

Running Head: Mental Toughness

**The Concept of Mental Toughness:
Tests of Dimensionality, Nomological Network and Traitness**

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Abstract

Objectives: Mental toughness has received increased scholarly attention in recent years, yet conceptual issues related to its (i) dimensionality, (ii) nomological network, and (iii) traitness remain unresolved. The series of studies reported in this paper were designed to examine these three substantive issues across several achievement contexts including sport, education, military and the workplace. **Methods:** Five studies were conducted to examine these research aims: Study 1: $N = 30$; Study 2: calibration sample ($n = 418$), tertiary students ($n = 500$), athletes ($n = 427$), and employees ($n = 550$); Study 3: $N = 497$ employees; Study 4: $N = 203$ tertiary students; Study 5: $N = 115$ army candidates. **Results:** Collectively, the results of these studies revealed that mental toughness may be best conceptualized as a unidimensional rather than a multidimensional concept; plays an important role in performance, goal progress, and thriving despite stress; and can vary and have enduring properties across situations and time. **Conclusion:** This series of studies provides a foundation for further basic and applied research of mental toughness across various achievement contexts.

Keywords: diary study; goal striving; multilevel structural equation modeling; personal resources; resilience; stress

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

35 The large volume of books within the popular press and news both in print and online
36 suggests that MT is a concept that is meaningful for achievement and, more broadly,
37 individuals' lives. The popularity of MT among the general public has inevitably led to the
38 upsurge in academic attention that has occurred over the past decade. For example, an
39 October 3rd 2013 search of the Web of Knowledge database from 1900 to 2013 revealed 145
40 papers, chapters, or conference presentations in which the term MT appears in the title or
41 topic; over 95% of which have surfaced since 2000. The vast majority of this research has
42 been conducted within sport contexts, relying initially on retrospective interviews with elite
43 athletes and coaches, and then cross-sectional interviews or surveys (for reviews, see

69 to what it really is and what it is not. Key scholarly definitions of MT derived from empirical
70 research are detailed in Table 1. These definitions of MT have sparked independent streams
71 of empirical research (for reviews, see Gucciardi & Gordon, 2011), yet more agreement on
72 common elements of a concept is required before such bodies of knowledge can contribute to
73 its evolution (Suddaby, 2010).

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

91 Our working conceptualization appears to adequately integrate key features of
92 academic descriptions of MT with dictionary definitions of “mental” and “tough” detailed in
93 Table 1 (cf. Locke, 2003). Central to both academic and English language definitions is the

94 personal nature of MT – it is a quality that resides within an individual. Also inherent within
95 these definitions is the notion of being able to withstand or endure challenging or adverse
96 situations. Although not explicitly captured in the English language definitions, the centrality
97 of this personal quality for high performance and/or goal attainment is central to academic
98 descriptions of MT. For example, Jones et al. (2002) linked MT with being “more consistent
99 and better than your opponents” (p. 201), whereas Coulter et al. (2010) described it as being
100 the foundation upon which to “consistently achieve [your] goals” (p. 715).

101 Unlike previous definitions that have encompassed examples of what is included in
102 the construct (e.g., Clough et al., 2002) or are other-dependent such as “cope better than your
103 opponents” (e.g., Jones et al., 2002, p. 209), our relatively broad description of MT includes
104 several important assumptions that we believe provide a useful foundation upon which to
105 help clarify its meaning. First, we contend that MT represents a “resource caravan” (Hobfoll,
106 2002, p. 312) or aggregation of several personal resources or assets which are common to
107 people who share social and environmental conditions (e.g., biology, culture); that is, these
108 personal resources or assets are interwoven, with the common conceptually identifiable
109 element among them being a process driving consistently high levels of subjective or
110 objective performance. Second, an inherent feature of this conceptualization is that MT
111 resides within an individual and – although providing a foundation for performance
112 consistency – is imperfectly translated into behavior or action. A third assumption is that MT
113 should be viewed as a continuous concept whereby individuals may be more or less mentally
114 tough, rather than mentally tough or not, or as comprising different profiles of MT (e.g., high
115 in self-efficacy and optimism but low in perseverance); that is, individuals will typically
116 score similarly on each of the key dimensions (cf. Gucciardi & Jones, 2012). This view of
117 MT is also consistent with resource-based perspectives of human adaptation, coping and
118 well-being (Hobfoll, 1989) in which it is said that having higher levels of one personal

119 resource such as self-efficacy is typically associated with higher levels of other resources
120 such as optimism, resilience, and hope (Stajkovic, 2006). Finally, aligned with leading
121 theories of stress (Hobfoll, 1989, 2002; Lazarus & Folkman, 1984), the key MT facets pertain
122 to everyday hassles (e.g., mundane pressures such as balancing work or study with other
123 aspects of one's life, maintaining quality relationships with others) as well as major life
124 events that pose a significant threat to one's normal level of performance or goal attainment
125 consistency (e.g., failed a course, major illness, death of a loved one). Therefore, we propose
126 that MT is fundamentally important for striving (e.g., working towards self-defined goals or
127 objectives), surviving (e.g., dealing with challenges, demands, or adversities), and thriving
128 (e.g., sustaining high levels of performance, experiencing vitality and learning or
129 performance gains).

130 **Dimensionality of Mental Toughness**

131 Whereas a definition of a concept ought to be described in relatively general terms,
132 the nature and number of dimensions should be encapsulated by a corresponding model
133 (Bacharach, 1989). We adopted two primary criteria to determine whether a variable was
134 included in a model of MT: (i) a personal resource or aspect of the self that is positively
135 linked with subjective or objective performance across at least two different stressful
136 achievement contexts (e.g., education, sport); and (ii) collectively, the personal resources
137 encompassed cognitions, emotions, and behaviors. Indeed, scholars (e.g., Covington &
138 Omelich, 1988; Raymond, 2009) have highlighted the importance of considering the dynamic
139 interaction among cognitive, emotional, and motivational domains when conceptualizing
140 processes related to achievement dynamics. We identified seven core personal resources from
141 an extensive review of the existing MT literature and our unpublished interviews with non-
142 sport performers that have the strongest empirical support in terms of their link with
143 performance and goal attainment or progress. The majority of these facets resemble existing

144 concepts (e.g., hope, emotion regulation, optimism, self-efficacy) that are generally supported
145 by well-established theories, frameworks or models (see Table 2).

146 Our research will also test a key feature of MT conceptualization that has yet to be
147 directly examined; specifically, is MT best conceptualized as a unidimensional or
148 multidimensional concept? When considered alongside previous work on MT (e.g., Clough et
149 al., 2002; Jones et al., 2002), our guiding theoretical framework (Hobfoll, 1989, 2002), and
150 related research (e.g., Luthans, Avolio, Avery, & Norman, 2007) and theory (Stajkovic,
151 2006), the various dimensions we have identified from our literature review and unpublished
152 interviews with non-sport performers support a multidimensional perspective. However, it is
153 important to recognize that much of the early work on MT adopted an exploratory, qualitative
154 approach with sport performers and therefore limits the extent to which these findings
155 generalize across samples and achievement contexts. Although exceptions do exist, equivocal
156 findings have been revealed when a multidimensional conceptualization of MT has been
157 psychometrically examined across diverse samples (cf. Gucciardi et al., 2012; Perry, Clough,
158 Crust, Earle, & Nicholls, 2013). Perhaps most important for MT concept development, the
159 notion of a multidimensional conceptualization appears to have been accepted by scholars
160 with little research conducted to directly test this assumption against a unidimensional model.

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

163 **Stress, Coping and Adversity**

164 Resources including objects, conditions and personal characteristics play a central
165 role in most models of the stress process. Within the context of a transactional perspective
166 (Lazarus & Folkman, 1984), for example, stress is said to occur when individuals perceive
167 events or situations in their environment to be taxing or exceeding their resources. Similarly,
168 the interaction between demands and resources is a core assumption of the Jobs Demands-

169 Resources model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), such that stress or
170 burnout develops when demands are high and resources are low. A central tenet of the
171 conservation of resources theory is the notion that people strive to obtain, preserve, and
172 protect resources (Hobfoll, 1989, 2002). In clarifying its conceptualization, therefore, we
173 propose that MT could be a useful organizing framework or “resource caravan” (Hobfoll,
174 2002) for those core *personal* resources central to the coping process in which individuals
175 managed the internal and external stressors of the person-environment relationship (Lazarus
176 & Folkman, 1984).

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

192 Also central to this process perspective of resilience is that it “is not necessarily about
193 superior functioning or flourishing, it is about doing okay, or better than could be expected,

194 given the individual circumstances” (Windle, 2012, p. 159). In other words, resilience is best
195 conceptualized as the process by which one bounces back or recovers from such major
196 assaults, which is consistent with the original and basic meaning of the word¹ (i.e., “spring
197 back into shape” and “recover or adjust”). This “bounce back” conceptualization of resilience
198 facilitates an important conceptual distinction between returning to normal levels of
199 functioning (i.e., resilience) and moving towards a superior level of functioning or thriving
200 following an adversity (Carver, 1998). Thriving is defined as “the psychological state in
201 which individuals experience both a sense of vitality and a sense of learning” (Spreitzer,
202 Sutcliffe, Dutton, Grant, & Sonenshein, 2005, p. 538). As an internal marker of individual
203 growth and upward trajectory, thriving is considered state-like and malleable, and is therefore
204 contingent upon the situation or task (Spreitzer & Porath, in press). With its focus on active,
205 intentional engagement in the process of attaining and sustaining high levels of performance
206 and/or goal attainment, MT should also play an important role in thriving.

