

1 Running Head: Mental Toughness

2

3

4

**The Concept of Mental Toughness:**

5

**Tests of Dimensionality, Nomological Network and Traitness**

6

7 Daniel F. Gucciardi<sup>1,2</sup>, Sheldon Hanton<sup>3</sup>, Sandy Gordon<sup>4</sup>, Clifford J. Mallett<sup>2</sup> and Philip  
8 Temby<sup>5</sup>

9

10 <sup>1</sup>*School of Physiotherapy and Exercise Science, Curtin University*

11

<sup>2</sup>*School of Human Movement Studies, The University of Queensland*

12

<sup>3</sup>*Cardiff School of Sport, Cardiff Metropolitan University*

13

<sup>4</sup>*School of Sport Science, Exercise, and Health, The University of Western Australia*

14

<sup>5</sup>*Land Operations Division, Defence Science and Technology Organization, South Australia*

15

16 Authors' Notes: This research was part funded by a University of Queensland Early  
17 Career Researcher Grant and Postdoctoral Research Fellowship to Daniel Gucciardi.

18 Appreciation is extended to Jon Chan for his assistance with data collection for Study 2, and  
19 to all those people and organizations that assisted with participant recruitment.

20 Corresponding Author: Daniel Gucciardi, School of Physiotherapy and Exercise

21 Science, Curtin University, GPO Box U1987, Perth, Australia, 6845. Phone: +61 8 9266

22 3653, Fax: +61 8 9266 3699, Email: daniel.f.gucciardi@gmail.com

---

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/jopy.12079

This article is protected by copyright. All rights reserved.

23

**Abstract**

24

**Objectives:** Mental toughness has received increased scholarly attention in recent years, yet

25

conceptual issues related to its (i) dimensionality, (ii) nomological network, and (iii) traitness

26

remain unresolved. The series of studies reported in this paper were designed to examine

27

these three substantive issues across several achievement contexts including sport, education,

28

military and the workplace. **Methods:** Five studies were conducted to examine these research

29

aims: Study 1:  $N = 30$ ; Study 2: calibration sample ( $n = 418$ ), tertiary students ( $n = 500$ ),

30

athletes ( $n = 427$ ), and employees ( $n = 550$ ); Study 3:  $N = 497$  employees; Study 4:  $N = 203$ 

31

tertiary students; Study 5:  $N = 115$  army candidates. **Results:** Collectively, the results of these

32

studies revealed that mental toughness may be best conceptualized as a unidimensional rather

33

than a multidimensional concept; plays an important role in performance, goal progress, and

34

thriving despite stress; and can vary and have enduring properties across situations and time.

35

**Conclusion:** This series of studies provides a foundation for further basic and applied

36

research of mental toughness across various achievement contexts.

37

38

39

**Keywords:** diary study; goal striving; multilevel structural equation modeling; personal

40

resources; resilience; stress

41 Facing adversity and dealing with challenges is commonplace in life's stressful  
42 achievement contexts. Students, for example, have to deal with the increased self-  
43 responsibility associated with their transition into tertiary education as well as perform under  
44 the pressure of a final exam. Businesspeople are under constant pressure to achieve key  
45 performance indicators to ensure that they remain employed in an unstable economic climate.  
46 Athletes often have to perform to their best under some of the most physically (e.g., fatigue)  
47 and mentally (e.g., crowd pressure) demanding circumstances. Across most achievement  
48 settings *mental toughness* (MT) is commonly referred to as the defining attribute that enables  
49 one to thrive in demanding situations (Jones & Moorhouse, 2007; Weinberg, 2010). Thus, it  
50 is not surprising that MT is a popular and highly valued concept, particularly within those  
51 contexts (e.g., business, education, medicine, military) where high performance underpins  
52 innovation, success, and competitive advantage (Asken, Grossman, & Christensen, 2010;  
53 Jones & Moorhouse, 2007). Some authors have gone as far to suggest that MT is fundamental  
54 to success in life (Wakefield, 2008; Weinberg, 2010).

55 The large volume of books within the popular press and news both in print and online  
56 suggests that MT is a concept that is meaningful for achievement and, more broadly,  
57 individuals' lives. The popularity of MT among the general public has inevitably led to the  
58 upsurge in academic attention that has occurred over the past decade. For example, an  
59 October 3<sup>rd</sup> 2013 search of the Web of Knowledge database from 1900 to 2013 revealed 145  
60 papers, chapters, or conference presentations in which the term MT appears in the title or  
61 topic; over 95% of which have surfaced since 2000. The vast majority of this research has  
62 been conducted within sport contexts, relying initially on retrospective interviews with elite  
63 athletes and coaches, and then cross-sectional interviews or surveys (for reviews, see  
64 Gucciardi & Gordon, 2011). In recent years, scholars have expanded their focus beyond the  
65 sporting field to achievement contexts such as surgery (Colbert, Scott, Dale, & Brennan,

66 2012) and the military (Godlewski & Kline, 2012), as well as the general public (Horsburgh,  
67 Schermer, Veselka, & Vernon, 2009).

68 Although the past decade has evidenced increased scholarly attention to MT, a  
69 number of conceptual and methodological concerns have limited the usefulness of these  
70 findings for conceptual development. First, the empirical focus on MT primarily within sport  
71 contexts limits the extent to which these findings generalize to other samples. Second, when  
72 MT has been examined in non-sport contexts, scholars have applied sport models with little  
73 explanation of the substantive or empirical evidence for doing so; there is evidence that it is  
74 sometimes erroneous to make this assumption (Gucciardi, Hanton, & Mallett, 2012). Third,  
75 with few exceptions (i.e., Hardy, Bell, & Beattie, in press), the area is characterized by  
76 piecemeal investigations in which the findings of individual studies have not been adequately  
77 integrated into a coherent conceptualization of MT. In particular, there have been at least 10  
78 qualitative investigations designed to delineate the key features of mental toughness, yet there  
79 has been no attempt to systematically synthesize this research. This apparent disconnect  
80 between empirical research and concept development or refinement with MT is at odds with  
81 the aim of substantive parsimony. There is still a need for a clearer definition and  
82 conceptualization that underpins concept development and subsequent testing of the  
83 substantive propositions of MT. Accordingly, the overarching goal of this research was to  
84 revisit the fundamental question “what is this thing called MT” (cf. Jones, Hanton, &  
85 Connaughton, 2002) via a series of systematic and theoretically integrated investigations.

### 86 **Conceptual Foundations**

87 As with many research topics in their relatively early stages of development,  
88 conceptual clarity is a problem for the field of MT because there is yet no clear consensus as  
89 to what it really is and what it is not. Key scholarly definitions of MT derived from empirical  
90 research are detailed in Table 1. These definitions of MT have sparked independent streams

91 of empirical research (for reviews, see Gucciardi & Gordon, 2011), yet more agreement on  
92 common elements of a concept is required before such bodies of knowledge can contribute to  
93 its evolution (Suddaby, 2010).

94 Owing to the lack of an established or empirically supported conceptual framework  
95 underpinning current conceptualizations of MT, we initially took an inductive approach to  
96 guide the development of our conceptual model (cf. Locke, 2007). Our conceptual model and  
97 associated working definition is based on a synthesis of the existing empirical evidence  
98 obtained from a comprehensive and up-to-date review of the literature (e.g., Gucciardi &  
99 Gordon, 2011), an electronic database search of articles that have been through a peer-review  
100 process (i.e., PsycINFO, Web of Science, Google Scholar), and unpublished interviews we  
101 have conducted with over 30 performers from non-sport contexts (i.e., military, surgery,  
102 business, tertiary education). In an effort to summarize and integrate these efforts, we propose  
103 a *working* definition of MT because it may be refined and extended over time as new findings  
104 about its nature emerge. Because MT is an umbrella term used to group a number of related  
105 concepts, it makes sense that a working definition would initially be relatively broad in  
106 nature, with the corresponding model providing specificity regarding the nature and number  
107 of dimensions (Bacharach, 1989). Thus, we define MT as a personal capacity to produce  
108 consistently high levels of subjective (e.g., personal goals or strivings) or objective  
109 performance (e.g., sales, race time, GPA) despite everyday challenges and stressors as well as  
110 significant adversities.

111 Our working conceptualization appears to adequately integrate key features of  
112 academic descriptions of MT with dictionary definitions of “mental” and “tough” detailed in  
113 Table 1 (cf. Locke, 2003). Central to both academic and English language definitions is the  
114 personal nature of MT – it is a quality that resides within an individual. Also inherent within  
115 these definitions is the notion of being able to withstand or endure challenging or adverse

116 situations. Although not explicitly captured in the English language definitions, the centrality  
117 of this personal quality for high performance and/or goal attainment is central to academic  
118 descriptions of MT. For example, Jones et al. (2002) linked MT with being “more consistent  
119 and better than your opponents” (p. 201), whereas Coulter et al. (2010) described it as being  
120 the foundation upon which to “consistently achieve [your] goals” (p. 715).

121 Unlike previous definitions that have encompassed examples of what is included in  
122 the construct (e.g., Clough et al., 2002) or are other-dependent such as “cope better than your  
123 opponents” (e.g., Jones et al., 2002, p. 209), our relatively broad description of MT includes  
124 several important assumptions that we believe provide a useful foundation upon which to  
125 help clarify its meaning. First, we contend that MT represents a “resource caravan” (Hobfoll,  
126 2002, p. 312) or aggregation of several personal resources or assets which are common to  
127 people who share social and environmental conditions (e.g., biology, culture); that is, these  
128 personal resources or assets are interwoven, with the common conceptually identifiable  
129 element among them being a process driving consistently high levels of subjective or  
130 objective performance. Second, an inherent feature of this conceptualization is that MT  
131 resides within an individual and – although providing a foundation for performance  
132 consistency – is imperfectly translated into behavior or action. A third assumption is that MT  
133 should be viewed as a continuous concept whereby individuals may be more or less mentally  
134 tough, rather than mentally tough or not, or as comprising different profiles of MT (e.g., high  
135 in self-efficacy and optimism but low in perseverance); that is, individuals will typically  
136 score similarly on each of the key dimensions (cf. Gucciardi & Jones, 2012). This view of  
137 MT is also consistent with resource-based perspectives of human adaptation, coping and  
138 well-being (Hobfoll, 1989) in which it is said that having higher levels of one personal  
139 resource such as self-efficacy is typically associated with higher levels of other resources  
140 such as optimism, resilience, and hope (Stajkovic, 2006). Finally, aligned with leading

141 theories of stress (Hobfoll, 1989, 2002; Lazarus & Folkman, 1984), the key MT facets pertain  
142 to everyday hassles (e.g., mundane pressures such as balancing work or study with other  
143 aspects of one's life, maintaining quality relationships with others) as well as major life  
144 events that pose a significant threat to one's normal level of performance or goal attainment  
145 consistency (e.g., failed a course, major illness, death of a loved one). Therefore, we propose  
146 that MT is fundamentally important for striving (e.g., working towards self-defined goals or  
147 objectives), surviving (e.g., dealing with challenges, demands, or adversities), and thriving  
148 (e.g., sustaining high levels of performance, experiencing vitality and learning or  
149 performance gains).

### 150 **Dimensionality of Mental Toughness**

151 Whereas a definition of a concept ought to be described in relatively general terms,  
152 the nature and number of dimensions should be encapsulated by a corresponding model  
153 (Bacharach, 1989). We adopted two primary criteria to determine whether a variable was  
154 included in a model of MT: (i) a personal resource or aspect of the self that is positively  
155 linked with subjective or objective performance across at least two different stressful  
156 achievement contexts (e.g., education, sport); and (ii) collectively, the personal resources  
157 encompassed cognitions, emotions, and behaviors. Indeed, scholars (e.g., Covington &  
158 Omelich, 1988; Raymond, 2009) have highlighted the importance of considering the dynamic  
159 interaction among cognitive, emotional, and motivational domains when conceptualizing  
160 processes related to achievement dynamics. We identified seven core personal resources from  
161 an extensive review of the existing MT literature and our unpublished interviews with non-  
162 sport performers that have the strongest empirical support in terms of their link with  
163 performance and goal attainment or progress. The majority of these facets resemble existing  
164 concepts (e.g., hope, emotion regulation, optimism, self-efficacy) that are generally supported  
165 by well-established theories, frameworks or models (see Table 2).

166 Our research will also test a key feature of MT conceptualization that has yet to be  
167 directly examined; specifically, is MT best conceptualized as a unidimensional or  
168 multidimensional concept? When considered alongside previous work on MT (e.g., Clough et  
169 al., 2002; Jones et al., 2002), our guiding theoretical framework (Hobfoll, 1989, 2002), and  
170 related research (e.g., Luthans, Avolio, Avey, & Norman, 2007) and theory (Stajkovic,  
171 2006), the various dimensions we have identified from our literature review and unpublished  
172 interviews with non-sport performers support a multidimensional perspective. However, it is  
173 important to recognize that much of the early work on MT adopted an exploratory, qualitative  
174 approach with sport performers and therefore limits the extent to which these findings  
175 generalize across samples and achievement contexts. Although exceptions do exist, equivocal  
176 findings have been revealed when a multidimensional conceptualization of MT has been  
177 psychometrically examined across diverse samples (cf. Gucciardi et al., 2012; Perry, Clough,  
178 Crust, Earle, & Nicholls, 2013). Perhaps most important for MT concept development, the  
179 notion of a multidimensional conceptualization appears to have been accepted by scholars  
180 with little research conducted to directly test this assumption against a unidimensional model.

