Running head: MENTAL TOUGHNESS SCALE FOR ADOLESCENTS

The development and validation of a mental toughness scale for adolescents (MTS-A)

Abstract

The present study examined the validity of a newly developed instrument, the Mental Toughness Scale for Adolescents (MTS-A), which examines the attributes of challenge, commitment, confidence (abilities and interpersonal) and control (life and emotion). The six factor model was supporting using Exploratory Factor Analysis (EFA, n = *373*) and Confirmatory Factor Analysis (CFA, n = *372*). In addition, the mental toughness attributes correlated with adolescents' academic motivation and engagement (n = 439), well-being (depression and anxiety) (n = 279) and test anxiety (n = 279), indicating relations with a number of affective, cognitive and behavioural dispositions, and demonstrating relevance in education and potentially mental health contexts.

Keywords; mental toughness, adolescence, education, mental health

Introduction

Mental toughness is receiving increasing interest within the area of performance psychology. What was once a concept studied almost exclusively within sports (Crust, 2008), the characteristics associated with mental toughness are now widely applied to many non-sports settings where performance is typically measured (e.g., occupational, health and educational contexts) and are associated with successful outcomes (Jones, Hanton & Connaughton, 2007). While there have been a number of models used to study mental toughness (e.g. Clough, Earle & Sewell, 2002; Fourie & Potgieter, 2001; Golby, Sheard & Van Wersch, 2007; Jones, Hanton & Connaughton, 2002; 2007), the model which has been most commonly used in an education context identifies six attributes: commitment, challenge, control (life and emotion), and confidence (abilities and interpersonal) (Clough et al., 2002). In the context of education, mental toughness attributes have been shown to correlate positively with academic achievement, school attendance, classroom behaviour, and peer relationships in secondary school students (St.Clair-Thompson, Bugler, Robinson, McGeown, Perry & Clough, 2014) and with achievement and progression among undergraduates (Crust, Earle, Perry, Earle, Clough & Clough, 2014). In addition, stronger mental toughness attributes have been associated with more successful educational transitions (St.Clair-Thompson et al., 2016) and in adolescent populations, have been associated with better physical and psychological health (e.g. Gerber et al., 2012; 2013a; 2013b; 2015).

In a recent review, McGeown, St.Clair-Thompson, and Clough (2015) discussed the concept of mental toughness specifically within an educational context, examining links between mental toughness attributes and cognate attributes commonly studied within education (e.g., self-efficacy, perseverance, resilience, motivation, etc). The authors argued that while these attributes are typically studied in isolation, mental toughness provides an overarching framework for the parallel study of different non-cognitive attributes, allowing a

more comprehensive approach. Drawing on the existing 4 C's model of mental toughness more commonly used in sport (Clough et al.,2002), McGeown et al., (2015) redefined these attributes within an educational context. Commitment was defined as the perseverance and ability to carry out tasks successfully, despite problems or obstacles. Students who scored high on commitment would set goals and strive to achieve them; indeed they would be determined to complete these goals, despite problems or obstacles they may encounter. Challenge was defined as seeking out opportunities for self-development. Those who scored high on challenge would see new situations as opportunities for self-development, rather than as threats, and would be more likely to actively seek out opportunities to develop. Control referred to being influential in one's own life and was subdivided into life control and emotional control. Adolescents with high levels of life control would feel that they have the power to shape their own life and future, while those with high emotion control would be able to regulate their emotions (e.g., anxiety, anger) to an appropriate level of intensity, particularly in difficult situations. Finally, confidence referred to levels of self-assurance and was divided into confidence in abilities and interpersonal confidence. Those who were confident in their abilities would feel confident at attempting new or difficult tasks, whereas those with high levels of interpersonal confidence would feel confident in social situations, particularly in new or unfamiliar environments.

Extant Mental Toughness Measures

While there are existing questionnaires to measure mental toughness, these have been developed and primarily used with adult populations. Of particular note are the Psychological Performance Inventory-A (PPI-A: Golby et al., 2007), previously the PPI (Loehr, 1986) which examines mental toughness within a sports context. Golby et al., (2007) noted adequate psychometric properties of data collected using their instrument, although a more recent psychometric evaluation by Gucciardi (2012), noted that while the model fit data

for the PPI-A was encouraging, and convergent validity sufficient, internal consistency was poor. In addition, the Mental Toughness Questionnaire – MTQ48 (Clough et al., 2002) is of particular relevance, as the MTS-A developed in the present study draws on the same conceptual framework as that assessed by the MTQ-48: challenge, commitment, control (life, emotions) and confidence (abilities, interpersonal). The factorial structure of data collected using the MTQ48 (Clough et al., 2002) has been assessed with large populations of adults (n = 686 and n = 639, Gucciardi, Hanton & Mallett, 2012; n = 8207, Perry, Clough, Crust, Earle & Nicholls, 2013) the latter study, with the largest sample, finding acceptable model fit. In addition, the MTQ-48 has been used with adolescents in an education context, to study correlates with academic attainment, attendance, behaviour, peer relationships (St.Clair-Thompson et al., 2014) and educational transitions (St.Clair-Thompson et al., 2016). In addition, Gerber et al., (2013; 2015) used the MTQ-48 (2013) and a shortened version, the MTQ-18 (2015) with older adolescents, showing higher mental toughness scores to correlate with lower stress (2013; 2015), less depressive symptoms (2013) and lower burnout (2015).

