental Toughness Inventory (MTI) factors are: SEFF = Self-Efficacy; PCOM = Positive Comparisons; VAL = Value; POT = Potential; TFAM = Task Familiarity; PB = Personal Bests; MIN = Stress Minimisation; MSC = Mental Self-Concept; POSI = Positivity; PERS = Perseverance; TFOC = Task Focus; COMM = Commitment.
Table 7.4.
Factor analysis structure for the MTI (5-item version) using both the male and female samples

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Multigroup CFA and Invariance across School- and Institute-Based Athletes

(Hypothesis 3.3)

Does the MTI measure the same components of mental toughness with equal validity for school- and institute-based athletes and for males and females? At a pragmatic level, the implications of this issue are substantial. For example, unless there is reasonable support for the invariance of the mental toughness structure across school- and institute-based athletes, it may not be justified to compare motivation responses across school and institute-based athletes. Such concerns about factor structure invariance are most appropriately evaluated by using CFA to determine whether—and how—the structure of mental toughness varies according to gender and context (see Byrne & Shavelson, 1987; Hattie, 1992; Marsh, 1993a).

It was of interest to determine factor invariance across school- and institute-based athletes and across males and females. Testing for factor invariance essentially involves comparing a number of models in which aspects of the factor structure are systematically held invariant across groups, and assessing fit indices when elements of these structures are constrained. Relatively invariant fit indices are indicative of invariant factor structure. The present analyses examined the comparative fit indices for a number of models that held successive elements of the factor structure invariant across school- and institute-based elite athletes, and then across males and females.

The first multigroup CFA examined the factor structure for school- and institute-based athletes and allowed all factor loadings, uniquenesses, and correlations to be freely estimated. This model yielded an excellent fit to the data ($\chi^2$ of 9717.65 (df = 3288), a NNFI of .98, RNI of .98, and RMSEA of .063). Although this model demonstrates a good fit to the data, it is important to test formally for invariance between school and institute-based athletes. The present study therefore examined the comparative fit indices for four additional models across school- and institute-based athletes. The first model holds the factor loadings invariant between groups; the second holds both factor loadings and uniquenesses invariant; the third holds the factor loadings and correlations invariant; and the fourth holds the factor loadings, the uniquenesses, and the correlations invariant.

Results in Table 7.5 indicate that when successive elements of the factor structure are held invariant across context, the fit indices are predominantly comparable. The application of recommended criteria for evidence of lack of
invariance (i.e., a change of 0.01 in fit indices—see Cheung & Rensvold, 2002) indicates that there is relative invariance across all models. This suggests that the factor structure, factor loadings, uniquenesses, and factor correlations are parallel for school-based athletes as they are for institute-based athletes (Hypothesis 3.3). Taken together, these data suggest that in terms of the underlying characteristics of mental toughness characteristics and the relationships amongst those characteristics, school and institute-based athletes are not substantially different.

**Multigroup CFA and Invariance across Males and Females (Hypothesis 3.4)**

The second multigroup CFA examined the factor structure for males and females, allowing all factor loadings, uniqueness’s, and correlations to be freely estimated. This model yielded an excellent fit to the data ($\chi^2$ of 9821.92 (df = 3288), a NNFI of .96, RNI of .96, and RMSEA of .069). Again, although this model demonstrates a good fit to the data, it is important to test formally for invariance between males and females. As above, this involved examining the comparative fit indices for the same four additional models across males and females.

Results in Table 7.5 indicate that when successive elements of the factor structure are held invariant across gender, the fit indices are predominantly comparable. Again, the application of recommended criteria for evidence of lack of invariance (i.e., a change of 0.01 in fit indices—see Cheung & Rensvold, 2002) indicates that there is relative invariance across all models. This suggests that the factor structure, factor loadings, uniquenesses, and factor correlations are much the same across males and females (Hypothesis 3.4). Taken together, these data suggest that in terms of the underlying characteristics of mental toughness characteristics and the relationships amongst those characteristics, males and females are not substantially different.
Table 7.5
CFA tests of the invariance of the Mental Toughness Inventory

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The Yields of this Quantitative Study and Implications for the Thesis

A particular strength of the MTI is its conceptual basis. The multidimensional model of mental toughness has been built from the analysis of interviews with over 30 world class athletes (i.e., the qualitative identification of mental toughness characteristics in Chapter 6). The model has face validity, is intuitively appealing, and has support from recent qualitative research into mental toughness (Fourie & Potgieter, 2001; Jones et al., 2002). Now, the present study provides quantitative data to support the qualitatively derived multidimensional model of mental toughness. Therefore, a significant yield of this study is the quantitative support provided to the multidimensional model of mental toughness.

One aim of this chapter was to refine the size of the MTI to be a valid and easily administered assessment instrument for testing mental toughness across a range of athletes. This aim was achieved, using multiple criteria to reduce the size of the instrument from 9-items per factor to 5-items per factor. CFA also demonstrated that a 3-item-per-factor version of the MTI, assessed using a subset of the 5-item testing data, provided equally good fit to the data. Although the 3-item per factor version provides many advantages to those wanting to use the MTI in the applied setting, further research is needed to test that model in an independent sample of elite athletes (i.e., the 3-item per factor version here was tested as a subset of the data...
obtained using the 5-item per factor MTI—(a) using only 3-item measures and also (b) using 5-item and also 3-item in same survey. Notwithstanding this, a major yield of this study is the refinement of the MTI to be a 60-item test (i.e., 5-items factor) assessing 12 characteristics of mental toughness.

Another important aim for this study was to examine the validity of the MTI from a within-network perspective. Internal properties of the MTI (such as internal reliability, factor structure, uniquenesses, and cross loadings) were closely examined. The data provided strong support for the internal structure of the MTI. Furthermore, tests of invariance showed how the structure of the MTI is equivalent for institute-based athletes as it is for school-based athletes, and also for males as it is for females. Taken together, the MTI is shaping as a sound instrument, strong in theory, conceptualisation and internal properties. The next step is to evaluate the strength of this instrument from a between-network approach—and this forms the basis of the results presented in the proceeding chapter (Chapter 8).
CHAPTER EIGHT

STUDY 4 RESULTS:
BETWEEN-NETWORK VALIDITY OF THE MENTAL TOUGHNESS INVENTORY (MTI)

Introduction

The fourth study of this thesis focuses on between-network validation of the Mental Toughness Inventory (MTI). This chapter follows on from the within-network validity study (i.e., Study 3—Chapter 7), where strong internal psychometric properties were observed for the MTI. Although within-network validity is a necessary condition in evaluating the validity of instruments, alone it is not sufficient. Demonstrating instrument validity also requires the presence of supporting data that shows appropriate relationships between the construct being validated and other known constructs—that is, sound between-network properties. Therefore, the task for this study is to examine the pattern of relationships between the MTI model and other key constructs.

This study also takes the opportunity to examine mean-level differences in mental toughness between school-based and institution-based athletes, males and females, and younger and older athletes. This research answers such questions as: How do institute and school-based athletes differ at the mean level on characteristics of mental toughness? Does mental toughness vary according to age? In what way does mental toughness differ between males and females? Taken together, the answers to these questions and more will provide further information of use to athletes and coaches.

Overview of Analyses

This study is an extension of the previous chapter in that the focus is on testing the validity of the Mental Toughness Inventory. Whereas the previous chapter addressed
within-network validity (reliability, factor structure), this chapter looks to explore the between-network validity of the MTI. Therefore, the analyses to be performed for this study include: (a) an evaluation of relationships (i.e., correlations) between the MTI factors and theoretically related constructs and (b) an evaluation of how institute-based/school-based, males/females, and younger and older athletes differ on levels of mental toughness characteristics. These research components are now outlined.

**Between-Network Validity Approaches**

As a between-network study, the research attempts to establish a logical, theoretically consistent pattern of relations between the MTI scales and other theoretically related constructs. These theoretically related constructs are called key correlates, and are selected because theory would predict them to be meaningfully related to mental toughness. Between-network validity is assessed by examining the correlation matrix between the MTI subscales and these theoretically related constructs. The next section presents the key correlates used in determining between-network validity for the MTI.

**Key Correlates**

Three key correlates were included in the study: multidimensional athletic self-concept, flow and personal effectiveness. These correlates were measured by the Elite Athlete Self-Description Questionnaire (EASDQ), Flow Trait Scale (FLOW) and Review of Personal Effectiveness and Locus of Control scale (ROPELOC) instruments respectively. These key correlates were selected on the basis of being well established measures in the sports psychology literature that were hypothesised a priori to be subsequently correlated to mental toughness. The relationships between the key correlates and mental toughness are predicted on the basis of their conceptual relatedness to mental toughness, either as correlates or outcomes of individuals’ mental toughness. Hence, they are deemed to be feasible constructs with which to validate the MTI structure.

**Elite Athlete Self-Description Questionnaire (EASDQ):** The EASDQ is a 28-item self-report instrument designed by Marsh, Hey, Johnson and Perry (1997; also see Marsh, Hey, Roche, & Perry, 1997; Marsh, 1997, 2002) to measure six components of elite athletes’ self-concept: Skills, Body, Aerobic, Anaerobic, Mental,
and Overall Performance. Marsh (2002) reported that EASDQ responses by elite swimmers were strongly correlated with performances in 16 different events and contributed to prediction of subsequent performance in international championships beyond what could be explained in terms of previous performances. See Methodology chapter for a complete review of this instrument.

Flow Trait Scale (FLOW): The 36-item FLOW instrument is based on Csikszentmihalyi’s theory of flow as applied to a sport setting (see Jackson & Csikszentmihalyi, 1999). The instrument, developed by Jackson and colleagues (Jackson, 1994; Jackson & Marsh, 1996; Marsh & Jackson, 1999), measures nine flow experiences in sport: action-awareness merging, clear goals, unambiguous feedback, concentration on task, sense of control, time transformation, and autotelic (intrinsically rewarding) experience. Study 1 demonstrated that five of the nine flow factors correlate strongly with a global mental toughness scale (challenge-skill, clear goals, concentration, control, and autotelic experience; see Table 5.3). Therefore, in order to reduce the total size of the testing package for the participants, we only included those five scales in this administration. Refer to the Methodology chapter of this thesis for a complete review of this instrument.

Review of Personal Effectiveness and Locus of Control Questionnaire (ROPELOC): The ROPELOC was developed by Richards and Neill (2000) to tap into key psychological and behavioural aspects of human functioning that indicate a person’s effectiveness in a variety of areas. The ROPELOC measures 12 areas of personal effectiveness, including personal abilities and beliefs (Self-Confidence, Self-Efficacy, Stress Management, Open Thinking), social abilities (Social Effectiveness, Cooperative Teamwork, Leadership Ability), organisational skills (Time Management, Quality Seeking, Coping with Change) an “energy” scale called Active Involvement and a measure of overall effectiveness in all aspects of life. The ROPELOC also measures Internal and External Locus of Control (i.e., ROPELOC consists of 14 scales in total). The instrument consists of 45 items. Please refer to the Methodology chapter for a complete review of this instrument.

**Participant Sample**

The test data for this study comes from the larger administration of the MTI in Study 3 (i.e., Time 2 administration to a wide sample of institute and school-based athletes). In that round of testing, the three key correlate questionnaires (i.e.,
EASDQ, FLOW and ROPELOC) were administered together with the MTI in one bundle.

The sample included 438 school-based athletes (age range = 12-18 years, mean age = 14.34 years, SD age = 1.5 years, males = 63%, females = 37%) from Westfield Sports High School. The sample also included 392 institute-based athletes from various elite institutes of sport around Australia (age range = 11 to 38 years, mean age = 18.55 years, SD age = 4.48, males = 51%, females = 49%). The total sample size, therefore, was 830 athletes. Refer to the Methods chapter of this thesis for a complete review of the participant sample.

**Multiple-Indicator-Multiple-Cause (MIMIC) Models**

The MIMIC approach is used in this study to assess the role of gender, age and context (i.e., the effect of being an institute-based athlete as opposed to school-based) on the mental toughness constructs. Kaplan (2000; see also Grayson et al., 2000) suggested the MIMIC approach, which is similar to a regression model in which latent variables (e.g., multiple dimensions of athlete mental toughness) are “caused” by discrete grouping variables (e.g., gender, competition level, gender x competition level) that are represented by a single indicator. Refer to the Methodology chapter for a more complete review of the MIMIC method.

The present MIMIC model included the effects of gender, context, age (treated as a continuous variable), gender x age interaction, gender x context interaction, age x context interaction, and gender x age x context interaction. Consistent with recommendations by Aiken and West (1991), age was zero-centred (put in deviation score form so that the mean is zero) so as to reduce the multicollinearity between age and the corresponding interaction term. Very high levels of multicollinearity can introduce technical problems in estimating regression coefficients, and centering variables often minimises these potential problems. The interaction term was calculated by multiplying gender and the zero-centred age variable. To further reduce collinearity between the interaction term and its composite main effects, a series of preliminary linear regressions where main effects predicted the interaction term and residuals saved. This thereby develops a “pure” interaction term with the collinearity of main effects removed.
**Between-Network Validity: Relating the MTI Model to Key Correlates**

Research Question 4.1 seeks to explore the pattern of relationships between the mental toughness factors and a selected range of theoretically related concepts. This exploration is useful at two levels. Firstly, it provides valuable information that can demonstrates the between-network validity of the MTI (i.e., when MTI scales relate as expected with key constructs). Secondly, this is a chance to observe how mental toughness relates to a range of concepts, and also, how those concepts relate to mental toughness. Three instruments were included within the MTI testing package for the purpose of validation (i.e., in relation to key correlates). These instruments related to athletic self-concept, flow and personal effectiveness. Table 8.1 presents the resulting correlation matrix between both the MTI factors and the factors contained within the EASDQ, FLOW and ROPELOC instruments.

The researcher examined the correlations between the MTI subscales to gain a sense of the broad pattern of the key correlates. The MTI factors correlated as expected (based on content analysis and guidance from theory) with the specific validating factors. That is, relationships between specific factors were differentially stronger and weaker as expected (i.e., based on content analyses and theory). For example, MTI factor “Task Focus” related more strongly with FLOW factor “Concentration” than with other, less theoretically related factors such as ROPELOC factors “External Locus of Control” and “Social Effectiveness”. By observing the correlation coefficients presented in Table 8.1 it can be seen that in general “like” concepts are more strongly correlated than “less like” concepts (i.e., MTI factor Self-Efficacy with concepts Self-Confidence and Self-Efficacy; MTI Factor Mental Self-Concept with Mental Competence; MTI Factors Stress Minimisation and Positivity with Stress Management and Coping with Change; and MTI factor Personal Best with Quality Seeing). At the broader level, then, in terms of between-network validation the MTI subscales performed well. These results demonstrate discriminant validity and support the between-network validity of the scales within the MTI.