181 *Hypothesis 1: MT is best conceptualized as a multidimensional concept when compared with*  
182 *a unidimensional representation*

### 183 **Stress, Coping and Adversity**

184 Resources including objects, conditions and personal characteristics play a central  
185 role in most models of the stress process. Within the context of a transactional perspective  
186 (Lazarus & Folkman, 1984), for example, stress is said to occur when individuals perceive  
187 events or situations in their environment to be taxing or exceeding their resources. Similarly,  
188 the interaction between demands and resources is a core assumption of the Jobs Demands-  
189 Resources model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), such that stress or  
190 burnout develops when demands are high and resources are low. A central tenet of the



191 conservation of resources theory is the notion that people strive to obtain, preserve, and  
192 protect resources (Hobfoll, 1989, 2002). In clarifying its conceptualization, therefore, we  
193 propose that MT could be a useful organizing framework or “resource caravan” (Hobfoll,  
194 2002) for those core *personal* resources central to the coping process in which individuals  
195 managed the internal and external stressors of the person-environment relationship (Lazarus  
196 & Folkman, 1984).

197 Resources are also an integral feature of resilience models (e.g., Masten, 2011;  
198 Windle, 2012) that deal with significant adversities including discrete experiences (e.g.,  
199 parental psychopathology, community violence), cumulative indices (e.g., tallies of life  
200 adversities over time), and acute trauma and chronic life difficulties (e.g., sexual abuse,  
201 neighborhood disorganization) (Obradović, Schaffer, & Masten, 2012). Although there  
202 remains considerable debate regarding a formal definition, common themes among most  
203 contemporary conceptualizations reveal that resilience encapsulates a *dynamic process*  
204 whereby one regains or sustains relatively stable, healthy levels of psychological and physical  
205 functioning, or experiences positive adaptation following exposure to significant adversity  
206 (Masten, 2011; Windle, 2011). Individual (e.g., psychological resources, biological factors),  
207 community (e.g., social support) and societal (e.g., health and social services) protective  
208 factors are central to this process of recovering from or adjusting to adversity (Masten, 2011;  
209 Windle, 2012). Thus, conceptualized as a collection of core personal resources, MT can be  
210 conceived as an important individual protective factor within the resilience process but  
211 should not be conceptually equated with this phenomenon.

212 Also central to this process perspective of resilience is that it “is not necessarily about  
213 superior functioning or flourishing, it is about doing okay, or better than could be expected,  
214 given the individual circumstances” (Windle, 2012, p. 159). In other words, resilience is best  
215 conceptualized as the process by which one bounces back or recovers from such major

216 assaults, which is consistent with the original and basic meaning of the word<sup>2</sup> (i.e., “spring  
217 back into shape” and “recover or adjust”). This “bounce back” conceptualization of resilience  
218 facilitates an important conceptual distinction between returning to normal levels of  
219 functioning (i.e., resilience) and moving towards a superior level of functioning or thriving  
220 following an adversity (Carver, 1998). Thriving is defined as “the psychological state in  
221 which individuals experience both a sense of vitality and a sense of learning” (Spreitzer,  
222 Sutcliffe, Dutton, Grant, & Sonenshein, 2005, p. 538). As an internal marker of individual  
223 growth and upward trajectory, thriving is considered state-like and malleable, and is therefore  
224 contingent upon the situation or task (Spreitzer & Porath, in press). With its focus on active,  
225 intentional engagement in the process of attaining and sustaining high levels of performance  
226 and/or goal attainment, MT should also play an important role in thriving.

227 *Hypothesis 2: MT is inversely related with perceived stress, and positively associated with*  
228 *performance, goal attainment, and thriving*

### 229 **On the Traitness of Mental Toughness**

230 An unresolved yet substantively important issue is whether MT is best conceptualized  
231 as a dispositional, trait-like or situational, state-like construct. It has been argued that “most  
232 psychological constructs vary along a continuum of stability or what [is referred to] as  
233 *traitness*” (Kenny & Zautra, 2001, p. 243). Some scholars (e.g., Clough et al., 2002; Hardy et  
234 al., in press) have proposed that MT represents a relatively stable dispositional trait, although  
235 some authors (e.g., Harmison, 2011) have argued for a state-like conceptualization. Despite  
236 these conflicting viewpoints, little empirical research has been conducted to directly examine  
237 this key feature of MT for concept development. Initial work in this area that gathered key  
238 stakeholders’ retrospective viewpoints provided indirect support for a state-like  
239 conceptualization; in other words, MT appears to be open to development and can both vary

---

<sup>2</sup> We consulted both the Merriam-Webster and Oxford English online dictionaries.

240 and have enduring properties across situations or time (e.g., Coulter et al., 2010; Jones et al.,  
241 2002). Subsequent research supported these claims by showing that MT could be enhanced  
242 among a sample of adolescent footballers via a psychological skills training intervention  
243 (Gucciardi, Gordon, & Dimmock, 2009b). Contrary to these initial reports, however,  
244 researchers have revealed an almost perfect test-retest relationship of informant-rated  
245 mentally behavior over three weeks ( $r = .96$ ) among a sample of 59 tertiary sport science  
246 students (Hardy et al., in press).

247 The equivocal nature of the available research means that uncertainty remains with  
248 regard to the traitness of MT. In particular, methodological features of this research limit our  
249 confidence in the findings. For example, the small sample sizes and focus on sport  
250 participants limited the extent to which these findings generalize to larger or more diverse  
251 populations. With regard to the temporality of these designs, retrospectively recalling mental  
252 processes may not be entirely accurate (Stone et al., 1998) and encompassing only two points  
253 across short time frames such as three weeks does little to capture the stability and dynamic  
254 nature of key concepts and their interrelationships (Chan, 1998). Also lacking in this previous  
255 research is guidance from established theory in terms of the rationale for expectations  
256 regarding the dispositional nature of psychological constructs. In this regard, Coulter, Mallett,  
257 Singer, and Gucciardi (2013) offered an alternative and broader view of mental toughness  
258 within the theoretical confines of contemporary personality psychology. They argued that  
259 mental toughness may be more appropriately understood across and within the multiple  
260 layers of personality as guided by an integrative personality framework (McAdams & Pals,  
261 2006). McAdams and Pals (2006) conceptualized personality as encompassing key individual  
262 difference variables situated across diverse layers of understanding, including dispositional  
263 traits (broad dimensions that evidence consistency across situations and over time),  
264 characteristic adaptations (contextualized expressions of traits which are activated by

265 contextual or social factors), and life narratives (internalized and evolving psychosocial  
266 construction of one's identity). As we have conceptualized MT as a caravan of personal  
267 resources pertinent to the coping process, we expected there to be some variation and stability  
268 in this concept across situations and time as individuals assess whether or not the  
269 characteristics of the event or situation exceeds their personal resources (Hobfoll, 1989, 2002;  
270 see also, Harmison, 2011).

271 *Hypothesis 3: The variance in MT will be accounted for by both within- (i.e., state-like) and*  
272 *between-person (i.e., trait-like) differences*

### 273 **Overview of the Present Research**

274 In light of the varied multidimensional conceptualizations and accompanying  
275 fragmented literature base, together with the largely myopic research focus on sport, we  
276 began our research by investigating the content universe (Study 1) and factor structure of MT  
277 across three achievement contexts (Study 2). Our focus was on sport, educational, and  
278 workplace contexts because they each cover a variety of different stressors and adversities  
279 that individuals must successfully negotiate to perform well. For example, in educational  
280 contexts, one's performances only affect oneself, whereas in sport and business one's  
281 performances affect oneself and one's team (e.g., teammates, peers, supervisors). We then  
282 tested central features of our conceptualization of MT including its role in the stress-  
283 performance relationship (Study 3); predictive validity in terms of goal progress, thriving and  
284 psychological health over a 10-week period, as well as its traitness (Study 4); and its  
285 predictive and incremental validity for selection testing in the military context (Study 5). We  
286 obtained approval from an institutional human ethics committee for each of the studies prior  
287 to data collection. In all studies, all participants were assured of confidentiality and  
288 anonymity in responses, and informed of the voluntary nature of their participation and their  
289 right to withdraw participation at any time before or after obtaining their consent.

## 290 **Study 1 – Item Generation**

291 We first created a pool of items that were designed to reflect the key dimensions of  
292 MT detailed in Table 2 but also hold meaning for our target populations (e.g., “I am  
293 determined to reach my full potential” and “I interpret adversity as a positive challenge”).  
294 Items were designed so that they could be adapted across achievement contexts such as sport,  
295 education, military and work. Before piloting a questionnaire with the target populations, it is  
296 important to obtain experts’ assessments of the conceptual model and item content to ensure  
297 that one is sampling all content that is potentially relevant to the construct of interest  
298 (DeVellis, 2003). It also important to capture the views of the “end users” by piloting new  
299 surveys with a representative sample of the target populations (Vogt, King, & King, 2004).  
300 Thus, the aims of Study 1 were to (a) examine experts’ views and opinions on the quality of  
301 our conceptual model of MT, and (b) to create and provide evidence for the face and content  
302 validity of a pool of items designed to capture this conceptualization.

## 303 **Method**

### 304 **Participants**

305 A total sample of 30 academic experts and representatives of the target populations  
306 participated in this study. We purposefully sampled nine researchers (3 females) with  
307 expertise in the psychology of performance and scale development from higher education  
308 institutions on four continents (i.e., Australia, New Zealand, United Kingdom, USA) via  
309 email invitation. Representatives of the target population were conveniently sampled from an  
310 Australian institution and via the authors’ personal networks: nine tertiary students (3  
311 females), six athletes (2 females), three coaches (all male), and four businesspeople (2  
312 females). All academics, athletes, coaches, and businesspeople were experienced in their  
313 achievement context (i.e., experience >10 years); tertiary students were nearing the end of a

314 Masters Coursework degree in applied psychology ( $n = 5$ ) or in their first year of an  
315 undergraduate course in psychology ( $n = 4$ ).

### 316 **Procedures**

317 Focus groups were conducted with representatives of each achievement context (i.e.,  
318 tertiary education, sport, business). Participants were provided with descriptions of the key  
319 dimensions and items designed to measure each characteristic and asked to identify whether  
320 the item corresponds to the dimension on which it is hypothesized to correspond to, as well as  
321 detail any issues with the item (e.g., length, readability). Subsequently, academic experts  
322 were invited by email to provide feedback using an online questionnaire developed for this  
323 study. Experts were asked to rate (i.e., 5 point Likert scale: 1 = *poor*, 3 = *good*, 5 = *excellent*)  
324 and comment (i.e., open-ended responses) on the breadth of the key dimensions and the  
325 definitions for each of the subscales, as well as rate the adequacy of each of the items for  
326 capturing its hypothesized component of MT (i.e., 5 point Likert scale: 1 = *poor match*, 3 =  
327 *good match*, 5 = *excellent match*).

### 328 **Results and Discussion**

329 We developed 70 items designed to assess the key dimensions of our  
330 conceptualization of MT (see Table 2) and obtained stakeholder's perspectives on the  
331 adequacy of these items and our conceptual model. Representatives of the target populations  
332 deemed all but seven items as corresponding to the MT facet it was intended to assess and  
333 were therefore eliminated. Of the remaining 63 items, nine were reworded to improve their  
334 clarity and applicability across different achievement contexts. The academic experts  
335 believed that our conceptual model was very good both in terms of breadth of the key  
336 dimensions ( $M = 4.33$ ) and quality of characteristic descriptions ( $M = 4.22$ ). The item pool ( $n$   
337 = 63) was also rated by our academic experts and subsequently used to calculate a Content  
338 Validity Index (CVI; Lynn, 1986) for each item; that is, the number of experts who gave a

339 rating of 3 or above divided by 9 (i.e., the total number of experts). We used the CVI (i.e.,  
340  $>.80$  deemed acceptable; Lynn, 1986) and open-ended responses to inform final decisions  
341 about whether to retain, eliminate, or revise an item. Two items with a CVI of  $.78$  ( $7/9$ ) were  
342 deemed unacceptable and therefore removed from the item pool. Although the remainder of  
343 the item pool evidenced adequate CVIs, the wordings of 14 items were modified slightly to  
344 improve clarity and reduce overlap with other key dimensions. This process led to 61 items  
345 being retained for inclusion in the initial survey.

### 346 **Study 2 – Dimensionality of Mental Toughness**

347 We administered the preliminary pool of items to participants from our target  
348 populations, namely students, athletes, and employees. The initial item pool developed in  
349 Study 1 was over-inclusive so we focused on refining these items down to a final, shorter  
350 version by selecting the best items according to the obtained statistical or psychometric  
351 properties of the items (Marsh, Hau, Balla, & Grayson, 1998) alongside conceptual criteria  
352 (i.e., content validity). Within-network evidence (e.g., factorial validity, reliability) represents  
353 “a logical prerequisite” (Marsh, 1997, p. 28) for instruments prior to examining more  
354 substantive issues such as locating the construct in a broader conceptual space. Consistent  
355 with our first hypothesis, we expected a multidimensional model encompassing seven first-  
356 order factors (see Table 2) and one second-order factor of MT to gain support.