Rationale for Questionnaire Development

Crust (2008) highlights the importance of considering context when studying mental toughness; previous mental toughness questionnaires were originally developed with adult athletes, typically within a sports context. Indeed, the study of mental toughness originally focused on elite and super elite sports participants; however this appears to be unnecessarily restrictive as the attributes associated with mental toughness appear to be relevant to the general population (Crust, 2008). Therefore, the development of a measure to examine mental toughness in adolescent populations, specifically within an education context, is crucial. The questionnaire was developed to be relatively short (18 items), and only include items that were developmentally appropriate for adolescents, and relevant both within and out

with an education context; however adolescents were asked to reflect on their experiences within education specifically.

Research aim and hypotheses

This study aimed to investigate the factorial structure and validity of a newly developed instrument, the MTS-A. Past research has demonstrated relationships between mental toughness and positive education outcomes (e.g., attainment, behaviour, peer relationships, educational transitions; St-Clair-Thompson et al., 2014; 2016) and physical and psychological health (Gerber et al., 2012; 2013a; 2013b; 2015). It was therefore hypothesised that scores on the subcomponents of the MTS-A would be related to adolescents' motivation and engagement, depression, generalised anxiety and test anxiety.

MTS-A: Proposed implications and use

The MTS-A was developed to be of use by researchers and practitioners interested in studying mental toughness within adolescent populations. If relationships between MTS-A and education and psychological outcomes were found, this would provide evidence of its potential for use within these contexts. Sex and age differences in mental toughness scores were also examined, to provide researchers and practitioners with insight into group differences in this construct, which may be helpful when interpreting scores.

Method

Sample 1

Four hundred and thirty-nine students from a single Scottish secondary school participated in this study (male $n = 216$, female $n = 223$). Scottish secondary education contains six years of study (S1 – S6 from the ages of 11 to 18 years). This opportunistic sample contained participants from all year groups (S1 $n = 56$, S2 $n = 110$, S3 $n = 102$, S4 n = 68, S5 $n = 62$, S6 $n = 40$) with mean age of 14.3 years ($SD = 1.6$). One participant did not disclose their year group.

Measures

Mental toughness scale – Adolescents. This group-administered 18-item scale was developed to measure the attributes of commitment, challenge, control (life), control (emotions), confidence (abilities) and confidence (interpersonal), with three items tapping into each construct. The scale consists of positively and negatively worded statements and takes approximately 10 minutes to complete. Prior to questionnaire development, adolescent students (n = 54 students, aged 12-17) took part in a focus group (n = 15 focus groups, ~30 minutes each) to understand mental toughness within this population. Students were also shown all questionnaire items to assess whether wording was understandable, appropriate and aligned with the constructs of interest. This process resulted in some revisions to the questionnaire items. All items used within the questionnaire were regarded as understandable and appropriate for students aged 11-17. See Appendix 1.

Academic motivation and engagement scale (High School). This is a group-administered 44-item scale measuring adaptive cognitions (self-belief, valuing, learning focus), adaptive behaviours (planning, task management, persistence), impeding/maladaptive cognitions (anxiety, failure avoidance, uncertain control), and maladaptive behaviours (self-sabotage and disengagement) (Martin, 2010). Data collected using this scale has demonstrated good reliability and validity (Martin, 2007; Martin, Yu, Papworth, Ginns & Collie, 2015) and has been used in a wide programme of research studies, demonstrating correlates with school enjoyment, classroom participation and educational aspirations (Martin, 2007).

Sample 2

Two hundred and seventy students from a single English middle school participated in this study (male $n = 133$, female $n = 112$, $n = 25$ not reported). This opportunistic sample

contained participants from the first two years of secondary education (Year 7 $n = 131$, Year 8 $n = 135$, $n = 4$ unreported) with a mean age of 12.1 years ($SD = 0.70$).

Measures

The Revised Anxiety Scale. This is a group-administered 20-item measure of test anxiety that contains two cognitive subscales (worry and test-irrelevant thoughts) and two affective-physiological scales (tension and physical anxiety symptoms) (Hagtvet & Benson, 1997). Participants responded to items on a four-point scale (1 = almost never, 4 = always). Data collected using this instrument in English secondary schools has shown excellent internal reliability and factorial validity (e.g., Putwain, Connors, & Symes, 2010; Putwain & Symes, 2012).

The revised child anxiety and depression scale (short version). Six items were used from this group-administered measure to assess major depressive disorder as and generalized anxiety disorder (Ebesutani et al., 2012). Participants respond to items on a 4-point scale (1 = never, 4 = always). Previous research has revealed suitable reliability and factorial validity (e.g. Ebesutani et al., 2012).