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

209 **On the Traitness of Mental Toughness**

210 An unresolved yet substantively important issue is whether MT is best conceptualized
211 as a dispositional, trait-like or situational, state-like construct. It has been argued that “most
212 psychological constructs vary along a continuum of stability or what [is referred to] as
213 *traitness*” (Kenny & Zautra, 2001, p. 243). Some scholars (e.g., Clough et al., 2002; Hardy et
214 al., in press) have proposed that MT represents a relatively stable dispositional trait, although
215 some authors (e.g., Harmison, 2011) have argued for a state-like conceptualization. Despite
216 these conflicting viewpoints, little empirical research has been conducted to directly examine
217 this key feature of MT for concept development. Initial work in this area that gathered key

¹ We consulted both the Merriam-Webster and Oxford English online dictionaries.

218 stakeholders' retrospective viewpoints provided indirect support for a state-like
219 conceptualization; in other words, MT appears to be open to development and can both vary
220 and have enduring properties across situations or time (e.g., Coulter et al., 2010; Jones et al.,
221 2002). Subsequent research supported these claims by showing that MT could be enhanced
222 among a sample of adolescent footballers via a psychological skills training intervention
223 (Gucciardi, Gordon, & Dimmock, 2009b). Contrary to these initial reports, however,
224 researchers have revealed an almost perfect test-retest relationship of informant-rated
225 mentally behavior over three weeks ($r = .96$) among a sample of 59 tertiary sport science
226 students (Hardy et al., in press).

227 The equivocal nature of the available research means that uncertainty remains with
228 regard to the traitness of MT. In particular, methodological features of this research limit our
229 confidence in the findings. For example, the small sample sizes and focus on sport
230 participants limited the extent to which these findings generalize to larger or more diverse
231 populations. With regard to the temporality of these designs, retrospectively recalling mental
232 processes may not be entirely accurate (Stone et al., 1998) and encompassing only two points
233 across short time frames such as three weeks does little to capture the stability and dynamic
234 nature of key concepts and their interrelationships (Chan, 1998). Also lacking in this previous
235 research is guidance from established theory in terms of the rationale for expectations
236 regarding the dispositional nature of psychological constructs. For example, personality
237 encompasses key individual difference variables situated across diverse layers of
238 understanding, including dispositional traits (broad dimensions that evidence consistency
239 across situations and over time), characteristic adaptations (contextualized expressions of
240 traits which are activated by contextual or social factors), and life narratives (internalized and
241 evolving psychosocial construction of one's identity; McAdams & Pals, 2006). As we have
242 conceptualized MT as a caravan of personal resources pertinent to the coping process, we

243 expected there to be some variation and stability in this concept across situations and time as
244 individuals assess whether or not the characteristics of the event or situation exceeds their
245 personal resources (Hobfoll, 1989, 2002; see also, Harmison, 2011).

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

248 **Overview of the Present Research**

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

265 **Study 1 – Item Generation**

266 We first created a pool of items that were designed to reflect the key dimensions of
267 MT detailed in Table 2 but also hold meaning for our target populations (e.g., "I am

268 determined to reach my full potential” and “I interpret adversity as a positive challenge”).
269 Items were designed so that they could be adapted across achievement contexts such as sport,
270 education, military and work. Before piloting a questionnaire with the target populations, it is
271 important to obtain experts’ assessments of the conceptual model and item content to ensure
272 that one is sampling all content that is potentially relevant to the construct of interest
273 (DeVellis, 2003). It also important to capture the views of the “end users” by piloting new
274 surveys with a representative sample of the target populations (Vogt, King, & King, 2004).
275 Thus, the aims of Study 1 were to (a) examine experts’ views and opinions on the quality of
276 our conceptual model of MT, and (b) to create and provide evidence for the face and content
277 validity of a pool of items designed to capture this conceptualization.

278 **Method**

279 **Participants**

280 A total sample of 30 academic experts and representatives of the target populations
281 participated in this study. We purposefully sampled nine researchers (3 females) with
282 expertise in the psychology of performance and scale development from higher education
283 institutions on four continents (i.e., Australia, New Zealand, United Kingdom, USA) via
284 email invitation. Representatives of the target population were conveniently sampled from an
285 Australian institution and via the authors’ personal networks: nine tertiary students (3
286 females), six athletes (2 females), three coaches (all male), and four businesspeople (2
287 females). All academics, athletes, coaches, and businesspeople were experienced in their
288 achievement context (i.e., experience >10 years); tertiary students were nearing the end of a
289 Masters Coursework degree in applied psychology ($n = 5$) or in their first year of an
290 undergraduate course in psychology ($n = 4$).

291 **Procedures**

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

303 **Results and Discussion**

304 We developed 70 items designed to assess the key dimensions of our
305 conceptualization of MT (see Table 2) and obtained stakeholder's perspectives on the
306 adequacy of these items and our conceptual model. Representatives of the target populations
307 deemed all but seven items as corresponding to the MT facet it was intended to assess and
308 were therefore eliminated. Of the remaining 63 items, nine were reworded to improve their
309 clarity and applicability across different achievement contexts. The academic experts
310 believed that our conceptual model was very good both in terms of breadth of the key
311 dimensions ($M = 4.33$) and quality of characteristic descriptions ($M = 4.22$). The item pool (n
312 = 63) was also rated by our academic experts and subsequently used to calculate a Content
313 Validity Index (CVI; Lynn, 1986) for each item; that is, the number of experts who gave a
314 rating of 3 or above divided by 9 (i.e., the total number of experts). We used the CVI (i.e.,
315 $>.80$ deemed acceptable; Lynn, 1986) and open-ended responses to inform final decisions
316 about whether to retain, eliminate, or revise an item. Two items with a CVI of .78 (7/9) were

317 deemed unacceptable and therefore removed from the item pool. Although the remainder of
318 the item pool evidenced adequate CVIs, the wordings of 14 items were modified slightly to
319 improve clarity and reduce overlap with other key dimensions. This process led to 61 items
320 being retained for inclusion in the initial survey.

321 **Study 2 – Dimensionality of Mental Toughness**

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

332 **Method**

333 **Participants**

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

336 **Calibration sample.** A total of 418 performers participated: 136 athletes (57 males,
337 76 females; $M_{\text{age}} = 27.21$, $SD_{\text{age}} = 10.36$), 137 students (58 males, 78 females; $M_{\text{age}} = 19.99$,
338 $SD_{\text{age}} = 3.81$), and 145 “white collar” workers (80 males, 64 females; $M_{\text{age}} = 48.04$, $SD_{\text{age}} =$
339 10.14). Some participants chose not to report their age or gender.

340 **Cross-validation samples.** Three independent samples were recruited: 500 students
341 (176 males, 323 females; $M_{\text{age}} = 20.43$, $SD_{\text{age}} = 4.70$), 427 athletes (167 males, 269 females;

342 $M_{\text{age}} = 27.21$, $SD_{\text{age}} = 10.34$), and 550 “white collar” workers (304 males, 243 females; $M_{\text{age}} =$
343 48.14 , $SD_{\text{age}} = 10.27$). Age and gender were not voluntarily reported by some participants.

344 **Measure and Procedures**

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

359 Informed consent and survey questions were completed online using a secure data
360 collection site. The survey contained the 61 items developed in Study 1 to capture the
361 hypothesized components of MT. Participants were instructed to indicate how true each
362 statement was an indication of how they typically think, feel, and behave as a performer in
363 their context (e.g., as an athlete). We adopted a 7-point Likert scale (1 = *false, 100% of the*
364 *time* to 7 = *true, 100% of the time*) for the MT items, as this response format has been shown
365 to optimize reliability, validity, discriminating power, and respondent preferences (Preston &

366 Colman, 2000). Participants were recruited from a large tertiary institution, via national
367 sporting organizations, and organizations in the services sector (e.g., education, health care).

368 **Data Analysis**

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

375 **Primary analyses.** The factorial validity of the hypothesized MT model was tested
376 with confirmatory factor analysis (CFA) in Mplus 7 (Muthén & Muthén, 2012) using a robust
377 maximum likelihood estimator (MLR). The χ^2 goodness-of-fit statistic, comparative fit index
378 (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root
379 mean square error of approximation (RMSEA) were used to evaluate the fit of the models.
380 Browne and Cudeck's (1992) guidelines were adopted as indicators of good fit (CFI, and TLI
381 $\geq .90$, and SRMR and RMSEA scores $\leq .08$).