### 357 **Method**

#### 358 **Participants**

359 Convenience samples from education, sport, and workplace contexts in Australia were  
360 recruited to participate.

361 **Calibration sample.** A total of 418 performers participated: 136 athletes (57 males,  
362 76 females;  $M_{\text{age}} = 27.21$ ,  $SD_{\text{age}} = 10.36$ ), 137 students (58 males, 78 females;  $M_{\text{age}} = 19.99$ ,

363  $SD_{age} = 3.81$ ), and 145 “white collar” workers (80 males, 64 females;  $M_{age} = 48.04$ ,  $SD_{age} =$   
364 10.14). Some participants chose not to report their age or gender.

365 **Cross-validation samples.** Three independent samples were recruited: 500 students  
366 (176 males, 323 females;  $M_{age} = 20.43$ ,  $SD_{age} = 4.70$ ), 427 athletes (167 males, 269 females;  
367  $M_{age} = 27.21$ ,  $SD_{age} = 10.34$ ), and 550 “white collar” workers (304 males, 243 females;  $M_{age} =$   
368 48.14,  $SD_{age} = 10.27$ ). Age and gender were not voluntarily reported by some participants.

### 369 **Measure and Procedures**

370 Tertiary students were recruited from a large Australian university and included  
371 individuals enrolled in undergraduate courses in psychology, sport science, and commerce;  
372 psychology and sport science students received course credit as part of an established  
373 research participation scheme, whereas commerce students received a lecture on the topic  
374 including an overview of their findings. Athletes were recruited via national sporting  
375 organizations, which included a variety of team (e.g., netball, waterpolo, Australian football)  
376 and individual sports (e.g., triathlon, swimming, golf) across all levels of competition,  
377 including amateur, semi-professional and professional competitions. The lead author obtained  
378 gatekeeper approval before invitations were distributed by key personnel (e.g., Manager of  
379 Science and Medicine, CEO) to athletes. Employees in full-time employment were recruited  
380 via the Australian Institute of Management, a not for profit entity designed to promote the  
381 advancement of education and learning in the fields of management and leadership for  
382 commerce, industry and government. An email invitation was sent to members by the CEO  
383 on behalf of the research.

384 Informed consent and survey questions were completed online using a secure data  
385 collection site. The survey contained the 61 items developed in Study 1 to capture the  
386 hypothesized components of MT. Participants were instructed to indicate how true each  
387 statement was an indication of how they typically think, feel, and behave as a performer in



388 their context (e.g., as an athlete). We adopted a 7-point Likert scale (1 = *false, 100% of the*  
389 *time to 7 = true, 100% of the time*) for the MT items, as this response format has been shown  
390 to optimize reliability, validity, discriminating power, and respondent preferences (Preston &  
391 Colman, 2000). Participants were recruited from a large tertiary institution, via national  
392 sporting organizations, and organizations in the services sector (e.g., education, health care).

### 393 **Data Analysis**

394 **Preliminary analyses.** The data were first examined for missing values, violations  
395 against assumptions of univariate normality, and both univariate (i.e.,  $z$  score  $> \pm 3.29$ ) and  
396 multivariate outliers (i.e., using a  $p < .001$  criterion for Mahalanobis  $D^2$ ) in IBM SPSS 20.  
397 With regard to normality, skewness and kurtosis values that exceed 2 and 7, respectively,  
398 indicate a non-normal distribution at the univariate level which can affect goodness of fit  
399 statistics (Tabachnick & Fidell, 2007).

400 **Primary analyses.** The factorial validity of the hypothesized MT model was tested  
401 with confirmatory factor analysis (CFA) in Mplus 7 (Muthén & Muthén, 2012) using a robust  
402 maximum likelihood estimator (MLR). The  $\chi^2$  goodness-of-fit statistic, comparative fit index  
403 (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root  
404 mean square error of approximation (RMSEA) were used to evaluate the fit of the models.  
405 Browne and Cudeck's (1992) guidelines were adopted as indicators of good fit (CFI, and TLI  
406  $\geq .90$ , and SRMR and RMSEA scores  $\leq .08$ ).

407 In keeping with the three-stage strategy advocated by Jöreskog (1993) and employed  
408 by others (e.g., Lonsdale, Hodge, & Rose, 2008), we initially examined one-factor congeneric  
409 models whereby CFA is performed on individual subscales using the calibration sample. We  
410 next performed a series of two-factor CFAs in which each dimension was paired with each of  
411 the other subscales. In the third and final stage, we tested the model in its entirety. Items were  
412 considered for deletion if modification indices suggested that the error term of an item

413 correlated with that of another item, an item had a low factor loading ( $<.50$ ), or modification  
414 indices suggested that an item cross-loaded on an unintended latent variable (Ford,  
415 MacCallum, & Tait, 1986). Conceptual issues (e.g., construct breadth) were also considered  
416 alongside these statistical criteria. The resulting model was subsequently tested on the cross-  
417 validation samples.

418 In all analyses, the discriminant validity of the latent factors was assessed by  
419 examining the 95% confidence intervals of the interfactor correlations. Discriminant validity  
420 is supported when the 95% confidence interval of the interfactor correlations does not  
421 encompass  $\pm 1.0$  (Anderson & Gerbing, 1988). With regard to convergent validity, we  
422 examined standardized solutions to evaluate the significance and strength of parameter  
423 estimates. Standardized factor loadings are interpreted using Comrey and Lee's (1992)  
424 recommendations (i.e.,  $>.71$  = excellent;  $>.63$  = very good;  $>.55$  = good;  $>.45$  = fair;  $<.32$   
425 = poor). Finally, a composite reliability coefficient ( $\rho$ ; Raykov, 1997) was calculated within a  
426 structural equation modeling framework to estimate the level of internal reliability for each  
427 factor (i.e., acceptable levels of reliability  $>.70$ ; Nunnally & Bernstein, 1994).

## 428 **Results and Discussion**

### 429 **Preliminary Analyses**

430 The data were examined for missing values prior to the main analyses. When less than  
431 5% of data points are randomly missing, almost any procedure for handling missing values  
432 yields similar results (Tabachnick & Fidell, 2007). Missing data (1.2% on all data points) did  
433 not relate to any of the demographic variables and were handled in IBM SPSS 20 using the  
434 expectation-maximization method. Data screening procedures did not reveal any univariate or  
435 multivariate outliers. However, item-level analyses revealed that some items were negatively  
436 skewed. Thus, we employed a robust maximum likelihood estimator (MLR) in all subsequent  
437 modeling, which produces standard errors and tests of fit that are robust in relation to non-

438 normality of observations and the use of categorical variables when there are at least four or  
439 more response categories (Beauducel & Herzberg, 2006).

#### 440 **Primary Analyses**

441 In stage one, the series of single subscale CFA resulted in the deletion of 19 items  
442 according to both empirical (e.g., low factor loadings, high cross-loadings) and conceptual  
443 (e.g., items with similar meanings) considerations. Each of the one-factor congeneric models  
444 displayed excellent fit with the data according to our multiple criteria. In stage two, an  
445 additional 21 items were deleted based on the results of a series of CFAs involving two latent  
446 factors. Finally, as detailed in Table 3, the resultant 21-item, seven-factor model evidenced  
447 good fit with the data in all samples as both a lower-order (i.e., correlated latent factors) and  
448 higher-order model. Composite reliabilities ( $\rho$ ) of the seven latent factors were adequate in  
449 the calibration ( $\rho = .74$  to  $.89$ ), athlete ( $\rho = .75$  to  $.90$ ), tertiary student ( $\rho = .71$  to  $.84$ ), and  
450 workplace samples ( $\rho = .70$  to  $.86$ ). An inspection of Table 4 reveals that we achieved good  
451 (i.e.,  $> .55$ ) factor loadings for each item, with the average loadings of all 21 items considered  
452 excellent (i.e.,  $> .71$ ) across all four samples. Despite the encouraging findings of the  
453 multidimensional models regarding fit indices, internal reliability, and factor loadings, there  
454 were several instances of inadmissible solutions resulting from a “not positive definite”  
455 covariance matrix. A non-positive definite matrix may be due to small sample size (e.g.,  $<$   
456  $300$ ), model over fitting, empirical under-identification, or model misidentification (Wothke,  
457 1993). Model misidentification appeared to be the most plausible explanation for the  
458 nonpositive definite matrix in our case<sup>3</sup>. Additionally, an inspection of the 95% confidence  
459 intervals of the latent factor correlations and higher-order coefficients revealed that several  
460 relationships encompassed 1 thereby suggesting a lack of discriminant validity.

---

<sup>3</sup> We subjected both the lower-order and higher-order seven factor models to a CFA with a combined sample involving the athletes, students, and employees ( $N=1492$ ). In both instances, the latent covariance matrix was not positive definite thereby highlighting the inadequacy of these models.

461 Our approach to establishing initial reliability and validity evidence for our  
462 hypothesized higher-order, multidimensional model (i.e., seven lower-order factors) of MT  
463 was unsuccessful. Although each of the lower-level facets are backed by an extensive history  
464 of research and theory (see Table 2), and were supported in our three samples using one-  
465 factor congeneric models, our findings suggested that they do not necessarily sum to a  
466 coherent whole. The large correlations observed across three independent samples suggested  
467 considerable empirical redundancy between the key dimensions of MT, despite the  
468 conceptual distinctions proposed by scholars (e.g., Luthans, Avolio et al., 2007; Stajkovic,  
469 2006). High correlations have also been observed elsewhere when self-efficacy, optimism,  
470 hope, and resilience have been examined as a resource caravan (e.g., Caza, Bagozzi,  
471 Woolley, Levy, & Caza, 2010; Luthans, Norman, Avolio, & Avey, 2008).

472 The majority of previous research which has sought to conceptualize MT has adopted  
473 a qualitative approach in which a small number of key stakeholders' (e.g., athletes, coaches)  
474 have retrospectively recalled their experiences to generate an understanding of this concept  
475 (for reviews, see Gucciardi & Gordon, 2011). Thus, it was considered important that these  
476 initial findings were tested on large samples across multiple achievement contexts. Contrary  
477 to expectations regarding a multidimensional conceptualization of MT (cf. Clough et al.,  
478 2002; Coulter et al., 2010; Jones et al., 2002), the findings of this study indicated that the  
479 (often subtle) conceptual distinctions among these key personal resources made by scholars  
480 are not readily made by individuals from diverse achievement contexts thereby suggesting  
481 that a unidimensional model may be more appropriate than a multidimensional  
482 representation.

483 Substantively, when conceptualized as a higher-order concept, MT must be inferred  
484 on the basis of factor analyses of scales that capture the key dimensions. This indirect  
485 approach to conceptualizing higher-order concepts can lead to confusion over whether the

486 multifaceted concept is a latent or aggregate construct (Carver, 1989). Thus, we subsequently  
487 examined the utility of a direct approach for measuring the underlying concept itself rather  
488 than the key dimensions of MT. A direct approach is also consistent with the emerging trend  
489 toward short measures of psychological concepts (e.g., Schulenberg, Schnetzer, & Buchanan,  
490 2011; West, Dyrbye, Satele, Sloan, & Shanafelt, 2012). Items were selected from the 21  
491 items displayed in Table 4 according to a combination of empirical (e.g., size of standardized  
492 loading, minimal cross-loadings) and conceptual (e.g., ratings from expert judges in Study 1,  
493 adequately captured the content domain of each facet) criteria. One item for each facet was  
494 retained, as well as an item to measure one's capacity to deal with adversity so as to capture  
495 both everyday challenges and major distresses. The 8-item unidimensional model evidenced  
496 excellent fit (see Table 3) and good-to-excellent factor loadings (see Table 5) across all four  
497 samples. Composite reliabilities for the unidimensional measure of MT were excellent ( $\rho =$   
498 .86 to .89).

499 **Conclusion.** Aligned with our first research hypothesis, our failure to support the  
500 discriminant validity of the hypothesized key dimensions of MT in the multidimensional  
501 model is at odds with our expectation and raised the question as to whether this concept is  
502 unidimensional rather than multidimensional as previously espoused by several scholars (e.g.,  
503 Clough et al., 2002; Coulter et al., 2010; Jones et al., 2002). Subsequent analyses indicated  
504 that the 8-item, direct assessment of unidimensional MT fit the data very well, displayed  
505 strong factor loadings, and produced an internally reliable score across three independent  
506 samples of performers. The brevity of the direct approach may offer practical appeal not only  
507 in academic but also field settings. Despite these encouraging findings, this study was limited  
508 to an examination of the within-network properties of mental toughness. Thus, it is important  
509 to ascertain whether MT functions in a theoretically expected way with regard to key features

510 of our working definition, namely perceived stress, performance, goal attainment, and  
511 thriving.

### 512 **Study 3 – Mental Toughness, Stress and Performance in the Workplace**

513 An inverse relationship between stress and performance has been evidenced across  
514 variety of achievement contexts, including the workplace (Gilboa, Shirom, Fried, & Cooper,  
515 2008) and educational settings (Richardson, Abraham, & Bond, 2012). Drawing from the  
516 transactional theory of stress (Lazarus & Folkman, 1984), a situation is appraised as stressful  
517 when an individual concludes that demands imposed by or perceived within a given context  
518 exceeds his or her available coping resources. Conceptualized as a personal capacity or  
519 resource, MT should play a role in determining the extent to which individuals perceive  
520 transactional experiences and their lives in general to be “unpredictable, uncontrollable, and  
521 overloaded” (Cohen, Kamarck, & Mermelstein, 1983, p. 385). Substantively, therefore, we  
522 proposed that the perceived stress concept should help explain the relationship between MT  
523 and performance. In other words, MT is postulated to exert some of its influence on  
524 performance through the distress and coping dimensions (i.e., mediation or indirect effect).