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Results

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Analytic Strategy

First we examined the construct validity of the MTS-A. The MTS-A responses from both Study 1 (the Scottish sample) and Study 2 (the English sample) were merged and randomly split into one dataset designated for exploratory factor analysis ($n = 373$) and a second designated for confirmatory factor analysis ($n = 372$). Second, we reverted to the original samples in Studies 1 and 2 in order to examine the relationship between the MTS-A and a range of cognate constructs that are known to influence learning and achievement. Analyses were performed in M*plus* 7.4 (Muthén & Muthén, 2013) with the exception of internal reliability and sampling adequacy coefficients (KMO) estimated in SPSS. Data

screening suggested that a number of mental toughness, distributed across all measures used in this study showed skewed distributions (skewness and kurtosis ±1). Accordingly, the MLR estimator (maximum likelihood with robust standard errors) was used in all subsequent M*plus* analyses. KMO indices for mental toughness items (EFA dataset = .867; CFA dataset = .879) suggested data were appropriate for factor analytic procedures. A small amount of data was missing (Study 1: 5.6%, Study 2: 0.9%) that was shown to be completely missing at random (Little's test (p >.05). Accordingly, missing data was handled in M*plus* useing full-information maximum likelihood.

Exploratory and Confirmatory Factor Analyses

An exploratory factor analysis (EFA) was performed on the first portion of the randomly split dataset in M*plus* 7.4 using the default Geomin rotation (an oblique rotation that assumes factors will be correlated). M*plus* reports a number of model fit indices that can be used as guidance when interpreting model fit. These include the χ^2 statistic, Comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). RMSEA and SRMR indices <.05, and CFI and TLI indices of <.95 are indicative of a good fitting model (Hu & Bentler, 1999). Models containing between one and seven factors were examined in M*plus* to allow for a comparison of various factor structures against the a priori model of mental toughness with six target factors. Model fit indices are reported in Table 1.

[Table 1 here]

The six-factor model showed the best fit to the data and a significantly better fit than the five-factor model: χ^2 (13), = 48.01, p <.001. Furthermore, items loaded onto target factors satisfactorily (λ >.4) with no cross-loading to non-target factors (see Table 2). Factor one contained items that corresponded to challenge, factor two contained items that corresponded to interpersonal confidence, factor three contained items that corresponded to confidence in

abilities, factor four contained items that corresponded to control of emotions, factor five

contained items that corresponded to control of life, and factor six contained items that

corresponded to commitment.

A confirmatory factor analysis (CFA) was performed on the second portion of the

randomly split dataset in M*plus* 7.4 using MLR estimation and evaluated on the same basis as

the EFA. The CFA showed a moderate fit to the data, $\chi^2(120) = 185.27$, $p < .001$, RMSEA =

.043, SRMR = .051, CFI = .942, TLI = .926, and standardized factor loadings are reported in

Table 2. Although the direction of the item loadings was reversed for interpersonal

confidence this resulted from CFA loadings being scaled against the first item per factor and

does not affect the substantive interpretation. Tests of invariance were conducted for gender,

age (below and above the mean age) and country of data collection. In each case invariance

for factor loadings and intercepts was shown without any substantial loss of model fit (ΔCFI/

TLI $\leq$ .01: Chen, 2007; Cheung & Rensvold, 2002)

[Table 2 here]

Study 1

The purpose of Studies 1 and 2 was to examine the relations between mental

toughness and a range of cognate constructs known to influence learning and achievement of

school aged populations, and relations with adolescent wellbeing.

Study 1 (the Scottish sample) examined the relations between mental toughness and

the eleven constructs included on Martin's (2007) Motivation and Engagement Scale. These

include adaptive thoughts and behaviours (self-belief, persistence, learning focus, valuing,

task management and planning) and non-adaptive thoughts and behaviours (disengagement,

self-sabotage, uncertain control, failure avoidance and anxiety). A structural regression model

that contained latent constructs for the six mental toughness factors and eleven motivation

and engagement factors (17 latent constructs in total), along with age and gender (0 = male, 1

= female) as covariates, showed a reasonable fit to the data: $\chi^2(1784) = 2635.69$, $p < .001$, RMSEA = .033, SRMR = .058, CFI = .936, TLI = .912 (see Hu & Bentler, 1999). Latent bivariate correlations are reported in Table 3 along with descriptive statistics and internal reliability coefficients. Internal reliability coefficients were acceptable (Cronbach's $\alpha > .7$, see Cortina, 1993) for all six mental toughness components. With one exception, the six mental toughness components were intercorrelated. That is, individuals who reported higher challenge, also reported, higher confidence in abilities, control of one's life, commitment, interpersonal confidence, and control of one's emotions. The exception was interpersonal confidence and control of emotions which were unrelated.

[Table 3 here]

Higher mental toughness scores were related to higher scores for adaptive thoughts (self-belief, value, and learning focus). For adaptive behaviours (persistence, planning and task-management), higher scores were related to higher challenge, commitment, confidence in abilities, and control of one's life. Higher control of emotions was related to higher persistence and planning, but not task-management. Higher interpersonal confidence was only related to higher planning. With one exception higher mental toughness scores were related to lower scores for non-adaptive behaviours (disengagement and self-sabotage). The exception was for interpersonal confidence and self-sabotage which were unrelated. For non-adaptive thoughts, higher mental toughness scores were related to lower uncertain control. Failure avoidance was only related to higher commitment, confidence in abilities, and control of emotions (and unrelated to challenge, interpersonal confidence, and life control). Lower anxiety was related to higher mental toughness with the exception of challenge.

Of the covariates, female students reported lower interpersonal confidence, lower confidence in abilities, lower commitment, higher persistence, higher task-management and

higher anxiety. Older students reported lower control of emotions, and greater valuing, disengagement, and anxiety.