382 In keeping with the three-stage strategy advocated by Jöreskog (1993) and employed
383 by others (e.g., Lonsdale, Hodge, & Rose, 2008), we initially examined one-factor congeneric
384 models whereby CFA is performed on individual subscales using the calibration sample. We
385 next performed a series of two-factor CFAs in which each dimension was paired with each of
386 the other subscales. In the third and final stage, we tested the model in its entirety. Items were
387 considered for deletion if modification indices suggested that the error term of an item
388 correlated with that of another item, an item had a low factor loading ($< .50$), or modification
389 indices suggested that an item cross-loaded on an unintended latent variable (Ford,
390 MacCallum, & Tait, 1986). Conceptual issues (e.g., construct breadth) were also considered

391 alongside these statistical criteria. The resulting model was subsequently tested on the cross-
392 validation samples.

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

403 **Results and Discussion**

404 **Preliminary Analyses**

405 The data were examined for missing values prior to the main analyses. When less than
406 5% of data points are randomly missing, almost any procedure for handling missing values
407 yields similar results (Tabachnick & Fidell, 2007). Missing data (1.2% on all data points) did
408 not relate to any of the demographic variables and were handled in IBM SPSS 20 using the
409 expectation-maximization method. Data screening procedures did not reveal any univariate or
410 multivariate outliers. However, item-level analyses revealed that some items were negatively
411 skewed. Thus, we employed a robust maximum likelihood estimator (MLR) in all subsequent
412 modeling, which produces standard errors and tests of fit that are robust in relation to non-
413 normality of observations and the use of categorical variables when there are at least four or
414 more response categories (Beauducel & Herzberg, 2006).

415 **Primary Analyses**

416 In stage one, the series of single subscale CFA resulted in the deletion of 19 items
417 according to both empirical (e.g., low factor loadings, high cross-loadings) and conceptual
418 (e.g., items with similar meanings) considerations. Each of the one-factor congeneric models
419 displayed excellent fit with the data according to our multiple criteria. In stage two, an
420 additional 21 items were deleted based on the results of a series of CFAs involving two latent
421 factors. Finally, as detailed in Table 3, the resultant 21-item, seven-factor model evidenced
422 good fit with the data in all samples as both a lower-order (i.e., correlated latent factors) and
423 higher-order model. Composite reliabilities (ρ) of the seven latent factors were adequate in
424 the calibration ($\rho = .74$ to $.89$), athlete ($\rho = .75$ to $.90$), tertiary student ($\rho = .71$ to $.84$), and
425 workplace samples ($\rho = .70$ to $.86$). An inspection of Table 4 reveals that we achieved good
426 (i.e., $> .55$) factor loadings for each item, with the average loadings of all 21 items considered
427 excellent (i.e., $> .71$) across all four samples. Despite the encouraging findings of the
428 multidimensional models regarding fit indices, internal reliability, and factor loadings, there
429 were several instances of inadmissible solutions resulting from a “not positive definite”
430 covariance matrix. A non-positive definite matrix may be due to small sample size (e.g., $<$
431 300), model over fitting, empirical under-identification, or model misidentification (Wothke,
432 1993). Model misidentification appeared to be the most plausible explanation for the
433 nonpositive definite matrix in our case². Additionally, an inspection of the 95% confidence
434 intervals of the latent factor correlations and higher-order coefficients revealed that several
435 relationships encompassed 1 thereby suggesting a lack of discriminant validity.

436 Our approach to establishing initial reliability and validity evidence for our
437 hypothesized higher-order, multidimensional model (i.e., seven lower-order factors) of MT
438 was unsuccessful. Although each of the lower-level facets are backed by an extensive history
439 of research and theory (see Table 2), and were supported in our three samples using one-

² 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.

440 factor congeneric models, our findings suggested that they do not necessarily sum to a
441 coherent whole. The large correlations observed across three independent samples suggested
442 considerable empirical redundancy between the key dimensions of MT, despite the
443 conceptual distinctions proposed by scholars (e.g., Luthans, Avolio et al., 2007; Stajkovic,
444 2006). High correlations have also been observed elsewhere when self-efficacy, optimism,
445 hope, and resilience have been examined as a resource caravan (e.g., Caza, Bagozzi,
446 Woolley, Levy, & Caza, 2010; Luthans, Norman, Avolio, & Avey, 2008).

447 The majority of previous research which has sought to conceptualize MT has adopted
448 a qualitative approach in which a small number of key stakeholders' (e.g., athletes, coaches)
449 have retrospectively recalled their experiences to generate an understanding of this concept
450 (for reviews, see Gucciardi & Gordon, 2011). Thus, it was considered important that these
451 initial findings were tested on large samples across multiple achievement contexts. Contrary
452 to expectations regarding a multidimensional conceptualization of MT (cf. Clough et al.,
453 2002; Coulter et al., 2010; Jones et al., 2002), the findings of this study indicated that the
454 (often subtle) conceptual distinctions among these key personal resources made by scholars
455 are not readily made by individuals from diverse achievement contexts thereby suggesting
456 that a unidimensional model may be more appropriate than a multidimensional
457 representation.

458 Substantively, when conceptualized as a higher-order concept, MT must be inferred
459 on the basis of factor analyses of scales that capture the key dimensions. This indirect
460 approach to conceptualizing higher-order concepts can lead to confusion over whether the
461 multifaceted concept is a latent or aggregate construct (Carver, 1989). Thus, we subsequently
462 examined the utility of a direct approach for measuring the underlying concept itself rather
463 than the key dimensions of MT. A direct approach is also consistent with the emerging trend
464 toward short measures of psychological concepts (e.g., Schulenberg, Schnetzer, & Buchanan,

2011; West, Dyrbye, Satele, Sloan, & Shanafelt, 2012). Items were selected from the 21 items displayed in Table 4 according to a combination of empirical (e.g., size of standardized loading, minimal cross-loadings) and conceptual (e.g., ratings from expert judges in Study 1, adequately captured the content domain of each facet) criteria. One item for each facet was retained, as well as an item to measure one's capacity to deal with adversity so as to capture both everyday challenges and major distresses. The 8-item unidimensional model evidenced excellent fit (see Table 3) and good-to-excellent factor loadings (see Table 5) across all four samples. Composite reliabilities for the unidimensional measure of MT were excellent ($\rho = .86$ to $.89$).

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

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

An inverse relationship between stress and performance has been evidenced across variety of achievement contexts, including the workplace (Gilboa, Shirom, Fried, & Cooper,

2008) and educational settings (Richardson, Abraham, & Bond, 2012). Drawing from the transactional theory of stress (Lazarus & Folkman, 1984), a situation is appraised as stressful when an individual concludes that demands imposed by or perceived within a given context exceeds his or her available coping resources. Conceptualized as a personal capacity or resource, MT should play a role in determining the extent to which individuals perceive transactional experiences and their lives in general to be “unpredictable, uncontrollable, and overloaded” (Cohen, Kamarck, & Mermelstein, 1983, p. 385). Substantively, therefore, we proposed that the perceived stress concept should help explain the relationship between MT and performance. In other words, MT is postulated to exert some of its influence on performance through the distress and coping dimensions (i.e., mediation or indirect effect).

Method

Participants and Procedure

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

Measures

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

Perceived stress. The 10-item Perceived Stress Scale (Cohen et al., 1983) was used to assess an individual’s subjective appraisal of global stress during the last month (e.g., “felt

515 nervous and stressed” and “found that you could not cope with all the things that you had to
516 do”). Items were rated on a scale from 0 (*never*) to 4 (*very often*). A correlated two-factor
517 model of perceived stress involving distress (6 items) and coping (3 items) dimensions was
518 employed because this factor structure has received support across diverse samples (e.g.,
519 Lavoie & Douglas, 2012). The distress ($\rho = .87$) was found to be internally reliable in the
520 current sample; however, coping ($\rho = .65$) was just below the minimum recommend level of
521 $.70$ (Nunnally & Bernstein, 1994).

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

529 Results and Discussion

530 We estimated and tested the significance of the indirect effect of MT on informant-
531 rated performance via perceived stress using the bootstrapping technique and 5000 resamples
532 (Preacher & Hayes, 2008). This method does not assume normality of the distribution of
533 indirect effects and uses a resampling procedure to create confidence intervals for the indirect
534 effect (Hayes, 2009). Bootstrapping allows for the examination of the total, direct and
535 indirect effects of the dependent variable on the independent variable. A significant
536 mediation or indirect effect is observed when the 95% confidence interval (CI) that is
537 obtained from the analysis does not include zero. These analyses were conducted within a
538 structural equation modeling framework using Mplus 7 (Muthén & Muthén, 2012).

539 The fit statistics for the meditational model indicated acceptable fit with the data,
540 $\chi^2(246) = 618.06, p < .001, CFI = .923, TLI = .914, SRMR = .045, RMSEA = .055$ (90% CI =
541 .050 to .061). Direct path coefficients from MT to distress ($\beta = -.52, B = -.63, p < .001$),
542 coping ($\beta = .51, B = .44, p < .001$), and performance ($\beta = .34, B = .41, p < .001$) were
543 significant. Performance evidenced direct relationships with coping ($\beta = .31, B = .44, p$
544 $< .001$) and distress ($\beta = -.15, B = -.15, p < .05$). The total indirect effect from MT to
545 performance via distress and coping was significant (standardized indirect effect estimate =
546 .24, $p < .001, 95\% CI [.17, .31]$). The specific indirect effects of MT to performance via
547 distress (standardized indirect effect estimate = .08, $p < .05, 95\% CI [.01, .15]$) and coping
548 (standardized indirect effect estimate = .16, $p < .001, 95\% CI [.08, .24]$) were significant,
549 thereby supporting our expectation that MT would exert some of its influence on
550 performance through the distress and coping dimensions. MT, distress, and coping explained
551 45% of the variance in performance, whereas MT explained 27% and 26% of the variance in
552 distress and coping, respectively.