## 525 **Method**

### 526 **Participants and Procedure**

527 An email invitation containing the study information was distributed to personal  
528 contacts of the research team, who subsequently disseminated the study information to their  
529 colleagues; this snowball approach resulted in a convenience sample of 497 employees (275  
530 male and 219 female, 3 did not report gender;  $M_{\text{age}} = 47.98$ ,  $SD = 9.95$ ). Employees were  
531 “white collar” workers in full-time employment drawn from different organizations and  
532 diverse ranks of the Australian services sector such as education, health care and finance.  
533 Informed consent and survey questions were completed online using a secure data collection  
534 site.

## 535 Measures

536 **MT.** The 8-item MTI developed in Study 2 was employed to measure MT, and was  
537 found to be internally reliable in the current sample ( $\rho = .86$ ).

538 **Perceived stress.** The 10-item Perceived Stress Scale (Cohen et al., 1983) was used to  
539 assess an individual's subjective appraisal of global stress during the last month (e.g., "felt  
540 nervous and stressed" and "found that you could not cope with all the things that you had to  
541 do"). Items were rated on a scale from 0 (*never*) to 4 (*very often*). A correlated two-factor  
542 model of perceived stress involving distress (6 items) and coping (3 items) dimensions was  
543 employed because this factor structure has received support across diverse samples (e.g.,  
544 Lavoie & Douglas, 2012). The distress ( $\rho = .87$ ) was found to be internally reliable in the  
545 current sample; however, coping ( $\rho = .65$ ) was just below the minimum recommend level of  
546  $.70$  (Nunnally & Bernstein, 1994).

547 **Performance.** Each participant's workplace performance over the last month was  
548 assessed by his or her supervisor using a 7-item measure (e.g., "Adequately completes  
549 assigned duties" and "Fulfills responsibilities specific in job description") of in-role  
550 behaviors (Williams & Anderson, 1991). An informant-rated approach is consistent with  
551 recent research on mentally tough behaviors (Hardy et al., in press). Items were rated on a  
552 scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Performance was found to be  
553 internally reliable in the current sample ( $\rho = .86$ ).

## 554 Results and Discussion

555 We estimated and tested the significance of the indirect effect of MT on informant-  
556 rated performance via perceived stress using the bootstrapping technique and 5000 resamples  
557 (Preacher & Hayes, 2008). This method does not assume normality of the distribution of  
558 indirect effects and uses a resampling procedure to create confidence intervals for the indirect  
559 effect (Hayes, 2009). Bootstrapping allows for the examination of the total, direct and

560 indirect effects of the dependent variable on the independent variable. A significant  
561 mediation or indirect effect is observed when the 95% confidence interval (CI) that is  
562 obtained from the analysis does not include zero. These analyses were conducted within a  
563 structural equation modeling framework using Mplus 7 (Muthén & Muthén, 2012).  
564 The fit statistics for the meditational model indicated acceptable fit with the data,  
565  $\chi^2(246) = 618.06, p < .001, CFI = .923, TLI = .914, SRMR = .045, RMSEA = .055$  (90% CI =  
566 .050 to .061). Direct path coefficients from MT to distress ( $\beta = -.52, B = -.63, p < .001$ ),  
567 coping ( $\beta = .51, B = .44, p < .001$ ), and performance ( $\beta = .34, B = .41, p < .001$ ) were  
568 significant. Performance evidenced direct relationships with coping ( $\beta = .31, B = .44, p$   
569  $< .001$ ) and distress ( $\beta = -.15, B = -.15, p < .05$ ). The total indirect effect from MT to  
570 performance via distress and coping was significant (standardized indirect effect estimate =  
571 .24,  $p < .001, 95\% CI [.17, .31]$ ). The specific indirect effects of MT to performance via  
572 distress (standardized indirect effect estimate = .08,  $p < .05, 95\% CI [.01, .15]$ ) and coping  
573 (standardized indirect effect estimate = .16,  $p < .001, 95\% CI [.08, .24]$ ) were significant,  
574 thereby supporting our expectation that MT would exert some of its influence on  
575 performance through the distress and coping dimensions. MT, distress, and coping explained  
576 45% of the variance in performance, whereas MT explained 27% and 26% of the variance in  
577 distress and coping, respectively.

578 Consistent with our second research hypothesis, three key features of our  
579 conceptualization of MT received support in this study. First, MT has been commonly  
580 associated with high performance yet little evidence was offered to support this conclusion.  
581 As self-reported MT was directly associated with higher levels of supervisor-rated  
582 performance, the results of this study are among the first to provide some support for this  
583 theoretical proposition. Second, the findings provided initial validity evidence to support an  
584 inverse relationship between distress, and a positive association with coping dimensions of



585 perceived stress. Third, the findings offer preliminary insight into the mechanisms by which  
586 MT has an effect on performance in the workplace. Employees with higher levels of MT are  
587 less distressed and better able to cope with the demands or challenges in their life, which in  
588 turn are associated with higher levels of performance. Consistent with our conceptualization,  
589 MT appears to play a role in influencing one's perception of whether his or her personal  
590 resources are sufficient to cope with the person-environment interactions and therefore the  
591 extent to which an individual appraises challenges or demands as stressful (cf. Lazarus &  
592 Folkman, 1984).

#### 593 **Study 4 – Mental Toughness and Key Outcomes in Education**

594 In this study, we sought to replicate and extend upon the results of Study 3 in several  
595 ways. First, we extended our focus to an educational context in which achievement is also a  
596 central feature. Second, consistent with our guiding definition and conceptualization,  
597 perceptions of goal progress and thriving (Spreitzer et al., 2005) were examined as  
598 hypothesized outcomes of MT. Third, owing to the prevalence of mental health issues among  
599 young people aged 16 to 34 years of age (e.g., approximately 25% in Australia; ABS, 2008),  
600 we also explored psychological health as a potential outcome of MT. Psychological health  
601 was conceptualized as consisting of the presence of positive symptoms (i.e., positive  
602 emotions) and the absence of negative symptoms (i.e., negative emotional states including  
603 depression, anxiety) (Keyes, 2003). Finally, we conducted a repeated measures design to  
604 explore prospective relationships among the study variables over the course of a university  
605 semester. Aligned with our third research hypothesis, obtaining repeated measurements of the  
606 same individual over time enables one to simultaneously model within-person (i.e., state) and  
607 between-person (i.e., trait) variability in study variables (Roesch et al., 2010) thereby  
608 permitting an examination of the traitness of MT. Such an approach enables an exploration of

609 an individual's current MT relative to their usual level (i.e., within-person variability), as well  
610 as relative to other people's MT (i.e., between-person variability).

611 Two research hypotheses underpinned this study. First, guided by our concept  
612 definition and theoretical model, we expected MT to be positively associated with goal  
613 progress, thriving, and our positive indicator (i.e., positive emotions) of psychological health,  
614 as well as inversely related with our negative indicator of psychological health (i.e., negative  
615 emotional states). Second, guided by both theory (Hobfoll, 1989, 2002) and research (e.g.,  
616 Harmison, 2001; Kenny & Zautra, 2001), we hypothesized that the variance in MT would be  
617 accounted for by both within- (i.e., state-like) and between-person (i.e., trait-like) differences  
618 in MT.

619

## Method

### 620 Participants and Procedure

621 A total of 203 undergraduate sport science students from an Australian university (92  
622 male and 105 female: 6 participants did not specify gender;  $M_{\text{age}} = 20.69$ ,  $SD = 2.62$ )  
623 participated in return for course credit. The lead author provided an overview of the study to  
624 all students in the first lecture of the semester. Students completed an online survey  
625 containing all study variables listed below every week for ten weeks over the course of a  
626 university semester. A reminder email containing the web link was sent every Friday  
627 afternoon to enrolled students who agreed to participate in the study. Participants completed  
628 the survey within the next 24 hours. Of the 203 participants registered for the study, three  
629 participants completed four surveys; four participants completed five surveys; 12 participants  
630 completed six surveys; 16 participants completed seven surveys; 29 participants completed  
631 eight surveys; 53 participants completed nine surveys; and 86 participants completed 10  
632 surveys ( $M_{\text{cluster size}} = 8.79$ ).

### 633 Measures

634 The weekly diary survey package contained measures of MT, goal progress, thriving,  
635 and psychological health. Owing to the repeated administration of the survey package, all  
636 scales with the exception of MT were reduced to achieve an approximate completion time of  
637 5 minutes and therefore minimize study fatigue. Pilot data not reported here were collected  
638 from a larger sample of undergraduate students ( $N = 533$ ) from a variety of courses (e.g.,  
639 psychology, sport science, business) to guide empirical decisions for item selection (i.e.,  
640 highest standardized factor loading) alongside theoretical criteria (i.e., adequate  
641 representation of the intended construct). For each measure, participants were instructed to  
642 indicate how much the statements applied to them as a university student over the past week  
643 (including dates). The ordering of the scales within the survey package was altered each week  
644 to minimize order effects.

645 **MT.** We employed the 8-item MTI developed in Study 2.

646 **Thriving.** Six items from the Thriving Scale (Porath, Spreitzer, Gibson, & Garnett,  
647 2012) were employed to assess the cognitive (learning) and affective (vitality) components of  
648 thriving in the educational context. Sample items include “I continued to learn more and  
649 more as time went by” and “I had energy and spirit”. Items were rated on a scale from 1  
650 (*strongly disagree*) to 5 (*strongly agree*).

651 **Goal progress.** Participants listed an academic and social goal which they intended to  
652 pursue over the course of the University semester at the first data collection point. The  
653 instructions for nominating personal goals were taken directly from previous research  
654 (Koestner, Otis, Powers, Pelletier, & Gagnon, 2008) and read as follows: “Personal goals are  
655 projects and concerns that people think about, plan for, carry out, and sometimes (though not  
656 always) complete or succeed at. They may be more or less difficult to implement; require  
657 only a few or a complex sequence of steps; represent different areas of a person’s life; and be  
658 more or less time consuming, attractive, or urgent. Please list the most important University

659 or study-related goal that you have for this coming semester. Now do the same for your most  
660 important social goal” (p. 235). At each follow-up survey, participants rated how much  
661 progress they had made toward each goal using a scale from 1 (*none*) to 9 (*a great deal*).

662 **Psychological health.** As health and illness are not considered the exact opposites of  
663 a single continuum (Keyes, 2003), it was important to assess psychological health both in  
664 terms of the presence of positive symptoms (i.e., positive emotions) and the absence of  
665 negative symptoms (i.e., negative emotional states). Positive emotions were measured with  
666 four items used in previous research (Tamir, John, Srivastava, & Gross, 2007). Items were  
667 rated on a scale from 1 (*not at all*) to 5 (*all of the time*). Sample items include “Happy /  
668 Pleased / Contented” and “Proud / Accomplished / Successful”. Negative emotional states  
669 were measured with six items from the Depression, Anxiety and Stress Scales (Lovibond &  
670 Lovibond, 1995). Sample items include “I found myself getting agitated” and “I felt I had  
671 nothing to look forward to”. Items were rated on a scale from 0 (*did not apply to me at all*) to  
672 3 (*applied to me very much/most of the time*).

### 673 **Results and Discussion**

674 As the data represented a 2-level structure – observations (Level 1) nested within  
675 participants (Level 2) – multilevel structural equation modeling (MLSEM; Preacher, Zyphur,  
676 & Zhang, 2010) was employed to examine the study hypotheses. Multilevel models  
677 accommodate the hierarchical nature of data characterized by non-independence (i.e., two  
678 observations from the same person are likely to be more similar than two observations from  
679 different persons) by simultaneously estimating the variability at each level of the data  
680 hierarchy. With the exception of goal progress, all constructs were modeled as latent  
681 variables with items representing observed indicators. The intercepts or means of Level 1  
682 variables were allowed to vary across Level 2 units (i.e., people). All analyses were  
683 conducted within Mplus 7 (Muthén & Muthén, 2012) using the MLR estimator to

684 accommodate for missing data and unbalanced cluster sizes (i.e., number of observations for  
685 each person). Composite reliability estimates ( $\omega$ ) of the study variables were computed  
686 within a multilevel CFA framework (Geldhof, Preacher, & Zyphur, in press).

687 **Null model.** We first calculated the intraclass correlation (ICC) for each of the  
688 observed variables (i.e., item indicators for latent constructs, goal progress score) to examine  
689 the between-person variability in the study variables. The ICC can range from 0 to 1, with  
690 values close to zero (e.g., .05) suggesting that multilevel modeling may not be required  
691 (Dyer, Hanges, & Hall, 2005). At least 38% of the variance in the study variables was  
692 associated with between-person differences. With regard to MT, on average, 44% of the total  
693 variance is due to between-person differences (ICCs ranged from .38 to .50). The remaining  
694 56% of the variance is due to the within-person variability across the 10 weeks of the study  
695 period. These findings supported our expectation that a comparable amount of variance  
696 would be accounted for by both within- (i.e., state-like) and between-person (i.e., trait-like)  
697 differences in MT. Consistent with a person-situation interaction perspective of MT (e.g.,  
698 Harmison, 2011), these findings provide preliminary support for the idea that some  
699 individuals bring a dispositional aspect of MT to their interactions with the environment.