Study 2

Study 2 (the English sample) examined the relations between mental toughness and generalized anxiety, depression and test anxiety. A structural regression model that contained latent constructs for the six mental factors, one latent generalized anxiety factor, one depression factor, and four test anxiety factors (12 latent constructs in total), along with age and gender (0 = male, 1 = female) as covariates, showed a reasonable fit to the data: $\chi^2(577)$ = 793.56, p <.001, RMSEA = .037, SRMR = .046, CFI = .939, TLI = .926 (see Hu & Bentler, 1999). Standardized bivariate correlations are reported in Table 4 along with descriptive statistics and internal reliability coefficients. Internal reliability coefficients were acceptable (Cronbach's α >.7) for challenge, interpersonal confidence, confidence in abilities, and control of one's emotions, and somewhat low for the remaining two components: control of one's life and commitment (Cortina, 1993).

[Table 4 here]

The six mental toughness components were intercorrelated. That is, individuals who reported higher challenge, also reported, higher confidence in abilities, control of one's life, commitment, interpersonal confidence, and control of one's emotions. All six mental toughness components were positively related to indicators of well-being (lower depression and generalized anxiety). With some exceptions, greater mental toughness was related to lower test anxiety (challenge was only related to lower test-irrelevant thinking and control of one's life was unrelated to tension).

In terms of covariates, male students reported higher challenge, confidence in one's abilities, and interpersonal confidence. Female students reported higher depression, generalized anxiety scores, and worry and bodily symptoms components of test anxiety.

Younger students reported higher depression, generalized anxiety, and bodily symptoms of test anxiety, but age was unrelated to mental toughness.

Discussion

As stated from the outset, the MTS-A was developed to be of use by researchers and practitioners interested in studying mental toughness within adolescent populations, and within an education context specifically. In order to examine the factor structure of the MTS-A, the combined sample was randomly split. An exploratory factor analysis with an oblique rotation was conducted on the first random split. A six factor solution, consistent with the six proposed attributes of mental toughness challenge, commitment, control (life, emotions) and confidence (abilities, interpersonal), showed the best model fit. All items loaded on their target factors with no cross-loadings ($\lambda > .4$). A confirmatory factor analysis conducted in the second random split showed an acceptable model fit for the six-factor model. Therefore, the MTS-A is regarded as a valid instrument to assess mental toughness, with support for the six constructs inherent within mental toughness framework discussed by McGeown and colleagues (2015) and evidence that these six constructs are statistically distinct.

Latent bivariate correlations between the mental toughness attributes and cognate attributes known to influence learning, achievement and well-being were also conducted. From Sample 1 and 2, the relationship between mental toughness and academic variables (i.e., academic motivation/engagement, test anxiety) and positive adolescent development (i.e., psychological wellbeing) were examined. This assessed the applicability of the mental toughness scale across different aspects of adolescents' lives (education and general well-being). Close intercorrelations were observed between the mental toughness attributes and those attributes assessed within Sample 1 and 2. Therefore, the MTS-A is a valid instrument for use in secondary school education contexts, and may have potential for use in adolescent mental health contexts. High scores on each of the six MTS-A constructs (i.e., challenge,

commitment, confidence in abilities, interpersonal confidence, life control and emotional control) can be interpreted as indicative of positive outcomes.

Within Sample 1, challenge showed the strongest and most consistent correlations with all adaptive cognitions and behaviours, while confidence in abilities and commitment were the most consistently inversely correlated with maladaptive cognitions and behaviours. This is consistent with previous suggestions that challenge aligns with adaptive constructs including intrinsic motivation and perceived competence (Boggiano, Main & Katz, 1998; McGeown et al. 2015), and also research demonstrating that commitment is inversely associated with negative classroom behaviours (St.Clair-Thompson et al., 2014).

Within Sample 2, particularly close correlations were observed between emotional control and depression and anxiety. In addition, confidence in abilities and control of life also correlated closely with adolescents' reports of depression. This is consistent with previous literature demonstrating links between mental toughness and psychological health and well-being among adolescents (Gerber et al., 2013; 2015) and also highlights the applicability of the mental toughness attributes to other aspects of the adolescents' lives. In addition, test anxiety was measured, with emotional control and confidence in abilities showing the most consistent close relationships with dimensions of test anxiety measured. This is consistent with research showing that test anxiety negatively correlates with measures of perceived academic competence and ability to respond positively to setbacks (e.g., Putwain, Chamberlain, Daly, & Saddredini, 2015; Putwain et al., 2013; Putwain & Symes, 2012; Putwain, Symes, Connors, & Douglas-Osborn, 2012).

The results from both samples have developed our understanding of mental toughness among adolescents in a number of ways. Firstly, as stated, results from the EFA and CFA supported the six factor model of mental toughness, providing evidence for the use of this six factor framework to support students in educational settings. Secondly, the six mental

toughness attributes correlated with reports of affective (e.g., depression), cognitive (e.g., self-belief) and behavioural (e.g., persistence) dispositions among adolescents, and were consistently positively related to constructive attributes (e.g., adaptive cognitions and behaviours) and consistently inversely correlated with potentially damaging attributes (e.g., depression, anxiety, maladaptive cognitions and behaviours), highlighting the potential for these attributes to lead to positive and successful outcomes. Finally, despite the MTS-A focusing on adolescents' thoughts, beliefs and feelings within an education context, mental toughness attributes were associated with better psychological well-being in general (depression/anxiety), highlighting the ability of these attributes to incur benefits across different aspects of adolescents' lives. Indeed, this provides further evidence for the utility of the mental toughness framework within both educational and mental health settings.