553 Consistent with our second research hypothesis, three key features of our
554 conceptualization of MT received support in this study. First, MT has been commonly
555 associated with high performance yet little evidence was offered to support this conclusion.
556 As self-reported MT was directly associated with higher levels of supervisor-rated
557 performance, the results of this study are among the first to provide some support for this
558 theoretical proposition. Second, the findings provided initial validity evidence to support an
559 inverse relationship between distress, and a positive association with coping dimensions of
560 perceived stress. Third, the findings offer preliminary insight into the mechanisms by which
561 MT has an effect on performance in the workplace. Employees with higher levels of MT are
562 less distressed and better able to cope with the demands or challenges in their life, which in
563 turn are associated with higher levels of performance. Consistent with our conceptualization,

564 MT appears to play a role in influencing one's perception of whether his or her personal
565 resources are sufficient to cope with the person-environment interactions and therefore the
566 extent to which an individual appraises challenges or demands as stressful (cf. Lazarus &
567 Folkman, 1984).

568 **Study 4 – Mental Toughness and Key Outcomes in Education**

569 In this study, we sought to replicate and extend upon the results of Study 3 in several
570 ways. First, we extended our focus to an educational context in which achievement is also a
571 central feature. Second, consistent with our guiding definition and conceptualization,
572 perceptions of goal progress and thriving (Spreitzer et al., 2005) were examined as
573 hypothesized outcomes of MT. Third, owing to the prevalence of mental health issues among
574 young people aged 16 to 34 years of age (e.g., approximately 25% in Australia; ABS, 2008),
575 we also explored psychological health as a potential outcome of MT. Psychological health
576 was conceptualized as consisting of the presence of positive symptoms (i.e., positive
577 emotions) and the absence of negative symptoms (i.e., negative emotional states including
578 depression, anxiety) (Keyes, 2003). Finally, we conducted a repeated measures design to
579 explore prospective relationships among the study variables over the course of a university
580 semester. Aligned with our third research hypothesis, obtaining repeated measurements of the
581 same individual over time enables one to simultaneously model within-person (i.e., state) and
582 between-person (i.e., trait) variability in study variables (Roesch et al., 2010) thereby
583 permitting an examination of the traitness of MT. Such an approach enables an exploration of
584 an individual's current MT relative to their usual level (i.e., within-person variability), as well
585 as relative to other people's MT (i.e., between-person variability).

586 Two research hypotheses underpinned this study. First, guided by our concept
587 definition and theoretical model, we expected MT to be positively associated with goal
588 progress, thriving, and our positive indicator (i.e., positive emotions) of psychological health,

589 as well as inversely related with our negative indicator of psychological health (i.e., negative
590 emotional states). Second, guided by both theory (Hobfoll, 1989, 2002) and research (e.g.,
591 Harmison, 2001; Kenny & Zautra, 2001), we hypothesized that the variance in MT would be
592 accounted for by both within- (i.e., state-like) and between-person (i.e., trait-like) differences
593 in MT.

594 **Method**

595 **Participants and Procedure**

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

608 **Measures**

609 The weekly diary survey package contained measures of MT, goal progress, thriving,
610 and psychological health. Owing to the repeated administration of the survey package, all
611 scales with the exception of MT were reduced to achieve an approximate completion time of
612 5 minutes and therefore minimize study fatigue. Pilot data not reported here were collected
613 from a larger sample of undergraduate students ($N = 533$) from a variety of courses (e.g.,

614 psychology, sport science, business) to guide empirical decisions for item selection (i.e.,
615 highest standardized factor loading) alongside theoretical criteria (i.e., adequate
616 representation of the intended construct). For each measure, participants were instructed to
617 indicate how much the statements applied to them as a university student over the past week
618 (including dates). The ordering of the scales within the survey package was altered each week
619 to minimize order effects.

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

621 **Thriving.** Six items from the Thriving Scale (Porath, Spreitzer, Gibson, & Garnett,
622 2012) were employed to assess the cognitive (learning) and affective (vitality) components of
623 thriving in the educational context. Sample items include “I continued to learn more and
624 more as time went by” and “I had energy and spirit”. Items were rated on a scale from 1
625 (*strongly disagree*) to 5 (*strongly agree*).

626 **Goal progress.** Participants listed an academic and social goal which they intended to
627 pursue over the course of the University semester at the first data collection point. The
628 instructions for nominating personal goals were taken directly from previous research
629 (Koestner, Otis, Powers, Pelletier, & Gagnon, 2008) and read as follows: “Personal goals are
630 projects and concerns that people think about, plan for, carry out, and sometimes (though not
631 always) complete or succeed at. They may be more or less difficult to implement; require
632 only a few or a complex sequence of steps; represent different areas of a person’s life; and be
633 more or less time consuming, attractive, or urgent. Please list the most important University
634 or study-related goal that you have for this coming semester. Now do the same for your most
635 important social goal” (p. 235). At each follow-up survey, participants rated how much
636 progress they had made toward each goal using a scale from 1 (*none*) to 9 (*a great deal*).

637 **Psychological health.** As health and illness are not considered the exact opposites of
638 a single continuum (Keyes, 2003), it was important to assess psychological health both in

639 terms of the presence of positive symptoms (i.e., positive emotions) and the absence of
640 negative symptoms (i.e., negative emotional states). Positive emotions were measured with
641 four items used in previous research (Tamir, John, Srivastava, & Gross, 2007). Items were
642 rated on a scale from 1 (*not at all*) to 5 (*all of the time*). Sample items include “Happy /
643 Pleased / Contented” and “Proud / Accomplished / Successful”. Negative emotional states
644 were measured with six items from the Depression, Anxiety and Stress Scales (Lovibond &
645 Lovibond, 1995). Sample items include “I found myself getting agitated” and “I felt I had
646 nothing to look forward to”. Items were rated on a scale from 0 (*did not apply to me at all*) to
647 3 (*applied to me very much/most of the time*).

648 **Results and Discussion**

649 As the data represented a 2-level structure – observations (Level 1) nested within
650 participants (Level 2) – multilevel structural equation modeling (MLSEM; Preacher, Zyphur,
651 & Zhang, 2010) was employed to examine the study hypotheses. Multilevel models
652 accommodate the hierarchical nature of data characterized by non-independence (i.e., two
653 observations from the same person are likely to be more similar than two observations from
654 different persons) by simultaneously estimating the variability at each level of the data
655 hierarchy. With the exception of goal progress, all constructs were modeled as latent
656 variables with items representing observed indicators. The intercepts or means of Level 1
657 variables were allowed to vary across Level 2 units (i.e., people). All analyses were
658 conducted within Mplus 7 (Muthén & Muthén, 2012) using the MLR estimator to
659 accommodate for missing data and unbalanced cluster sizes (i.e., number of observations for
660 each person). Composite reliability estimates (ω) of the study variables were computed
661 within a multilevel CFA framework (Geldhof, Preacher, & Zyphur, in press).

662 **Null model.** We first calculated the intraclass correlation (ICC) for each of the
663 observed variables (i.e., item indicators for latent constructs, goal progress score) to examine

664 the between-person variability in the study variables. The ICC can range from 0 to 1, with
665 values close to zero (e.g., .05) suggesting that multilevel modeling may not be required
666 (Dyer, Hanges, & Hall, 2005). At least 38% of the variance in the study variables was
667 associated with between-person differences. With regard to MT, on average, 44% of the total
668 variance is due to between-person differences (ICCs ranged from .38 to .50). The remaining
669 56% of the variance is due to the within-person variability across the 10 weeks of the study
670 period. These findings supported our expectation that a comparable amount of variance
671 would be accounted for by both within- (i.e., state-like) and between-person (i.e., trait-like)
672 differences in MT. Consistent with a person-situation interaction perspective of MT (e.g.,
673 Harmison, 2011), these findings provide preliminary support for the idea that some
674 individuals bring a dispositional aspect of MT to their interactions with the environment.

