

The MTQ48 Technical Manual

This handbook provides information on the construction, validation and use of the MTQ48. By utilising a folder style system, up-to-date research findings will be added regularly to provide valuable information on the MTQ48.

For more information go to:

www.aqr.co.uk



Note: A list of the references used in this handbook can be provided on request.

Mental Toughness and the MTQ48 measure

The MTQ48 provides a reliable and quick assessment of an individual's ability to withstand pressure in a wide range of environments. It measures mental toughness in terms of 4 core components – control, commitment, challenge and confidence.

What is Mental Toughness?

Since starting the journey to understand and apply the mental toughness model and questionnaire we have found that the following definition works well wherever it is needed.

It is a personality trait which determines, in some part, how individuals perform when exposed to stressors, pressure and challenge irrespective of the situation.

Clough & Strycharczyk (2011)

This can be seen as a logical development of an early and in some ways original definition:

The ability to consistently perform towards the upper range of your capabilities regardless of competitive circumstances

Loehr (1982)

The ability to “perform under pressure”

Tim Henman (in *Coaching Excellence*, 1996)

Mental Toughness refers to an individual's resilience and an inner drive to succeed - particularly when the going is challenging. It explains why it is possible to place two individuals into the same working environment and to see that one finds it difficult to cope with pressure and one thrives.

The **mentally tough** individual tends to be:

- Sociable and comfortable dealing with all types of people;
- Able to remain calm and relaxed in most circumstances - they are competitive or goal orientated in many situations and have lower anxiety levels than others.
- With a high sense of self-belief and an unshakeable faith that they control their own destiny, these individuals can remain relatively unaffected by competition or adversity. They can be enthusiastic about change and change even when the challenge is daunting.

An individual with a low level of mental toughness is described as mentally sensitive (not as mentally weak).

The **key issues** around Mental Toughness that individuals and organisations seek to understand, in their life, work and play, are:

- What causes one person to succumb and another of equal ability and experience to thrive in essentially the same circumstances?
- Can we identify people's strengths and weaknesses in these areas?
- Can we improve the mental toughness of individuals to enable them to handle stressors, pressures and challenge more effectively and more positively?
- How can we support individuals better with their specific needs?

A significant body of research since 2002 shows that the mental toughness of an individual is a significant factor in:

- **Wellbeing** - mentally tough individuals enjoy greater wellbeing and appear to be "comfortable in their own skins"
- **Behaviour** – mentally tough individuals consistently demonstrate more positive behaviours – they tend to see opportunity where the mentally sensitive see threats.
- **Attainment** – mentally tough individuals typically achieve more than mentally sensitive individuals. They are minded "to be the best that they can be".

In turn these enable a wide range of useful, valuable and tangible outcomes for individuals in almost everything they do. It includes achieving more but also embraces completing things, managing change and transition effectively, employability, contentment, building better relationships with people, influencing others and openness to learning.

Mentally tough individuals will typically work harder and more effectively than most and appear to derive satisfaction in doing this.

The Core Components of Mental Toughness

Research, initially at the University of Hull and now at Manchester Metropolitan University, under the direction of Professor Peter Clough identified 4 key components of Mental Toughness:

- **Control**
- **Commitment**
- **Challenge**
- **Confidence**

Control

Individuals who score high on this scale feel that they are in control of their work and of the environment in which they work. They are capable of exerting more influence on their working environment and are more confident about working in complex or multi-tasked situations. This means for example that, at one end of the scale individuals are able to handle lots of things at the same time. At the other end they may only be comfortable handling one thing at a time. Ongoing development of MTQ48 has enabled the identification of 2 subscales to this scale:

- **Control (Emotion)** - Individuals scoring highly on this scale are better able to control their emotions and will manage what they show to others. They are able to keep anxieties in check and, in these circumstances, are less likely to reveal their emotional state to other people.
- **Control (Life)** - Individuals scoring higher on this scale are more likely to believe that they have a significant degree of control over their lives. They feel that their plans will not be thwarted and that they can make a difference.

Commitment

Sometimes described as "stickability", this describes the ability for an individual to carry out tasks successfully despite any problems or obstacles that arise whilst achieving the goal. Consequently an individual who scores at the high end of the scale will be able to handle and achieve things to tough unyielding deadlines. Whereas an individual at the other end will need to be free from those kind of demands to achieve their goals.

Experience of usage of the MTQ48 indicates that there may be two components to this scale:

- **Goal or target orientation.** Individuals scoring high appear to translate what they need to do into SMART-ish goals and targets which enable them to prioritise, plan and monitor several tasks at the same time.
- **Delivery (Completion).** Individuals scoring high appear to be prepared to do what it takes to deliver what has been promised (to themselves and to others) including working hard where needed.

Challenge (Sometimes Called Change Orientation)

Describes the extent to which individuals see change, setbacks and challenges as opportunities. Individuals who see them as opportunities will actively seek them out and will identify problems as ways for self-development. At the other end challenges are perceived as problems and threats. So, for example, at one end of the scale we find those who thrive in continually changing environments. At the other end we find those who prefer to minimise their exposure to change and the problems that come with that - and will strongly prefer to work in stable environments.

Experience of usage of the MTQ48 indicates that there may be two components to this scale:

- **Preparedness to stretch oneself and push back boundaries.** This includes being prepared to take risks and seek out new experiences and challenges. In some cases, it will include creating those opportunities.
- **Openness to learning.** Being prepared to see all outcomes as learning opportunities – whatever the outcome, good or bad. Includes being minded to repeat an experience even it was originally a failure to apply what has been learned.