It was also of interest to observe how mental toughness related to some of the more specific concepts. Factor by factor, the following positive and strong key correlations were observed: Self-efficacy (MTI)—Self-efficacy and Self-Confidence (ROPELOC); Value (MTI)—Clear Goals (Flow); Personal Bests (MTI)—Quality Seeking (ROPELOC); Stress Minimisation (MTI)—Stress Management (ROPELOC); Perseverance (MTI)—Active Involvement (ROPELOC); Task Focus
(MTI)—Concentration (FLOW); Potential (MTI)—Clear Goals (Flow); Mental Self-Concept (MTI)—Mental Competence (EASDQ); Task Familiarity (MTI)—Skill and Overall Performance (EASDQ); Commitment (MTI)—Clear Goals (FLOW); Positivity (MTI)—Mental Competence (EASDQ) and Stress Management (ROPELOC). The MTI factor Positive Comparisons is not theoretically related to any of the key correlates, and does not subsequently relate strongly with any scale. It is important to note that all MTI dimensions are positive psychological traits, and so will relate strongly to the chosen key correlates. Nonetheless, theoretically related constructs do reveal higher correlations than non-theoretically-related constructs.
Table 8.1. Correlations between MTI factors and key correlates (combined institute and school-based sample)

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</table>

The Mental Toughness Inventory (MTI) factors are: SEFF = Self-Efficacy; PCOM = Positive Comparisons; VAL = Value; POT = Potential; TFAM = Task Familiarity; PB = Personal Bests; MIN = Stress Minimisation; MSC = Mental Self-Concept; POSI = Positivity; PERS = Perseverance; TFOC = Task Focus; COMM = Commitment.
MIMIC Modelling: Institute/School-Based, Gender and Age Effects

It was of interest to explore the possible role of gender, context (i.e., institute versus school-based athletes) and age on the mental toughness constructs (Research Question 4.2). Multiple-indicator multiple-cause (MIMIC) modelling was the analytical method to examine this issue. This involved a structural equation model in which gender, context, age and their interaction were used as predictors of the twelve latent first order factors of the Mental Toughness Inventory. This model yielded an excellent fit to the data ($\chi^2 = 6047.74$, df = 1980, CFI = .99, NNFI = .99, RMSEA = .050). Derived beta coefficients are presented in Table 8.2 and significant main effects for gender, context and age as well as significant interaction effects are discussed. A conservative Bonferroni correction was used to minimise the risk of Type I error by dividing the p-value of 0.05 by the number of outcome variables (12) to yield a revised significance criterion level of .005 (rounded). Therefore, this paper focuses on results significant at the p < .005 level.

There were large between-group effects of gender (favouring males), context (favouring school-based athletes), age (favouring older athletes) and age x context interaction, such that context differences (i.e., institute versus school-based athletes) were larger for older athletes than for younger athletes. There were also small gender x age x context effects (non significant however, at the .005 level of significance). None of the other interaction effects were statistically significant.
Table 8.2. MIMIC analysis: Beta coefficients and effects for gender, context, age and all interactions

<table>
<thead>
<tr>
<th>MTI Factors</th>
<th>Gender (β)</th>
<th>Age (β)</th>
<th>Context (β)</th>
<th>Gend x Age (β)</th>
<th>Gend x Context (β)</th>
<th>Age x Context (β)</th>
<th>Gend x Age x Context (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>-.23*</td>
<td>.12</td>
<td>.22*</td>
<td>-.06</td>
<td>-.01</td>
<td>-.07</td>
<td>-.10</td>
</tr>
<tr>
<td>Positive Comparisons</td>
<td>-.17*</td>
<td>-.06</td>
<td>-.05</td>
<td>-.03</td>
<td>.04</td>
<td>-.02</td>
<td>.03</td>
</tr>
<tr>
<td>Value</td>
<td>-.06</td>
<td>-.10</td>
<td>-.10</td>
<td>-.06</td>
<td>-.09</td>
<td>-.10</td>
<td>-.11</td>
</tr>
<tr>
<td>Potential</td>
<td>-.16*</td>
<td>.05</td>
<td>-.01</td>
<td>-.06</td>
<td>-.07</td>
<td>-.12*</td>
<td>-.10</td>
</tr>
<tr>
<td>Task Familiarity</td>
<td>-.15*</td>
<td>.20*</td>
<td>.39*</td>
<td>.01</td>
<td>.04</td>
<td>-.06</td>
<td>-.02</td>
</tr>
<tr>
<td>Personal Bests</td>
<td>.09</td>
<td>-.08</td>
<td>-.04</td>
<td>.05</td>
<td>.05</td>
<td>-.11</td>
<td>.03</td>
</tr>
<tr>
<td>Stress Minimisation</td>
<td>-.14*</td>
<td>.14</td>
<td>.20*</td>
<td>-.12</td>
<td>-.07</td>
<td>-.03</td>
<td>-.11</td>
</tr>
<tr>
<td>Mental Self-Concept</td>
<td>-.22*</td>
<td>.21*</td>
<td>.30*</td>
<td>-.03</td>
<td>.00</td>
<td>-.06</td>
<td>-.06</td>
</tr>
<tr>
<td>Positivity</td>
<td>-.10</td>
<td>.16*</td>
<td>.19*</td>
<td>-.11</td>
<td>-.08</td>
<td>-.12*</td>
<td>-.17</td>
</tr>
<tr>
<td>Perseverance</td>
<td>-.08</td>
<td>.05</td>
<td>.04</td>
<td>.00</td>
<td>-.04</td>
<td>-.11</td>
<td>-.15</td>
</tr>
<tr>
<td>Task Focus</td>
<td>-.15*</td>
<td>.16*</td>
<td>.20*</td>
<td>-.01</td>
<td>-.05</td>
<td>-.03</td>
<td>-.08</td>
</tr>
<tr>
<td>Commitment</td>
<td>.05</td>
<td>.02</td>
<td>-.02</td>
<td>-.03</td>
<td>-.04</td>
<td>-.17*</td>
<td>-.09</td>
</tr>
</tbody>
</table>

* p < 0.005
Effects of Gender and Age on Mental Toughness

Table 8.2 shows a number of significant main effects for gender on mental toughness characteristics. Specifically, the data shows that females reported themselves significantly lower than males on 7 of the 12 characteristics of mental toughness. This is consistent with findings in the area of self-concept research that also found significant gender differences favouring males on factors such as self-confidence and physical ability (Byrne, 1990; Eagly, 1987; Marsh, 1998).

Table 8.2 also shows a number of significant main effects for age on mental toughness characteristics. Age is positively related to the mental toughness characteristics task familiarity, mental self-concept, positivity and task focus. This finding for age is also consistent with the works by Marsh (1998) that reported the same positive relationship between age and physical self-concept during adolescence.

Effects of Context on Mental Toughness

The athletes’ context (i.e., institute versus school-based) proved to have 6 significant main effects on characteristics of mental toughness (See Table 8.2). Institute athletes self-report mental toughness characteristics of self-efficacy, task familiarity, stress minimisation, mental self-concept, positivity, and task focus, lower than do school-based athletes. These results—surprising in part—suggest the presence of a context and frame-of-reference effect. What these results suggest is not that institution-based athletes are less mentally tough than school-based athletes, but rather that institution and school-based athletes are affected by contextual elements in making self-report style assessments of mental toughness. Moreover, as discussed below, the institution-based athletes reflect increasing mental toughness scores in later adolescence and beyond whereas school-based athletes’ mental toughness declines at this time.

Social comparison theory suggests that one’s context provides an important frame-of-reference. In an application of this theoretical approach, Marsh (1991, 1993a) reviewed a growing body of research showing that academically elite students tend to experience a decline in academic self-concept when they attend academically selective schools compared to equally able students who attend non-selective schools. This
follows, in that a very bright student may be “average” in comparison to other students in an academically selective school, whereas the same student would be well above average in a non-selective school. Of particular relevance to the present study, this frame-of-reference effect has also been demonstrated with athletes in selective sporting programs. Marsh, Perry, Horsely, and Roche (1995) showed how the physical self-concepts of elite athletes were significantly attenuated due to elite athletes using other elite athletes to evaluate their physical self-concepts (i.e., other elite athletes create a frame of reference). A similar phenomenon appears to be affecting athletes’ self-perceptions about mental toughness when participating in selective sports programs such as those run by the Australian Institute of Sport (AIS). That is, athletes at a selective sports institution (like the AIS) appear to view their mental toughness in lower terms than do school-based athletes because they compare their mental toughness to their social comparison group of other athletes within the sporting institute (such as the AIS). Tests of this suggestion and an evaluation of implications if support is found are clearly beyond the scope of the present investigation, but will provide an important area for further research.

Level of experience may also provide a contextual effect that influences ratings of mental toughness. Markus and Wurf (1987) identify that views formed about the self depend on the information available and the cognitive ability to process that information. Institute-based athletes have significantly more experience and information available to them from which to form perhaps a more accurate view of their mental toughness as compared to school-based and less experienced athletes. As athletes increase in age and become more experienced with elite sports competition and training, it follows that they also become more aware of their relative strengths and weaknesses. Therefore, it should be expected that institute-based athletes are perhaps more aware of their relative strengths and weaknesses in terms of mental toughness. The current results seem to support this notion.

The role of perfectionist type personalities may also significantly affect athlete self-ratings of mental toughness. Athletes who have been identified by inclusion into a sporting institute show a level of dedication and commitment towards achieving athletic excellence that in many ways represents perfectionist tendencies. Perfectionist athletes
are people who crave excellence, always striving for better, perhaps never being entirely satisfied with current achievements or performances (Botterill, 2005; Horsley, 1995). The same may be expected when institute-based athletes come to rate their mental toughness. These perfectionist tendencies perhaps lead to “harsher” evaluations of mental toughness compared to their school-based counterparts. The suggestion that perfectionist type tendencies affect institution-based athletes’ self-ratings of mental toughness is an important question also to be explored through future research.

An interesting question to be resolved in future research then, is the question of whether self-reported MTI responses assess perceived or actual levels of mental toughness. From an observer’s point of view, institute-based athletes would appear more mentally tough than school-based athletes. However, the institute-based athletes appear to be rating themselves lower due to a number of contextual effects (frame-of-reference group, level of experience, and perfectionism). It would seem, then, that perceived and actual mental toughness may be different. Self-report style assessment tends to assess perceived mental toughness (because the nature of self-assessment is such that contextual effects are unavoidable). In striving to assess actual mental toughness levels, researchers may have to consider a multi-method approach to assessment. Research on “toughness” showed some support for physiological tests of toughness. Dienstbier (1991) reviewed both human and animal studies to reveal that the physiological pattern of “toughness” led to improved performance in challenge/stress situations, increased tolerance of stressors (i.e., reduced behavioural suppression and depression), emotional stability, and immune system enhancement. Perhaps there is a place for combining self-report with physiologically-based testing (particularly physiological tests that assess catecholamine capacities in relation to stressors). Another direction for assessment may come from using a 360-degree assessment method, whereby self-assessment is coupled with assessment by significant others (i.e., coach, peers). The development of a multi-method approach to the assessment of mental toughness is a highly important future direction. Such assessment is likely to include 360-degree style testing along with a physiological testing component.
Age x Context (Institute versus School-Based) Interaction Effect

There are significant age x context (institute versus school-based) interaction effects on the mental toughness characteristics of potential, positivity, and commitment. In all cases, these mental toughness characteristics consistently decrease with age for school-based athletes. This pattern of decreasing mental toughness is also observed for institute athletes between the ages of 12 and 14 years of age. The difference between the two groups becomes apparent from the age of 15 years. It is at this time that mental toughness continues to decrease for school-based athletes but increases for institute athletes (See Figure 8.1).

There are a number of explanations that can help to explain this pattern of interaction effects. Firstly, junior athletes (11 to 14 years of age) may over-report their mental toughness due to a lack of experience that would otherwise allow them to predict their strengths and weaknesses in mental toughness more accurately. This explanation would explain why for all athletes (institute and school) mental toughness is consistently rated higher at 11-14 years old than for any other age group. The pattern follows that all athletes begin with high self-ratings, then “wise-up” during the middle years (15-16), becoming more aware of their strengths and weaknesses. School-based athletes see a continual decline in key dimensions of mental toughness whereas institute athletes make significant increases in mental toughness during their senior years (17 years and above).

A second explanation for this pattern of age x group interaction effects on mental toughness has to do with how athletes of different ages rate their mental toughness. The frame of reference effect (where athletes rate their mental toughness relative to their immediate social comparison group) may play out with mental toughness such that younger/school-based athletes may rate themselves higher (than older elite) in mental toughness relative to their peer group (i.e., other young/school-based athletes). Also, older/institute athletes may rate themselves lower (than younger school-based) on mental toughness relative to their peer group (i.e., other older/institute athletes). What this suggests for theory, measurement and practice is that perhaps levels of mental toughness cannot be compared across groups. There seems to be a need to develop normative data for a range of groups and ages.
Hence, the interactions provide part of an answer to the question posed at the outset of the study: what makes a champion? What makes a champion, is bouncing back from a decline in mental toughness. What makes a champion is being able to survive a highly competitive environment and claw back on key dimensions after initial context effects have affected them negatively. What makes a champion is a more accurate self-perception that can withstand the competitive context to increase as skill and experience are gained.

The Yields of this Study and Implications for the Thesis

A core purpose of this research thesis was to adopt a construct validity approach in the development and testing of a questionnaire to measure mental toughness. This includes using both within-network and between-network studies to evaluate the validity of the questionnaire. Study 4 contributes to the thesis by completing the process. This study demonstrates between-network validity in the context of a conceptual model and questionnaire to measure multidimensional mental toughness. From a construct validity perspective, then, it is evident that the MTI is psychometrically sound and appropriate for use with a range of athletes.
Figure 8.1a.
Age x Group interaction on POTENTIAL

Figure 8.1b.
Age x Group interaction on POSITIVITY

Figure 8.1c.
Age x Group interaction on COMMITMENT

Junior = 11-14 years
Middle = 15-16 years
Senior = 17+ years
Summary
First and foremost, this study has demonstrated the between-network validity of the MTI. The scales measured by the MTI relate as hypothesised, with a range of established constructs. The results of Study 4 also revealed a number of significant main effects of age (favouring older athletes), gender (favouring male athletes) and context (favouring school-based athletes) on mental toughness as well as some key interactions which broadly show that institute athletes decrease in mental toughness from 12 to 16 years of age (as do school-based athletes) before making significant improvements on several characteristics of mental toughness from 17 years and older, while school-based athletes continue to decrease in mental toughness through to adulthood. As discussed below, the potential frame of reference effect is important to understand when looking at how institute athletes self-report mental toughness. Taken together, this research uncovers a series of group differences in mental toughness for gender, age and context that hold implications for research and practice aimed at developing champion athletes who can successfully deal with challenge and adversity in their pathway to athletic success.
CHAPTER 9

DISCUSSION AND CONCLUSION

Introduction

This research examined mental toughness through three central processes. First, the current study, in a rigorous process established a model and definition of mental toughness. Second, once definition and conceptualisation were achieved, the study constructed a multidimensional questionnaire for mental toughness. Third, the current study then conducted rigorous measurement to validate the mental toughness instrument. This discussion chapter begins with an overview of the central aims and methods and how they were met in the empirical work, and then assesses some of the key findings and results, followed by a discussion of the implications of the current study for theory and practice.