700 **Multilevel scale reliability.** Cronbach's alpha, which assumes a single-level structure  
701 in one's data, is typically reported to support scale reliability in research that encompasses  
702 multilevel data (Geldhof et al, in press). Drawing from recent guidelines (Geldhof et al., in  
703 press), we conducted separate multilevel CFAs to account for the clustered nature of our data  
704 and simultaneously assess scale reliability at both the within and between levels of analysis:  
705 MT ( $\omega_{\text{within}} = .80$ ;  $\omega_{\text{between}} = .98$ ), thriving ( $\omega_{\text{within}} = .78$ ;  $\omega_{\text{between}} = .96$ ), negative emotional  
706 states ( $\omega_{\text{within}} = .69$ ;  $\omega_{\text{between}} = .91$ ) and positive emotions ( $\omega_{\text{within}} = .80$ ;  $\omega_{\text{between}} = .94$ ).

707 **Multilevel structural model.** We analyzed a full structural model in which MT  
708 served as a predictor of psychological health, thriving, and goal progress. The fit statistics

709 indicated acceptable fit with the data,  $\chi^2(572) = 1772.37, p < .001, CFI = .925, TLI = .915,$   
710  $SRMR_{within} = .035, SRMR_{between} = .089, RMSEA = .034.$  An overview of the parameter  
711 estimates for the multilevel structural model is detailed in Table 6. All of the direct  
712 relationships between MT and the outcome variables were statistically significant and  
713 consistent with our expectations. MT emerged as a statistically significant predictor of  
714 negative emotional states ( $R^2_{within} = 10\%; R^2_{between} = 21\%$ ), positive emotions ( $R^2_{within} = 33\%;$   
715  $R^2_{between} = 75\%$ ), thriving ( $R^2_{within} = 41\%; R^2_{between} = 87\%$ ), and academic ( $R^2_{within} = 15\%;$   
716  $R^2_{between} = 53\%$ ) and social goal progress ( $R^2_{within} = 3\%; R^2_{between} = 45\%$ ) at both levels of  
717 analysis. The strength of the relationship between MT and the outcome variables were  
718 stronger at the between-person level when compared with the within-person level. These data  
719 also provided further evidence for our third hypothesis because the direct relationships  
720 between MT and all five outcome variables were significant at both levels of analysis.  
721 Specifically, MT appears to play an important role in understanding goal progress, thriving,  
722 and psychological health both in terms of variation within a person (e.g., over time) and  
723 between people.

#### 724 **Study 5 – Mental Toughness and Selection Testing in the Military**

725 In this study, we tested the predictive and incremental validity of MT for selection  
726 testing in a military context using a naturalistic design. Aligned with our guiding  
727 conceptualization of MT, selection testing of already enlisted military personnel was chosen  
728 as an appropriate setting in which to examine these aspects of validity because it is a highly  
729 stressful course that requires candidates to sustain high levels of performance over an  
730 extended period of time (i.e., 6 weeks) across multiple and varied assessment tasks. Thus, this  
731 study was designed to provide an insight into whether or not MT was important for  
732 *sustaining* high levels of performance despite stress or adversity. We considered it important  
733 to test our new unidimensional conceptualization of MT against the popular 4Cs

734 multidimensional model (i.e., control, commitment, challenge, confidence; Clough et al.,  
735 2002). In other words, what is the value of this new unidimensional conceptualization of MT  
736 above and beyond the existing multidimensional perspective of MT? Because the  
737 psychometric properties of the MTQ48, which is designed to capture the 4Cs model of MT,  
738 have been shown to be potentially problematic (Gucciardi et al., 2012), we employed  
739 established measures of the four key components of this hypothesized conceptualization of  
740 MT. We expected MT to predict success in the selection test, that is, contribute to whether  
741 one failed or passed the test, as well as retain its significance when control, commitment,  
742 challenge, efficacy were included as predictors of performance.

### 743 **Participants and Procedure**

744 A total of 115 male candidates aged 20 to 41 years ( $M_{\text{age}} = 27.16$ ,  $SD = 4.09$ ) with  
745 between one and 17 years of service ( $M_{\text{years}} = 6.50$ ,  $SD = 3.38$ ) in the Australian Defence  
746 Force participated in this study. These individuals voluntarily signed up to complete a six-  
747 week selection test for entry into the Special Forces unit. Participants completed a  
748 multisection survey containing all study variables listed below in the measures section prior  
749 to completing the selection test. Candidates completed the survey package on the first night  
750 of the course immediately following a briefing about the study by a research team member.  
751 To encourage honest responding, candidates were informed that the survey was for research  
752 purposes only and that their responses would be kept confidential and not influence their  
753 course outcome. No time limit was imposed on candidates for filling-in the survey, and return  
754 of completed surveys was taken as informed consent.

755 The selection test consisted of a six-week selection course specifically designed to  
756 assess each candidate's suitability for entry into elite military training (i.e., Special Forces).  
757 The selection course comprised a range of individual and team activities that were both  
758 physically and mentally demanding, while being relevant to the military context (e.g.,

759 navigating between waypoints, planning a mission, firing weapons, carrying heavy loads for  
760 extended periods after minimal sleep). Candidate performance was continuously monitored  
761 and assessed throughout the course by instructional staff. Candidates could be removed from  
762 the course at any stage for not meeting the required standards or due to medical reasons (e.g.,  
763 physical injury). Alternatively, candidates could elect to voluntarily withdraw from the  
764 course at any stage. Aligned with the highly stressful and challenging nature of the selection  
765 test, no feedback was given to candidates about their performance by instructional staff  
766 during the course. Each candidate's final outcome on the selection test (i.e., pass / fail) was  
767 obtained by the fifth author with permission from a staff member involved in running the  
768 selection course; in total, 50 out of 115 candidates (43%) passed the course.

#### 769 **Measures**

770 **MT.** The 8-item MTI developed in Study 2 was employed to measure MT, and was  
771 found to be internally reliable in the current sample ( $\alpha = .84$ ).

772 **Hardiness.** The 15-item Norwegian Dispositional Resilience Scale (Hystad, Eid,  
773 Johnsen, Laberg, & Bartone, 2010) to measure hardiness. This scale has three 5-item  
774 subscales designed to assess control (e.g., "How things go in my life depends on my own  
775 actions"), commitment (e.g., "I really look forward to my work activities") and challenge  
776 (e.g., "I enjoy the challenge when I have to do more than one thing at a time"). Items were  
777 rated on a scale from 0 (*not at all true*) to 3 (*completely true*). Scale scores were computed by  
778 reverse scoring negatively keyed items and averaging across items, with higher scores  
779 indicating higher levels of each facet of hardiness. In this sample, Cronbach's alpha for total  
780 hardiness ( $\alpha = .73$ ) and the commitment factor ( $\alpha = .71$ ) were good, whereas the control ( $\alpha =$   
781  $.62$ ) and challenge ( $\alpha = .64$ ) facets were below the minimum recommend level of  $.70$   
782 (Nunnally & Bernstein, 1994).



783 **Self-efficacy.** The 8-item New General Self-Efficacy Scale (Chen et al., 2001) was  
784 employed to assess an individual's overall perceived efficacy or ability across different tasks  
785 and situations (e.g., "Compared to other people, I can do most tasks very well" and "In  
786 general, I think I can obtain outcomes that are important to me"). Items were rated on a scale  
787 from 1 (*strongly disagree*) to 5 (*strongly agree*). A total self-efficacy score was created by  
788 averaging the 8 items, with higher scores indicating higher levels of perceived efficacy. Self-  
789 efficacy was found to be internally reliable in the current sample ( $\alpha = .88$ ).

790 **Selection test outcome.** Performance was coded as a dichotomous variable, where  
791 failure = 0 and pass = 1.

## 792 Results and Discussion

793 Missing data represented less than 0.5% of all data points and was therefore imputed  
794 using expectation-maximization method in IBM SPSS 20. Subscale level skewness (-.68 to 0)  
795 and kurtosis (-.89 to 1.15) estimates were acceptable, and none of the data violated  
796 assumptions of multivariate normality (Mahalanobis distance at  $p < .001$ ) (Tabachnick &  
797 Fidell, 2007). However, three participants violated assumptions of univariate normality for  
798 the commitment ( $n = 2$ ) and control subscales ( $n = 2$ ); the removal of these participants did  
799 not alter the outcomes of the main analyses. MT was positively associated with the three  
800 hardiness facets ( $r_{\text{commitment}} = .42$ ;  $r_{\text{control}} = .44$ ;  $r_{\text{challenge}} = .34$ ) and self-efficacy ( $r = .70$ ).  
801 Similar relationships were observed between self-efficacy and the hardiness components  
802 ( $r_{\text{commitment}} = .37$ ;  $r_{\text{control}} = .39$ ;  $r_{\text{challenge}} = .34$ ). Hardiness subscales were positively associated  
803 with each other ( $r = .20$  to  $.30$ ). Nevertheless, the correlations need to be considered with  
804 caution given the low reliability estimates for the control and challenge subscales.

805 To examine the primary research question, we employed logistic regression in Mplus  
806 7 (Muthén & Muthén, 2012) using a robust maximum likelihood estimator (MLR). The three  
807 hardiness facets of commitment ( $B = .00$ ,  $SE = .55$ ,  $p = .99$ , Odds Ratio [OR] = 1.00), control

808 (B = -.95, SE = .67,  $p = .15$ , OR = .39) and challenge (B = .02, SE = .55,  $p = .97$ , OR = 1.02),  
809 and self-efficacy (B = -.35, SE = .69,  $p = .62$ , OR = .72) did not emerge as a significant  
810 contributor to the prediction of selection test outcome; however, MT significantly predicted  
811 the performance outcome (B = 1.25, SE = .63,  $p < .05$ , OR = 3.48). Therefore, consistent with  
812 expectations, we found that MT was significantly associated with the successful completion  
813 of a rigorous military selection test, even when hardiness and self-efficacy are considered.  
814 These findings provide further evidence for the importance of MT for high performance and  
815 extend the data obtained with employees in Study 3. Specifically, as the selection test is  
816 conducted over six weeks and requires candidates to successfully complete multiple and  
817 varied assessment tasks, the findings of this naturalistic study provide initial evidence to  
818 support the importance of MT for *sustaining* performance over an extended period of time.

### 819 **General Discussion**

820 Despite its pervasiveness among both popular press and scholarly literature over the  
821 past decade, MT has suffered from both conceptual and methodological concerns thereby  
822 limiting its usefulness as a psychological concept. In an attempt to progress this area of  
823 research, we offered an alternative conceptualization of MT that drew from existing research  
824 (for reviews, see Gucciardi & Gordon, 2011) and related theory (Hobfoll, 2002; Lazarus &  
825 Folkman, 1984), and conducted a series of studies aimed at validating the concept. Of  
826 particular interest were fundamental issues pertaining to the dimensionality, nomological  
827 network, and “traitness” of MT. Collectively, this series of studies has offered three key  
828 substantive and methodological contributions to clarifying the scientific understanding of  
829 MT.

830 The first key contribution of this research pertains to the dimensionality of MT.  
831 Previous research (e.g., Clough et al., 2002; Coulter et al., 2010; Jones et al., 2002) and  
832 guiding theory (Hobfoll, 2002) led us to expect that MT would be best conceptualized as a

833 multidimensional concept when compared with a unidimensional structure. In testing these  
834 two competing conceptual representations in Study 2, our expectation that MT represented a  
835 higher-order concept that accounts for the shared variance or commonality among several  
836 important personal resources was not supported. Instead, we identified a considerable degree  
837 of empirical overlap or lack of discriminant validity between the key personal resources, with  
838 a unidimensional model identified as an adequate fit with the data. The lack of discriminant  
839 validity among the key dimensions of MT was also evident in the lower-order model in  
840 which the attributes were allowed to freely correlate with each other. These findings are in  
841 direct contrast to the commonly accepted multidimensional view of MT. Recent research  
842 (Gucciardi & Jones 2012) and guiding theory (Hobfoll, 1989) offers a platform upon which  
843 to understand the considerable empirical overlap between the MT facets; specifically, it is  
844 said that having higher levels of one personal resource is associated with higher levels of  
845 other resources (Stajkovic, 2006). Collectively, our findings suggested that the interpretations  
846 regarding the dimensionality of MT scholars have made of performers' perceptions of this  
847 construct from qualitative research may not be entirely accurate, including our own early  
848 work, and therefore require reconsideration and examination in future research.

849 The second key contribution of this research relates to the nomological network of  
850 MT. Our conceptualization of MT as a personal capacity to produce consistently high levels  
851 of subjective (e.g., goal progress) or objective performance (e.g., sales, race time, GPA)  
852 despite everyday challenges and stressors as well as significant adversities received support  
853 across several studies. First, in Study 3, we confirmed our substantive expectation of an  
854 association with perceived stress in that MT was inversely related with the distress  
855 dimension, and positively associated with the coping dimension. These findings align with  
856 our expectation that MT plays an important role in determining how individuals perceive the  
857 demands or challenges they encounter during their transactions with the environment

858 (Lazarus & Folkman, 1984). Specifically, individuals with higher levels of MT are less likely  
859 to believe that the demands imposed by a given situation exceed their available coping  
860 resources.