No notable age related changes were observed in the mental toughness attributes; however there was some evidence of sex differences. Specifically, males reported higher confidence in abilities and interpersonal confidence (Studies 1 & 2), higher commitment (Study 1) and higher challenge (Study 2). This aligns with previous research in both adult (e.g. Crust et al., 2014; St Clair-Thompson et al., 2016) and child samples (St Clair-Thompson et al., 2016).

It is important to note that while all the mental toughness attributes were important for positive academic outcomes and psychological well-being, specific aspects of mental toughness were particularly important in certain contexts (e.g., emotional control correlated more closely with psychological wellbeing and test anxiety, compared to academic motivation and engagement). Mental toughness researchers have varied by applying either a general (i.e., global mental toughness) or specific (i.e., commitment, challenge) approach to the study of mental toughness. We would argue that mental toughness provides a framework (McGeown et al., 2015) to study a number of important positive psychological attributes

which are related, but also statistically independent. While there is value in using a global measure of mental toughness, the application of specific attributes (e.g., challenge) is likely to yield more meaningful and helpful data to inform, support and develop these positive attributes among adolescents', to ensure they achieve positive well-being and successful educational outcomes.

Limitations

It should be noted that the samples used in these studies may restrict the bounds of recommendation for use of this instrument. The MTS-A is a valid instrument for use among adolescents (aged 11-18) within an education context. While there is evidence that student reported mental toughness within an education context was related to their general psychological well-being, research using the MTS-A specifically within mental health settings is necessary to test this. This instrument was used in both Scotland and England, which are geographically close, but have different education systems. Nevertheless, we suggest users exert caution if using the MTS-A within different countries and education systems.

Conclusion

The development of the MTS-A provides a new tool for the scientific study of mental toughness in adolescent populations and within an education context specifically. The mental toughness attributes assessed within the questionnaire correlate with adolescents' reports of affective, cognitive and behavioural dispositions, and transferred from the education context to adolescents' lives in general. While there is value in using a global measure to understand overall levels of mental toughness, there is arguably greater merit in considering mental toughness as a framework for the comprehensive study of important positive psychological characteristics which are likely to be related to successful outcomes.

References

Boggiano, A. L., Main, D. S., & Katz, P. A. (1988). Children's preference for challenge: The role of perceived competency and control. Journal of Personality and Social Psychology, 54, 134–141. Doi: 10.1037/0022-3514.54.1.134.

Chen, F.F. (2007). Sensitivity of goodness of fit indices to lack of measurement invariance. *Structural Equation Modeling 14*(3), 464–504. doi:10.1080/10705510701301834

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255. doi:10.1207/S15328007SEM0902_5

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

Cortina, J.M. (1993). What is coefficient alpha? An examination of theory and applications. Journal of *Applied Psychology 78*, 98–104. doi*:10.1037/0021-9010.78.1.98.*

Crust, L. (2008). A review and conceptual re-examination of mental toughness: Implications for future researchers. *Personality and Individual Differences, 45*, 576- 583. DOI: 10.1016/j.paid.2008.07.005.

Crust, L., Earle, K., Perry, J., Earle, F., Clough, A., & Clough, P. J. (2014). Mental toughness in higher education: Relationships with achievement and progression in first-year university sports students. *Personality and Individual Differences, 69,* 87-91. DOI: 10.1016/j.paid.2014.05.016

Ebesutani, C., Reise, S. P., Chorpita, B. F., Ale, C., Regan, J., Young, J., Higa-McMillan, C., & Weisz, J. R. (2012). The revised child anxiety and depression scale-short version: Scale reduction via exploratory bifactor modelling of the broad anxiety factor. *Psychological Assessment, 24,* 833-845. DOI: 10.1037/a0027283

Fourie, S., & Potgieter, J. R. (2001). The nature of mental toughness in sport. *South African Journal for Research in Sport, Physical Education and Recreation*, 23, 4 63-72.

Gerber, M., Brand, S., Feldmeth, A. K., Lang, C., Elliot, C., Holsboer-Trachsler, E., &
Pühse, U. (2013a). Adolescents with high mental toughness adapt better to perceived
stress: A longitudinal study with Swiss vocational students. *Personality and Individual
Differences, 54,* 808–814. DOI:10.1016/j.paid.2012.12.003

Gerber, M., Kalak, N., Lemola, S., Clough, P., Perry, J., Puhse, U., Elliot, C., Holsboertrachsler, E.,
& Brand, S. (2013b) Are adolescents with high mental toughness levels more resilient against
stress? *Stress & Health*, 29, 164 – 171. DOI: 10.1002/smi.2447

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Pühse, U., Elliot, C., Holsboer-Trachsler, E., &
Brand, S. (2012). Adolescents' exercise and physical activity are associated with mental
toughness. *Mental Health and Physical Activity, 5,* 35-42. DOI:
10.1016/j.mhpa.2012.1002.1004