Overview of Central Aims and Purpose of the Thesis

In today’s competitive elite sport environment, coaches and athletes are increasingly realising that differences between good and great sporting achievers are becoming less about physical differences, and more about psychological characteristics such as mental toughness (Gould et al., 2002). Mental toughness is commonly referred to as the elusive “X” factor that determines champion performances. Despite growing interest, large-scale empirical studies on the composition of mental toughness are rare and the studies that have been conducted, lack rigorous scientific evaluation. The current study bridges the gap between research and current performance by using construct validation methods to operationalise the concept of mental toughness, and furthermore, develop a
psychometrically proven and valid measurement tool for assessing mental toughness in elite athletes.

The primary aims of this thesis were to extend research and practice by:
(a) Critically examining a popularised test of mental toughness (Loehr’s Psychological Performance Inventory), with a view to gaining valuable insights that would guide conceptualisation and measurement later in the thesis;
(b) Producing a mental toughness definition;
(c) Identifying component mental toughness factors;
(d) Developing the Mental Toughness Inventory to be a robust and valid instrument that demonstrates a sound factor structure, strong reliability and invariance across gender and level of competition (i.e., school- or institute-based athletes); and,
(e) Determining the relationships between mental toughness and a range of selected concepts such as flow, self-concept and life effectiveness.

In the development of mental toughness conceptualisation and measurement, this research employed a construct validity approach through a two-part examination of the instrument under focus. Firstly, the construct validity approach involved a “within-network” examination of validity. In these analyses the internal properties of the concept and of the instrument are examined for validity (i.e., factor structure, reliability, discriminant validity). The second phase of the construct validity approach adopted a “between-network” assessment. This phase of the research examined the relationships between mental toughness factors and a range of theoretically related concepts. Taken together, within-network and between-network approaches provide strong tests of the validity of mental toughness conceptualisation and measurement.

Overall, this research sought to provide the scope to learn about mental toughness from some of Australia’s significant sporting figures, and for future athletes to benefit from the associated data collected. Some of the significant outcomes of this research include: a conceptually-informed mental toughness factor structure comprising constructs hypothesised to reflect the attainment of mental toughness; the development of a valid and reliable measurement instrument—the Mental Toughness Inventory (MTI); timely confirmatory measurement data on mental toughness and the factors that
underlie it; and, understanding of the differences in mental toughness across school-based and institution-based athletes, across males and females, and across younger and older athletes. Findings arising from this research hold a number of implications for interventions designed to address mental toughness in elite sport settings.

### Summary of Preliminary Quantitative Findings—Study 1

#### Evaluation of the Psychological Performance Inventory

The purpose of Study 1 was to analyse the psychometric (within-network and between-network) properties of the Psychological Performance Inventory (PPI). These analyses were designed to inform the researcher on the status of an existing—yet unsubstantiated—mental toughness measurement instrument, with the view to guiding the development of a new measure of mental toughness.

Loehr developed the PPI to assess the factors he believed to be dimensions of mental toughness. The factors have good face validity and are widely considered to be conceptually compelling. However, when the factor structure was examined using CFA in this study, the a priori model resulted in a poor fit to the data and an improper solution. The associated correlation matrix for the instrument revealed numerous factor correlations approaching or exceeding unit value. From a within-network validity perspective, then, support for the PPI instrument is questionable.

Exploratory factor analysis was then carried out to explore the possibility that an alternate set of factors (measured using the same items Loehr proposed were important to mental toughness) could better explain the variance that was observed in this study. Through an iterative process of item deletion and re-specification of factors (see Chapter 7), a 5-factor solution was derived that explained most variance, demonstrated fewer cross-loadings and higher target loadings, and which was conceptually feasible. The fit of this alternative structure was good and so, from a within-network validity perspective, the alternative model was considered to be superior to the PPI’s original model.

However, when both models were related to a battery of key correlates (i.e., a between-network validity check), the original PPI factors correlated more strongly with the key correlates and with the global mental toughness measure than did the factors from the alternative structure. From a between-network validity perspective, then, the
original PPI structure performed better than the alternative structure and a unidimensional global measure of mental toughness.

Findings of Particular Note in Quantitative Study 1

Evaluation of the Psychological Performance Inventory

The evaluation of a popularised yet unsubstantiated test of mental toughness—the Psychological Performance Inventory (PPI)—presented a number of findings significant for guiding the development of future mental toughness measurement. Beyond providing a number of insights into the status of the PPI itself, the results presented an interesting conundrum regarding the interface between conceptualisation and instrumentation. Although the within-network validity of the PPI was poor, its conceptualisation and between-network validity were sound. Although an alternative model fitted the data well, support for its conceptual underpinning and validity were not so strong. A number of important lessons were identified in Study 1 and are summarised here before being discussed in more depth further below:

- This study highlighted the need for a strong conceptual/theoretical rationale for the selection of mental toughness factors and the items that measure them;
- This study highlighted the need for adequate relatedness between mental toughness component factors and key correlates; and,
- This study highlighted the importance of taking care in the area of item development—such that the resulting mental toughness assessment instrument is strong on theoretical/conceptual grounds as well as having a sound factor structure.

Mental Toughness Measurement

What the Study 1 data underscore is the importance of developing research measures that are strong in terms of conceptual bases, within-network properties, and between-network properties. This is important not only for the researcher collecting large-scale data but also for the practitioner who wants to be confident that data collected on an individual athlete are meaningful and related to other processes or outcomes relevant to
their given sport. Neither the PPI, nor the alternative structure qualified on all three counts. On this basis, it was concluded that in the field of mental toughness there was no sound measure—hence the need to develop a mental toughness instrument in subsequent studies. This study was important for the present investigation as it allowed the researcher to identify the strengths of an existing mental toughness measurement tool, thereby illuminating possible directions for the development of future instrumentation.

A particular strength of the PPI is its conceptual basis. The factors identified by Loehr (1986) have face validity, are intuitively appealing, and have some support from recent qualitative research into mental toughness (e.g., Fourie & Potgieter, 2001; Jones et al., 2002). Five constructs in particular seem to emerge consistently in psychological skills research incorporating mental toughness: self-confidence, control, motivation, imagery/mental practice, and concentration/attention (Murphy & Tammen, 1998). All five are represented in the PPI. Self-confidence emerged as the factor most strongly related to the key correlates. Hence, the difficulty with the PPI is not its conceptual basis or the factors it seeks to quantify, but rather, the items that are used to assess the factors.

A particular strength of the alternative structure is that it is composed of a set of factors that provide a good fit to the data. Through item deletion and re-assignment the researcher was able to derive factors that were internally consistent and which yielded relatively fewer cross-loadings than those in the PPI. However, the alternative structure, although sound from a within-network perspective, may not be as conceptually appealing as the PPI and was certainly not as strong from a between-network perspective. One concern with the alternative structure is that it does not include a measure of self-confidence, nor does it comprise an intuitively appealing measure of control, two factors that are routinely identified in the mental toughness literature (Fourie & Potgieter, 2001; Jones et al., 2002; Loehr, 1986). Another concern is that it comprises factors that in many cases are not so markedly related with key correlates. Moreover, it could be the case that stronger psychometric properties of the alternative structure might at least partly be due to capitalisation on chance through testing the same data repeatedly to generate a better fit.

Drawing on the strengths identified through the analysis of each of the PPI structures (i.e., the original model and the alternative model derived by EFA), some
guidance was gained for the development of future mental toughness instrumentation. There needs to be a strong conceptual/theoretical rationale for the measure, much along the lines of the PPI. Recent qualitative work (Fourie & Potgieter, 2001; Jones et al., 2002) and the pioneering work by Loehr (1986) provides a good basis for such conceptualising. Also along the lines of the PPI, there needs to be adequate relatedness between the component factors and key correlates. In the first instance, this will emerge directly from the conceptual/theoretical validity of the instrument. However, it will also directly emanate from item development. It is at the item level that the PPI falls short, and this is thought to be the basis of the poor goodness of fit and improper solutions based on responses to the original PPI. It is suggested that the development of items needs to be undertaken not only with a view to conceptual/theoretical and between-network validity but obviously, also with a view to sound factor structure (within-network validity).

**Summary and Implications of Study 1**

This study provided a number of important insights into the development of mental toughness measurement. Taken together, these data suggest that there currently exists no comprehensively sound measure of mental toughness and that vital further work is required to develop a multifaceted conceptualisation of mental toughness before constructing a measure that is strong on conceptual, within-network, and between-network grounds. This brought the present investigation to the need for an in-depth qualitative study capable of unveiling the multiple dimensions of mental toughness. Once this conceptualisation was in hand, quantitative measurement work could then be pursued.
Summary of the Qualitative Findings—Study 2

Mental Toughness Unearthed: A Qualitative Study of Mental Toughness in Elite Athletes

Study 2—a qualitative study—provided direction for the further definition and conceptualisation of mental toughness. By drawing upon the experiences of world champion athletes and coaches, and linking these experiences with established theory, the researcher was able to develop a conceptual understanding of mental toughness. The data indicated that there are twelve relatively salient characteristics of mental toughness (self-efficacy, mental self-concept, potential, task focus, perseverance, task familiarity, personal bests, task value, goal commitment, positivity, stress minimisation, and positive comparisons—see Chapter 6 for a detailed description of each of these factors). These twelve characteristics were drawn together to develop a conceptual model of mental toughness that subsumes the factors of mental toughness in a way that lends clarity to the construct but is also useful to athletes and coaches from a practical perspective. The resulting model is a multidimensional one that comprises twelve first-order factors. Following on from the development of a model of mental toughness, mental toughness was defined as “an unshakeable perseverance and conviction towards some goal despite pressure or adversity.” The specific yields of Study 2, then, are the development of mental toughness definition and the conceptualisation of the construct. These yields provided the platform needed to pursue measurement approaches further into the thesis.

Findings of Particular Note in Study 2:

A Qualitative Study of Mental Toughness in Elite Athletes

Before one could attempt to develop a tool to measure mental toughness (Studies 3 and 4), it was imperative that the bases for the development of that tool were accurate and sound. That is, the model of mental toughness used as the basis for designing the measurement instrument needs to reflect the lived experiences of sportspeople as much as possible. Loehr offered a model of mental toughness (i.e., the basis of the PPI), yet was built on Loehr’s heuristic view of what factors should be there. Moving forward, Jones et al. (2002) provided a model that was built using qualitative research on 10
world champions. Jones et al’s use of more scientific methods to characterise mental toughness is to be commended and is a step in the right direction. As with any qualitative research, however, there is a degree of subjectivity in interpreting the data. A limitation in the way Jones et al. interpreted the data is their definition that describes what mental toughness allows one to do, rather than what mental toughness actually is. The Study 2 qualitative work therefore aimed to unearth a model of mental toughness that defines it directly rather than in terms of its effects.

The results of Study 2 revealed a multidimensional model comprising 12 first-order factors. Hence, the qualitative results revealed a number of other findings significant in guiding researchers investigating mental toughness:

- Qualitative methods are valuable for researchers wishing to learn about the experience of mental toughness;
- Mental toughness is multidimensional—with 12 first order factors;
- The factors of mental toughness are: self-efficacy, potential, mental self-concept, value, personal bests, commitment, stress minimisation, positive comparisons, perseverance, positivity, task familiarity, and task focus;
- Mental toughness exists in the context of adversity or pressure; and,
- Mental toughness may take the form of an interaction between the person and the stressor.

**Benefits of Using Qualitative Method**

Qualitative research (and particularly the predominantly grounded theoretical approach to qualitative research that was adopted here) allowed themes and factors of mental toughness to emerge from the participants’ experience. More precisely, the qualitative method strived to achieve understanding about mental toughness without being unduly affected by preconceived beliefs about the concept. Hence, qualitative research in the present study better enabled the researcher to explore the experience of mental toughness.

The qualitative research approach was also beneficial to the thesis because it provided both the richness and breadth of information needed to advance current conceptualisation of mental toughness. The qualitative data were rich in that the
participants were the most direct sources of mental toughness. They were world champions, gold medallists, Olympic coaches, and sport psychologists. These were people who had first hand experience with performance pressure and adversity at the elite level. The qualitative approach derived a breadth of information on mental toughness, specifically 30 separate experiences of mental toughness. Such depth about mental toughness is not so readily available through quantitative methods.

**Mental Toughness and Adversity**

Study 2 results also indicated that mental toughness exists in the presence of adversity. All participants spoke of their experiences with mental toughness in the context of how they reacted to pressure or adversity. Mental toughness is a descriptive term that describes the use of a series of cognitive, behavioural and emotional processes in response to some pressure or adversity. This finding has several important implications for research and practice. Chiefly, mental toughness is best understood in context. This gives rise to questions for further research. Do the strategies used for mental toughness change depending on the context? Do the various mental toughness characteristics change depending on various stages of interaction with a stressor?

**Mental Toughness: An Outcome or a Process?**

One possible failing of mental toughness research is that it can describe what mental toughness allows one to do, rather than understanding what mental toughness is. The results of Study 2 suggest that mental toughness is a process. Mental toughness is the process of employing cognitive, behavioural and emotional skills and strategies to counter what must be viewed as an adverse or potentially adverse situation. When people describe mental toughness, what they are seeing is how the person interacts with a particular context (adversity or pressure). It is the process of what the person does to overcome a challenging situation that people see as mental toughness. This is a consistent finding with an emerging body of research that identifies the “resilience process” (e.g., Cleary & Zimmerman, 2004). In this process, the individual realistically evaluates the risk and the available coping resources, before enacting protective factors.
to counter the adverse experience. Future research would do well to determine if the factors of mental toughness are employed in a similar order.

Recognising that mental toughness is a process, is a significant yield for this research. This result has applications both for future research and also in an applied sense for athletes and coaches. Athletes are more interested in “how” to be mentally tough, not “what” it looks like. Understanding the process of being mentally tough provides real practical benefits to those aspiring towards mental toughness. For research, it is most important to understand both the “how” (i.e., how it happens) and the “what” (i.e., what it looks like) when considering mental toughness—two features of the present set of studies.