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

682 **Multilevel structural model.** We analyzed a full structural model in which MT
683 served as a predictor of psychological health, thriving, and goal progress. The fit statistics
684 indicated acceptable fit with the data, $\chi^2(572) = 1772.37$, $p < .001$, CFI = .925, TLI = .915,
685 $\text{SRMR}_{\text{within}} = .035$, $\text{SRMR}_{\text{between}} = .089$, RMSEA = .034. An overview of the parameter
686 estimates for the multilevel structural model is detailed in Table 6. All of the direct
687 relationships between MT and the outcome variables were statistically significant and
688 consistent with our expectations. MT emerged as a statistically significant predictor of

689 negative emotional states ($R^2_{within} = 10\%$; $R^2_{between} = 21\%$), positive emotions ($R^2_{within} = 33\%$;
690 $R^2_{between} = 75\%$), thriving ($R^2_{within} = 41\%$; $R^2_{between} = 87\%$), and academic ($R^2_{within} = 15\%$;
691 $R^2_{between} = 53\%$) and social goal progress ($R^2_{within} = 3\%$; $R^2_{between} = 45\%$) at both levels of
692 analysis. The strength of the relationship between MT and the outcome variables were
693 stronger at the between-person level when compared with the within-person level. These data
694 also provided further evidence for our third hypothesis because the direct relationships
695 between MT and all five outcome variables were significant at both levels of analysis.
696 Specifically, MT appears to play an important role in understanding goal progress, thriving,
697 and psychological health both in terms of variation within a person (e.g., over time) and
698 between people.

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

700 In this study, we tested the predictive and incremental validity of MT for selection
701 testing in a military context using a naturalistic design. Aligned with our guiding
702 conceptualization of MT, selection testing of already enlisted military personnel was chosen
703 as an appropriate setting in which to examine these aspects of validity because it is a highly
704 stressful course that requires candidates to sustain high levels of performance over an
705 extended period of time (i.e., 6 weeks) across multiple and varied assessment tasks. Thus, this
706 study was designed to provide an insight into whether or not MT was important for
707 *sustaining* high levels of performance despite stress or adversity. We considered it important
708 to test our new unidimensional conceptualization of MT against the popular 4Cs
709 multidimensional model (i.e., control, commitment, challenge, confidence; Clough et al.,
710 2002). In other words, what is the value of this new unidimensional conceptualization of MT
711 above and beyond the existing multidimensional perspective of MT? Because the
712 psychometric properties of the MTQ48, which is designed to capture the 4Cs model of MT,
713 have been shown to be potentially problematic (Gucciardi et al., 2012), we employed

714 established measures of the four key components of this hypothesized conceptualization of
715 MT. We expected MT to predict success in the selection test, that is, contribute to whether
716 one failed or passed the test, as well as retain its significance when control, commitment,
717 challenge, efficacy were included as predictors of performance.

718 **Participants and Procedure**

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

730 The selection test consisted of a six-week selection course specifically designed to
731 assess each candidate's suitability for entry into elite military training (i.e., Special Forces).
732 The selection course comprised a range of individual and team activities that were both
733 physically and mentally demanding, while being relevant to the military context (e.g.,
734 navigating between waypoints, planning a mission, firing weapons, carrying heavy loads for
735 extended periods after minimal sleep). Candidate performance was continuously monitored
736 and assessed throughout the course by instructional staff. Candidates could be removed from
737 the course at any stage for not meeting the required standards or due to medical reasons (e.g.,
738 physical injury). Alternatively, candidates could elect to voluntarily withdraw from the

739 course at any stage. Aligned with the highly stressful and challenging nature of the selection
740 test, no feedback was given to candidates about their performance by instructional staff
741 during the course. Each candidate's final outcome on the selection test (i.e., pass / fail) was
742 obtained by the fifth author with permission from a staff member involved in running the
743 selection course; in total, 50 out of 115 candidates (43%) passed the course.

744 **Measures**

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

747 **Hardiness.** The 15-item Norwegian Dispositional Resilience Scale (Hystad, Eid,
748 Johnsen, Laberg, & Bartone, 2010) to measure hardiness. This scale has three 5-item
749 subscales designed to assess control (e.g., "How things go in my life depends on my own
750 actions"), commitment (e.g., "I really look forward to my work activities") and challenge
751 (e.g., "I enjoy the challenge when I have to do more than one thing at a time"). Items were
752 rated on a scale from 0 (*not at all true*) to 3 (*completely true*). Scale scores were computed by
753 reverse scoring negatively keyed items and averaging across items, with higher scores
754 indicating higher levels of each facet of hardiness. In this sample, Cronbach's alpha for total
755 hardiness ($\alpha = .73$) and the commitment factor ($\alpha = .71$) were good, whereas the control ($\alpha =$
756 $.62$) and challenge ($\alpha = .64$) facets were below the minimum recommend level of $.70$
757 (Nunnally & Bernstein, 1994).

758 **Self-efficacy.** The 8-item New General Self-Efficacy Scale (Chen et al., 2001) was
759 employed to assess an individual's overall perceived efficacy or ability across different tasks
760 and situations (e.g., "Compared to other people, I can do most tasks very well" and "In
761 general, I think I can obtain outcomes that are important to me"). Items were rated on a scale
762 from 1 (*strongly disagree*) to 5 (*strongly agree*). A total self-efficacy score was creating by

763 averaging the 8 items, with higher scores indicating higher levels of perceived efficacy. Self-
764 efficacy was found to be internally reliable in the current sample ($\alpha = .88$).

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

767 **Results and Discussion**

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

780 To examine the primary research question, we employed logistic regression in Mplus
781 7 (Muthén & Muthén, 2012) using a robust maximum likelihood estimator (MLR). The three
782 hardiness facets of commitment ($B = .00$, $SE = .55$, $p = .99$, Odds Ratio [OR] = 1.00), control
783 ($B = -.95$, $SE = .67$, $p = .15$, OR = .39) and challenge ($B = .02$, $SE = .55$, $p = .97$, OR = 1.02),
784 and self-efficacy ($B = -.35$, $SE = .69$, $p = .62$, OR = .72) did not emerge as a significant
785 contributor to the prediction of selection test outcome; however, MT significantly predicted
786 the performance outcome ($B = 1.25$, $SE = .63$, $p < .05$, OR = 3.48). Therefore, consistent with
787 expectations, we found that MT was significantly associated with the successful completion

788 of a rigorous military selection test, even when hardiness and self-efficacy are considered.
789 These findings provide further evidence for the importance of MT for high performance and
790 extend the data obtained with employees in Study 3. Specifically, as the selection test is
791 conducted over six weeks and requires candidates to successfully complete multiple and
792 varied assessment tasks, the findings of this naturalistic study provide initial evidence to
793 support the importance of MT for *sustaining* performance over an extended period of time.

794 **General Discussion**

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

805 The first key contribution of this research pertains to the dimensionality of MT.
806 Previous research (e.g., Clough et al., 2002; Coulter et al., 2010; Jones et al., 2002) and
807 guiding theory (Hobfoll, 2002) led us to expect that MT would be best conceptualized as a
808 multidimensional concept when compared with a unidimensional structure. In testing these
809 two competing conceptual representations in Study 2, our expectation that MT represented a
810 higher-order concept that accounts for the shared variance or commonality among several
811 important personal resources was not supported. Instead, we identified a considerable degree
812 of empirical overlap or lack of discriminant validity between the key personal resources, with

813 a unidimensional model identified as an adequate fit with the data. The lack of discriminant
814 validity among the key dimensions of MT was also evident in the lower-order model in
815 which the attributes were allowed to freely correlate with each other. These findings are in
816 direct contrast to the commonly accepted multidimensional view of MT. Recent research
817 (Gucciardi & Jones 2012) and guiding theory (Hobfoll, 1989) offers a platform upon which
818 to understand the considerable empirical overlap between the MT facets; specifically, it is
819 said that having higher levels of one personal resource is associated with higher levels of
820 other resources (Stajkovic, 2006). Collectively, our findings suggested that the interpretations
821 regarding the dimensionality of MT scholars have made of performers' perceptions of this
822 construct from qualitative research may not be entirely accurate, including our own early
823 work, and therefore require reconsideration and examination in future research.

824 The second key contribution of this research relates to the nomological network of
825 MT. Our conceptualization of MT as a personal capacity to produce consistently high levels
826 of subjective (e.g., goal progress) or objective performance (e.g., sales, race time, GPA)
827 despite everyday challenges and stressors as well as significant adversities received support
828 across several studies. First, in Study 3, we confirmed our substantive expectation of an
829 association with perceived stress in that MT was inversely related with the distress
830 dimension, and positively associated with the coping dimension. These findings align with
831 our expectation that MT plays an important role in determining how individuals perceive the
832 demands or challenges they encounter during their transactions with the environment
833 (Lazarus & Folkman, 1984). Specifically, individuals with higher levels of MT are less likely
834 to believe that the demands imposed by a given situation exceed their available coping
835 resources.

836 Aligned with our guiding definition and calls for scholars to provide evidence on the
837 link between MT and performance, we revealed initial evidence to support the importance of

838 MT for performance in three achievement settings. Among a sample of employees in Study 3,
839 we showed that MT was both directly and indirectly (i.e., via a reduction in perceived distress
840 and an increase in perceived coping ability) related to supervisor-rated performance. We
841 extended these findings in Study 5 to objective performance in terms of success or failure in a
842 selection test within the military context. The results of Study 5 were particularly
843 encouraging, given that our short and direct assessment of MT emerged as the only
844 significant predictor of sustaining high performance alongside the three hardiness and general
845 self-efficacy (collectively, the 4Cs model of MT; Clough et al., 2002). In Study 4, we found
846 that MT was directly related to both academic and social goal progress over a university
847 semester among tertiary students. In these studies performance was assessed retrospectively
848 over the past month by an informant (Study 3), prospectively over the course of a University
849 semester (Study 4), and based on multiple and accumulating tasks over a six-week period
850 (Study 5). Nevertheless, it is important to recognize that additional variance in performance
851 remained unexplained and therefore the influence of MT was small but nevertheless
852 important.