861 Aligned with our guiding definition and calls for scholars to provide evidence on the  
862 link between MT and performance, we revealed initial evidence to support the importance of  
863 MT for performance in three achievement settings. Among a sample of employees in Study 3,  
864 we showed that MT was both directly and indirectly (i.e., via a reduction in perceived distress  
865 and an increase in perceived coping ability) related to supervisor-rated performance. We  
866 extended these findings in Study 5 to objective performance in terms of success or failure in a  
867 selection test within the military context. The results of Study 5 were particularly  
868 encouraging, given that our short and direct assessment of MT emerged as the only  
869 significant predictor of sustaining high performance alongside the three hardiness and general  
870 self-efficacy (collectively, the 4Cs model of MT; Clough et al., 2002). In Study 4, we found  
871 that MT was directly related to both academic and social goal progress over a university  
872 semester among tertiary students. In these studies performance was assessed retrospectively  
873 over the past month by an informant (Study 3), prospectively over the course of a University  
874 semester (Study 4), and based on multiple and accumulating tasks over a six-week period  
875 (Study 5). Nevertheless, it is important to recognize that additional variance in performance  
876 remained unexplained and therefore the influence of MT was small but nevertheless  
877 important.

878 The third key contribution of this research relates to the traitness of MT. Assessments  
879 of MT have traditionally relied on a general approach in which participants were asked to  
880 reflect on their typical thoughts, emotions, or behaviors thereby emphasizing a trait  
881 perspective (cf. Clough et al., 2002). However, MT may be better conceptualized as a state-  
882 like concept such that it can both vary and have enduring properties across situations and

883 time (Harmison, 2011). Our research is the first to directly test this hypothesis. Using a  
884 weekly assessment timeframe with tertiary students in Study 4, we found that approximately  
885 44% of the total variance in MT was due to between-person differences, with the remaining  
886 56% attributable to within-person variability across the 10 weeks of the university semester.  
887 In other words, there was slightly more variability across situations than between individuals  
888 thereby supporting the hypothesis that MT may be best conceptualized as a state-like concept.  
889 These findings indicated that MT may not be as stable (i.e., trait) as previously hypothesized  
890 (Clough et al., 2002) and reported (Hardy et al., in press). From the perspective of an  
891 integrative science of personality psychology (McAdams & Pals, 2006), and specifically, a  
892 contemporary conceptualization of mental toughness which encompasses multiple personality  
893 layers (Coulter et al., 2013), these findings support an interpretation of MT as a characteristic  
894 adaptation, that is, a contextualized expression of dispositional traits that are activated or  
895 shaped by contextual or social factors (e.g., motives, values, coping styles, personal strivings,  
896 self-beliefs).

### 897 **Research Strengths and Limitations, and Conclusion**

898 The key strengths of this research included the use of samples from four different  
899 achievements contexts, and evidence to support different types of validity for the MT concept  
900 in terms of theoretical expectations (e.g., predict performance). Nevertheless, the key  
901 contributions of our research should be considered in light of the methodological limitations.  
902 With the exception of Studies 3 (i.e., informant-rated in role performance) and 5 (i.e.,  
903 selection test outcome), our reliance on self-reported data introduced concerns associated  
904 with common method biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Additionally,  
905 we relied on non-experimental designs, which do not permit causality interpretations of the  
906 relationships among study variables. Although we sampled participants from four different  
907 achievement contexts, our research was conducted solely within an Australian context using

908 convenience samples thus limiting any claims as to the generalizability of our findings.  
909 Future research would do well to replicate and extend our research by focusing on samples  
910 beyond the Western world to places such as the Middle East and Asia in which MT has  
911 gained interest yet relies on outdated conceptualizations and measurement tools. Finally, we  
912 did not explicitly examine MT in relation to major assaults of one's normal functioning (e.g.,  
913 serious injury or health issue, death of a loved one, failed a course). This complex aspect of  
914 our conceptualization of MT requires attention in future research.

915 In summary, the series of studies detailed in this paper are both timely and important  
916 because they challenge existing conceptualizations of MT as a multidimensional concept and  
917 offer a conceptual refinement based on nomological validity evidence with several diverse  
918 samples of performers. The results of Study 5, in particular, indicated that our direct  
919 assessment of MT performed better in terms of predictive validity than the indirect approach  
920 in which individual facets of the 4Cs conceptual model (Clough et al., 2002) were measured.  
921 Despite these encouraging findings, additional research is required to examine the  
922 incremental validity of MT over related concepts (see Table 2) and other umbrella concepts  
923 such as psychological capital (Luthans et al., 2007). It is not unreasonable to expect  
924 conceptual overlap between broad concepts and related specific attributes (e.g., Study 5: MT  
925 and self-efficacy). We expect this popular, umbrella concept to continue to receive scholarly  
926 attention despite such conceptual overlap, so the distinctiveness of MT must be examined in  
927 future research.

## References

- 928
- 929 ABS (2008). *National survey of mental health and wellbeing: Summary of results, 2007*.
- 930 ABS 2008. Cat. no. 4326.0. ABS, Canberra.
- 931 Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A
- 932 review and recommended two-step approach. *Psychological Bulletin*, *103*, 411–423.
- 933 doi: 10.1037/0033-2909.103.3.411
- 934 Asken, M. J., Grossman, D., & Christensen, L. W. (2010). *Warrior mindset: Mental*
- 935 *toughness skills for a nation's peacekeepers*. United States of America: Warrior
- 936 Science Group.
- 937 Bacharach, S.B. (1989). Organizational theories: Some criteria for evaluation. *Academy of*
- 938 *Management Review*, *14*, 496-515. doi: 10.2307/258555
- 939 Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- 940 Beauducel, A., & Herzberg, P. Y. (2006). On the performance of maximum likelihood versus
- 941 means and variance adjusted weighted least squares estimation in CFA. *Structural*
- 942 *Equation Modeling*, *13*, 186-203. doi: 10.1207/s15328007sem1302\_2.
- 943 Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological*
- 944 *Methods & Research*, *21*, 230-258. doi:10.1177/0049124192021002005
- 945 Carver, C. S. (1989). How should multifaceted personality constructs be tested? Issues
- 946 illustrated by self-monitoring, attributional style, and hardiness. *Journal of Personality*
- 947 *and Social Psychology*, *56*, 577–585. doi: 10.1037/0022-3514.56.4.577
- 948 Carver, C. S. (1998). Resilience and thriving: Issues, models, and linkages. *Journal of Social*
- 949 *Issues*, *54*, 245–266. doi: 10.1111/0022-4537.641998064
- 950 Caza, A., Bagozzi, R. P., Woolley, L., Levy, L., & Caza, B. B. (2010). Psychological capital
- 951 and authentic leadership: Measurement, gender, and cultural extension. *Asia-Pacific*
- 952 *Journal of Business Administration*, *2*, 53-70. doi: 10.1108/17574321011028972

- 953 Chan, D. (1998). The conceptualization and analysis of change over time: An integrative  
954 approach incorporating longitudinal mean and covariance structures analysis (LMACS)  
955 and multiple indicator latent growth modeling (MLGM). *Organizational Research*  
956 *Methods, 1*, 421-483. doi:10.1177/109442819814004
- 957 Chen, G., Gully, S. M., & Eden, D. (2001). Validation of a new general self-efficacy scale.  
958 *Organizational Research Methods, 4*, 62-83. doi: 10.1177/109442810141004
- 959 Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale  
960 development. *Psychological Assessment, 7*, 309-319. doi: 10.1037/1040-3590.7.3.309
- 961 Clough, P., Earle, K., & Sewell, D. (2002). Mental toughness: The concept and its  
962 measurement. In I. Cockerill (Ed.), *Solutions in sport psychology* (pp. 32-45). London:  
963 Thomson.
- 964 Clough, P., & Strycharczyk, D. (2012). *Developing mental toughness: Improving*  
965 *performance, wellbeing and positive behavior in others*. London: Kogan Page.
- 966 Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress.  
967 *Journal of Health and Social Behavior, 24*, 385-396. doi: 10.2307/2136404
- 968 Colbert, S. D., Scott, J., Dale, T., & Brennan, P. A. (2012). Performing to a world class  
969 standard under pressure: Can we learn lessons from the Olympians? *British Journal of*  
970 *Oral & Maxillofacial Surgery, 50*, 291-297. doi: 10.1016/j.bjoms.2012.04.263
- 971 Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, NJ: Erlbaum.
- 972 Coulter, T., Mallett, C. J., & Gucciardi, D. F. (2010). Understanding mental toughness in  
973 Australian soccer: Perceptions of players, parents, and coaches. *Journal of Sports*  
974 *Sciences, 28*, 699-716. doi: 10.1080/02640411003734085
- 975 Coulter, T. J., Mallett, C. J., Singer, J. A., & Gucciardi, D. F. (2013). *The big picture:*  
976 *Reconceptualizing mental toughness in sport*. Manuscript in preparation. The School of  
977 Human Movement Studies, University of Queensland, St. Lucia, Australia.



- 978 Covington, M. V., & Omelich, C. L. (1988). Achievement dynamics: The interaction of  
979 motives, cognitions, and emotions over time. *Anxiety Research, 1*, 165-183. doi:  
980 10.1080/08917778808248717
- 981 Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands–  
982 resources model of burnout. *Journal of Applied Psychology, 86*, 499–512. doi:  
983 10.1037//0021-9010.86.3.499
- 984 DeVellis, R.F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand  
985 Oaks, CA: Sage.
- 986 Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance  
987 and passion for long-term goals. *Journal of Personality and Social Psychology, 92*,  
988 1087-1101. doi: 10.1037/0022-3514.92.6.1087
- 989 Dyer, N. G., Hanges, P. J., & Hall, R. J. (2005). Applying multilevel confirmatory factor  
990 analysis techniques to the study of leadership. *Leadership Quarterly 16*, 149–167. doi:  
991 10.1016/j.leaqua.2004.09.009
- 992 Ford, J., MacCallum, R., & Tait, M. (1986). The application of factor analysis in psychology:  
993 A critical review and analysis. *Personnel Psychology, 39*, 291–314. doi:  
994 10.1111/j.1744-6570.1986.tb00583.x
- 995 Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (in press). Reliability estimation in a  
996 multilevel confirmatory framework analysis framework. *Psychological Methods*. doi:  
997 10.1037/a0032138
- 998 Gilboa, S., Shirom, A., Fried, Y., & Cooper, C. (2008). A meta-analysis of work demand  
999 stressors and job performance: Examining main and moderating effects. *Personnel*  
1000 *Psychology, 61*, 227–271. doi:10.1111/j.1744-6570.2008.00113.x
- 1001 Godlewski, R., & Kline, T. (2012). A model of voluntary turnover in male Canadian forces  
1002 recruits. *Military Psychology, 24*, 251-265. doi: 10.1080/08995605.2012.678229

- 1003 Gross, J. J., & Thompson, R. (2007). Emotion regulation: Conceptual foundations. In J.  
1004 Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford.
- 1005 Gucciardi, D. F., & Gordon, S. (Eds.) (2011). *Mental toughness in sport: Developments in*  
1006 *research and theory*. Abingdon, Oxon: Routledge.
- 1007 Gucciardi, D.F., Gordon, S., & Dimmock, J.A. (2009b). Evaluation of a mental toughness  
1008 training program for youth-aged Australian footballers: I. A quantitative analysis.  
1009 *Journal of Applied Sport Psychology, 21*, 307-323. doi: 10.1080/10413200903026066
- 1010 Gucciardi, D. F., Hanton, S., & Mallett, C. F. (2012). Current issues for measuring mental  
1011 toughness: A case example of the Mental Toughness Questionnaire-48. *Sport, Exercise*  
1012 *and Performance Psychology, 1*, 194-214. doi: 10.1037/a0027190
- 1013 Gucciardi, D. F., & Jones, M. I. (2012). Beyond performance excellence: Mental toughness  
1014 profiles and indicators of developmental success in adolescent cricketers. *Journal of*  
1015 *Sport & Exercise Psychology, 34*, 16-36.
- 1016 Hardy, L., Bell, J., & Beattie, S. (in press). Preliminary evidence for a neuropsychological  
1017 model of mentally tough behavior. *Journal of Personality*.
- 1018 Harmison, R. J. (2011). A social-cognitive framework for understanding and developing  
1019 mental toughness in sport. In D. F. Gucciardi & S. Gordon (Eds.) (2011). *Mental*  
1020 *toughness in sport: Developments in research and theory* (pp. 47-68). Abingdon, Oxon:  
1021 Routledge.
- 1022 Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new  
1023 millennium. *Communication Monographs, 76*, 408-420. doi:  
1024 10.1080/03637750903310360
- 1025 Hemphill, J. F. (2003). Interpreting the magnitudes of correlation coefficients. *American*  
1026 *Psychologist, 58*, 78–79. doi: 10.1037/0003-066X.58.1.78

- 1027 Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress.  
1028 *American Psychologist*, *44*, 513-524. doi: 10.1037/0003-066X.44.3.513
- 1029 Hobfoll, S. E. (2002). Social and psychological resources and adaptation. *Review of General*  
1030 *Psychology*, *6*, 307–324. doi: 10.1037//1089-2680.6.4.307
- 1031 Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A. (2009). A behavioral genetic  
1032 study of mental toughness and personality. *Personality and Individual Differences*, *46*,  
1033 100-105. doi:10.1016/j.paid.2008.09.009
- 1034 Hystad, S.W., Eid, J., Johnsen, B.H., Laberg, J.C., & Bartone, P.T. (2010). Psychometric  
1035 properties of the revised Norwegian dispositional resilience (hardiness) scale.  
1036 *Scandinavian Journal of Psychology*, *51*, 237–245. doi: 10.1111/j.1467-  
1037 9450.2009.00759.x
- 1038 Jones, G. (2012). The role of superior performance intelligence in sustained success. In S.  
1039 Murphy (Ed.), *The Oxford Handbook of Sport and Performance Psychology* (pp. 62-  
1040 80). New York: Oxford University Press.
- 1041 Jones, G., Hanton, S., & Connaughton, D. (2002). What is this thing called mental  
1042 toughness? An investigation of elite sport performers. *Journal of Applied Sport*  
1043 *Psychology*, *14*, 205-218. doi: 10.1080/10413200290103509
- 1044 Jones, G., & Moorehouse, A. (2007). *Developing mental toughness: Gold medal strategies*  
1045 *for transforming your business performance*. Begbroke, Oxford: Spring Hill.
- 1046 Jöreskog, K. G. (1993). Testing structural equation models. In K. A. Bollen & J. S. Long  
1047 (Eds.), *Testing structural equation models* (pp. 294–316). Newbury Park, CA: Sage.
- 1048 Kenny, D. A., & Zautra, A. (2001). The trait-state models for longitudinal data. In L. M.  
1049 Collins & A. G. Sayer (Eds.), *New methods for the analysis of change* (pp. 243–263).  
1050 Washington, DC: American Psychological Association. doi: 10.1037/10409-008