**Mental Toughness versus Winning or Success**

In reviewing the results arising from this study, winning or success was not presented as a necessary outcome for an athlete to be considered mentally tough. The data indicate that mental toughness is about continuing to believe in oneself, effective coping, unshakeable focus, and continuing to pursue a goal with conviction, despite adversity. At no stage did the results indicate that winning is necessary to mental toughness. In practice, then, one can be mentally tough and “lose”. Also, one can win with or without mental toughness. The researcher concedes that with increased mental toughness, logic would suggest increased winning, but winning itself is not a necessary condition for mental toughness. Winning and mental toughness are not the same thing—perhaps highly related, but nevertheless distinct.

An important future research direction is to specifically examine the relationship between mental toughness and winning. A compelling study would be to examine mean-level differences on each mental toughness characteristic between successful and unsuccessful performers. It might be predicted that increased mental toughness would correlate positively with increased success. The results of such a study would prove beneficial to coaches and athletes, by illuminating the mental toughness characteristics most related to enhancing athletic success.

The differentiation between success and mental toughness is also an important distinction for those interested in researching mental toughness further. Researchers
interested in mental toughness need to be mindful of selecting participants on the basis of mental toughness rather than the level of success. Although there is overlap between mentally tough individuals and successful performance, there are successful people who display less mental toughness. Researchers should beware assuming that because a participant is successful, they are also mentally tough.

The Interaction between the Person and the Stressor

Does the nature of mental toughness change as a person moves into and through adversity? Earlier discussion identified mental toughness as a process. While the results reveal 12 characteristics of mental toughness, in reality does a person activate all 12 characteristics at once? More likely, there would be some level of interaction whereby the mental toughness characteristics might change as they progress through the experience. In related research on cognitive strategies associated with improved endurance performance, McCaul and Mallot (1984) demonstrated how the use of cognitive strategies changes through the experience of overcoming endurance-related discomfort. They concluded that for higher intensity and discomfort levels, redefinitional (associative type cognitions) are most successful, whereas at lower intensity levels, distraction (dissociative type cognitions) fills attentional space and prevents or reduces the conscious sensation of pain. At higher levels, pain reaches a degree of salience that results in an inevitable invasion of awareness. For mental toughness, the strategies used are likely to change, too, as the athlete moves through the adversity (whether that be pain or pressure). As with McCaul and Mallot’s findings, changes in cognitive strategy throughout the experience may be related to the intensity of the adverse stimulus (i.e., pain or pressure). Hence, future research is needed to understand precisely how these characteristics are used as a person moves through challenging experiences. Examining the degree of interaction between mental toughness characteristics and factors within the stressor or environment will help to further understand how mental toughness plays out in real time.
Summary and Implications of Study 2

Study 2 provided a more fine-grained view of mental toughness that is useful to coaches and athletes wishing to train mental toughness. Built on the insights of over 30 elite sportspeople, this study unearthed a multidimensional model of mental toughness containing 12 specific and identifiable characteristics. Findings indicated that mental toughness is a concept that captures the process of employing a series of cognitive, behavioural, and emotional skills and strategies that are used to counter an adverse experience. More immediately, for the thesis, this conception of mental toughness as a series of skills and strategies underpins the development of a tool to measure it. This conceptually developed model of mental toughness formed the blueprint for the construction and validation of the mental toughness inventory in later chapters. Studies 3 and 4 provided the opportunity to gain quantitative support for this qualitatively derived model.

Summary of Quantitative Findings on Mental Toughness—Studies 3 and 4

Development and Validation of the Mental Toughness Inventory (MTI)

Study 3 set out to construct a questionnaire to measure the multidimensional model of mental toughness arising from the qualitative study (Study 2). An item bank was developed, an instrument was constructed, and the subsequent Mental Toughness Inventory (MTI) administered to school- and institution-based athletes. Using multiple psychometric criteria the instrument was reduced to 5-items per factor (i.e., a 60-item test—12 factors measured by 5 items each). When the instrument was tested across a broad range of athletes, confirmatory factor analysis (CFA) demonstrated that the proposed model of mental toughness (i.e., 12 specific factors) provided a good fit to the data. Furthermore, multigroup CFA demonstrated the MTI factor structure to be invariant across school-based and institution-based athlete samples, and across male and female samples. On all tests of within-network validity, then, the MTI performed well.

Although within-network validity is a necessary condition, it is not sufficient in demonstrating overall construct validity. Construct validation also requires the demonstration of appropriate relationships between the construct being validated and
other known constructs—that is, sound between-network properties. Therefore, Study 4 examined the pattern of relationships between the MTI model and other key correlates. The results indicated that the MTI scales relate as should be expected with a range of established and cognate constructs. Relationships were differentially stronger or weaker when factors were theoretically more or less related, respectively. Thus, between-network validity was demonstrated.

Study 4 also revealed a number of significant main effects of age (favouring older athletes), gender (favouring male athletes) and the context from which the sample was drawn (favouring school-based athletes over institution-based athletes) on mental toughness. Furthermore, some key interactions were revealed which broadly showed that institution-based athletes decrease in mental toughness from 12 to 16 years of age (as do school-based athletes) before making significant improvements on several characteristics of mental toughness from 17 years and older (whereas school-based athletes continue to decrease in mental toughness through to adulthood).

Taken together, Study 3 and Study 4 demonstrated the validity of the Mental Toughness Inventory (both within-network and between-network validity), confirmed the invariance of the MTI structure across school-based and institution-based athletes as well as for gender, and identified a series of group differences in mental toughness for gender, age and context (i.e., school versus institution based). These findings hold implications for research and practice aimed at developing champion athletes who can successfully deal with challenge and adversity.

Findings of Particular Note in Quantitative Studies 3 and 4

Development and Validation of the Mental Toughness Inventory (MTI)

Combining Qualitative and Quantitative Methods

A particular strength of this thesis is its approach in combining qualitative and quantitative methods in developing mental toughness conceptualisation and measurement. Earlier in the thesis, quantitative analysis drew from the strengths of a popularised yet unsubstantiated test of mental toughness (Loehr’s Psychological Performance Inventory) to inform mental toughness conceptualisation and measurement.
An in-depth qualitative analysis of mental toughness in elite sportspeople followed. By employing the qualitative method the researcher was able to learn about mental toughness from those most directly relevant to the construct—elite sportspeople (in many cases world champions) who display mental toughness. Taken together, the quantitative data from Study 1 and the qualitative data from Study 2 were used to construct a conceptual model of mental toughness. Then, Studies 3 and 4 completed the research by providing support for the qualitatively derived conceptual model using sophisticated construct validity quantitative techniques.

**Reducing the Overall Size of the MTI**

One aim of Studies 3 and 4 was to refine the size of the MTI to be a valid and easily administered assessment instrument for testing mental toughness across a range of athletes and situations. This aim was achieved using multiple criteria (see Chapter 7) to reduce the size of the instrument to 5-items per factor. CFA also demonstrated a 3-item per factor version of the MTI, assessed using a subset of the 5-item testing data, and which provided an equally good fit to the data. Although the 3-item per factor version provides many advantages to those wanting to use the MTI in the applied setting, further research is needed to test that model in an independent sample of elite athletes—(a) using only the 3-item measure and also (b) using the 5-item and also the 3-item sets in the same survey to assess their comparative psychometric properties. Notwithstanding this, a major yield of this study is the refinement of the MTI into a 60-item test (i.e., 5-items per factor) assessing 12 characteristics of mental toughness.

**Establishing the Within and Between Network Validity of the MTI**

An important aim for this study was to examine the validity of the MTI from a within-network perspective. Internal properties of the MTI (such as internal reliability, factor structure, uniquenesses, and cross loadings) were closely examined. The data provided strong support for the internal structure of the MTI. Furthermore, tests of invariance showed how the structure of the MTI is equivalent for school-based athletes as it is for institution-based athletes, and also for males as it is for females. Taken together, the
MTI proved to be a sound instrument, strong in theory, conceptualisation and internal properties.

It was also of interest to observe how mental toughness related, in general, to a range of concepts (i.e., between-network validity). Of all the key correlate scales, self-efficacy- and confidence-related scales correlated most strongly with the mental toughness factors (i.e., challenge-skill, mental competence, self-efficacy, and self-confidence). This may be one indication that the self-efficacy/confidence domain is central in determining the mental toughness of athletes. Another of the key correlate scales to relate consistently highly with mental toughness was the control factor (of the Flow instrument). Perhaps a sense of control (i.e., over a situation, an event, or over one’s future) has a significant role to play in mental toughness. Future research should consider the concept “control” and the precise ways in which it plays out to influence mental toughness.

**Effects of Context on Mental Toughness**

The results also showed that context (i.e., school-based versus institution-based) proved to have six significant main effects on characteristics of mental toughness (see Table 8.2). Institution-based athletes self-report themselves relatively lower than do school-based athletes on the mental toughness characteristics of self-efficacy, task familiarity, stress minimisation, mental self-concept, positivity, and task focus. These results—surprising in part—suggest the presence of a context and frame-of-reference effect and are discussed in depth in the results of Chapter 8.

The data also revealed significant age x context (institute versus school-based) interaction effects on the mental toughness characteristics potential, positivity, and commitment. In all cases, these mental toughness characteristics consistently decrease with age for school-based athletes. This pattern of decreasing mental toughness is also observed for institute athletes between the ages of 12 and 14 years of age. The difference between the two groups becomes apparent from the age of 15 years. It is at this time that mental toughness continues to decrease for school athletes but increases for institute athletes (see Figure 8.1). These results—which are critical in understanding the
contextual and frame-of-reference effects of being school-based as opposed to institute-based, as reported above—are discussed in depth in the results of Chapter 8.

**Summary and Implications for the Thesis**

Studies 3 and 4 completed the research cycle by providing quantitative support for the conceptual model of mental toughness, the MTI, and the underlying theory. There were some particularly significant findings drawn from Studies 3 and 4, and these provide direction for future research and practice. The major yields of these final two studies are identification of:

- A final and validated version of the Mental Toughness Inventory—a 60-item test measuring 12 factors of mental toughness (each factor measured by 5-items);
- Age effects such that older athletes report higher mental toughness than do juniors;
- Gender effects such that males report higher mental toughness than do females;
- An interaction on mental toughness between age and context—uncovering a possible frame of reference effect; and,
- The need to explore multi-method assessment techniques.

**Implications for Coaches and Sport Psychologists**

The findings of the present program of research hold a number of implications for practice. Lessons learnt from this research can be used both at an individual level (e.g., athletes, coaches, and sport psychologists) and at an organisational level (e.g., institutes) to enhance the mental toughness qualities of developing athletes.
What do Coaches and Sport Psychologists do at an Individual Level?

The Mental Toughness Inventory (MTI) provides a reliable and valid tool that captures the characteristics of mental toughness in a meaningful and useful way—making the ability to train for mental toughness more achievable. The characteristics measured by the MTI fit neatly into established research domains, each with recognized training and development methods. For example, the MTI measures characteristics of self-belief and self-concept—research domains that have received extensive interest and have yielded a variety of effective developmental methods. Likewise, the MTI measures a range of coping skills, which also have a variety of valid training methods grounded in a history of solid research. Following already established training approaches, then, sport psychologists and coaches can develop training regimes to enhance specific characteristics of mental toughness.

By understanding the characteristics of mental toughness and how they develop, coaches are in a better position to structure their training sessions and specific training drills in a way that fosters the development of mental toughness. Underlying the process of mental toughness is a particular motivational style. This style is one of curiosity, a need to learn and develop, an interest in personal improvement, and a striving for personal best performances. By word and method, coaches can help foster this motivational style. When working with athletes, coaches can be less focused on outcomes and more genuinely interested in personal development towards the ability to execute skills to perfection under conditions of pressure and adversity. When coaches can create an environment that is more interested in excellence in execution as a means to winning, they create the most positive environment conducive to developing mental toughness (Martin & Marsh, 2006). Coaches can influence the environment by the way they talk about the challenges ahead, by the things they focus on at training and competition, and by the way they recognize and reward their athletes.

When using the Mental Toughness Inventory it is important that sport psychologists and coaches use the instrument as a training tool—not a selection tool. Selection and screening require multi-methods, of which the MTI can be one part. The MTI is a self-report instrument, and therefore can only be as accurate in measuring
mental toughness as the athletes are in rating themselves. There is the potential that if an athlete believes testing results will play a part in selection, they will naturally rate themselves higher to aid their selection chances. This is a limitation of any self-report measure. The MTI rather should be used as a training tool, whereby athletes rate themselves accurately and honestly, with the view to gaining a clearer picture of the factors that affect their mental toughness. An honest assessment will provide them with useful information identifying specific areas in which to train. The MTI will be most beneficial to athletes and coaches when the assessment is presented as a training aid with little or no impact on team selection.

For athlete development programs that aim to help athletes make “the leap from good to great”, coaches and psychologists would do well to expose athletes to a variety of elite level experiences. This exposure is likely to help developing athletes become increasingly aware of their own mental toughness strengths and weaknesses, thus enabling more accurate reporting, assessment, training and subsequent development. When exposing developing athletes to elite level competition, care must be taken to ensure that these athletes are coached through the experience in a way that promotes positive outcomes for mental toughness.

Those who impact upon the athlete’s immediate environment (e.g., parents, coaches, sport psychologists) have a role to play in creating a climate conducive to developing characteristics of mental toughness. For example, Roberts (1993) contends that the psychological climate created by parents, coaches, and even the organised structure of competitive sport affects the development of mastery and competitiveness type motivational goal perspectives (areas cognate to the motivational style identified in this research). For this reason, a significant implication of this research is the identification of the need to develop healthy training and competition environments such that specific elements of mental toughness are enhanced (e.g., motivational style). This will be achieved through the training of those who work with athletes.

The current study, therefore, holds some important implications for the professional training of sport psychologists. Professionally trained sport psychologists are in a position to be able to educate and work with coaches, parents, and athletes on creating positive training environments conducive to the development of mental
toughness. The inclusion of a discussion on mental toughness, and factors associated with the development of mental toughness, would be worthy inclusions in practical supervision programs and in professional texts (e.g., Andersen, 2000, 2005; Murphy, 2005). Furthermore, the model of mental toughness integrates self-belief, motivation coping and attention together into one model that helps explain mental toughness and performance. The model of mental toughness draws these four key psychological performance domains together, making it easy for sport psychologists to impart knowledge about each psychological performance domain (e.g., self-belief, motivation, coping and attention) individually in the context of developing overall mental toughness.

**What can Sporting Groups do at an Organisational Level?**

There are a number of things that can be done at an organisational level to enhance the mental toughness of athletes. Specifically, organisations can influence mental toughness by influencing the environments in which the athletes must operate. The environment most conducive to developing mental toughness is one that inspires athletes. It is an environment that inspires athletes to become excited about striving, improvement, and personal accomplishment. Organisations would do well to create an environment where athletes are striving for success but are mindful of and genuinely excited by, the personal challenge of improvement.