853 The third key contribution of this research relates to the traitness of MT. Assessments
854 of MT have traditionally relied on a general approach in which participants were asked to
855 reflect on their typical thoughts, emotions, or behaviors thereby emphasizing a trait
856 perspective (cf. Clough et al., 2002). However, MT may be better conceptualized as a state-
857 like concept such that it can both vary and have enduring properties across situations and
858 time (Harmison, 2011). Our research is the first to directly test this hypothesis. Using a
859 weekly assessment timeframe with tertiary students in Study 4, we found that approximately
860 44% of the total variance in MT was due to between-person differences, with the remaining
861 56% attributable to within-person variability across the 10 weeks of the university semester.
862 In other words, there was slightly more variability across situations than between individuals

863 thereby supporting the hypothesis that MT may be best conceptualized as a state-like concept.
864 These findings indicated that MT may not be as stable (i.e., trait) as previously hypothesized
865 (Clough et al., 2002) and reported (Hardy et al., in press). From the perspective of an
866 integrative science of personality psychology (McAdams & Pals, 2006), these findings
867 support an interpretation of MT as a characteristic adaptation, that is, a contextualised
868 expression of dispositional traits that are activated or shaped by contextual or social factors
869 (e.g., motives, values, coping styles, personal strivings, self-beliefs).

870 **Research Strengths and Limitations, and Conclusion**

871 The key strengths of this research included the use of samples from four different
872 achievements contexts, and evidence to support different types of validity for the MT concept
873 in terms of theoretical expectations (e.g., predict performance). Nevertheless, the key
874 contributions of our research should be considered in light of the methodological limitations.
875 With the exception of Studies 3 (i.e., informant-rated in role performance) and 5 (i.e.,
876 selection test outcome), our reliance on self-reported data introduced concerns associated
877 with common method biases (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Additionally,
878 we relied on non-experimental designs, which do not permit causality interpretations of the
879 relationships among study variables. Although we sampled participants from four different
880 achievement contexts, our research was conducted solely within an Australian context using
881 convenience samples thus limiting any claims as to the generalizability of our findings.
882 Future research would do well to replicate and extend our research by focusing on samples
883 beyond the Western world to places such as the Middle East and Asia in which MT has
884 gained interest yet relies on outdated conceptualizations and measurement tools. Finally, we
885 did not explicitly examine MT in relation to major assaults of one's normal functioning (e.g.,
886 serious injury or health issue, death of a loved one, failed a course). This complex aspect of
887 our conceptualization of MT requires attention in future research.

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

References

- 901
902 ABS (2008). *National survey of mental health and wellbeing: Summary of results, 2007*.
903 ABS 2008. Cat. no. 4326.0. ABS, Canberra.
- 904 Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A
905 review and recommended two-step approach. *Psychological Bulletin*, *103*, 411–423.
906 doi: 10.1037/0033-2909.103.3.411
- 907 Asken, M. J., Grossman, D., & Christensen, L. W. (2010). *Warrior mindset: Mental*
908 *toughness skills for a nation's peacekeepers*. United States of America: Warrior
909 Science Group.
- 910 Bacharach, S.B. (1989). Organizational theories: Some criteria for evaluation. *Academy of*
911 *Management Review*, *14*, 496-515. doi: 10.2307/258555
- 912 Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- 913 Beauducel, A., & Herzberg, P. Y. (2006). On the performance of maximum likelihood versus
914 means and variance adjusted weighted least squares estimation in CFA. *Structural*
915 *Equation Modeling*, *13*, 186-203. doi: 10.1207/s15328007sem1302_2.
- 916 Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological*
917 *Methods & Research*, *21*, 230-258. doi:10.1177/0049124192021002005
- 918 Carver, C. S. (1989). How should multifaceted personality constructs be tested? Issues
919 illustrated by self-monitoring, attributional style, and hardiness. *Journal of Personality*
920 *and Social Psychology*, *56*, 577–585. doi: 10.1037/0022-3514.56.4.577
- 921 Carver, C. S. (1998). Resilience and thriving: Issues, models, and linkages. *Journal of Social*
922 *Issues*, *54*, 245–266. doi: 10.1111/0022-4537.641998064
- 923 Caza, A., Bagozzi, R. P., Woolley, L., Levy, L., & Caza, B. B. (2010). Psychological capital
924 and authentic leadership: Measurement, gender, and cultural extension. *Asia-Pacific*
925 *Journal of Business Administration*, *2*, 53-70. doi: 10.1108/17574321011028972

- 926 Chan, D. (1998). The conceptualization and analysis of change over time: An integrative
927 approach incorporating longitudinal mean and covariance structures analysis (LMACS)
928 and multiple indicator latent growth modeling (MLGM). *Organizational Research*
929 *Methods, 1*, 421-483. doi:10.1177/109442819814004
- 930 Chen, G., Gully, S. M., & Eden, D. (2001). Validation of a new general self-efficacy scale.
931 *Organizational Research Methods, 4*, 62-83. doi: 10.1177/109442810141004
- 932 Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale
933 development. *Psychological Assessment, 7*, 309-319. doi: 10.1037/1040-3590.7.3.309
- 934 Clough, P., Earle, K., & Sewell, D. (2002). Mental toughness: The concept and its
935 measurement. In I. Cockerill (Ed.), *Solutions in sport psychology* (pp. 32-45). London:
936 Thomson.
- 937 Clough, P., & Strycharczyk, D. (2012). *Developing mental toughness: Improving*
938 *performance, wellbeing and positive behavior in others*. London: Kogan Page.
- 939 Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress.
940 *Journal of Health and Social Behavior, 24*, 385-396. doi: 10.2307/2136404
- 941 Colbert, S. D., Scott, J., Dale, T., & Brennan, P. A. (2012). Performing to a world class
942 standard under pressure: Can we learn lessons from the Olympians? *British Journal of*
943 *Oral & Maxillofacial Surgery, 50*, 291-297. doi: 10.1016/j.bjoms.2012.04.263
- 944 Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, NJ: Erlbaum.
- 945 Coulter, T., Mallett, C. J., & Gucciardi, D. F. (2010). Understanding mental toughness in
946 Australian soccer: Perceptions of players, parents, and coaches. *Journal of Sports*
947 *Sciences, 28*, 699-716. doi: 10.1080/02640411003734085
- 948 Covington, M. V., & Omelich, C. L. (1988). Achievement dynamics: The interaction of
949 motives, cognitions, and emotions over time. *Anxiety Research, 1*, 165-183. doi:
950 10.1080/08917778808248717

- 951 Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands–
952 resources model of burnout. *Journal of Applied Psychology, 86*, 499–512. doi:
953 10.1037//0021-9010.86.3.499
- 954 DeVellis, R.F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand
955 Oaks, CA: Sage.
- 956 Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance
957 and passion for long-term goals. *Journal of Personality and Social Psychology, 92*,
958 1087-1101. doi: 10.1037/0022-3514.92.6.1087
- 959 Dyer, N. G., Hanges, P. J., & Hall, R. J. (2005). Applying multilevel confirmatory factor
960 analysis techniques to the study of leadership. *Leadership Quarterly 16*, 149–167. doi:
961 10.1016/j.leaqua.2004.09.009
- 962 Ford, J., MacCallum, R., & Tait, M. (1986). The application of factor analysis in psychology:
963 A critical review and analysis. *Personnel Psychology, 39*, 291–314. doi:
964 10.1111/j.1744-6570.1986.tb00583.x
- 965 Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (in press). Reliability estimation in a
966 multilevel confirmatory framework analysis framework. *Psychological Methods*. doi:
967 10.1037/a0032138
- 968 Gilboa, S., Shirom, A., Fried, Y., & Cooper, C. (2008). A meta-analysis of work demand
969 stressors and job performance: Examining main and moderating effects. *Personnel*
970 *Psychology, 61*, 227–271. doi:10.1111/j.1744-6570.2008.00113.x
- 971 Godlewski, R., & Kline, T. (2012). A model of voluntary turnover in male Canadian forces
972 recruits. *Military Psychology, 24*, 251-265. doi: 10.1080/08995605.2012.678229
- 973 Gross, J. J., & Thompson, R. (2007). Emotion regulation: Conceptual foundations. In J.
974 Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford.