- 1051 Keyes, C. L. M. (2003). Complete mental health: An agenda for the 21st century. In C. L. M.  
1052 Keyes & J. Haidt (Eds.). *Flourishing: Positive psychology and the life well-lived* (pp.  
1053 293–312). Washington, DC: American Psychological Association.
- 1054 Koestner, R., Otis, N., Powers, T. A., Pelletier, L., & Gagnon, H. (2008). Autonomous  
1055 motivation, controlled motivation, and goal progress. *Journal of Personality, 76*, 1201–  
1056 1229. doi: 10.1111/j.1467-6494.2008.00519.x
- 1057 Larson, R. J. (2000). Toward a science of mood regulation. *Psychological Bulletin, 108*, 480-  
1058 498. doi: 10.1207/S15327965PLI1103\_01
- 1059 Lavoie, J. A. A., & Douglas, K. S. (2012). The Perceived Stress Scale: Evaluating configural,  
1060 metric and scalar invariance across mental health status and gender. *Journal of*  
1061 *Psychopathology and Behavioral Assessment, 34*, 48-57. doi: 10.1007/s10862-011-  
1062 9266-1
- 1063 Lazarus, R. S., & Folkman, S. (1984). *Stress appraisal and coping*. New York: Springer.
- 1064 Locke, E. A. (2003). Good definitions: The epistemological foundation of scientific progress.  
1065 In J. Greenberg (Ed.), *Organizational behavior: The state of the science* (pp. 395-423).  
1066 Mahwah, NJ: Lawrence Erlbaum.
- 1067 Locke, E. A. (2007). The case for inductive theory building. *Journal of Management, 33*,  
1068 867-890. doi: 10.1177/0149206307307636
- 1069 Lonsdale, C., Hodge, K., & Rose, E. A. (2008). The Behavioral Regulation in Sport  
1070 Questionnaire (BRSQ): Instrument development and initial validity evidence. *Journal*  
1071 *of Sport & Exercise Psychology, 30*, 323-355.
- 1072 Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales*.  
1073 Sydney: The Psychology Foundation of Australia Inc.

- 1074 Luthans, F., Avolio, B. J., Avey, J. B., & Norman, S. M. (2007). Positive psychological  
1075 capital: Measurement and relationship with performance and satisfaction. *Personnel*  
1076 *Psychology, 60*, 541-572. doi: 10.1111/j.1744-6570.2007.00083.x
- 1077 Luthans, F., Norman, S. M., Avolio, B. J., & Avey, J. B. (2008). The mediating role of  
1078 psychological capital in the supportive organizational climate–employee performance  
1079 relationship. *Journal of Organizational Behavior 29*, 219–238. doi: 10.1002/job.507
- 1080 Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research,*  
1081 *35*, 382–385. doi: 10.1097/00006199-198611000-00017
- 1082 Maddi, S. R. (2007). Relevance of hardiness assessment and training to the military context.  
1083 *Military Psychology, 19*, 61–70. doi: 10.1080/08995600701323301
- 1084 Marsh, H.W. (1997). The measurement of physical self-concept: A construct validation  
1085 approach. In K. Fox (Ed.), *The physical self: From motivation to well-being* (pp. 27–  
1086 58). Champaign, IL: Human Kinetics.
- 1087 Marsh, H. W., Hau, K.-T., Balla, J. R., & Grayson, D. (1998). Is more ever too much? The  
1088 number of indicators per factor in confirmatory factor analysis. *Multivariate Behavioral*  
1089 *Research, 33*, 181–220. doi: 10.1207/s15327906mbr3302\_1
- 1090 Martin, A. J., & Marsh, H. W. (2008). Workplace and academic buoyancy: Psychometric  
1091 assessment and construct validity amongst school personnel and students. *Journal of*  
1092 *Psychoeducational Assessment, 26*, 169-184. doi:10.1177/0734282907313767
- 1093 Martin, A. J., & Marsh, H. W. (2009). Academic resilience and academic buoyancy:  
1094 Multidimensional and hierarchical conceptual framing of causes, correlates and cognate  
1095 constructs. *Oxford Review of Education, 35*, 353-370.  
1096 doi:10.1080/03054980902934639

- 1097 Masten, A. S. (2011). Resilience in children threatened by extreme adversity: Frameworks for  
1098 research, practice, and translational synergy. *Development and Psychopathology*, *23*,  
1099 493-506. doi:10.1017/S0954579411000198
- 1100 McAdams, D. P., & Pals, J. L. (2006). A new big five: Fundamental principles for an  
1101 integrative science of personality. *American Psychologist*, *61*, 204-217.  
1102 doi:10.1037/0003-066X.61.3.204
- 1103 Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7th ed.). Los Angeles,  
1104 CA: Muthén & Muthén.
- 1105 Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York:  
1106 McGraw-Hill.
- 1107 Obradović, J., Schaffer, A., & Masten, A. S. (2012). Adversity and risk in developmental  
1108 psychopathology: Progress and future directions. In L. C. Mayes & M. Lewis (Eds.),  
1109 *The Cambridge handbook of environment of human development* (pp. 35-57). New  
1110 York: Cambridge University Press.
- 1111 Perry, J. L., Clough, P. J., Crust, L., Earle, K., & Nicholls, A. R. (2013). Factorial validity of  
1112 the Mental Toughness Questionnaire-48. *Personality and Individual Differences*, *54*,  
1113 587-592. doi: 10.1016/j.paid.2012.11.020
- 1114 Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method  
1115 biases in behavioral research: A critical review of the literature and recommended  
1116 remedies. *Journal of Applied Psychology*, *88*, 879-903. doi: 10.1037/0021-  
1117 9101.88.5.879
- 1118 Porath, C., Spreitzer, G., Gibson, C., & Garnett, F. G. (2012). Thriving at work: Toward its  
1119 measurement, construct validation, and theoretical refinement. *Journal of*  
1120 *Organizational Behavior*, *33*, 250-275. doi: 10.1002/job.756

- 1121 Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing  
1122 and comparing indirect effects in multiple mediator models. *Behavior Research*  
1123 *Methods, 40*, 879-891. doi: 10.3758/BRM.40.3.879
- 1124 Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for  
1125 assessing multilevel mediation. *Psychological Methods, 15*, 209–233.  
1126 doi:10.1037/a0020141
- 1127 Preston, C. C., & Colman, A. M. (2000). Optimal number of response categories in rating  
1128 scales: Reliability, validity, discriminating power, and respondent preferences. *Acta*  
1129 *Psychologica, 104*, 1-15. doi: 10.1016/S0001-6918(99)00050-5
- 1130 Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied*  
1131 *Psychological Measurement, 21*, 173-184. doi: 10.1177/01466216970212006.
- 1132 Raymond, J. (2009). Interactions of attention, emotion, and motivation. *Progress in Brain*  
1133 *Research, 176*, 293-308. doi: 10.1016/S0079-6123(09)17617-3
- 1134 Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university  
1135 students' academic performance: A systematic review and meta-analysis. *Psychological*  
1136 *Bulletin, 138*, 353-387. doi: 10.1037/a0026838
- 1137 Robinson, M. D., Schmeichel, B. J., & Inzlicht, M. (2010). A cognitive control perspective of  
1138 self-control strength and its depletion. *Social and Personality Psychology Compass, 4*,  
1139 189-200. doi: 10.1111/j.1751-9004.2009.00244.x
- 1140 Roesch, S. C., Aldridge, A. A., Stocking, S. N., Villodas, F., Leung, Q., Bartley, C. E., &  
1141 Black, L. J. (2010). Multilevel factor analysis and structural equation modeling of daily  
1142 diary coping data: Modeling trait and state variation. *Multivariate Behavioral Research,*  
1143 *45*, 767–789. doi: 10.1080/00273171.2010.519276

- 1144 Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of  
1145 psychological well-being. *Journal of Personality and Social Psychology*, *57*, 1069-  
1146 1081. doi: 10.1037/0022-3514.57.6.1069
- 1147 Scheier, M. F., & Carver, C. S. (1985). Optimism, coping and health: Assessment and  
1148 implications of generalized outcome expectancies. *Health Psychology*, *4*, 219–247. doi:  
1149 10.1037//0278-6133.4.3.219
- 1150 Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from  
1151 neuroticism (and trait anxiety, self-mastery, and self-esteem) – A reevaluation of the  
1152 life orientation test. *Journal of Personality and Social Psychology*, *67*, 1063–1078. doi:  
1153 10.1037/0022-3514.67.6.1063
- 1154 Schulenberg, S. E., Schnetzer, L. W., & Buchanan, E. M. (2011). The Purpose in Life Test-  
1155 Short Form: Development and psychometric support. *Journal of Happiness Studies*, *12*,  
1156 861-876. doi: 10.1007/s10902-010-9231-9
- 1157 Seligman, M. E. P. (1991). *Learned optimism*. New York, NY: Knopf.
- 1158 Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural  
1159 equation models. *Sociological Methodology*, *13*, 290-312. doi: 10.2307/270723
- 1160 Snyder, C. R., Harris, C., Anderson, J. R., Irving, L., Sigmon, S. T., Yoshinobu, L., et al.  
1161 (1991). The will and the ways: Development and validation of an individual-differences  
1162 measure of hope. *Journal of Personality and Social Psychology*, *60*, 570–585. doi:  
1163 10.1037/0022-3514.60.4.570
- 1164 Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations models.  
1165 In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290-312). San Francisco: Jossey-  
1166 Bass.
- 1167 Spreitzer, G., & Porath, C. (in press). Self-determination theory as a nutriment for thriving:  
1168 Building an integrative model of human growth at work. In M. Gagné (Ed.), *Oxford*



- 1169       *handbook of work engagement, motivation and self-determination theory*. New York,  
1170       NY: Oxford University Press.
- 1171       Spreitzer, G., Sutcliffe, K., Dutton, J., Grant, A. M., & Sonenshein, S. (2005). A socially  
1172       embedded model of thriving at work. *Organization Science*, *16*, 537–549. doi:  
1173       10.1287/orsc.1050.0153
- 1174       Stajkovic, A. D. (2006). Development of a core confidence-higher order construct. *Journal of*  
1175       *Applied Psychology*, *91*, 1208-1224. doi: 10.1037/0021-9010.91.6.1208
- 1176       Sternberg, R. J. (1998). A balance theory of wisdom. *Review of General Psychology*, *2*, 347–  
1177       365. doi:10.1037/1089-2680.2.4.347
- 1178       Stone, A, Schwartz, J., Neale, J., Shiffman, S., Marco, C., Hickcox, M., &...Cruise, L.  
1179       (1998). A comparison of coping assessed by ecological momentary analysis and  
1180       retrospective recall. *Journal of Personality and Social Psychology*, *74*, 1670–1680. doi:  
1181       10.1037/0022-3514.74.6.1670
- 1182       Suddaby, R. (2010). Editor's comments: Construct clarity in theories of management and  
1183       organization. *Academy of Management Review*, *35*, 346-357. doi:  
1184       10.5465/AMR.2010.51141319
- 1185       Tabachnick, B. S., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed). Needham  
1186       Heights, MA: Allyn and Bacon.
- 1187       Tamir, M., John, O. P., Srivastava, S., & Gross, J. J. (2007). Implicit theories of emotion:  
1188       Affective and social outcomes across a major life transition. *Journal of Personality and*  
1189       *Social Psychology*, *92*, 731–744. doi:10.1037/0022-3514.92.4.731
- 1190       Thelwell, R., Weston, N., & Greenlees, I. (2005). Defining and understanding mental  
1191       toughness in soccer. *Journal of Applied Sport Psychology*, *17*, 326-332. doi:  
1192       10.1080/10413200500313636

- 1193 Vogt, D. S., King, D. W., & King, L. A. (2004). Focus groups in psychological assessment:  
1194 Enhancing content validity by consulting members of the target population.  
1195 *Psychological Assessment, 16*, 231–243. doi: 10.1037/1040-3590.16.3.231
- 1196 Wakefield, T. S. (2008). *Mental toughness: Understanding the game of life*. Bloomington,  
1197 IN: AuthorHouse.
- 1198 Weinberg, R. (2010). *Mental toughness for sport, business, and life*. Bloomington, IN:  
1199 AuthorHouse.
- 1200 West, C. P., Dyrbye, L. N., Satele, D. V., Sloan, J. A., & Shanafelt, T. D. (2012). Concurrent  
1201 validity of single-item measures of emotional exhaustion and depersonalization in  
1202 burnout assessment. *Journal of General Internal Medicine, 27*, 1445-1452. doi:  
1203 10.1007/s11606-012-2015-7
- 1204 Williams, L. J., & Anderson, S. E. (1991). Job satisfaction and organizational commitment as  
1205 predictors of organizational citizenship and in-role behaviors. *Journal of Management,*  
1206 *17*, 601-617. doi: 10.1177/014920639101700305
- 1207 Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical*  
1208 *Gerontology, 21*, 152–169. doi: 10.1017/S0959259810000420
- 1209 Windle, G. (2012). The contribution of resilience to healthy ageing. *Perspectives in Public*  
1210 *Health, 132*, 159-160. doi: 10.1177/1757913912449572
- 1211 Wothke, W. (1993). Nonpositive definite matrices in structural modeling. In K. A. Bollen, &  
1212 J. S. Long (Eds.), *Testing structural equation models* (pp. 256–293). Newbury Park,  
1213 CA: Sage Publications.
- 1214 Zelazo, P. D., Carter, A., Reznick, J. S., & Frye, D. (1997). Early development of executive  
1215 function: A problem-solving framework. *Review of General Psychology, 1*, 198-226.