Organisations can influence athletes’ environments in numerous ways. Organisations can reward and recognise effort and personal accomplishment rather than outright performance results or outcomes. When an organisation only recognises the great results achieved by their athletes (i.e., and not the effort), they are inadvertently sending a message that sport is about achieving results. This environment is one that breeds athletes who are outcome focused and particularly susceptible to suffering from high expectations, a fear of failure and performance pressure (Martin & Marsh, 2006). Alternatively, by recognising effort and personal accomplishment, an organisation creates an environment where athletes are process focused and are less susceptible to expectations and other performance pressures.

Organisations can further influence the environment by investing in education programs for coaches and parents, such that the key stakeholders in an athlete’s training
environment are inspiring a passion in athletes for personal success over outright
performance results and outcomes. The core message for training mental toughness is
that athletes need to become less focused on outcomes and more inspired by personal
improvement, developing a genuine curiosity to explore personal limits and to strive for
excellence in execution. By investing in the education of coaches and parents,
organisations are creating an environment that will help to shape mental toughness in the
athlete population that they deal with.

**Significance for Current Conceptualising about Mental Toughness**

The results identified 12 characteristics of mental toughness, integrated those
characteristics into a conceptual model, and then demonstrated the validity of that model
using both within- and between-network tests of validity and the purpose-built Mental
Toughness Inventory. Taken together, these results, while useful to coaches and athletes
in an applied sense, are also highly significant for current theorising about mental
toughness.

**Characteristics Providing Conceptual Building Blocks**

For purposes of comparison, three of the most significant works on mental toughness
(Fourie & Potgeiter, 2001; Jones, et al, 2002; Loehr, 1986) are presented in Table 9.1
along with the results of the current study. The following comparative discussion
between these studies’ findings on mental toughness is divided into three sections,
examining the sub-scales that can be seen as direct parallels, semi-parallel, or unique
factors emerging from this study.

**Factors that directly parallel previous research findings**

Self-Efficacy or Self-Belief. Self-efficacy as reported in this study, has direct
parallels to “self-belief in ability to achieve competition goals” (Jones et al., 2002) and
to “self confidence” (Loehr, 1986), and is quite similar to “confidence maintenance”
(Fourie & Potgieter, 2001). The common theme here is that mentally tough athletes
require a sound and solid belief in their capacity to achieve in their sport. Accordingly,
when mentally tough athletes are under pressure in their sport, they continue to believe
in themselves. Despite performance pressure, mentally tough athletes believe in their potential to achieve, in their ability to do the task, and in their overall mental strength. On the other hand, athletes lower in mental toughness doubt themselves. When the going gets tough, these athletes question themselves and their abilities, sometimes looking for excuses or ways to avoid the situation. Self-belief factors are routinely reported here in mental toughness research, and also in related resilience research that seeks to explore how individuals bounce back from adversity.

Task Focus or Attention Control. Task focus also has direct parallels across studies of mental toughness. Jones et al. (2002) report the need for: 1) remaining fully focused on the task at hand in the face of competition-specific distractions; 2) remaining fully focused in the face of personal life distractions; and 3) switching a sport focus on and off as required. Fourie and Potgieter (2001) reported the need for high cognitive skill, which they define as “the ability to concentrate, focus, think, make decisions and analyse” (pg. 67). Loehr (1986) also included attention control as a mental toughness factor, which was defined as “the ability to sustain a continuous focus on the task at hand” (pg. 158). Taken together, the research highlights the centrality of task-specific focus or attention on being mentally tough. Mentally tough athletes are able to focus on the execution of the task whilst blocking out or not being adversely affected by “distractions.”
Table 9.1. Overview of Subscales/Skills Identified in Mental Toughness Research

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Self-efficacy</td>
<td>Having an unshakeable self-belief in your ability to achieve your competition goals</td>
<td>Motivation level</td>
<td>Self confidence</td>
</tr>
<tr>
<td>Mental self-concept</td>
<td>Having an unshakeable self-belief that you possess unique qualities and abilities that make you better than your opponents</td>
<td>Coping Skills</td>
<td>Negative energy</td>
</tr>
<tr>
<td>Potential</td>
<td>Having an insatiable desire and internalised motives to succeed</td>
<td>Confidence maintenance</td>
<td>Attention control</td>
</tr>
<tr>
<td>Personal best (motivation)</td>
<td>Bouncing back from performance setbacks as a result of increased determination to succeed</td>
<td>Cognitive skill</td>
<td>Visual &amp; imagery control</td>
</tr>
<tr>
<td>Value (or importance)</td>
<td>Thriving on the pressure of competition</td>
<td>Discipline and goal-directedness</td>
<td>Motivation level</td>
</tr>
<tr>
<td>Task familiarity</td>
<td>Accepting that competition anxiety is inevitable and knowing that you can cope with it</td>
<td>Competitiveness</td>
<td>Positive energy</td>
</tr>
<tr>
<td>Goal commitment</td>
<td>Not being adversely affected by others’ good or bad performances</td>
<td>Possession of prerequisite physical and mental requirements</td>
<td>Attitude control</td>
</tr>
<tr>
<td>Perseverance</td>
<td>Remaining fully focused in the face of personal life distractions</td>
<td>Team unity</td>
<td></td>
</tr>
<tr>
<td>Task-specific attention</td>
<td>Switching a sport focus on and off as required</td>
<td>Preparation skills</td>
<td></td>
</tr>
<tr>
<td>Stress minimisation</td>
<td>Remaining fully focused on the task at hand in the face of competition-specific distractions</td>
<td>Psychological hardiness</td>
<td></td>
</tr>
<tr>
<td>Positivity</td>
<td>Pushing back the boundaries of physical and emotional pain, while still maintaining technique and effort under distress</td>
<td>Religious convictions</td>
<td></td>
</tr>
<tr>
<td>Positive comparison</td>
<td>Regaining psychological control following unexpected, uncontrollable events (competition-specific)</td>
<td>Ethics</td>
<td></td>
</tr>
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</table>
Factors sharing some parallels with previous research findings

Motivation. The importance of including motivation as a mental toughness characteristic receives support from the literature and from this study. However, comparison of the range of motivation factors reported in the mental toughness literature highlights that the type of motivation identified as best suited for mental toughness varies from study to study. The general theme that appears to be emerging is that motivations that are internally derived are seen to be of most importance to mental toughness. The current study highlights personal bests and tasks that are personally significant, whilst Jones et al. report internalised motivation and thriving on competition. Fourie and Potgieter report determination and commitment and Loehr reports self-motivation. The central theme here is internal sources of motivation (i.e., personal bests, internalised motivation, self-motivation).

Mental Self-Concept. Mental self-concept shares some level of parallel with factors identified in earlier mental toughness research. The essence of this factor is that mentally tough athletes, even under pressure, still believe they have the quality of mental strength. They believe they are mentally stronger than their opponents, and better able to cope with pressure than their opponents (i.e., positive comparisons). This is in many ways similar to the factor Jones et al. (2002) describe as “having an unshakeable self-belief that you possess unique qualities and abilities that make you better than your opponents.” The way athletes view themselves (i.e., self-concept), and in particular their mental strength (i.e., mental self-concept), seems to play an important role in mental toughness.

Coping Skills. Fourie and Potgieter (2001) draw attention to the importance of effective coping, with their factor “Coping Skills.” They define coping skills as “the ability of the athlete to reveal his/her coping ability, demonstrate composure, acceptance, activation control and adaptability” (p. 67). Although the definition captures a range of coping elements, the authors draw these elements together under one factor heading (i.e., coping skills). The current study concurs with the importance of coping skills. However, the current results present a more fine-grained understanding that details specific coping skills used in mental toughness (e.g., positivity, minimisation and
positive comparison). Similarly, Jones et al., (2002) present one clear-cut coping factor—“Accepting that competition anxiety is inevitable and knowing that you can cope with it”—along with a range of other skills that can easily be linked to an effort to cope (i.e., thriving, increased motivation/effort, task focus, and regained control). Even Loehr’s (1986) seven factors include factors pertaining to the ability to cope, such as attention control, attitude control, and positive and negative energy. In summing the various research findings, effective coping is a part of mental toughness. The current results move the field of research forward by revealing specific ways mentally tough athletes cope with contextual pressures.

A unique characteristic that emerged from this investigation

Task Familiarity (experience). A familiarity with their sport and the associated adversities was supported by the participants of this study. The general message from participants was that with increased experience comes increased mental toughness. Athletes reported that specific events (e.g., Olympics) and specific adversities (e.g., injury) become easier to deal with the second time around. For this reason, it comes as a surprise that the role of familiarity and experience has to date remained relatively neglected in previous conceptualisations of mental toughness. In any case, the results of this thesis support the role of familiarity/experience in mental toughness. The identification of this important factor is again an example of how beneficial qualitative methods can be in better understanding and progressing a concept.

Mental Toughness Conceptualisation

Comparing and contrasting the present findings against significant works in the area reveals a commonality of four key research domains that play out to influence mental toughness. Despite small differences in the specific factors identified, at a broader level researchers do fundamentally agree that the four domains of motivation, self-belief, coping and attention are important for mental toughness. The fine-grained differences may be due to things such as varied research methods, differences in the way data are interpreted, and definitions and terminology. In contributing to ongoing mental toughness theory development, then, the efforts of the present study taken as a whole,
combined with previous works, moves theory forward by flagging motivation, self-belief, coping and attention as the four key research domains significant for mental toughness.

**Coping Theory**

Lazarus and Folkman (1984) provide a widely accepted theoretical perspective on coping. Their work separates styles of coping into emotion- and problem-focused coping. Problem-focused coping is described as “coping that is directed at managing or altering the problem causing distress” (p. 150). It is used when the individual appraises a challenging situation as manageable and open to change. Problem-focused coping serves primarily to increase efforts at overcoming adversity. Emotion-focused coping is described as “coping that is directed at regulating emotional response to the problem” (p. 150). Emotion-focused coping is more likely to occur when there has been an appraisal that nothing can be done to modify the challenging situation. Emotion-focused coping serves primarily to ease emotional discomfort associated with adversity.

Central to Lazarus and Folkman’s conceptualisation of coping is the power of “appraisal” or “perception”. The type of coping is regulated by the athlete’s perception of whether the experience is manageable and open to change. It may be that mentally tough athletes make more positive appraisals such that they remain problem-focused in their coping efforts (i.e., committed to overcoming the experience) and thus appear to others as mentally tough in their ability to perform despite pressure or adversity. Although others would buckle under such conditions, the mentally tough athlete does not perceive the situation to be debilitating; instead, they choose to do what they can to move forward through the experience towards a skillful performance.

Mental toughness seems to draw on both styles of coping. Characteristics such as stress minimisation, positivity, and positive comparisons are examples of emotion-focused coping. On the other hand, task focus, perseverance, and mastery-type sources of motivation such as personal bests are all examples of problem-focused coping. This is consistent with research looking at the coping strategies used by US Olympic wrestlers (Gould, Eklund, & Jackson, 1993) and national champion figure skaters (Gould, Finch, & Jackson, 1993)—where multiple methods of coping were observed. What is clear is
that coping is an important aspect of mental toughness. Investigating Lazarus and Folkman’s theory of coping and how it relates to mental toughness would be a fruitful future research direction, particularly in understanding differences in perception, differences in coping styles under pressure, and how these vary through adversity and at different levels of adversity.

**Achievement Goals and Motivation**

The achievement goal approach (Roberts, 1984; 1992) to understanding motivation in sport presents a useful theory to explain motivation underpinning mental toughness. Goal theory proposes that each achievement situation evokes two basic motives (or achievement orientations): (a) the motive to achieve mastery and skill (mastery orientation) and (b) the motive to outperform others and demonstrate competence (performance orientation). When individuals are mastery oriented, they are focused on developing new skills, improving their own level of competence or skill, or obtaining a sense of mastery based on an internalised set of standards (Ames, 1992). When individuals are performance oriented, emphasis is on demonstrating superior competence over others (Duda, 1993). Goal theory suggests that one’s motivation orientation can explain behaviours such as effort, adherence, consistency and level of athletic performance above and beyond underlying physical ability (Tenenbaum, 1996). According to goal theory, mastery orientation should correspond to adaptive cognitions and positive achievement behaviours (Duda, Chi, Newton, Walling, & Catley, 1995). Negative achievement behaviours and maladaptive cognitive responses (such as debilitating performance, rescinding effort and lack of persistence) are assumed to result when individuals are performance oriented and doubt their competence (Duda et al. 1995).

The type of motivation likened to mental toughness (as reported in Study 2) is very much akin to “mastery orientation” (Ames, 1992; Dweck, 1986; Roberts, 1993) and “task orientation” (Duda, 1993). The research demonstrates that mastery-type goal perspectives correlate more favourably with positive achievement behaviours. For example, Jackson and Roberts (1992) found competitive goal oriented individuals to be less likely than mastery-goal oriented individuals to experience positive performance
states—such as the experience of peak performance. Similarly, Roberts, Hall, Jackson, Kimiecik, and Tonymon (1990) reported that athletes higher on mastery-type orientations experienced greater satisfaction with sport and showed an increased desire to learn and gain social approval in practice. Alternatively, athletes high on competitive-type orientations were bored in practice, focused on winning in competition, and believed that sport should boost one’s status. The findings of the current study, then, are consistent with the body of research on motivational styles, achievement behaviours and performance. The natural progression now is to explicitly link these two fields of study—goal theory and mental toughness. This remains an important future direction.

**Self-Concept Theory**

Self-concept research has much to offer the mental toughness research domain. Self-concept and self-belief type factors are perhaps the most commonly reported in research characterising mental toughness. In this thesis, factors such as self-efficacy, mental self-concept, and potential all fall into this category. The self-concept research domain has received considerable attention of late, with recent advances specifically conceptualising the self-concept of elite athletes and relating it to achievement in performance settings. In the interest of developing a theoretical basis for mental toughness then, one would do well to capitalise on those recent advances in elite athlete self-concept research.

Probably one of the most significant advancements in self-concept research is the finding that self-concept is multidimensional (for example, athletes can have positive self-concepts about their aerobic ability and average or negative self-concepts about their anaerobic ability). To this end, researchers developed the Elite Athlete Self-Concept (Marsh, Hey, Johnson, & Perry, 1997). Forming the basis of the elite athlete self-concept are skill levels, body suitability, physiological (aerobic and anaerobic) competence, and mental competence. The proposition that self-concept is multidimensional has resolved years of inconsistent findings, significantly progressing self-concept research.