Confidence

Individuals who are high in confidence have the self-belief to successfully complete tasks, which may be considered too difficult by individuals with similar abilities but with lower confidence. Less confident individuals are also likely to be less persistent and may make more errors.

For example, individuals at one end of the scale will be able to take setbacks (externally and self generated) in their stride. They keep their heads when things go wrong and it may even strengthen their resolve to do something. At the other end individuals will be unsettled by setbacks and will feel undermined by these. Their heads are said to "drop".

Ongoing development of MTQ48 has enabled the identification of 2 subscales to this scale:

- **Confidence (Abilities)** - Individuals scoring highly on this scale are more likely to believe that they are a truly worthwhile person. They are less dependent on external validation and tend to be more optimistic about life in general.
- **Confidence (Interpersonal)** - Individuals scoring highly on this scale tend to be more assertive. They are less likely to be intimidated in social settings and are more likely to push themselves forward in groups. They are also better able to cope with difficult or awkward people.

The Mental Toughness model and its components can be summarised as follows:

Mental Toughness Scale	What this means ... what does MTQ48 assess
CONTROL	<i>Life Control</i> – I really believe I can do it
	<i>Emotional Control</i> – I can manage my emotions as well as the emotions of others
COMMITMENT	<i>Goal Setting</i> – I promise to do it – I like working to goals and targets
	<i>Achieving</i> – I’ll do whatever it takes to keep my promises and achieve my goals
CHALLENGE	<i>Prepared to accept risk</i> – I will stretch myself – I am driven to be the best that I can be
	<i>Learning from Experience</i> – even setbacks are opportunities for learning
CONFIDENCE	<i>In Abilities</i> – I believe I have the ability to do it – or can acquire the ability
	<i>Interpersonal Confidence</i> – I can influence others – I can stand my ground if needed.

The Mental Toughness Team

Professor Peter Clough MSc, BSc (Hons), Chartered Psychologist, Chartered Sport and Exercise Psychologist, Chartered Occupational Psychologist, BASES.
Chair of Applied Psychology, Manchester Metropolitan University, Department of Psychology

After a lengthy career at The University of Hull, sometimes as Head of Psychology, Professor Clough joined Manchester Metropolitan University in 2014. A major area of interest (and one where he is an acknowledged authority) is **Mental Toughness**. Often quoted but little understood, Peter has operationalised this concept and developed an approach where individuals and teams can learn to deal more effectively with the stressors and challenges in the workplace. His Mental Toughness work makes a significant contribution to our understanding of how to develop performance in the workplace. In the course of that work he led the development of the Mental Toughness Measure - MTQ48.

Dr John Perry BSc (Hons), MSc, PGCE, PhD, FHEA, CSci, CPsychol, Chartered Scientist, Chartered Psychologist, Accredited Sports and Exercise Scientist

Dr Perry is a Lecturer in Sport Performance and Coaching at University of Hull. Formerly at Leeds Trinity University, John is a Chartered Psychologist and an accredited Sport and Exercise Scientist. John has been instrumental in carrying out psychometric analyses for much of the published research work on MTQ48 as well as other measures. His published research includes the development of a new model of sportspersonship and examining coping in sport.

Doug Strycharczyk BA (Hons) Economics
CEO of AQR Ltd which was founded in 1989.

Doug's expertise includes development of Psychometric Tests and Programmes for Developing Mental Toughness, Organisational Development, Top Team Assessment, Senior Management/Leadership Development and Talent Management.

Doug has pioneered the application of the mental toughness concept to a wide variety of sectors. Now recognised as one of the leading authorities worldwide on the application of the model, Doug works in the Occupational, Educational, Social Work, Sports and Health worlds in more than 80 countries.

Doug is currently in the process of completing a Doctorate in Psychology developing new subscales for the Commitment and Challenge scales in MTQ48 the measure of mental toughness.

Dr Keith Earle BSc (Hons)

Dr Keith Earle is a Chartered Sport and Exercise Psychologist working as a senior lecturer at the University of Hull. He is both an active researcher and an applied sport psychologist, working with athletes from a wide range of sports. Keith is the co-developer with Dr Peter Clough of the mental toughness model.

In addition both AQR International and Professor Peter Clough work with academics and practitioners around the world to carry out and support research which continues to grow our understanding of Mental Toughness – its applications and its connection with important models and ideas.

Mental Toughness Construction

Development Sample

To evaluate the proposed factor structure, a development sample was tested. Nine hundred and sixty three questionnaires were completed. The sample consisted of following; Students 619, Administrators/Managers 136, Engineers 42 and Athletes 166. It consisted of 338 males (35.1%) males and 376 (39%) females and 249 (25.9%) did not state their gender. The age range of the sample was 18 to 59 (mean = 24.21; sd = 5.23).

As with the first development sample, the data were coded, entered into SPSS and subjected to data reduction. Principal components analysis with varimax rotation was used and eigenvalues greater than one were accepted. Six factors had eigenvalues greater than one, which together accounted for 62.7% of the variance. Only factor loadings above .3 were acknowledged.

Analysis of the six factor solution

The first factor, **Challenge**, accounted for 15.1% of the variance. Only eight of the challenge items loaded strongly onto this factor (factor loadings ranged from .339 to .625). In addition to the eight challenge items, one commitment item also loaded on this factor; “I don’t usually give up under pressure”. However, this factor possessed a higher loading on the commitment factor. Three further items did not reach the cut-off level of .3 and therefore were removed from further analysis.

The second factor, **Life Control**, accounted for 13.5% of the variance. Only seven of the Life Control items loaded onto this factor (factor loadings ranged from .412 to .609. As with the previous factor, one further item; “I often wish my life was more predictable” was also loaded on the on this factor, but as before it was more heavily loaded on the challenge factor. Surprisingly, four items failed to load onto the Life Control factor above the cut-off level of .3 and therefore were removed from further analysis.