Table 1. *Definitions of mental toughness from English language and psychology research.*

Source	Definition
Clough, Earle, and Sewell (2002, p. 38)	“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 of adversity.”
Jones, Hanton, and Connaughton (2002, p. 209)	“Mental toughness is having the natural or developed edge that enables you to: (i) generally, cope better than your opponents with the many demands (competition, training, lifestyle) that sport places on a performer; (ii) specifically, be more consistent and better than your opponents in remaining determined, focused, confident, and in control under pressure.”
Thelwell, Weston, and Greenlees (2005)	“Mental toughness is having the natural or developed edge that enables you to: (i) <i>always</i> [emphasis added], cope better than your opponents with the many demands (competition, training, lifestyle) that sport places on a performer; (ii) specifically, be more consistent and better than your opponents in remaining determined, focused, confident, and in control under pressure.”
Coulter, Mallett, and Gucciardi (2010, p. 715)	“Mental toughness is <i>the presence of some or the entire</i> collection of experientially developed and inherent values, attitudes, emotions, cognitions, <i>and behaviours</i> that influence the way in which an individual approaches, responds to, and appraises both negatively and positively construed pressures, challenges, and adversities to consistently achieve his or her goals.”
Clough and Strycharczyk (2012, p. 1)	“The quality which determines in large part how people deal effectively with challenge, stressors and pressure...irrespective of prevailing circumstances.”
Merriam-Webster Dictionary	Mental: “of or relating to the mind.” Tough: “a strong or firm texture but flexible and not brittle.”
Oxford Dictionary	Mental: “relating to the mind.” Tough: “(of a substance or object) strong enough to withstand adverse conditions or rough handling” and “able to endure hardship or pain.”
Cambridge Dictionary	Mental: “relating to the mind, or involving the process of thinking.” Tough: “strong, not easily broken or made weaker or defeated.”

Table 2. *Hypothesized indicators of a core mental toughness construct and associated theoretical perspectives.*

<b>Key Dimension</b>	<b>Definition</b>	<b>Supporting Theory and Research</b>
Generalized Self-efficacy	A belief in your abilities to achieve success in your achievement context	Self-efficacy theory (Bandura, 1997)
Buoyancy	The ability to effectively execute to the required skills and processes in response to the challenges and pressures of everyday life.	Academic and workplace buoyancy (Martin & Marsh, 2008, 2009)
Success Mindset	The desire to achieve success and ability to act upon this motive	Grit (Duckworth, Peterson, Matthews, & Kelly, 2007); Hope theory (i.e., ‘the will’; Snyder et al., 1991)
Optimistic Style	The tendency to expect positive events in the future, and attribute positive causes and outcomes to different events in their lives.	Optimism (Scheier & Carver, 1985) and explanatory style (Seligman, 1991)
Context Knowledge	An awareness and understanding of the performance context, and how to apply this knowledge in achieving success or reaching one’s goals	Cognitive theories of wisdom (e.g., Sternberg, 1998); hope theory (i.e., ‘the ways’; Snyder et al., 1991); and performance intelligence (Jones, 2012)
Emotion Regulation	An awareness of and ability to use emotionally relevant processes to facilitate optimal performance and goal attainment	Process (Gross & Thompson, 2007) and goal-oriented models (e.g., Larson, 2000) of emotion regulation
Attention Regulation	The ability to focus on what is relevant while ignoring irrelevant information	Cognitive control perspectives (e.g., Robinson, Schmeichel, & Inzlicht, 2010), and executive functions (e.g., Zelazo, Carter, Reznick, & Frye, 1997)

Table 3. Summary of fit indices for measurement models examined with the calibration sample, and context specific samples for cross-validation purposes in Study 2.

Models	$\chi^2$	df	p	CFI	TLI	SRMR	RMSEA (90% CI)
<sup>a</sup> Model 1: Unidimensional model (21 items)							
Calibration sample (n = 418)	536.58	189	.000	.917	.908	.040	.066 (.060 to .073)
Athletes (n = 445)	609.01	189	.000	.901	.890	.043	.071 (.064 to .077)
Tertiary students (n = 500)	628.49	189	.000	.899	.888	.046	.068 (.062 to .074)
Employees (n = 550)	534.91	189	.000	.920	.911	.042	.058 (.052 to .063)
<sup>b</sup> Model 2: First-order model							
Calibration sample (n = 418)	347.28 <sup>#</sup>	168	.000	.951	.938	.036	.054 (.047 to .062)
Athletes (n = 445)	378.33 <sup>#</sup>	168	.000	.950	.938	.040	.053 (.046 to .060)
Tertiary students (n = 500)	411.03 <sup>#</sup>	168	.000	.944	.930	.045	.054 (.047 to .060)
Employees (n = 550)	362.09 <sup>#</sup>	168	.000	.955	.944	.039	.046 (.039 to .052)
<sup>c</sup> Model 3: Higher-order model							
Calibration sample (n = 418)	438.95	182	.000	.939	.929	.038	.058 (.051 to .065)
Athletes (n = 445)	434.78 <sup>#</sup>	182	.000	.941	.931	.039	.056 (.049 to .063)
Tertiary students (n = 500)	471.07	182	.000	.934	.923	.046	.056 (.050 to .063)
Employees (n = 550)	417.38 <sup>#</sup>	182	.000	.946	.937	.039	.048 (.042 to .055)
<sup>d</sup> Model 4: Unidimensional model (8 items)							
Calibration sample (n = 418)	43.93	20	.001	.975	.965	.031	.054 (.032 to .075)
Athletes (n = 445)	39.65	20	.005	.980	.972	.027	.047 (.025 to .068)
Tertiary students (n = 500)	47.75	20	.000	.973	.963	.031	.053 (.034 to .072)
Employees (n = 550)	65.97	20	.000	.968	.955	.032	.065 (.048 to .082)

Note: <sup>a</sup>Model 1: unidimensional model of the 21 items; <sup>b</sup>Model 2: correlated 7-factor model of the 21 items; <sup>c</sup>Model 3: second-order model of the 21 items with a core mental toughness factor accounting for the variance between the seven lower-order factors; <sup>d</sup>Model 4: unidimensional model of the 8 items;  $\chi^2$  = chi square; df = degrees of freedom; CFI = comparative fit index; IFI = incremental fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean residual; RMSEA = root mean square error of approximation; # denotes not positive definite covariance matrix; residual error terms were not correlated.

Table 4. Standardized factor loadings ( $\lambda$ ) and residual variances ( $\Theta$ ) of the second-order, seven-factor model of mental toughness in Study 2.

	Calibration sample ( <i>n</i> = 418)		Athletes ( <i>n</i> = 445)		Tertiary students ( <i>n</i> = 500)		Employees ( <i>n</i> = 550)	
	$\lambda$	$\Theta$	$\lambda$	$\Theta$	$\lambda$	$\Theta$	$\lambda$	$\Theta$
<i>Self-Belief</i>	.97	.06	.90	.19	.95	.10	.96	.08
When faced with challenge or adversity, I believe in my ability to perform well	.86	.25	.87	.25	.81	.35	.82	.32
I believe in my ability to achieve my goals	.84	.30	.85	.27	.79	.38	.80	.36
I believe in my ability to consistently produce high levels of performance	.86	.27	.86	.26	.80	.37	.83	.31
<i>Attention Regulation</i>	.99	.02	1.02	-.03	.94	.11	.96	.07
I am able to direct my attention towards relevant information	.74	.45	.68	.53	.63	.60	.71	.50
I remain focused on the task at hand despite adversity or challenge	.83	.31	.79	.38	.77	.40	.76	.42
I am able to regulate my focus when performing tasks	.79	.37	.81	.35	.75	.44	.82	.32
<i>Emotion Regulation</i>	.93	.14	.97	.06	.89	.21	.84	.29
I am able to use my emotions to perform the way I want to	.71	.50	.74	.45	.71	.49	.75	.44
I am able to effectively manage my emotions during times of adversity	.73	.46	.77	.40	.79	.38	.78	.38
When I am performing well, my emotions do not get the better of me	.71	.50	.61	.63	.62	.61	.66	.56
<i>Success Mindset</i>	.90	.19	.85	.27	.83	.31	.87	.24
I make things happen	.78	.40	.79	.38	.75	.43	.74	.45
I am determined to push myself towards higher goals	.81	.34	.83	.31	.84	.29	.73	.47
I strive for continued success	.86	.25	.86	.27	.84	.30	.82	.33
<i>Context Knowledge</i>	.97	.06	.94	.13	.98	.04	.98	.03
I am aware of what I need to do to be successful	.63	.60	.72	.49	.58	.66	.57	.68
I effectively execute my knowledge of what is required to achieve my goals	.78	.40	.77	.41	.78	.39	.78	.39
I have deep knowledge of the area in which I perform	.68	.54	.64	.59	.65	.57	.62	.61
<i>Buoyancy</i>	1.00	.00	1.00	.00	.99	.01	1.02	-.03
I consistently overcome adversity	.79	.38	.75	.43	.74	.45	.74	.45
I enjoy performing when things get tough	.68	.54	.66	.56	.62	.62	.64	.59
I am able to execute appropriate skills or knowledge when challenged	.81	.34	.74	.45	.74	.45	.80	.36
<i>Optimism</i>	.97	.07	1.00	.01	.94	.12	.96	.08
I can find a positive in most situations	.65	.58	.63	.61	.60	.64	.59	.65
I think about what can be done rather than what has happened	.71	.49	.71	.49	.69	.52	.65	.58
I can manage my thoughts to be productive	.83	.31	.80	.35	.80	.36	.79	.37

Table 5. Standardized factor loadings ( $\lambda$ ) and residual variances ( $\Theta$ ) of the 8-item unidimensional model of mental toughness in Study 2.

	Calibration sample ( <i>n</i> = 418)		Athletes ( <i>n</i> = 445)		Tertiary students ( <i>n</i> = 500)		Employees ( <i>n</i> = 550)	
	$\lambda$	$\Theta$	$\lambda$	$\Theta$	$\lambda$	$\Theta$	$\lambda$	$\Theta$
I believe in my ability to achieve my goals	.75	.43	.68	.54	.70	.51	.73	.47
I am able to regulate my focus when performing tasks	.77	.40	.81	.35	.70	.51	.80	.36
I am able to use my emotions to perform the way I want to	.68	.54	.70	.51	.63	.61	.61	.63
I strive for continued success	.68	.54	.70	.52	.66	.57	.67	.55
I effectively execute my knowledge of what is required to achieve my goals	.77	.41	.73	.47	.77	.40	.75	.44
I consistently overcome adversity	.72	.48	.67	.56	.65	.58	.68	.53
I am able to execute appropriate skills or knowledge when challenged	.67	.56	.66	.57	.63	.60	.66	.56
I can find a positive in most situations	.64	.60	.61	.63	.57	.68	.56	.68

Table 6. Standardized parameter estimates for the MLSEM exploring mental toughness as a predictor of goal progress, thriving, and psychological health in Study 3b.

Structural Path	Within Person (Level 1)		Between Person (Level 2)	
	$\beta$	SE	$\beta$	SE
<b>Direct Effects</b>				
MT → DASS	-.32***	.05	-.46***	.10
MT → EMO	.58***	.04	.87***	.03
MT → THRIVE	.64***	.03	.93***	.02
MT → AcGOAL	.38***	.03	.73***	.04
MT → ScGOAL	.18***	.04	.67***	.06
<b>Latent Correlations</b>				
EMO ↔ DASS	-.33***	.05	-.20	.10
THRIVE ↔ DASS	-.18***	.05	.14	.13
THRIVE ↔ EMO	.54**	.04	.51**	.09
AcGOAL ↔ DASS	-.06	.04	.22*	.11
AcGOAL ↔ EMO	.23***	.04	.24*	.10
AcGOAL ↔ THRIVE	.18***	.04	.29*	.14
ScGOAL ↔ DASS	-.12**	.04	-.03	.11
ScGOAL ↔ EMO	.23**	.04	.30**	.10
ScGOAL ↔ THRIVE	.14**	.04	.08	.12
ScGOAL ↔ AcGOAL	.27***	.03	.39***	.09

*Note:* MT = mental toughness; THRIVE = thriving; AcGOAL = academic goal progress; ScGOAL = social goal progress; DASS = negative emotional states; EMO = positive emotions; \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$