- 975 Gucciardi, D. F., & Gordon, S. (Eds.) (2011). *Mental toughness in sport: Developments in*
976 *research and theory*. Abingdon, Oxon: Routledge.
- 977 Gucciardi, D.F., Gordon, S., & Dimmock, J.A. (2009b). Evaluation of a mental toughness
978 training program for youth-aged Australian footballers: I. A quantitative analysis.
979 *Journal of Applied Sport Psychology, 21*, 307-323. doi: 10.1080/10413200903026066
- 980 Gucciardi, D. F., Hanton, S., & Mallett, C. F. (2012). Current issues for measuring mental
981 toughness: A case example of the Mental Toughness Questionnaire-48. *Sport, Exercise*
982 *and Performance Psychology, 1*, 194-214. doi: 10.1037/a0027190
- 983 Gucciardi, D. F., & Jones, M. I. (2012). Beyond performance excellence: Mental toughness
984 profiles and indicators of developmental success in adolescent cricketers. *Journal of*
985 *Sport & Exercise Psychology, 34*, 16-36.
- 986 Hardy, L., Bell, J., & Beattie, S. (in press). Preliminary evidence for a neuropsychological
987 model of mentally tough behavior. *Journal of Personality*.
- 988 Harmison, R. J. (2011). A social-cognitive framework for understanding and developing
989 mental toughness in sport. In D. F. Gucciardi & S. Gordon (Eds.) (2011). *Mental*
990 *toughness in sport: Developments in research and theory* (pp. 47-68). Abingdon, Oxon:
991 Routledge.
- 992 Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new
993 millennium. *Communication Monographs, 76*, 408-420. doi:
994 10.1080/03637750903310360
- 995 Hemphill, J. F. (2003). Interpreting the magnitudes of correlation coefficients. *American*
996 *Psychologist, 58*, 78-79. doi: 10.1037/0003-066X.58.1.78
- 997 Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress.
998 *American Psychologist, 44*, 513-524. doi: 10.1037/0003-066X.44.3.513

- 999 Hobfoll, S. E. (2002). Social and psychological resources and adaptation. *Review of General*
1000 *Psychology, 6*, 307–324. doi: 10.1037//1089-2680.6.4.307
- 1001 Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A. (2009). A behavioral genetic
1002 study of mental toughness and personality. *Personality and Individual Differences, 46*,
1003 100-105. doi:10.1016/j.paid.2008.09.009
- 1004 Hystad, S.W., Eid, J., Johnsen, B.H., Laberg, J.C., & Bartone, P.T. (2010). Psychometric
1005 properties of the revised Norwegian dispositional resilience (hardiness) scale.
1006 *Scandinavian Journal of Psychology, 51*, 237–245. doi: 10.1111/j.1467-
1007 9450.2009.00759.x
- 1008 Jones, G. (2012). The role of superior performance intelligence in sustained success. In S.
1009 Murphy (Ed.), *The Oxford Handbook of Sport and Performance Psychology* (pp. 62-
1010 80). New York: Oxford University Press.
- 1011 Jones, G., Hanton, S., & Connaughton, D. (2002). What is this thing called mental
1012 toughness? An investigation of elite sport performers. *Journal of Applied Sport*
1013 *Psychology, 14*, 205-218. doi: 10.1080/10413200290103509
- 1014 Jones, G., & Moorehouse, A. (2007). *Developing mental toughness: Gold medal strategies*
1015 *for transforming your business performance*. Begbroke, Oxford: Spring Hill.
- 1016 Jöreskog, K. G. (1993). Testing structural equation models. In K. A. Bollen & J. S. Long
1017 (Eds.), *Testing structural equation models* (pp. 294–316). Newbury Park, CA: Sage.
- 1018 Kenny, D. A., & Zautra, A. (2001). The trait-state models for longitudinal data. In L. M.
1019 Collins & A. G. Sayer (Eds.), *New methods for the analysis of change* (pp. 243–263).
1020 Washington, DC: American Psychological Association. doi: 10.1037/10409-008
- 1021 Keyes, C. L. M. (2003). Complete mental health: An agenda for the 21st century. In C. L. M.
1022 Keyes & J. Haidt (Eds.), *Flourishing: Positive psychology and the life well-lived* (pp.
1023 293–312). Washington, DC: American Psychological Association.

- 1024 Koestner, R., Otis, N., Powers, T. A., Pelletier, L., & Gagnon, H. (2008). Autonomous
1025 motivation, controlled motivation, and goal progress. *Journal of Personality, 76*, 1201–
1026 1229. doi: 10.1111/j.1467-6494.2008.00519.x
- 1027 Larson, R. J. (2000). Toward a science of mood regulation. *Psychological Bulletin, 108*, 480-
1028 498. doi: 10.1207/S15327965PLI1103_01
- 1029 Lavoie, J. A. A., & Douglas, K. S. (2012). The Perceived Stress Scale: Evaluating configural,
1030 metric and scalar invariance across mental health status and gender. *Journal of*
1031 *Psychopathology and Behavioral Assessment, 34*, 48-57. doi: 10.1007/s10862-011-
1032 9266-1
- 1033 Lazarus, R. S., & Folkman, S. (1984). *Stress appraisal and coping*. New York: Springer.
- 1034 Locke, E. A. (2003). Good definitions: The epistemological foundation of scientific progress.
1035 In J. Greenberg (Ed.), *Organizational behavior: The state of the science* (pp. 395-423).
1036 Mahwah, NJ: Lawrence Erlbaum.
- 1037 Locke, E. A. (2007). The case for inductive theory building. *Journal of Management, 33*,
1038 867-890. doi: 10.1177/0149206307307636
- 1039 Lonsdale, C., Hodge, K., & Rose, E. A. (2008). The Behavioral Regulation in Sport
1040 Questionnaire (BRSQ): Instrument development and initial validity evidence. *Journal*
1041 *of Sport & Exercise Psychology, 30*, 323-355.
- 1042 Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales*.
1043 Sydney: The Psychology Foundation of Australia Inc.
- 1044 Luthans, F., Avolio, B. J., Avey, J. B., & Norman, S. M. (2007). Positive psychological
1045 capital: Measurement and relationship with performance and satisfaction. *Personnel*
1046 *Psychology, 60*, 541-572. doi: 10.1111/j.1744-6570.2007.00083.x

- 1047 Luthans, F., Norman, S. M., Avolio, B. J., & Avey, J. B. (2008). The mediating role of
1048 psychological capital in the supportive organizational climate–employee performance
1049 relationship. *Journal of Organizational Behavior* 29, 219–238. doi: 10.1002/job.507
- 1050 Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*,
1051 35, 382–385. doi: 10.1097/00006199-198611000-00017
- 1052 Maddi, S. R. (2007). Relevance of hardiness assessment and training to the military context.
1053 *Military Psychology*, 19, 61–70. doi: 10.1080/08995600701323301
- 1054 Marsh, H.W. (1997). The measurement of physical self-concept: A construct validation
1055 approach. In K. Fox (Ed.), *The physical self: From motivation to well-being* (pp. 27–
1056 58). Champaign, IL: Human Kinetics.
- 1057 Marsh, H. W., Hau, K.-T., Balla, J. R., & Grayson, D. (1998). Is more ever too much? The
1058 number of indicators per factor in confirmatory factor analysis. *Multivariate Behavioral*
1059 *Research*, 33, 181–220. doi: 10.1207/s15327906mbr3302_1
- 1060 Martin, A. J., & Marsh, H. W. (2008). Workplace and academic buoyancy: Psychometric
1061 assessment and construct validity amongst school personnel and students. *Journal of*
1062 *Psychoeducational Assessment*, 26, 169-184. doi:10.1177/0734282907313767
- 1063 Martin, A. J., & Marsh, H. W. (2009). Academic resilience and academic buoyancy:
1064 Multidimensional and hierarchical conceptual framing of causes, correlates and cognate
1065 constructs. *Oxford Review of Education*, 35, 353-370.
1066 doi:10.1080/03054980902934639
- 1067 Masten, A. S. (2011). Resilience in children threatened by extreme adversity: Frameworks for
1068 research, practice, and translational synergy. *Development and Psychopathology*, 23,
1069 493-506. doi:10.1017/S0954579411000198

- 1070 McAdams, D. P., & Pals, J. L. (2006). A new big five: Fundamental principles for an
1071 integrative science of personality. *American Psychologist, 61*, 204-217.
1072 doi:10.1037/0003-066X.61.3.204
- 1073 Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7th ed.). Los Angeles,
1074 CA: Muthén & Muthén.
- 1075 Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York:
1076 McGraw-Hill.
- 1077 Obradović, J., Schaffer, A., & Masten, A. S. (2012). Adversity and risk in developmental
1078 psychopathology: Progress and future directions. In L. C. Mayes & M. Lewis (Eds.),
1079 *The Cambridge handbook of environment of human development* (pp. 35-57). New
1080 York: Cambridge University Press.
- 1081 Perry, J. L., Clough, P. J., Crust, L., Earle, K., & Nicholls, A. R. (2013). Factorial validity of
1082 the Mental Toughness Questionnaire-48. *Personality and Individual Differences, 54*,
1083 587-592. doi: 10.1016/j.paid.2012.11.020
- 1084 Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method
1085 biases in behavioral research: A critical review of the literature and recommended
1086 remedies. *Journal of Applied Psychology, 88*, 879-903. doi: 10.1037/0021-
1087 9101.88.5.879
- 1088 Porath, C., Spreitzer, G., Gibson, C., & Garnett, F. G. (2012). Thriving at work: Toward its
1089 measurement, construct validation, and theoretical refinement. *Journal of*
1090 *Organizational Behavior, 33*, 250-275. doi: 10.1002/job.756
- 1091 Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing
1092 and comparing indirect effects in multiple mediator models. *Behavior Research*
1093 *Methods, 40*, 879-891. doi: 10.3758/BRM.40.3.879