All 11 items loaded onto the third factor of **Commitment** (accounting for 11.3% of the variance). In addition to the 11 commitment items (factor loadings ranging from .316 to .692) one of the Emotion Control items (“When I am feeling tired I find it difficult to get going”) loaded onto commitment, although this item was found to also load onto its target factor. Therefore, these items were retained to represent their original factor.

The **Confidence in Abilities** factor accounted for 9.3% of the variance. The allowable factor loadings ranged from .397 to .606 however, two items did not reach the .3 cut-off level and therefore were removed.

The **Emotional Control** factor accounted for 7.4% of the variance. Unfortunately four of items did not reach the .3 cut-off level. The remaining seven items had factor loading ranging from .376 to .702.

The final factor of **Interpersonal Confidence** accounted for 6.1% of the variance. Only six of the items loaded strongly onto this factor (factor loadings ranged from .432 to .690). However, there were another two items which also loaded on this factor; “When I am upset or annoyed I usually let others know” and “I generally hide my emotion from others”. Both these items factored more highly on this factor than their target factor but it was decided not to incorporate them into the interpersonal confidence factor due to the fact that the items can clearly be seen as having aspects of emotional control and interpersonal confidence, but the items on face validity were clearly items relating more to emotional control.

Therefore the Mental Toughness Questionnaire comprised of 48 items, Challenge (8 items), Commitment (11 items), Emotional Control (7 items), Life Control (7 items), Confidence in Abilities (9 items) and Interpersonal Confidence (6 items).

MTQ48 Reliability

Initial scale reliability of the Mental Toughness Questionnaire 48 (MTQ48)

The MTQ48 has an overall test-retest coefficient of .90, with the internal consistency of the subscales presented in the table below.

MTQ48 Sub Scales	No. of Items	Cronbach's alpha
Challenge	8	.71
Commitment	11	.80
Control	14	.74
Emotional Control	7	.70
Life Control	7	.72
Confidence	15	.81
Confidence in Abilities	9	.75
Interpersonal Confidence	6	.76
Whole scale	48	.91

All subscales reached the minimum acceptable level (0.70) recommended by Kline (Kline, 1999) when investigating the reliability of psychological constructs. This supports the homogeneity of each subscale and the MTQ48 as a whole.

Numerous published studies have reported acceptable reliability scores for the overall measure and the sub scales. On occasions, the emotional control scale has not achieved the 0.70 cut off. Some researchers have therefore often removed items 28 and 32 in their analyses. This usually produces a significantly enhanced reliability score

MTQ48 Construct Validation

Initial Construct Validation of the Mental Toughness Questionnaire 48 (MTQ48)

To investigate the convergent validity of the MTQ48, Pearson’s correlations were calculated for the Total scores for MTQ48 and the eight sub-scales of the PREVUE personality scale. A sample of 205 within the development sample completed both the MTQ48 and the PREVUE personality scale.

Prevue Scale Description	Correlation with MTQ48
Co-operative – Competitive	.203
Submissive – Assertive	.382**
Innovative – Conventional	.074
Reactive – Organised	-.050
Self-sufficient - Group Oriented	.242*
Reserved – Outgoing	.387**
Restless – Poised	.377**
Excitable – Relaxed	.478**

* - significant at the .05 level

** - significant at the .01 level

As expected there were a number of significant and predicted relationships. The aspects where these relationships were most strongly highlighted were first, in the PREVUE scale dimension of “Excitable-Relaxed” where a correlation of .478 was found. This coupled with the significant correlation (.377) on the “Restless-Poised” scale highlights an important aspect of mental toughness, that being the ability to control anxiety and nervous tension.

The other significant correlations centre on the concepts of confidence and the ability to work with others (“Submissive - Assertive and Self-sufficient - Group Oriented).

The three remaining non-relating sub-scales were “Co-operative - Competitive”, “Reactive-Organised” and “Innovative - Conventional”. It can be logically concluded that an approximately equivalent measure of each of these dimensions is required in order to function effectively as an individual, therefore it was no surprise to see these sub-scales not significantly correlate with mental toughness.

Factorial validity of the MTQ-48 (Confirmatory Factor Analysis).

A small number of authors have reported poor construct validity of the MTQ 48. We believe that these criticisms are unfounded and have published our response at

Clough, P. J., Earle, K., Perry, J. L., & Crust, L. (2012). A response to "Progressing measurement in mental toughness: A case example of the mental toughness questionnaire 48" by Gucciardi, D., Hanton, S., & Mallett, C. Sport, Exercise and Performance Psychology, 1, 283-287. doi:10.1037/a0029771

In addition, we have also carried out a major study examining the construct validity of the MTQ48. This is reported below,

This study, in 2013/14, aimed to formally re-assess the factorial validity of the MTQ-48 using the MTQ-48 in a varied sample. 8207 participants (male=4019, female=3922 and unspecified=266, mean age=37.00, SD=12.09);

- Senior managers (4342, male=2067, female=2009, unspecified=266, mean age=42.27, SD=9.87)
- Lower and middle managers (1440, male=693, female 747, mean age=40.19, SD=9.32)
- Clerical/administrative workers (1004, male=514, female 490, mean age=34.39, SD=10.62)
- Athletes (442, male=320, female=122, mean age=24.21, SD=9.12)
- Students (978, male=424, female=554, mean age=21.30, SD=4.52)

They completed the MTQ-48 measuring total mental toughness and the subscales; challenge, commitment, control (life and emotional) and confidence (abilities and interpersonal)

Results summary

Overall sample subjected to CFA as a single factor, 4-factor and 6-factor model

The examination of the AIC suggested that the 6-factor model utilising all subscales represents the best model fit (χ^2 (1065)= 19791.9, CFI= .854, TLI= .845, SRMR =.045, RMSEA=.048, 90% confidence interval (CI) [.046, .047]).