Gerber, M., Feldmeth, A. K., Lang, C., Brand, S., Elliott, C., Nolsboer-Trachsler, E., & Puhse, U.
(2015). The relationship between mental toughness, stress and burnout among adolescents: A
longitudinal study with Swiss vocational students. *Psychological Reports: Employment
Psychology & Marketing, 117,* 703-723. DOI 10.2466/14.02.PR0.117c29z6

Golby, J., Sheard, M., & van Wersch, A. (2007). Evaluating the factor structure of the *11*
psychological performance inventory. *Perceptual and Motor Skills*, *105,* 309-312*. DOI:
10.2466/pms.105.1.309-325

Gucciardi, D. F. (2012). Measuring mental toughness in sport: A psychometric examination of the
psychological performance inventory and its predecessor. *Journal of Personality Assessment,
94,* 393-403. DOI: 10.1080/00223891.2012.660292.

Gucciardi, D.F., Hanton, S., & Mallett, C.J. (2012). Progressing measurement in mental toughness:
A case example of the Mental Toughness Questionnaire 48. *Sport, Exercise and Performance
Psychology, 1,* 194-214. DOI: 10.1037/a0027190.

Hagtvet, K.A., & Benson, J. (1997) The motive to avoid failure and test anxiety responses: empirical

   support for integration of two research traditions. *Anxiety, Stress and Coping*, 10(1), 35-57.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis:

   Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55.doi:

   10.1080/10705519909540118

Jones, G., Hanton, S., & Connaughton, D. (2002). What is this thing called mental toughness?

   An investigation of elite sport performers. *Journal of Applied Sport Psychology,*

   14, 205-218. DOI:10.1080/10413200290103509

Jones, G., Hanton, S., & Connaughton, D. (2007). A framework of mental toughness in the world's

   best performers. *The Sport Psychologist, 21*, 243–264.

Loehr, J. F., (1986). Mental toughness training for sports: achieving athletic excellence. Lexington,

   MA: Stephen Greene Press.

Marsh, H. W., Hau, K.T. & Wen, Z. (2004). In search of golden rules: Comment on hypothesis

   testing approaches to setting cut-off values for fit indexes and dangers in overgeneralising Hu

   & Bentler's (1999) findings. *Structural Equation Modeling, 11*(3), 320–

   341.doi:10.1207/s15328007sem1103_2

Marsh, H. W., Hau, K-T & Grayson, D. (2005). Goodness of fit evaluation in structural equation

   modeling. In A. Maydeu-Olivares & J. McArdle (Eds.) *Contemporary psychometrics. A*

   festschrift for Roderick P. McDonald (pp. 275–340). Mahwah, NJ: Erlbaum.

Martin, A.J. (2010). The Motivation and Engagement Scale (10th Edition) Sydney, Australia.

   Lifelong Achievement Group

Martin, A. J. (2007). Examining a multidimensional model of student motivation and engagement using a construct validation approach. *British Journal of Educational Psychology, 77*, 413-440. DOI: 10.1348/000709906X118036

Martin, A. J., Yu, K., Papworth, B., Ginns, P., & Collie, R. J. (2015). Motivation and engagement in the United States, Canada, United Kingdom, Australia and China: Testing a Mulit-Dimensional Framework. *Journal of Psychoeducational Assessment, 33,* 103-114. DOI: 10.1177/0734282914546287

McGeown, S. P., St.Clair-Thompson, H., & Clough, P. (2015). The study of non-cognitive attributes in education: Proposing the mental toughness framework. *Educational Review, 68, 96-113.* DOI: 10.1080/00131911.2015.1008408

Perry, J. L., Clough, P. J., Crust, L., Earle, K., & Nicholls, A.R. (2013) Factorial validity of the mental toughness questionnaire – 48. *Personality and Individual Differences, 54*, 587-592. DOI:10.1016/j.paid.2012.11.020

Putwain, D.W., Connors, E., & Symes, W. (2010) Do cognitive distortions mediate the test anxiety and examination performance relationship? *Educational Psychology: An International Journal of Experimental Educational Psychology*, *30*, 11-26. DOI: 10.1080/01443410903328866

Putwain, D.W., Chamberlain, S., Daly, T., & Saddredini, S. (2015). Academically buoyant students are less anxious about and perform better in high-stakes examinations. *British Journal of Educational Psychology, 85*, 247–263. DOI: 10.1111/bjep.12068

Putwain, D.W., & Symes, W. (2012). Are low competence beliefs always associated with high test anxiety? The mediating role of achievement goals. *British Journal of Educational Psychology,82*, 207-224. DOI: 10.1111/j.2044-8279.2011.02021.x

Putwain, D.W., Symes, W., Connors, E. & Douglas-Osborn, E. (2012). Is academic buoyancy anything more than adaptive coping? *Anxiety, Stress and Coping 25*, 349-358. DOI: 10.1080/10615806.2011.582459

St.Clair-Thompson, H., Bugler, M., Robinson, J., McGeown, S., Perry, J., & Clough, P. (2014). Mental toughness in education: Exploring relationships with attainment, attendance, behaviour and peer relationships. *Educational Psychology: An International Journal of Experimental Educational Psychology, 35, 886-907.* DOI: 10.1080/01443410.2014.895294.