The findings of this thesis further support the multidimensionality of the self-concepts of mentally tough athletes. Factors such as mental self-concept and potential
capture specific beliefs the person has about their mental strength and their potential. Furthermore, the self-efficacy factor captures the belief the athlete holds regarding their ability to perform well at a task.

**Attention Theory**

Theories of attention are also relevant for mental toughness because they help explain how cognitive processes are directed towards task-specific stimuli—not distracted by the potential sources of adversity and pressure. Moran (1996) surmises that there are three primary components of the attentional system: selectivity of processing, mental time-sharing of actions, and regulation of alertness. All elements of this system work to achieve optimal concentration under pressure. In developing mental toughness theory, then, it is of critical importance to understand the elements that unfold to affect optimal concentration and attention under pressure.

Selectivity of processing refers to choosing what to focus on and what to exclude from one’s attention. During any sporting moment, athletes receive multiple sources of information, from both inside and outside the body. It is also known that individuals have limited attentional capacity, such that it is not humanly possible to concentrate on and deal with the wide range of information available at any one time. For mental toughness, where the goal is to remain perseverant and driven towards task execution despite pressure, athletes require the ability to be selective about where they direct their concentration. Hence, the mental toughness factor, task familiarity, is likely to influence athletes’ ability to be selective about their attention—whereby with increased experience and knowledge about their sport they improve in their understanding of what to focus on and when.

Regulating alertness is another component of attention and concentration that is closely related to mental toughness. Overall alertness and readiness depend on the emotional state of the athlete. Janelle (2002) reveals that as anxiety increases, concurrent alterations to attention lead to (1) attentional narrowing, (2) conscious, controlled processing, (3) inefficiencies in attentional allocation, and (4) distraction by irrelevant or threatening cues. Mental toughness draws together motivational drives, self-belief, and
coping mechanisms to explain how athletes remain emotionally stable and, hence, more alert and ready to achieve optimal concentration under pressure.

Nideffer (1979) has presented an alternative model of attention that may add value to understanding attention and mental toughness. Nideffer contends that individuals have different attentional styles, depicted as internal, external, broad, or narrow. Nideffer’s theory suggests that each person possesses a unique style of attending to environmental stimuli, and that task performance is a function of compatibility between the person’s attentional style and the attentional demands of the task. Relating attention research to mental toughness, it would follow that mentally tough athletes are the ones who can focus their attention in the right way (i.e., appropriately to the attentional demands of the task) at the right time. Despite contextually-related pressure, mentally tough athletes remain locked in to the appropriate attentional style.

**Mental Toughness as a Process**

Ultimately, the four domains of self-belief, motivation, coping and focus operate together in a process fashion such that the athlete continues to persevere with conviction, despite stressful or potentially stressful circumstances. The present investigation has identified 12 attributes which maybe part of the process of exercising mental toughness. In reality though, it is most unlikely that an athlete uses all 12 factors at the one time. More likely, an athlete uses various characteristics at different times throughout the adverse experience. Future research is needed to understand how the process works. How do these elements operate at various stages of interaction between the person and the stressor? Are different characteristics more important at different times? The answers to such questions have considerable applied value, demonstrating how mental toughness plays out in real time. With such knowledge in hand, trainers are better equipped to teach athletes not only what mental toughness is, but how to achieve it. Further research into the mental toughness process is an important future direction.
**Gate Control Theory and Mental Toughness**

Study 2 (Qualitative study) revealed that overcoming pain was something that characterised mental toughness (e.g., overcoming injury, fatigue, exhaustion). Hence, there is a need to consider pain more carefully. One line of interesting research is Gate Control Theory (GCT). GCT was the first comprehensive theory of pain that accounted for the capability of emotional and cognitive factors to regulate the perception of pain (Coren, Ward, & Evans, 1999). GCT theory provides a useful framework for understanding mental toughness as it relates specifically to overcoming the sensation of pain. Perhaps GCT can be used more broadly to explain the regulation of other types of adverse sensations (such as psychological stress and pressure).

At the heart of the GCT is a neural “gate” that can be opened or closed in varying degrees, thereby modulating incoming pain signals before they reach the brain. The theory proposes that the gating mechanism is located in the spinal cord. Noxious stimulation enters the gating mechanism of the spinal cord from small diameter pain fibres, called A-Delta and C fibres. After these signals pass through the gating mechanism, they activate transmission cells, which send impulses to the brain. When the output of the signals from the transmission cells reaches a critical level, the person perceives pain. The greater the output beyond this level the greater the pain intensity (Coren et al., 1999).

The gating mechanism can control the output of impulses by the transmission cells (Coren et al., 1999). When pain signals enter the spinal cord and the gate is open, the transmission cells send impulses freely; but to the extent that the gate is closed, the output of the transmission cells is inhibited. The GCT proposes that three factors are involved in controlling the opening and closing of the gate. Firstly, the amount of activity in the pain fibres affects the opening of the gate. Secondly, the amount of activity in other peripheral fibres affects the opening of the gate (i.e., activity in peripheral fibres such as touching, rubbing, or slightly scratching the skin can inhibit the perception of pain). Thirdly, and most importantly for mental toughness, messages that descend from the brain can modify the gate-control system. It has been suggested that this central pathway to the gate may respond to cognitive and emotional events signalled
by the brain, which may be capable of changing the nature of a potentially painful experience (Melzack & Casey, 1968). There is experimental evidence that the descending pathways can inhibit responses of spinal cord neurons to noxious stimuli (for example, Dickhaus, Pauser, & Zimmerman, 1985; Light, 1993).

The GCT provides a biological model of how mentally tough individuals may control adverse stimuli such as pain by volition through the mediation of three psychological dimensions: “sensory-discriminative”, “motivation-affective” and “cognitive-evaluative” (Tenenbaum, 1996). Sensory-discrimination relates to the detection of the intensity and location of painful stimuli. The motivational-affective dimension involves an evaluation of the negative connotations of the stimuli. The cognitive-evaluative dimension involves a decision-making process such as, “What can I do about this?”

The cognitive-evaluative dimension is particularly important for the psychological mediation of adverse stimuli such as pain (i.e., mental toughness). The different meaning (a cognitive dimension) that athletes attach to the circumstance in which pain is experienced may result in the perception of the pain as less noxious (Tenenbaum, 1996). The essence of this theory is that adverse input is mediated by cognitions before “stress” is evoked and maladaptive strategies subsequently employed. For mental toughness it is suggested that the combination of motivation energy and positive perception skills mediates the experience of “stressors”. The GCT provides a biological basis for how this occurs, specifically to do with pain. Future research is needed to explore the mediating effects of mental toughness cognitions (such as motivation and perception) on the experience of pain and stress and then subsequent performance.

**Physiological basis for mental toughness**

The discussion above, on pain, brings into consideration the physiological basis for mental toughness. Dienstbier (1991) presented “the toughness model”—a model that relates sympathoadrenal reactivity in response to stressors, to improved performance, emotional control, and toughness. Dienstbier demonstrated that increased levels of catecholamines following mental challenge/stress situations were associated with better
performance in those situations and with emotional stability. The research also showed a number of advancements in the sympathoadrenal system in response to training stimuli (repeated exposure to stress). These include: (a) increased CNS catecholamine capacity; (b) lower peripheral catecholamine base rates but increased capacity and responsivity—although catecholamine responses diminish post-stress more quickly; (c) an increased tissue-specific sensitivity (as in, greater blood glucose response to a given amount of catecholamine); and (d) a delay or suppression of pituitary-adrenal-cortical responses.

All of these training improvements result in enhanced catecholamine reactivity in response to stress signals sent down from the brain. Future research is needed to explicitly link this physiological toughness model to the psychological mental toughness model developed here. Linking the physiological toughness model to the psychological mental toughness model is beyond the scope of the current investigation.

Mental Toughness Measurement

Prior to the current research project, mental toughness measurement was scarce and unproven, from a construct validation perspective. Loehr offered the Psychological Performance Inventory (PPI) as a test of his heuristically developed seven factor model of mental toughness. Loehr presented incomplete conceptual rationale for the development of the instrument and offered little validational data supporting the use of the PPI. Clough et al. (2002) have also developed a mental toughness measurement—the MT48. This instrument was designed to measure mental toughness based substantially on the cognate construct, hardiness. At the time the current research study commenced, the PPI was the most widely used and available of the two. The MT48 was not published until part way through the first year of the current study. Therefore, in the process of examining prior instrumentation, the PPI was examined closely using sound statistical methods and a construct validity approach (i.e., Study 1). Study 1 revealed that while the PPI was conceptually appealing, the instrument fell short on several psychometric criteria. It is recognised here that further research is needed to test the psychometric properties of the MT48 along similar lines to those already conducted with the PPI.
Study 2 of the current research project then developed a model of mental toughness following from the yields of the qualitative research. This model formed the basis of the Mental Toughness Inventory (MTI). Studies 3 and 4 of the current project then demonstrated the validity of the MTI from both within- and between-network perspectives. The MTI, then, offers psychometrically sound measurement built on a large and in-depth qualitative study of mental toughness.

The MTI as a research tool adds significant value to researchers wishing to study mental toughness. A valid instrument such as this has the potential to answer many questions of interest in mental toughness research. The results of Study 4 highlight the need to develop age- and group-based normative data. Study 4 results revealed a contextual effect whereby athletes differentially rated their levels of mental toughness (on the various characteristics) on the basis of whether they were a school-based athlete or an institution-based athlete. Those results also revealed that age had an effect on the way in which mental toughness was reported, as did gender. Future research is needed to develop specific normative data for athletes in different circumstances (e.g., ages, contextually related circumstances). Such normative data would be useful for athletes, coaches and sport psychologists wanting to compare their athlete/s against the norm—thereby aiding the interpretation of results and what they mean for identifying training needs.

Mental toughness is desirable construct for athletes wishing to perform under pressure, bounce back from adversity, and perform in the face of obstacles. What this research means for measurement and practice is that there is now a valid tool to assess characteristics of mental toughness. This research presents a valid model of mental toughness – one that athletes can measure themselves against and train specifically. Being able to measure, train, and enhance mental toughness has a myriad of associated benefits for coaches, athletes and researchers alike.

**Limitations of Study and Implications for Research**

When interpreting these findings, it is important to recognise some limitations associated with the research, which may also provide directions for future work in this area.
Self-Report Data

The Mental Toughness Inventory (MTI) and all key correlate scales are self-report measures. An athlete may not want others to know the exact nature of their mental toughness, and may therefore respond to how they think they “should” respond rather than how they actually feel at the time. Therefore, broader measures ought to be included in future research derived through reports by significant others (e.g., coaches), performance outcomes, observational techniques, and perhaps physiological measures. For theory development, there is a need to look at social-desirability and self-presentation response distortion in single questionnaires to assess mental toughness.

Defensive Responding

Related to the above point, there is the potential for defensive responding in this type of research. The concept under investigation is generally a desirable quality, and certainly one seen as advantageous to performance. The athletes under investigation exist in a highly competitive environment where only a relatively few “succeed”. An assessment of mental toughness could be perceived as a threat to an athlete who perhaps suffers from performance anxiety. In a situation like this, and in many others too, there is the possibility of defensive responding for the purposes of gaining team selection (where admitting performance anxiety might be thought to detract from their selection chances). It is suggested that for testing to be more accurate, participants need to feel assured that test results are for their personal training use and not for selection. Perhaps another method to improve accuracy of testing would be to have significant others rate the athlete as well. A future research direction also would be to evaluate the validity of self-report as an assessment method for mental toughness.

Cross-Sectional

One limitation of this research thesis is that the data collected were cross sectional. Collecting data at one time point provides a vital snapshot of mental toughness. However, what cross-sectional research designs cannot do is observe over time how an individual adapts and “hangs in there” through various experiences of adversity and pressure. Cross-sectional research does not uncover how mental toughness develops in
an athlete over time. Individuals’ vulnerabilities and protective mechanisms may vary at
different ages and life stages, and stages of the adversity experience (Cicchetti & Toth,
1995; Egeland, Carlson & Sroufe, 1993; Rutter, 1990). Future research should examine
the predictive validity of mental toughness by examining related processes and outcomes
over time.

**Retrospective Data**

The research presented here is based on retrospective accounts of mental toughness. For
example, in the qualitative study participants were recalling previous experiences to
describe what mental toughness means to them. Also, for the Mental Toughness
Inventory participants rated themselves on various dimensions of mental toughness
based on their experience. However, data are sensitive to the point at which information
is collected (Beehr & McGrath, 1996; Heller, Larrieu, D’Imperi & Boris, 1999; Rutter,
1985; Staudinger, Marsiske, & Baltes, 1995). Future research efforts would do well to
validate the MTI using data collected in close proximity to the actual experience.

**The Need for Athletes to be at Risk**

The qualitative results suggested that mental toughness occurs in the context of
adversity. When assessing mental toughness, then, do athletes need to be experiencing
adversity to qualify as respondents? Do athletes need to be “at risk” to assess mental
toughness? One limitation of this study is that athletes were not assessed at risk (i.e.,
under performance pressures or during adversity). Athletes in this study were assessed
within the context of a non-confrontational testing environment. Although athletes were
asked to think of their sporting performance when responding to the research, in reality
they were not experiencing that adversity at the time of responding. Future research
would do well to assess mental toughness at the actual experience of adversity. This
study produced a shortened version of the MTI (3-items per scale, 36 items in total).
Although this instrument needs further validity testing, such an instrument may be useful
for studies of athletes at risk in that its brevity makes it less intrusive for athletes to
complete at performance events.
Actual Performance Data

One limitation of the research presented here is that it does not include actual performance data. How does mental toughness affect performance? To what extent is it related to success? To what extent is it related to overcoming adversity? Does self-reported mental toughness predict future occurrences of mental toughness? Along the same lines it would be of interest to see how mental toughness affects levels of performance at times of significant risk. With the development of a valid MTI, researchers can address the above questions through well structured research that examines related performance outcomes with mental toughness processes.

Triangulation of Responses

One limitation of the qualitative research component of this research was that it did not examine differences in the way coach and athletes describe their mental toughness. This method, triangulation, would allow the researcher to examine the mental toughness experience from the observer’s point of view and also from the internal experience of the athlete. Drawing these experiences together would add further insight to researchers developing conceptual models of mental toughness.