Table 1: CFA and ESEM for various models on overall 8207 sample.

Model	χ^2		df		CFI		TLI		SRMR		RMSEA		AIC	
	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM
Single factor	29.335.3	29335.3	1080	1808	.786	-	.777	-	.048	-	.056	-	824044.9	824044.9
4 factor	25467.7	13724.4	1074	942	.816	.903	.806	.884	.046	.026	.052	.040	819827.3	806921.6
6 factor	20454.1	8508.0	1065	855	.853	.942	.845	.924	.045	.019	.046	.033	814390.1	801619.2

χ^2 = chi-square, df = degrees of freedom, CFI = comparative fit index, TLI = Tucker-Lewis index, SRMR = standardized root-mean-square residual, RMSEA = root mean square error of approximation, AIC = Akaike Information Criterion, CFA = confirmatory factor analysis, ESEM = exploratory structural equation modeling.

ESEM analysis supported the 6-factor solution as the best, representing good model fit (χ^2 (855)= 8269.1, CFI=.924, TLI=.924, SRMR=.019, RMSEA=.033, 90% CI [.032, .033]).

Table 2: CFA and ESEM for 6-factor model with various samples

Sample	χ^2		CFI		TLI		SRMR		RMSEA	
	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM
Senior management	11156.1	5121.3	.857	.939	.848	.920	.044	.021	.046	.034
Lower and middle management	9463.9	2154.8	.840	.932	.830	.910	.047	.023	.045	.032
Clerical and administrative	3451.4	1845.3	.823	.927	.812	.903	.050	.026	.047	.034
Athletes	3133.1	1679.8	.779	.912	.766	.884	.059	.029	.057	.040
Students	3832.9	1811.2	.827	.940	.816	.921	.057	.024	.051	.034
Overall	20454.1	8508.0	.853	.942	.845	.924	.045	.019	.046	.033

Note: χ^2 = chi-square, CFI = comparative fit index, TLI = Tucker-Lewis index, SRMR = standardized root-mean-square residual, RMSEA = root mean square error of approximation, CFA = confirmatory factor analysis, ESEM = exploratory structural equation modeling. Degrees of freedom (df) for CFA models = 1065. For ESEM model, df = 855.

All latent factors significantly correlated to each other ($r=.61-.90$, $p<.01$), with interrelationships between factors as this, it is evident that the less constrained ESEM provides a more appropriate method for assessing the model fit in this instance. Overall, CFA loadings supported the 6-factor model, with loadings largely good to excellent on all subscales. Only emotional control demonstrated weaker loadings.

Examining reliability, 5 of the 6-factors had acceptable internal consistency ($\alpha=.78-.85$). Emotional control was less consistent ($\alpha=.65$). Composite reliability data was similar with 5 of the 6 factors having acceptable reliability (.71-.80) and emotional control (.59)

All samples revealed reasonably consistent results from the CFA and ESEM.

- Senior management-best model fit for CFA ($\chi^2(1065)=20454.1$, CFI=.857, TLI=.848, SRMR=.044, RMSEA=.046, 90% CI [.048, .047]) and for ESEM ($\chi^2(855)=8508.0$, CFI=.939, TLI=.920, SRMR=.021, RMSEA=.034, 90% CI [.033, .035])
- Athletes-weakest model fit-CFA ($\chi^2(1065)=2535.4$, CFI=.771, TLI=.758, SRMR=.063, RMSEA=.056, 90% CI [.053, .059]) and for ESEM ($\chi^2(855)=1354.8$, CFI=.922, TLI=.897, SRMR=.031, RMSEA=.036, 90% CI [.033, .040])

The ESEM analysis presented the better model fit between samples. All subscales demonstrated significant correlations ($r=.54-.94$, $p<.01$) with each other in all samples 5 out of the 6 factors exhibited acceptable internal consistency in the individual samples ($\alpha=.73-.85$) and composite reliability (CR) (.61-.79). Emotional control had significantly less reliable internal consistency ($\alpha=.46-.65$) and CR of .34-.60.

Overall, the large-scale analysis of the structure of the MTQ48 supported its validity and it is recommended as a valid and reliable tool for future psychometric assessment.

Mental Toughness: Gender Differences

With a sample of 28 males and 25 females (mean age 24.51, SD 4.82), in support of the MTQ48 as a viable testing method no statistically significant difference was observed between male and female participants for any MTQ 48 Subscale, thus preventing bias between genders. See table.

Measure	Male			Female		
	N	Mean	SD	N	Mean	SD
Mental Toughness	28	3.58	0.31	25	3.51	0.32
Challenge	28	3.77	0.45	25	3.78	0.51
Commitment	28	3.66	0.46	25	3.52	0.39
Emotional Control	28	3.46	0.34	25	3.41	0.39
Life Control	28	3.28	0.49	25	3.32	0.36
Ability Confidence	28	3.52	0.43	25	3.44	0.35
Interpersonal Confidence	28	3.74	0.53	25	3.60	0.74

Some researchers have noted small gender differences. Whilst these are statistically significant when analysing the raw scores they are very rarely noted in relation to the stens.

Mental Toughness: Differences between Police Recruits and First Year University Students

Using a sample of 30 Police Recruits (mean age, 30.37, SD 8.75) and 23 Students (mean age 18.65, SD 0.88), differences in the subscales of the MTQ48 were investigated. See table.