St. Clair-Thompson, H., Giles, R., McGeown, S. P., Clough, P., Putwain, D., & Perry, J. (2016). Mental toughness and educational transitions. *Educational Psychology: An International Journal of Experimental Educational Psychology.* doi: 10.1080/01443410.2016.1184746

Mental Toughness Scale – Adolescents

Introduction. This questionnaire asks you about your thoughts, beliefs and feelings as a secondary school student. Please answer the questions below. There are no right or wrong answers as every student is different, simply provide the answer that best describes you. If you want to change an answer, please score it out and circle another.

Scale range: 1 (strongly disagree), 2 (disagree), 3 (agree), 4 (strongly agree)

An example is provided to the student: I am easily distracted.

Challenge

It's always good to try challenging things

I am happy to try new and challenging tasks

Challenges bring out the best in me

Interpersonal confidence

I feel nervous around new people (reverse)

I feel confident in social situations

I feel confident speaking in front of other people

Confidence in abilities

I believe in my own abilities

In general, I lack confidence in my abilities (reverse)

In general, I am confident in my abilities

Emotion control

My emotions (e.g., anger, sadness, worry) sometimes take control of me (reverse)

I find it difficult to stop myself getting angry/upset/stressed (reverse)

I am good at managing negative emotions (e. g., anger, sadness, worry)

Life control

If I work hard, my future can be whatever I want it to be

I cannot control what will happen in my future (reverse)

I feel in control of what happens in my life

Commitment

I give up if I'm under pressure (reverse)

I leave many things unfinished (reverse)

When faced with difficulties, I usually give up (reverse)

Table 1

Model fit indices from the exploratory factor analyses.

Model	χ^2	df	RMSEA	SRMR	CFI	TLI
1 Factor	673.65	135	.115	.094	.635	.587
2 Factor	476.04	118	.100	.071	.758	.686
3 Factor	299.87	102	.080	.048	.866	.799
4 Factor	224.08	87	.072	.038	.907	.837
5 Factor	136.08	73	.053	.029	.957	.910
6 Factor	81.68[†]	60	.034	.017	.985	.963

Note. χ^2 values $p \leq .001$ for all models with the exception of [†] $p \leq .05$

Table 2

Standarized factor loadings and latent bivariate correlations from the EFA and CFA.

Items	EFA Factors						CFA Factors					
	1	2	3	4	5	6	1	2	3	4	5	6
It's always good to try challenging things	**.67**	-.01	-.04	-.01	-.19	.01	**.59**					
I am happy to try new and challenging tasks	**.51**	.05	.09	-.11	-.20	-.03	**.69**					
Challenges bring out the best in me	**.46**	.15	.11	.03	-.02	.16	**.60**					
I feel confident in social situations	-.12	**.65**	.22	.01	-.04	-.04		**.65**				
I feel nervous around new people	-.03	**-.72**	.06	.01	.04	-.01		**-.72**				
I feel confident speaking in front of other people	.06	**.84**	.02	-.02	.05	.05		**.80**				
I believe in my own abilities	.12	-.03	**.70**	.02	-.03	.08			**.75**			
In general, I lack confidence in my abilities	.11	-.01	**-.60**	.04	.17	-.01			**-.69**			
In general, I am confident in my abilities	.05	.19	**.66**	-.05	.05	-.01			**.77**			
I am good at managing negative emotions (e. g., anger, sadness, worry	-.04	.01	.05	**.73**	.04	.06				**.71**		
My emotions (e.g., anger, sadness, worry) sometimes take control of me	.15	.03	-.01	**-.72**	.07	-.01				**-.75**		
I find it difficult to stop myself getting angry/upset/stressed	.03	.04	.09	**-.76**	.12	.06				**-.71**		
If I work hard, my future can be whatever I want it to be	.29	-.08	-.01	.01	**.52**	.04					**.52**	
I cannot control what will happen in my future	.11	-.05	.01	-.01	**-.59**	.06					**-.61**	
I feel in control of what happens in my life	.04	.02	.03	-.08	**.64**	-.04					**.72**	
I give up if I'm under pressure [a]	.02	-.11	.04	.10	-.04	**.69**						**.66**
I leave many things unfinished [a]	-.05	.01	-.04	-.08	.03	**.57**						**.56**

When faced with difficulties, I usually give up [a]	-.10	.04	-.09	.01	-.05	**.74**						**.79**

Standardised Latent Bivariate Correlations	1	2	3	4	5	6	1	2	3	4	5	6
Factor 1 (Challenge)	—	.25	.09	.18	.23	.26	—	.39	.52	.19	.53	.70
Factor 2 (Interpersonal confidence)		—	.27	.42	.20	.25		—	.65	.27	.46	.33
Factor 3 (Confidence in abilities)			—	.47	.33	.21			—	.36	.59	.45
Factor 4 (Control of emotions)				—	.40	.45				—	.16	.27
Factor 5 (Control of life)					—	.40					—	.53
Factor 6 (Commitment)						—						—

Note. Standardized factor loadings λ >.4 emboldened. [a] item scoring was reversed to align the metric with other mental toughness items