Multi-Method Measurement Approach

Measurement in mental toughness research is of particular importance. The difficulty of accurately measuring mental toughness relates to problems such as: temporal proximity to the actual event (i.e., times when the athlete exhibited the qualities of being mentally tough), test instructions, method of recording thoughts, and the presence of reasons an athlete may want to influence their results (e.g., team selections or coach observing results). The cognitions being investigated are internal to the participant and not directly observable to the researcher. Furthermore, athletes are involved in challenging circumstances when the mental toughness cognitions occur, making immediate measurement difficult. It might be that more accurate information on mental toughness processes could be obtained by recording cognitive content as it happens. However, there are limitations to using this approach. Having athletes regularly report on their thoughts as they progress through a mentally tough experience (for example, on a tape
Mental Toughness: Conceptualisation and Measurement

recorder), forces them to think internally, which may or may not affect mental toughness. The alternative is to measure thoughts immediately after the event, using a questionnaire such as the Mental Toughness Inventory. This method also has limitations because there is some delay between when the mental toughness occurs and when it is recorded. In terms of temporal proximity the MTI is probably the more effective alternative as it does not interfere with the event when it is happening.

But what of athletes wishing to influence their results? A self-report questionnaire is particularly susceptible to participants who wish to influence results. This then raises the question as to what other assessment methods can be used either in place of, or congruently with self-reports, to measure mental toughness more accurately? The answer may lie in developing a physiological test that supplements self-report assessment. Dienstbier’s (1991) research suggests that chemical responses to a specific stressor (catecholamine reactivity) may act as a marker for the mental toughness response—whereby “tougher” individuals have a more advanced hormone response system in relation to stress. Such a test is measured through urine analysis, and together with the MTI may offer a more complete assessment of mental toughness. This requires further research.

In developing a measurement strategy for mental toughness, there is reasonable validity in investigating the need for multi-method assessment (e.g., combining self-report with a physiological test). Given the range of contributing factors in mental toughness, and the potential for athletes to influence self-report assessment, it is unlikely that any one single measurement method will capture with great accuracy the true nature of an athlete’s mental toughness. Future research needs to consider the development of multi-method assessment and improving temporal proximity to the actual experience of mental toughness.

Conclusion

The central purpose of the present research was to further develop a mental toughness definition, progress mental toughness conceptualisation, and construct and validate a mental toughness measurement tool. Both qualitative and quantitative approaches were employed to develop a conceptual model and definition of mental toughness. These
developments were used as building blocks to construct the Mental Toughness Inventory (MTI). Quantitative methods using a construct validity approach were then used to establish the MTI as a valid tool (based on multiple psychometric criteria) capable of measuring mental toughness across a range of athlete groups.

Taken together, it can be concluded that the present program of research resulted in several significant yields for research and practice, as follows:

- The study provides confirmatory measurement work on the structure of mental toughness in athletes and clarifies the factors giving rise to mental toughness;
- The study extends mental toughness research, not only by directly locating it in the context of influential self-concept, coping, motivation and attention research and theory, but also by identifying a variety of factors proposed to be core mental toughness factors;
- The study is among the first to explicitly draw together a range of qualitatively derived mental toughness factors under a common conceptual framework and to assess that framework quantitatively;
- The findings provide important insights into patterns of mental toughness across males and females, younger and older athletes, and across institution- and school-based athletes; and,
- The study provided a more comprehensive understanding of the process of mental toughness and the factors and conditions that might facilitate it, thereby providing important direction for practitioners.

In summary, the quantitative and qualitative components of this thesis have provided a great deal of data on mental toughness in the sporting context. Strengths and limitations of the Psychological Performance Inventory were used to guide the development of a new mental toughness measurement. Rich qualitative data on mental toughness were gathered through recording the collective experience of over 30 world class athletes and coaches. Factors giving rise to mental toughness were identified and were drawn together into a multidimensional structure of 12 key factors. The Mental Toughness Inventory was developed and its 12 component factors were validated. Taken
together, then, the findings of the present investigation hold not only substantive and methodological implications for researchers studying mental toughness, but are also relevant to sport psychologists and coaches aiming to help athletes in their quest for mental toughness and sporting excellence under diverse and challenging performance domains.
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APPENDICES
APPENDIX A

Qualitative Study Participant Consent Form

INFORMATION FOR PARTICIPANTS:
We would like to invite you to be part of a study investigating the elements that contribute to mental toughness in athletes. Coaches and athletes universally agree that mental toughness is important to success in sport, but are not clear exactly how to measure, train, and improve/enhance mental toughness. This project aims to marry theory, measurement, empirical research, and practice in order to define the concept of mental toughness. Developing and testing a model of mental toughness, and increasing understanding of the phenomenon, will lay the groundwork for the development of an instrument that directly measures mental toughness. We hope to talk with nationally elite athletes, coaches and sports staff, and to ask them to articulate the key elements of being “mentally tough.”

CERTIFICATION BY PARTICIPANT
I, ______________ Certify that I am at least 18 years old and that I am voluntarily giving my consent to participate in the study entitled “Mental Toughness: What Makes a Champion”, being conducted by the Australian Institute of Sport and the University of Western Sydney by Professor Herb Marsh, Dr. Jacqueline Savis, Mr. Clark Perry, and Mr. Cory Middleton.

I certify that the objectives of the study, together with any risks to me associated with the procedures listed hereunder to be carried out in the study, have been fully explained to me by Mr. Cory Middleton and that I freely consent to participation as described in the following procedures. I am aware that this study may cause some stress and where required, and independent psychologist will be made available for counselling.

PROCEDURES
As a participant in this study, you will be requested to take part in an interview, lasting from 45 to 60 minutes, which gives you the opportunity to recall your experiences with mentally tough athletes. The interview will focus on what you feel are the major elements that contribute to mental toughness. Questions will cover topics such as your history of competitive sport, your views on the elements that contribute to mental toughness, a description of mentally tough athletes, and your views on how experiences and external influences relate to mental toughness. The interview will be audio taped. Please be aware that the strictest confidentiality will be upheld in dealing with all research data.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardize me in any way. I have been informed that the information I provide will be kept confidential.

Signed:…………………………………………………  Date:………………………………
Witness other than the researcher:……………………………………………………

Any queries about your participation in this project may be directed to the researcher, Professor Herb Marsh, ph. (02) 9772 6633. You may also contact associate researcher, Mr. Clark Perry, ph. (02) 6214 1586 or the student researcher, Mr. Cory Middleton, ph. (02) 6214 1733. If you have any queries or complaints about the way you have been treated, you may contact the University of Western Sydney Ethics Committee through the Research Ethics Officer, ph. (02) 4570 1136. If you have concerns with respect to the conduct of this study, you may contact John Williams, the Secretary of the AIS Ethics Committee on (02) 6214 1816. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
APPENDIX B

Semi-Structured Qualitative Interview Guide

STAGE 1 – INTERVIEW: Coaches, Athletes, Sports Science and Medicine Personnel
Can you tell me a little about your involvement in elite sport?

1. Elements that contribute to mental toughness

i) Elements that contribute to mental toughness

Sample questions:
- Can you tell me what you think mental toughness is?
- What do mentally tough athletes have that makes them mentally tough?
- Form your experience, what do you think separates athletes who are not mentally tough from those who are?

ii) Probing questions & follow-up (clarifying not leading questions)

2. Questions focusing on characteristics of the athlete

i) Open-ended responses to questions

Sample questions:
- Can you describe the act of being mentally tough?
- Can you describe the experience or feelings associated with being mentally tough?
- What makes someone be mentally tough? What motivates them to do this?
- Do mentally tough athletes think of themselves as being different to others? If so, in what way? How does this effect them when in the face of adversity?
- Do mentally tough athletes think their ability is different to others? What sorts of ability?
- Why would an athlete feel they need to be tough?

ii) Probing questions & follow-up (clarifying not leading questions)

3. Questions focusing on the experience of the athlete

i) Open-ended responses to questions

Sample questions:
- Think of a time when you had to be mentally tough….  
  - Tell me about the situation, what thoughts were going on, what feelings did you have, how did you behave?
- Out of all the areas in your life, what situation would trigger you to act in a mentally tough way?
  - Why would this trigger you to be tough? Why is it important to you?

ii) Probing questions & follow-up (clarifying not leading questions)
4. Questions Focusing on external influences
Sample questions:
- What sorts of external influences effect mental toughness?
- What situations in an athlete’s life might influence mental toughness?

Probing questions & follow-up (clarifying not leading questions)

5. Identifying a mentally tough athlete?
- Can you tell me a list of athletes who are mentally tough? (identify potential participants)

6. How does being mentally tough fit in with performance?
- What are the outcomes of being mentally tough?
- What role does being mentally tough play in being a champion?
APPENDIX C

**Item Wording and Subscale Statistics**

Results in the main body of the tables are based on FINAL models having removed some items due to poor loadings (see Chapter 7 for further details).

Items removed are indicated at the bottom of the table along with their associated statistics obtained in one factor models.

### C1. Mental Self-Concept

Cronbach’s alpha .92

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I am mentally very strong in my area</td>
<td>.66</td>
<td>.93</td>
<td>.74</td>
</tr>
<tr>
<td>-I excel because of my mental strength</td>
<td>.83</td>
<td>.92</td>
<td>.87</td>
</tr>
<tr>
<td>-I know I have great mental strength</td>
<td>.80</td>
<td>.92</td>
<td>.87</td>
</tr>
<tr>
<td>-I don’t give-up when things are tough</td>
<td>.83</td>
<td>.92</td>
<td>.87</td>
</tr>
<tr>
<td>-Overall I am mentally tough</td>
<td>.86</td>
<td>.92</td>
<td>.88</td>
</tr>
<tr>
<td>*I have better mental skills than people at my level</td>
<td>.62</td>
<td>.94</td>
<td>.69</td>
</tr>
<tr>
<td>*I am mentally able to motivate myself appropriate to the situation</td>
<td>.66</td>
<td>.93</td>
<td>.75</td>
</tr>
<tr>
<td>*I am mentally stronger than my competitors</td>
<td>.77</td>
<td>.93</td>
<td>.83</td>
</tr>
<tr>
<td>*My mental strength is the reason I do well</td>
<td>.77</td>
<td>.93</td>
<td>.85</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process

### C2. Stress Minimisation

Cronbach’s alpha .92

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<th>Item-Total Correlation</th>
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<th>Factor Loading</th>
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</thead>
<tbody>
<tr>
<td>-I am good at keeping stresses in perspective</td>
<td>.71</td>
<td>.91</td>
<td>.74</td>
</tr>
<tr>
<td>-I don’t let stress get out of proportion</td>
<td>.75</td>
<td>.91</td>
<td>.81</td>
</tr>
<tr>
<td>-I minimise the impact that stress and pressure has on me</td>
<td>.77</td>
<td>.90</td>
<td>.84</td>
</tr>
<tr>
<td>-I am good at minimising the effects of stress</td>
<td>.80</td>
<td>.90</td>
<td>.86</td>
</tr>
<tr>
<td>-I am wise about how to deal with stress</td>
<td>.78</td>
<td>.90</td>
<td>.86</td>
</tr>
<tr>
<td>*No matter how stressful an event, I try to minimise the effect it has on me</td>
<td>.63</td>
<td>.91</td>
<td>.71</td>
</tr>
<tr>
<td>*I am good at keeping stress in perspective</td>
<td>.76</td>
<td>.91</td>
<td>.83</td>
</tr>
<tr>
<td>*I refuse to let stressful things become a big deal</td>
<td>.50</td>
<td>.92</td>
<td>.51</td>
</tr>
<tr>
<td>*I don’t let little stresses get in the way of the big picture</td>
<td>.70</td>
<td>.91</td>
<td>.72</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process
### C3. Personal Bests

Cronbach’s alpha .89

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I am most satisfied when I know I have done my best</td>
<td>.52</td>
<td>.89</td>
<td>.60</td>
</tr>
<tr>
<td>-Trying to do the best that I can is what is important to me</td>
<td>.69</td>
<td>.88</td>
<td>.77</td>
</tr>
<tr>
<td>-It is important to me to have done the best I can</td>
<td>.77</td>
<td>.87</td>
<td>.81</td>
</tr>
<tr>
<td>-To have done my best is the most important thing to me</td>
<td>.75</td>
<td>.87</td>
<td>.81</td>
</tr>
<tr>
<td>-Doing my very best is what it is all about</td>
<td>.74</td>
<td>.87</td>
<td>.82</td>
</tr>
<tr>
<td>*To be happy with my performance, I need to have done my best</td>
<td>.45</td>
<td>.90</td>
<td>.46</td>
</tr>
<tr>
<td>*What drives me is wanting to see how good my best really is</td>
<td>.70</td>
<td>.87</td>
<td>.79</td>
</tr>
<tr>
<td>*What drives me on is my need to achieve my best</td>
<td>.72</td>
<td>.87</td>
<td>.82</td>
</tr>
<tr>
<td>*Trying to get the best out of myself is what motivates me</td>
<td>.55</td>
<td>.89</td>
<td>.64</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process

### C4. Task Focus

Cronbach’s alpha .93

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I get absolutely focused on the task, nothing distracts me</td>
<td>.74</td>
<td>.92</td>
<td>.78</td>
</tr>
<tr>
<td>-I focus on the task without getting distracted</td>
<td>.76</td>
<td>.91</td>
<td>.80</td>
</tr>
<tr>
<td>-It is hard to distract me from my focus on the task</td>
<td>.77</td>
<td>.91</td>
<td>.83</td>
</tr>
<tr>
<td>-My concentration and focus are hard to break</td>
<td>.79</td>
<td>.91</td>
<td>.85</td>
</tr>
<tr>
<td>-I don’t get distracted. I keep focused on the task</td>
<td>.83</td>
<td>.91</td>
<td>.88</td>
</tr>
<tr>
<td>*I stay focused on the task under pressure</td>
<td>.76</td>
<td>.92</td>
<td>.84</td>
</tr>
<tr>
<td>*Even under pressure I focus on the right thing at the right time</td>
<td>.53</td>
<td>.93</td>
<td>.61</td>
</tr>
<tr>
<td>*I give total attention and focus to the task at hand</td>
<td>.74</td>
<td>.92</td>
<td>.81</td>
</tr>
<tr>
<td>*I have an unshakeable focus on the task</td>
<td>.65</td>
<td>.92</td>
<td>.72</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process
### C5. Potential

Cronbach’s alpha .96

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I fell that my future in this area will be good</td>
<td>.86</td>
<td>.95</td>
<td>.89</td>
</tr>
<tr>
<td>-I am sure that I will achieve the potential I have in this area</td>
<td>.83</td>
<td>.95</td>
<td>.87</td>
</tr>
<tr>
<td>-I have great potential in this area and I will fulfil it</td>
<td>.89</td>
<td>.95</td>
<td>.93</td>
</tr>
<tr>
<td>-I feel as though I have a lot of future potential in this area</td>
<td>.91</td>
<td>.95</td>
<td>.93</td>
</tr>
<tr>
<td>-I feel that I will make some major achievements in this area in the future</td>
<td>.88</td>
<td>.95</td>
<td>.92</td>
</tr>
<tr>
<td>*When I think about my potential in this area I am sure I will achieve it</td>
<td>.85</td>
<td>.95</td>
<td>.88</td>
</tr>
<tr>
<td>*I will reach my potential in this area</td>
<td>.70</td>
<td>.96</td>
<td>.75</td>
</tr>
<tr>
<td>*I have potential and I will achieve it</td>
<td>.75</td>
<td>.96</td>
<td>.79</td>
</tr>
<tr>
<td>*I am very likely to achieve my potential in this area</td>
<td>.80</td>
<td>.96</td>
<td>.83</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process