Measure	Police		Students	
	Mean	Standard deviation	Mean	Standard deviation
Mental Toughness 1	3.62	.33	3.45	.27
Challenge 1	3.84	.41	3.68	.55
Commitment 1	3.71	.44	3.44	.38
Emotional Control 1	3.48	.37	3.39	.37
Life Control 1	3.32	.51	3.27	.30
Ability Confidence 1	3.57	.39	3.37	.38
Interpersonal Confidence 1	3.76	.60	3.57	.68

Police recruits measured significantly higher ($p=.05$) **total mental toughness**; the magnitude of the differences between the means was substantial ($\eta^2 = .44$).

The police recruits did not differ significantly from the student cohort in scores for the **Challenge** sub-scale pre ($\eta^2 = .21$).

For **Commitment**, the difference between groups is significant ($p=.02$) and is supported by the effect size between each group ($\eta^2 = .52$).

The scores presented for **Emotional Control** indicate that the relationship between the two groups is not significant.

The **Life Control** sub-scale shows no significant relationship exists between the two populations.

Confidence in Abilities scores suggest there to be no significant relationship between groups.

For **Interpersonal Confidence** analysis did not indicate any strength of potential significance of relationship between groups ($t=1.11$).

MTQ48 and Other Scales

The MTQ48 has been shown to correlate significantly with the following well documented scales and measures.

	Pearson's Correlation	Scale
Optimism	0.48	Life Orientation Test
Life Satisfaction	0.56	Satisfaction with Life Scale
Self-Image	0.42	Self-Esteem Scale
Self-Efficacy	0.68	Self Efficacy Scales
Trait Anxiety	0.57	State-Trait Anxiety Questionnaire

Summary

Individuals scoring higher in Mental Toughness on the MTQ48 also scored significantly higher in Optimism, Life Satisfaction, Positive Self-Image, Self-Efficacy, and lower Trait Anxiety.

Mental Toughness Research: An Overview

- A comparison of two mental toughness measures
- A Dutch equivalency study
- Identifying the cognitive basis of mental toughness
- Behavioural genetic study of mental toughness
- Evidence for a general heritability factor of personality
- A genetically informed link between the Dark Triad and mental toughness
- Adolescents' mental toughness and its links to stress
- Mental toughness and stress resilience in adolescents
- Mental toughness in adolescents
- Classroom behaviour: the contributions of motivation and mental toughness
- Mental toughness in education: exploring relationships with attainment, attendance, classroom behaviour and peer relationships
- Mental toughness in Higher Education and the link with drop-out, achievement and progression in a degree programme
- Adolescents exercise and physical activity and its relationship with mental toughness
- The direct and moderating role of mental toughness in sport
- Mental toughness and athletes use of psychological strategies
- The relationship between mental toughness and the use imagery in sport
- The relationship between body awareness and mental toughness
- The role of mental toughness in the acquisition and retention of a sports skill
- Mental toughness and sleeping patterns
- Mental toughness and attitudes to risk-taking
- Mental toughness in relation to managerial position and age
- The relationship between mental toughness and affect intensity
- Mental toughness and body image perception

Comparing two measures of mental toughness.

Crust, L., & Swann, C. (2011).

Personality and Individual Differences, 50(2), 217–221.

<http://doi.org/10.1016/j.paid.2010.09.032>

Background and method

The study tested the relations between two measures of mental toughness. They hypothesized that the scales and subscales from two different instruments, which purported to measure the same or substantially overlapping scales, would be strongly correlated. Participants were 110 male club or university athletes (mean age= 20.81 years, SD= 2.76).

All participants had at least 1 year of experience in their chosen sport (mean experience= 9.34 years, SD=5.43). Each participant completed the MTQ-48, measuring total mental toughness and subcomponents; challenge, commitment, emotional control, life control, confidence in abilities and interpersonal confidence. They also completed the SMTQ questionnaire measuring global mental toughness and subcomponents; confidence, constancy and control.

Results

The results showed that MTQ-48 emotional control item 34 was found to be unrelated to the subcomponent but was significantly and negatively correlated with three other subcomponent items.

All of the items from MTQ-48 life control and SMTQ subcomponents constancy and control were found to be significantly and positively related to the subcomponents in the question, a number of items were found to be unrelated to each other.

Total mental toughness (MTQ-48) and global mental toughness (SMTQ) were found to be significantly correlated ($r=.75$). The scales predicted to be highly and significantly related (MTQ-48 emotional control and SMTQ control; MTQ-48 confidence in abilities and SMTQ confidence; MTQ-48 commitment and SMTQ constancy), were all found to be significantly related but moderately as opposed to high correlations.

The highest correlations between MTQ-48 and SMTQ subcomponents were found to be; MTQ-48 challenge and SMTQ confidence ($r=.62$); MTQ-48 commitment and SMTQ constancy ($r=.61$); and MTQ-48 commitment and SMTQ confidence ($r=.59$)

Conclusion

In conclusion high and significant positive correlations were found between total mental toughness (MTQ-48) and global mental toughness (SMTQ), but only accounts for 56% of common variance, which leave 44% of unexplained variance. This suggests that the two measures are measuring different components of mental toughness from each other.

Dutch Equivalent Study

The study aimed to determine the equivalency of the Dutch MTQ-48 version to the English MTQ-48 version. This was achieved by reviewing a Dutch sample and testing similarities to the English sample.