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Table 3

Standarized bivariate correlations, descriptive statistics, and internal reliability coefficients, for mental toughness, and motivation and engagement constructs.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
1. Challenge	—	.40‡	.68‡	.20†	.76‡	.68‡	.69‡	.68‡	.59‡	.68‡	.65‡	.60‡	-.53‡	-.34‡	-.34‡	-.03	-.02	-.02	-.06
2. Interpersonal confidence		—	.59‡	.11	.33‡	.30‡	.35‡	.13	.21†	.17*	.10	.17*	-.21†	.14	-.18†	-.03	-.23†	-.28‡	-.04
3. Confidence in abilities			—	.32‡	.73‡	.54‡	.63‡	.46‡	.46‡	.53‡	.30‡	.36‡	-.45‡	-.46‡	-.55‡	-.25†	-.29‡	-.20‡	-.03
4. Control of emotions				—	.24†	.37‡	.30‡	.24†	.24†	.32‡	.11	.21†	.30‡	-.25‡	-.21†	-.31‡	-.32‡	-.12	-.17†
5. Control of life					—	.61‡	.78‡	.43‡	.43‡	.61‡	.29‡	.39‡	-.48‡	-.35‡	-.49‡	-.17	-.20*	-.03	-.07
6. Commitment						—	.41‡	.31‡	.31‡	.35‡	.41‡	.39‡	.52‡	-.56‡	-.51‡	-.23†	-.29‡	-.13*	-.02
7. Self-belief							—	.74‡	.74‡	.81‡	.58‡	.61‡	-.63‡	-.29‡	-.42‡	-.08	-.01	-.04	-.04
8. Persistence								—	.60‡	.68‡	.75‡	.76‡	-.61‡	-.39‡	-.37‡	-.05	.08	.12*	-.07
9. Learning focus									—	.79‡	.55‡	.57‡	-.53‡	-.27‡	-.22†	.07	.26†	.07	.08
10. Valuing										—	.56‡	.58‡	-.74‡	-.35‡	-.32‡	-.08	.12	.03	.21‡
11. Task management											—	.81‡	-.51‡	-.36‡	-.25‡	.01	.21†	.17†	.08
12. Planning												—	-.50‡	-.32‡	-.32‡	.09	.11	.08	-.07
13. Disengagement													—	.56‡	.52‡	.27‡	.11	.07	.15†
14. Self-sabotage														—	.59‡	.46‡	.13	-.06	-.01
15. Uncertain control															—	.44‡	.47‡	.02	.01
16. Failure avoidance																—	.32‡	-.03	-.03
17. Anxiety																	—	.22‡	.22‡
18. Gender																		—	—

19. Age																			—
Scale range	1–4	1–4	1–4	1–4	1–4	1–4	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	—	—
Mean	3.06	2.68	3.89	2.56	3.08	2.91	5.40	4.78	5.52	5.58	4.79	4.09	2.68	2.76	3.73	3.44	4.74	14.3	—
SD	.58	.52	.67	.70	.58	.64	1.18	1.16	1.08	1.04	1.34	1.24	1.30	1.25	1.29	1.51	1.36	1.56	—
Cronbach's α	.74	.79	.77	.74	.73	.73	.85	.82	.85	.77	.84	.77	.80	.80	.79	.85	.78	—	—

Note. $^* p \leq .05,$ $^\dagger p \leq .01,$ $^\ddagger p \leq .001$

Table 4

Standarized bivariate correlations, descriptive statistics, and internal reliability coefficients, for mental toughness, depression, generalized anxiety and test anxiety (worry, test-irrelevant thinking, tension, bodily symptoms).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Challenge	—	.39‡	.60‡	.33‡	.59‡	.65‡	-.35†	-.19*	-.14	-.33‡	-.10	-.07	-.20†	-.08
2. Interpersonal confidence		—	.65‡	.43‡	.40‡	.34‡	-.43‡	-.43‡	-.42‡	-.22†	-.39‡	-.34‡	-.32‡	-.10
3. Confidence in abilities			—	.50‡	.64‡	.49‡	-.63‡	-.44‡	-.47‡	-.34‡	-.38‡	-.39‡	-.28‡	.08
4. Control of emotions				—	.29‡	.32‡	-.66‡	-.57‡	-.46‡	-.45‡	-.43‡	-.43‡	-.13	.11
5. Control of life					—	.54‡	-.50‡	-.22*	-.25†	-.21*	-.11	-.29†	-.14	.01
6. Commitment						—	-.38‡	-.24†	-.37‡	-.41‡	-.20†	-.26‡	-.08	-.03
7. Depression							—	.64‡	.51‡	.39‡	.40‡	.60‡	.30‡	-.15*
8. Generalized anxiety								—	.66‡	.50‡	.56‡	.65‡	.15*	-.13*
9. Worry									—	.75‡	.94†	.74‡	.17*	-.12
10. Test-irrelevant thinking										—	.58‡	.62‡	.09	-.01
11. Tension											—	.76‡	.13	-.08
12. Bodily symptoms												—	.15*	-.13*
13. Gender													—	—
14. Age														—
Scale range	1–4	1–4	1–4	1–4	1–4	1–4	1–4	1–4	1–4	1–4	1–4	1–4	—	—
Mean	3.26	2.07	3.14	2.46	3.26	3.13	1.52	1.84	2.16	1.97	2.30	1.69	12.1	—

SD	.52	.72	.62	.80	.60	.59	.50	.76	.85	.83	.90	.79	.70	—
Cronbach's α	.70	.77	.77	.81	.67	.66	.71	.80	.81	.80	.79	.78	—	—