- 1094 Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for
1095 assessing multilevel mediation. *Psychological Methods, 15*, 209–233.
1096 doi:10.1037/a0020141
- 1097 Preston, C. C., & Colman, A. M. (2000). Optimal number of response categories in rating
1098 scales: Reliability, validity, discriminating power, and respondent preferences. *Acta*
1099 *Psychologica, 104*, 1-15. doi: 10.1016/S0001-6918(99)00050-5
- 1100 Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied*
1101 *Psychological Measurement, 21*, 173-184. doi: 10.1177/01466216970212006.
- 1102 Raymond, J. (2009). Interactions of attention, emotion, and motivation. *Progress in Brain*
1103 *Research, 176*, 293-308. doi: 10.1016/S0079-6123(09)17617-3
- 1104 Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university
1105 students' academic performance: A systematic review and meta-analysis. *Psychological*
1106 *Bulletin, 138*, 353-387. doi: 10.1037/a0026838
- 1107 Robinson, M. D., Schmeichel, B. J., & Inzlicht, M. (2010). A cognitive control perspective of
1108 self-control strength and its depletion. *Social and Personality Psychology Compass, 4*,
1109 189-200. doi: 10.1111/j.1751-9004.2009.00244.x
- 1110 Roesch, S. C., Aldridge, A. A., Stocking, S. N., Villodas, F., Leung, Q., Bartley, C. E., &
1111 Black, L. J. (2010). Multilevel factor analysis and structural equation modeling of daily
1112 diary coping data: Modeling trait and state variation. *Multivariate Behavioral Research,*
1113 *45*, 767–789. doi: 10.1080/00273171.2010.519276
- 1114 Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of
1115 psychological well-being. *Journal of Personality and Social Psychology, 57*, 1069-
1116 1081. doi: 10.1037/0022-3514.57.6.1069

- 1117 Scheier, M. F., & Carver, C. S. (1985). Optimism, coping and health: Assessment and
1118 implications of generalized outcome expectancies. *Health Psychology, 4*, 219–247. doi:
1119 10.1037//0278-6133.4.3.219
- 1120 Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from
1121 neuroticism (and trait anxiety, self-mastery, and self-esteem) – A reevaluation of the
1122 life orientation test. *Journal of Personality and Social Psychology, 67*, 1063–1078. doi:
1123 10.1037/0022-3514.67.6.1063
- 1124 Schulenberg, S. E., Schnetzer, L. W., & Buchanan, E. M. (2011). The Purpose in Life Test-
1125 Short Form: Development and psychometric support. *Journal of Happiness Studies, 12*,
1126 861-876. doi: 10.1007/s10902-010-9231-9
- 1127 Seligman, M. E. P. (1991). *Learned optimism*. New York, NY: Knopf.
- 1128 Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural
1129 equation models. *Sociological Methodology, 13*, 290-312. doi: 10.2307/270723
- 1130 Snyder, C. R., Harris, C., Anderson, J. R., Irving, L., Sigmon, S. T., Yoshinobu, L., et al.
1131 (1991). The will and the ways: Development and validation of an individual-differences
1132 measure of hope. *Journal of Personality and Social Psychology, 60*, 570–585. doi:
1133 10.1037/0022-3514.60.4.570
- 1134 Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations models.
1135 In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290-312). San Francisco: Jossey-
1136 Bass.
- 1137 Spreitzer, G., & Porath, C. (in press). Self-determination theory as a nutriment for thriving:
1138 Building an integrative model of human growth at work. In M. Gagné (Ed.), *Oxford*
1139 *handbook of work engagement, motivation and self-determination theory*. New York,
1140 NY: Oxford University Press.

- 1141 Spreitzer, G., Sutcliffe, K., Dutton, J., Grant, A. M., & Sonenshein, S. (2005). A socially
1142 embedded model of thriving at work. *Organization Science, 16*, 537–549. doi:
1143 10.1287/orsc.1050.0153
- 1144 Stajkovic, A. D. (2006). Development of a core confidence-higher order construct. *Journal of*
1145 *Applied Psychology, 91*, 1208-1224. doi: 10.1037/0021-9010.91.6.1208
- 1146 Sternberg, R. J. (1998). A balance theory of wisdom. *Review of General Psychology, 2*, 347–
1147 365. doi:10.1037/1089-2680.2.4.347
- 1148 Stone, A, Schwartz, J., Neale, J., Shiffman, S., Marco, C., Hickcox, M., &...Cruise, L.
1149 (1998). A comparison of coping assessed by ecological momentary analysis and
1150 retrospective recall. *Journal of Personality and Social Psychology, 74*, 1670–1680. doi:
1151 10.1037/0022-3514.74.6.1670
- 1152 Suddaby, R. (2010). Editor’s comments: Construct clarity in theories of management and
1153 organization. *Academy of Management Review, 35*, 346-357. doi:
1154 10.5465/AMR.2010.51141319
- 1155 Tabachnick, B. S., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed). Needham
1156 Heights, MA: Allyn and Bacon.
- 1157 Tamir, M., John, O. P., Srivastava, S., & Gross, J. J. (2007). Implicit theories of emotion:
1158 Affective and social outcomes across a major life transition. *Journal of Personality and*
1159 *Social Psychology, 92*, 731–744. doi:10.1037/0022-3514.92.4.731
- 1160 Thelwell, R., Weston, N., & Greenlees, I. (2005). Defining and understanding mental
1161 toughness in soccer. *Journal of Applied Sport Psychology, 17*, 326-332. doi:
1162 10.1080/10413200500313636
- 1163 Vogt, D. S., King, D. W., & King, L. A. (2004). Focus groups in psychological assessment:
1164 Enhancing content validity by consulting members of the target population.
1165 *Psychological Assessment, 16*, 231–243. doi: 10.1037/1040-3590.16.3.231

- 1166 Wakefield, T. S. (2008). *Mental toughness: Understanding the game of life*. Bloomington,
1167 IN: AuthorHouse.
- 1168 Weinberg, R. (2010). *Mental toughness for sport, business, and life*. Bloomington, IN:
1169 AuthorHouse.
- 1170 West, C. P., Dyrbye, L. N., Satele, D. V., Sloan, J. A., & Shanafelt, T. D. (2012). Concurrent
1171 validity of single-item measures of emotional exhaustion and depersonalization in
1172 burnout assessment. *Journal of General Internal Medicine*, *27*, 1445-1452. doi:
1173 10.1007/s11606-012-2015-7
- 1174 Williams, L. J., & Anderson, S. E. (1991). Job satisfaction and organizational commitment as
1175 predictors of organizational citizenship and in-role behaviors. *Journal of Management*,
1176 *17*, 601-617. doi: 10.1177/014920639101700305
- 1177 Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical*
1178 *Gerontology*, *21*, 152–169. doi: 10.1017/S0959259810000420
- 1179 Windle, G. (2012). The contribution of resilience to healthy ageing. *Perspectives in Public*
1180 *Health*, *132*, 159-160. doi: 10.1177/1757913912449572
- 1181 Wothke, W. (1993). Nonpositive definite matrices in structural modeling. In K. A. Bollen, &
1182 J. S. Long (Eds.), *Testing structural equation models* (pp. 256–293). Newbury Park,
1183 CA: Sage Publications.
- 1184 Zelazo, P. D., Carter, A., Reznick, J. S., & Frye, D. (1997). Early development of executive
1185 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.*

Key Dimension	Definition	Supporting Theory and Research
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	χ^2	df	p	CFI	TLI	SRMR	RMSEA (90% CI)
^a 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)
^b Model 2: First-order model							
Calibration sample (n = 418)	347.28 [#]	168	.000	.951	.938	.036	.054 (.047 to .062)
Athletes (n = 445)	378.33 [#]	168	.000	.950	.938	.040	.053 (.046 to .060)
Tertiary students (n = 500)	411.03 [#]	168	.000	.944	.930	.045	.054 (.047 to .060)
Employees (n = 550)	362.09 [#]	168	.000	.955	.944	.039	.046 (.039 to .052)
^c 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 [#]	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 [#]	182	.000	.946	.937	.039	.048 (.042 to .055)
^d 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: ^aModel 1: unidimensional model of the 21 items; ^bModel 2: correlated 7-factor model of the 21 items; ^cModel 3: second-order model of the 21 items with a core mental toughness factor accounting for the variance between the seven lower-order factors; ^dModel 4: unidimensional model of the 8 items; χ^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 (λ) and residual variances (Θ) of the second-order, seven-factor model of mental toughness in Study 2.

	Calibration sample ($n = 418$)		Athletes ($n = 445$)		Tertiary students ($n = 500$)		Employees ($n = 550$)	
	λ	Θ	λ	Θ	λ	Θ	λ	Θ
<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 (λ) and residual variances (Θ) 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)	
	λ	Θ	λ	Θ	λ	Θ	λ	Θ
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)	
	β	SE	β	SE
Direct Effects				
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
Latent Correlations				
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; * $p < .05$, ** $p < .01$, *** $p < .001$