The Dutch sample consisted of 1280 participants (male n= 636, female n= 643, unspecified n= 1), 252 were 20 or under, 1092 were 21-25, 128 were 26-30, 140 were 31-33, 137 were 36-40, 163 were 41 and 45, 157 were 46-50, 112 were 51-55, 59 were 56-60, 10 were 61-65 and 3 above 65.

The internal reliability of the Dutch sample was tested using Cronbach Alpha, values greater or equal to .70 are considered as good, while >.60 is considered as ok.

Table 1: Internal consistency estimates

Subscale	α
Challenge	.79
Commitment	.82
Life control	.68
Emotional control	.66
Overall control	.79
Confidence in abilities	.74
Interpersonal confidence	.73
Overall confidence	.81
Overall mental toughness	.93

The factor structure was tested using a confirmatory factor analysis (CFA) and exploratory structural equation modelling (ESEM), this allows all observe variables (items) to load onto all latent factors (subscales) to overcome issues with CFA.

An English sample was assessed using ESEM, a sample of 8207 and findings showed a model fit of $\chi^2(855) = 8269.1$, CFI=.94, TLI=.92, SRMR=.02, RMSEA=.03 (90% CI=.032, .033). Scores greater than .90 for CFI and TLI are acceptable, while scores below .08 for SRMR and .06 for RMSEA are considered acceptable. The Dutch sample had a model fit of $\chi^2(855) = 2357.3$, CFI=.93, TLI=.90, SRMR=.03, RMSEA=.04 (90% CI=.035, .039), showing a good factor structure.

The English sample that was used to compare the Dutch sample to, consisted of 38363 participants (male n= 16972, female n= 16693, unspecified n= 4698). 4399 were aged 20 or below, 3396 were 21-25, 2991 were 26-30, 2791 were 31-25, 2712 were 36-40, 3102 were 41-45, 2728 were 46-50, 1993 were 51-55, 1031 were 56-60, 283 were 61-65 and 40 were above 65.

They compared the mean scores of the English and Dutch sample, across the subscales. Independent t-tests were conducted using Cohen's *d*, which is a relative movement in terms of standard deviation. Scores below .20 are considered as negligible effect. All effect sizes of

Cohen's d were below .20 apart from life control (see table 2). The r value was also observed, which is the common effect, which presents a standardised effect. Values 0.20 are considered as no effect, and therefore there were no significant differences between the samples for any of the subscales.

Table 2: Mean and standard deviation scores with effect sizes

Subscale	Mean		SD		d	r
	English	Dutch	English	Dutch		
Challenge	5.70	5.53	2.09	2.14	.030	.015
Commitment	6.24	6.06	2.00	1.97	.031	.016
Life control	5.85	5.00	2.11	1.87	.140	.072
Emotional Control	5.64	5.75	1.92	1.90	-.021	.011
Overall control	5.92	5.54	1.99	1.89	.07-	.035
Confidence in abilities	5.99	5.63	2.03	1.95	.063	.032
Interpersonal confidence	5.49	5.48	1.82	1.86	.001	.001
Overall confidence	6.01	5.80	1.93	1.91	.040	.020
Overall mental toughness	6.24	5.96	1.96	1.99	.050	.025

The scoring of MTQ-48 is standardised against normative values and represented as a standardised ten (STEN) score.

As no substantial differences were found between mean scores, the next step is to explore the extent the two samples presented similar patterns in STEN scoring. Where 95% confidence interval error bars overlap, it is appropriate to assume that STEN scores are sufficiently similar.

For overall mental toughness, the only STEN score that doesn't show any overlap between error bars is one, which is more susceptible to variance because there were fewer participants scoring here. Overall, very few STENS across all subscales presented had any meaningful variance between languages.

Identifying the cognitive basis of mental toughness: Evidence from the directed forgetting paradigm. *Personality and Individual Differences*, 53(5), 587–590.
Dewhurst, S. A., Anderson, R. J., Cotter, G., Crust, L., & Clough, P. J. (2012).
<http://doi.org/10.1016/j.paid.2012.04.036>

Background

The present study attempts to identify the cognitive underpinnings of mental toughness using the direct forgetting paradigm, in which participants were given a surprise memory test for material they were previously instructed to forget. The participants were 60 students (33 males, 27 females) with a mean age of 23.28 years (SD=6.94).

Method

Participants were asked to complete the MTQ-48 which measures total mental toughness and subscales; challenge, commitment, life control, emotional control, interpersonal confidence and confidence in abilities. The stimuli used for the directed forgetting task were 40 high frequency nouns taken from the MRC Psycholinguistic database. The words were randomly divided into two lists of 20 items each. The participants completed the MTQ-48 first, after completion the researcher read aloud the first list of words and afterwards told the participants that, that list was ‘just for practice’ and they wouldn’t be recalling those words, the researchers asked participants to forget these words. The researcher then read out the second list of words, then the researchers told participants they would be asked to recall the words from both lists. They were asked to write down the words they could recall from both lists.

Results

A paired samples t-test indicated a significant difference between list 1 recall and list 2 recall ($t(59)=2.72$, $p<.01$). A multiple regression was used to assess the ability of the four main subscales of MTQ-48 (challenge, commitment, control and confidence) to predict recall. Separate analyses investigated recall of list 1, recall of list 2 and the differences in recall between list 1 and list 2. For the recall of list 1, mental toughness accounted for less than 1% ($R^2=.05$) of the variance, $F<1$. However mental toughness was found to account for more than 20% ($R^2=.21$) of the variance for recall of list 2 ($F(4,59)=.74$, $p<.01$).