### C6. Perseverance

Cronbach’s alpha .93

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-When something doesn’t work out at first I keep trying hard to get it right</td>
<td>.75</td>
<td>.92</td>
<td>.79</td>
</tr>
<tr>
<td>-If I don’t understand something I keep trying until I get it</td>
<td>.76</td>
<td>.92</td>
<td>.79</td>
</tr>
<tr>
<td>-I keep working at things until I overcome them</td>
<td>.81</td>
<td>.92</td>
<td>.86</td>
</tr>
<tr>
<td>-I keep on persisting until the job is done</td>
<td>.82</td>
<td>.92</td>
<td>.88</td>
</tr>
<tr>
<td>-When faced with difficulty I keep working at it and won’t accept defeat</td>
<td>.70</td>
<td>.92</td>
<td>.77</td>
</tr>
<tr>
<td>*When faced with obstacles I keep going at it</td>
<td>.79</td>
<td>.92</td>
<td>.87</td>
</tr>
<tr>
<td>*If something is difficult, I keep working at it to overcome it</td>
<td>.64</td>
<td>.93</td>
<td>.68</td>
</tr>
<tr>
<td>*I keep trying to get around obstacles</td>
<td>.66</td>
<td>.93</td>
<td>.72</td>
</tr>
<tr>
<td>*I always keep trying to overcome difficult situations</td>
<td>.75</td>
<td>.92</td>
<td>.81</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process
### C7. Value

Cronbach’s alpha .94

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I value this as one of the most important things in my life</td>
<td>.81</td>
<td>.93</td>
<td>.85</td>
</tr>
<tr>
<td>-This activity is one of the most valuable parts of my life</td>
<td>.83</td>
<td>.93</td>
<td>.87</td>
</tr>
<tr>
<td>-Involvement in this area gives value and meaning to my life</td>
<td>.84</td>
<td>.93</td>
<td>.86</td>
</tr>
<tr>
<td>-Few things have as much value to me as doing well in this area</td>
<td>.74</td>
<td>.93</td>
<td>.76</td>
</tr>
<tr>
<td>-Performing well in this area is one of the most valuable things for me</td>
<td>.85</td>
<td>.93</td>
<td>.90</td>
</tr>
<tr>
<td>*I see my performances in this area as very valuable to me</td>
<td>.79</td>
<td>.93</td>
<td>.84</td>
</tr>
<tr>
<td>*I see myself as a valuable person because I do well in this area</td>
<td>.67</td>
<td>.94</td>
<td>.75</td>
</tr>
<tr>
<td>*Good performances in this area are a large part of the way I value myself</td>
<td>.72</td>
<td>.93</td>
<td>.79</td>
</tr>
<tr>
<td>*Doing well in this area has more value to me than most things</td>
<td>.65</td>
<td>.94</td>
<td>.69</td>
</tr>
</tbody>
</table>

* *Item removed following instrument refinement process*

### C8. Task Familiarity

Cronbach’s alpha .94

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I perform well at this level because of my experience</td>
<td>.77</td>
<td>.94</td>
<td>.79</td>
</tr>
<tr>
<td>-My previous experience helps me to do well</td>
<td>.74</td>
<td>.94</td>
<td>.76</td>
</tr>
<tr>
<td>-I know I will perform well because of my experience</td>
<td>.73</td>
<td>.94</td>
<td>.77</td>
</tr>
<tr>
<td>-My experience makes me stronger when performing</td>
<td>.80</td>
<td>.93</td>
<td>.86</td>
</tr>
<tr>
<td>-My experience is of great use to me</td>
<td>.83</td>
<td>.93</td>
<td>.87</td>
</tr>
<tr>
<td>*My experience gives me confidence</td>
<td>.64</td>
<td>.94</td>
<td>.67</td>
</tr>
<tr>
<td>*My experience helps pull me through all situations</td>
<td>.78</td>
<td>.93</td>
<td>.84</td>
</tr>
<tr>
<td>*I am better prepared to perform because of my experience</td>
<td>.82</td>
<td>.93</td>
<td>.88</td>
</tr>
<tr>
<td>*Because of my experience I do well</td>
<td>.87</td>
<td>.93</td>
<td>.90</td>
</tr>
</tbody>
</table>

* *Item removed following instrument refinement process*
### C9. Goal Commitment

Cronbach’s alpha .96

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I am totally committed to achieving my goals</td>
<td>.86</td>
<td>.95</td>
<td>.87</td>
</tr>
<tr>
<td>-I am fully committed to achieving the goals I have set myself</td>
<td>.86</td>
<td>.95</td>
<td>.90</td>
</tr>
<tr>
<td>-My commitment to my goals is at a very high level</td>
<td>.87</td>
<td>.95</td>
<td>.90</td>
</tr>
<tr>
<td>-No matter what, I remain committed to my goals</td>
<td>.88</td>
<td>.95</td>
<td>.92</td>
</tr>
<tr>
<td>-My commitment to my goals is strong</td>
<td>.86</td>
<td>.95</td>
<td>.90</td>
</tr>
<tr>
<td>*I stay committed to my goals at all times</td>
<td>.85</td>
<td>.95</td>
<td>.88</td>
</tr>
<tr>
<td>*My commitment to my goals is genuine and firm</td>
<td>.86</td>
<td>.95</td>
<td>.89</td>
</tr>
<tr>
<td>*I am totally committed</td>
<td>.74</td>
<td>.96</td>
<td>.75</td>
</tr>
<tr>
<td>*People at my level would say I’m very committed to my goals</td>
<td>.72</td>
<td>.96</td>
<td>.76</td>
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</tbody>
</table>

* *Item removed following instrument refinement process*

### C10. Positivity

Cronbach’s alpha .93

<table>
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<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I turn negatives into positives</td>
<td>.67</td>
<td>.93</td>
<td>.72</td>
</tr>
<tr>
<td>-I always try to find the positive and good in every situation</td>
<td>.79</td>
<td>.92</td>
<td>.84</td>
</tr>
<tr>
<td>-I can see positives when things are difficult</td>
<td>.81</td>
<td>.92</td>
<td>.85</td>
</tr>
<tr>
<td>-When things are bad I try to turn them around into something positive</td>
<td>.76</td>
<td>.92</td>
<td>.81</td>
</tr>
<tr>
<td>-During difficult times I look for something positive in what is happening</td>
<td>.80</td>
<td>.92</td>
<td>.87</td>
</tr>
<tr>
<td>*Seeing the positives in situations is important to me</td>
<td>.70</td>
<td>.93</td>
<td>.78</td>
</tr>
<tr>
<td>*I stay positive in the face of difficulty</td>
<td>.74</td>
<td>.92</td>
<td>.83</td>
</tr>
<tr>
<td>*I am good seeing the positives in bad situations</td>
<td>.69</td>
<td>.93</td>
<td>.74</td>
</tr>
<tr>
<td>*When things go wrong I try to see the positives</td>
<td>.77</td>
<td>.92</td>
<td>.79</td>
</tr>
</tbody>
</table>

* *Item removed following instrument refinement process*
### C11. Self-Efficacy

Cronbach’s alpha .95

<table>
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<tr>
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<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-I believe in myself in all situations</td>
<td>.80</td>
<td>.94</td>
<td>.82</td>
</tr>
<tr>
<td>-No matter what the criticism I still believe in myself</td>
<td>.77</td>
<td>.94</td>
<td>.79</td>
</tr>
<tr>
<td>-When things are difficult I still believe in myself</td>
<td>.81</td>
<td>.94</td>
<td>.86</td>
</tr>
<tr>
<td>-My belief in myself gets me through difficulties</td>
<td>.80</td>
<td>.94</td>
<td>.86</td>
</tr>
<tr>
<td>-No matter what the pressure I still believe in myself</td>
<td>.84</td>
<td>.94</td>
<td>.88</td>
</tr>
<tr>
<td>*I believe in myself to do well no matter what the difficulty</td>
<td>.79</td>
<td>.94</td>
<td>.86</td>
</tr>
<tr>
<td>*No matter what, I believe in my ability to perform</td>
<td>.81</td>
<td>.94</td>
<td>.85</td>
</tr>
<tr>
<td>*I believe in my self when things are difficult</td>
<td>.68</td>
<td>.94</td>
<td>.74</td>
</tr>
<tr>
<td>*I believe in myself to overcome difficulties to achieve my goals</td>
<td>.79</td>
<td>.94</td>
<td>.84</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process

### C12. Positive Comparison

Cronbach’s alpha .93

<table>
<thead>
<tr>
<th>Item</th>
<th>Item-Total Correlation</th>
<th>Alpha with item removed</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-If the opposition is not coping as well as me it gives me greater confidence</td>
<td>.75</td>
<td>.92</td>
<td>.75</td>
</tr>
<tr>
<td>-I gain confidence when I see others not coping as well as I am</td>
<td>.78</td>
<td>.92</td>
<td>.81</td>
</tr>
<tr>
<td>-Seeing the opposition feeling the pressure builds my confidence</td>
<td>.85</td>
<td>.91</td>
<td>.89</td>
</tr>
<tr>
<td>-Seeing the opposition not coping as well increases my confidence</td>
<td>.84</td>
<td>.91</td>
<td>.89</td>
</tr>
<tr>
<td>-I often gain confidence when I see signs that the opposition is not coping well</td>
<td>.83</td>
<td>.92</td>
<td>.87</td>
</tr>
<tr>
<td>*If things are difficult I gain confidence from coping better than the opposition</td>
<td>.45</td>
<td>.94</td>
<td>.49</td>
</tr>
<tr>
<td>*I gain confidence from seeing that I am not weakening as much as the rest</td>
<td>.57</td>
<td>.93</td>
<td>.62</td>
</tr>
<tr>
<td>*I can sense when my opposition is weakening and I gain greater confidence from it</td>
<td>.77</td>
<td>.92</td>
<td>.81</td>
</tr>
<tr>
<td>*Seeing my opposition’s weaknesses gives me greater confidence</td>
<td>.80</td>
<td>.92</td>
<td>.84</td>
</tr>
</tbody>
</table>

*Item removed following instrument refinement process
APPENDIX D

Mental Toughness Inventory (MTI)

1. Your Name: _________________________  2. Your Gender:  Male □  Female □
3. Today’s Date: ______/_____/_____  4. Your Date of Birth: ______/_____/_____
5. Your Age: ________years  6. What is your Sport: __________________________

This is not a selection test - there are no right or wrong answers.

It is important that you:
• are honest, and give your own views about yourself
• report how you feel about each question NOW

Use the eight-point scale to indicate how true (like you) or how false (unlike you), each statement over the page is as a description of you. Please do not leave any statements blank.

PLEAS E FOCUS ON HOW YOU FEEL NOW ABOUT YOUR SPORT

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>FALSE not like me</th>
<th>TRUE like me</th>
</tr>
</thead>
<tbody>
<tr>
<td>01. I don’t give up when things get tough.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>02. I am most satisfied when I know I’ve done my best.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>03. I don’t let stress get out of proportion.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>04. I focus on the task without getting distracted.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>05. I am sure that I will achieve the potential I have in this area.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06. When something doesn’t work out at first I keep trying hard to get it right.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>07. Few things have as much value to me as doing well in this area.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>08. My previous experience helps me to do well.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>09. I am totally committed to achieving my goals.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>10. I turn negatives into positives.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>11. No matter what the criticism I still believe in myself.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>12. If the opposition is not coping as well as me it gives me greater confidence.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>13. I am mentally very strong in my area.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>14. Trying to do the best that I can is what is important to me.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>15. I am good at keeping stress in perspective.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
</tbody>
</table>
**PLEASE FOCUS ON HOW YOU FEEL NOW ABOUT YOUR SPORT**

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>FALSE not like me</th>
<th>TRUE like me</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. I get absolutely focused on the task, nothing distracts me.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>17. I feel as though I have a lot of future potential in this area.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>18. If I don’t understand something I keep trying until I get it.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>19. Involvement in this area gives value and meaning to my life.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>20. I know I will perform well because of my experience.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>21. My commitment to my goals is at a very high level.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>22. When things are bad I try to turn it around into something positive.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>23. I believe in myself in all situations.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>24. I gain confidence when I see others not coping as well as I am.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>25. I excel because of my mental strength.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>26. It is important to me to have done the best I can.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>27. I minimise the impact that stress and pressure has on me.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>28. It is hard to distract me from my focus on the task.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>29. I feel that I will make some major achievements in this area in future.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>30. When faced with difficulty I keep working at it and won’t accept defeat.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>31. Performing well in this area is one of the most valuable things for me.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>32. I perform well at this level because of my experience.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>33. I am fully committed to achieving the goals I have set myself.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>34. I can see positives when things are difficult.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>35. My belief in myself gets me through difficulties.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>36. I often gain confidence when I see signs that the opposition is not coping well.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>37. I know I have great mental strength.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>38. Doing my very best is what it is all about.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>39. I am wise about how to deal with stress.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>40. My concentration and focus are hard to break.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>41. I have great potential in this area and I will fulfil it.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>42. I keep working at things until I overcome them.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>43. I value this as one of the most important things in my life.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>44. My experience makes me stronger when performing.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
<tr>
<td>45. My commitment to my goals is strong.</td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
</tr>
</tbody>
</table>
### Mental Toughness: Conceptualisation and Measurement

#### PLEASE FOCUS ON HOW YOU FEEL NOW ABOUT YOUR SPORT

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>FALSE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not like me</td>
<td>like me</td>
</tr>
<tr>
<td>46. During difficult times I look for something positive in what is</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>happening.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47. When things are difficult I still believe in myself.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>48. Seeing the opposition feeling the pressure builds my confidence.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>49. Overall I am mentally tough.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>50. To have done my best is the most important thing to me.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>51. I am good at minimising the effects of stress.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>52. I don’t get distracted. I keep focused on the task.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>53. I feel that my future in this area will be good.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>54. I keep on persisting until the job is done.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>55. This activity is one of the most valuable parts of my life.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>56. My experience is of great use to me.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>57. No matter what, I remain committed to my goals.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>58. I always try to find the positive and good in every situation.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>59. No matter what the pressure I still believe in myself.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
<tr>
<td>60. Seeing the opposition not coping as well increases my confidence.</td>
<td>1 2 3 4 5 6 7</td>
<td>8</td>
</tr>
</tbody>
</table>