The analysis of coefficients indicated that the effect was driven by the commitment subscale ($\beta=.43$, $p<.01$) with none of the other subscales accounting for significant additional variance, all $p>.42$. For the differences between list 1 and list 2 ($M=.88$) mental toughness accounted for more than 20% ($R^2=.21$) of the variance ($F(4,59)=3.56$, $p<.05$). Which also found to be driven by the commitment subscale ($\beta=.37$, $p<.05$).

Conclusion-The main findings indicated that the commitment subscale was significantly correlated with enhanced recall of the to-be-remembered list (list 2) after instructed to forget the previous studied list (list 1). Therefore this suggests that mentally tough people find it easier to put things behind them when they are perceived as not important, and focus on present tasks.

A behavioural genetic study of mental toughness and personality.

Horsburgh, V. A., Schermer, J. A., Veselka, L., & Vernon, P. A. (2009). University of estern Ontario

Personality and Individual Differences, 46(2), 100–105.

<http://doi.org/10.1016/j.paid.2008.09.009>

Background

This is the first behavioural genetic investigation of mental toughness, and the first investigation of the relationship between mental toughness and the Big-5 factors of personality. Participants were 152 MZ twin pairs, and 67 DZ twin pairs, meaning 438 participants in total took part, 30 male MZ twin pairs and 122 female MZ twin pairs, 8 male DZ twin pairs and 59 female DZ twin pairs. The age range was between 18-82 years (mean=23.88 years, SD=6.22).

Method

Participants completed a 16-item zygosity questionnaire assessing physical similarity and the frequency they are mistaken for one another by family members and friends. They then completed the 240-item NEO-PI-R which assess the Big-5 factors of personality; extroversion (E), neuroticism (N), openness to experience (O), agreeableness (A) and conscientiousness (C). They then completed the MTQ-48 assessing overall mental toughness and its component scales

Results

Exploratory and confirmatory factor analyses were conducted to test the presence of the four factors that MTQ-48 was developed to measure (challenge, commitment, control and confidence). The twins within each pair were designated twin 1 and twin 2 and exploratory analyses were performed separately among all twin 1s, then twin 2s, in order to have independent observations. In each of these analyses the suggested four factors accounted for 40% and 42% of the variance. Confirmatory factor analyses were conducted to compare one and four-factor solutions, four-factor solution provided a better fit to the data.

Individual differences in all mental toughness variables, except the subscale life control can be fully accounted for by additive genetic (a^2) and non-shared environmental factors (e^2). Shared environmental factors were found to make a very small contribution to life control. Heritability estimates for mental toughness variables range from .36 to .56 while unique environmental factors estimates range from .44 to .64.

Univariate model-fitting analyses were examined for the Big-5 factors of personality. Individual differences in the Big-5 factors of personality show negligible influence of the shared environment and are instead largely attributable to genetic and non-shared environmental factors.

Phenotypic correlations were performed and at this level all correlations were significant at .01 level. Ranging from .15 (interpersonal confidence and life control) to .91 (confidence in abilities and emotional control). The majority of the correlations were very strong with 23

out of the 36 correlations greater than .60 and 10 greater than .80. All the genetic correlations among the 9 mental toughness variables were significant, except between interpersonal confidence and life control. These ranged from .36 (life control and commitment) to .95 (mental toughness and confidence), 30 out of the 36 genetic correlations were greater than .60. Significant non-shared environmental factors correlations ranged from .29 (interpersonal confidence and confidence as well as interpersonal confidence and commitment) to .88 (confidence in abilities and emotional control). The correlations were smaller than the genetic correlations, as only 11 out of the 36 correlations exceeded .60.

Correlations of genetic and non-shared environmental factors between the 9 mental toughness scales and the Big-5 factors of personality variables were conducted. Many significant correlations were found, some quite low (.17 between commitment and openness to experience) but several were high (-.64 between control and neuroticism, between confidence in abilities and neuroticism and between mental toughness and neuroticism). Of the 43 correlations 40 were found to be significant at a .01 level.

Significant genetic correlations ranged from .23 (commitment and openness to experience) to .91 (control and neuroticism). Significant non-shared environmental correlations ranged from .17 (interpersonal confidence and neuroticism) to .47 (mental toughness and conscientiousness). 32 out of the 45 genetic correlations were significant at a .05 level, and non-shared environmental correlations between mental toughness and Big-5 factors were generally smaller than the genetic correlations. Shared environmental factors did not contribute significantly to any phenotypic correlation.

Conclusions

The researcher had two goals to examine the extent to which genetic and environmental factors contribute to individual differences in mental toughness, and to also examine the extent to which mental toughness would correlate with the Big-5 factors of personality, and the extent to which any phenotypic correlations between these would be attributable to correlated genetic and/or correlated environmental factors.

The results showed that genetic and non-shared environmental factors contribute to the development of individual differences in mental toughness; the four subscales of mental toughness (challenge, commitment, control and confidence) show a somewhat lower level heritability than over all mental toughness scores. However individual differences in challenge, commitment, control and confidence were nonetheless attributable to genetic and non-shared environmental factors, this could have implications for potential therapeutic interventions designed to modify an individual's level of mental toughness.

This research suggested that mental toughness, which individuals try to strengthen, is highly heritable and therefore this might make it harder for people to develop. It may be easier to strengthen certain components of mental toughness such as commitment or control: the two subscales with the lowest heritability scores.

Evidence for a Heritable General Factor of Personality in Two Studies.

Veselka, L., Schermer, J. A., Petrides, K. V., & Vernon, P. A. (2009).

Twin Research and Human Genetics, 12(03), 254–260.

<http://doi.org/10.1375/twin.12.3.254>

Background

The studies aimed to see whether a general factor of personality (GFP) could be extracted from different measures of personality, and the assessment of the extent to which genetic and/or environmental factors contributed to individual differences in the GFP.

Study 1 - Method

In the first study 152 pairs of MZ twins and 67 pairs of same-sex DZ twins with a mean age of 23.88 years (SD=6.22) took part in a study where they completed the NEO-PI-R 240-item assessment of the Big-5 factors of personality; extroversion (E), neuroticism (N), openness to experience (O), agreeableness (A) and conscientiousness (C). They also completed the MTQ-48 assessing total mental toughness and subscales; challenge, commitment, confidence in abilities, interpersonal confidence, life control and emotional control. The zygosity questionnaire was completed which measures physical similarity and the frequency one is mistaken for the other by family and friends.

Results

Table 1: Unrotated factors extracted from the NEO and the MTQ-48 in study 1

Variable	Twin-1 I	Twin-1 II	Twin-2 I	Twin-2 II
N	-0.77	0.3	-0.71	0.33
E	0.55	0.48	0.48	0.52
O	0.25	0.7	0.21	0.79
A	0.38	-0.56	0.37	-0.5
C	0.66	-0.31	0.54	-0.27
Challenge	0.78	0.19	0.76	0.26
Commitment	0.81	0.09	0.82	0.08
Control	0.86	-0.08	0.86	-0.15
Confidence	0.87	0.07	0.89	0.02

The first factor in each analyses accounts for the majority of the variance: 47.6% among the twin 1 group and 44.3% among the twin 2 group. All of the 9 variables from the MTQ-48 and the NEO load on the first factor, with loadings ranging from .25 to .87 in twin 1 data and .21 to .89 in twin 2 data.

In both analyses the first factors receive their highest loadings (greater than .45) from the four MTQ-48 variables (challenge, commitment, control and confidence), neuroticism, conscientiousness and extroversion. Openness had the lowest loadings and agreeableness had moderate loadings on both of the first factors.

The two sets of first factor loadings are very consistent (Spearman's $\rho=1.0$, $df=7$, $p<.01$) thus showing excellent cross replication of the GFP. Correlations between MZ twins on the first unrotated (GFP) factor were .55 and between DZ twins was .19.

A full ACE model was fit and showed additive genetic (53%) and non-shared environmental factors (47%) fully accounted for individual differences in the GFP. The pattern of the loadings on these GFPs was very similar, representing high scores on mental toughness, extroversion, and conscientiousness and low scores on neuroticism.

Univariate behavioural genetic analyses found that individual differences in the GFP were fully attributable to genetic and non-shared environmental factors. MZ correlations for GFP were more than twice as large as DZ correlations, which therefore suggest a genetic dominance.

Study 2-Method

In the second study 213 pairs of MZ twins and 103 pairs of DZ twins (mean age=38.4, $SD=15.23$) completed the NEO-PI-R and the zygosity questionnaire, the same as in study 1. Participants then completed the TEIQue which yields scores on 15 facets, four factors and global traits of emotional intelligence (EI).

Table 2: First unrotated factors extracted from the NEO and TEIQue in study 2

Variable	Twin-1	Twin-2
N	-0.69	-0.65
E	0.58	0.53
O	0.33	0.35
A	0.42	0.35
C	0.58	0.48
Self esteem	0.74	0.73
Emotion expression	0.64	0.61
Self motivation	0.69	0.63
Emotion regulation	0.58	0.54
Happiness	0.77	0.72
Empathy	0.63	0.59
Social awareness	0.69	0.73
Impulsivity (low)	0.59	0.49
Emotion perception	0.63	0.64
Stress management	0.69	0.63
Emotion management	0.39	0.39
Optimism	0.77	0.74
Relationships	0.73	0.64
Adaptability	0.6	0.64
Assertiveness	0.48	0.55

Four factors with eigenvalues greater than 1 emerged, but first factor with an eigenvalue of 7.72 accounted for 38.6% of the variance in twin 1 data. In the twin 2 data five factors with

eigenvalues greater than 1 emerged but the first factor, with an eigenvalue of 7.03 accounted for 35.2% of the variance.

All of the 20 variables from the TEIQue and NEO load on the first factor, loadings ranging from .32 to .77 in twin 1 data and .35 to .74 in twin 2 data. In twin 1 data, only two variables (openness from the NEO and emotion management from the TEIQue) have loadings less than .40: among twin 2 data 3 variables (openness and agreeableness from the NEO and emotion management from the TEIQue) have loadings less than .40.

The majority of variables have loading of .60 or higher in both sets of data. This provides strong evidence for a GFP. The patterns of twins are very similar (Spearman's $\rho = .92$, $df = 18$, $p < .0005$) providing excellent cross replication. Correlations between MZ twins at the first unrotated (GFP) factor in study 2 were .46, while for DZ twins it was .23.

An ACE model was fitted and showed additive genetic (46%) and non-shared environmental factors (54%) fully accounted for individual differences in the GFP.

Overall Conclusion

In both studies, the GFP represents a cluster of desirable personality traits. There is also evidence for a genetic contribution to individual differences in the GFP, also obtained in both of the studies.

The inclusion of mental toughness in the GFP supports the evolutionary theory put forward by Rushton et al. (2008) suggesting the positive pole of GFP comprises of traits that allow for social acceptance and dominance in competition. Mental toughness by definition facilitates both as it implies a confident and well-adjusted individual who functions well under stress.

Survival of the Scheming: A Genetically Informed Link Between the Dark Triad and Mental Toughness.

Onley, M., Veselka, L., Schermer, J. A., & Vernon, P. A. (2013). University of Western Ontario

Twin Research and Human Genetics, 16(06), 1087–1095.

<http://doi.org/10.1017/thg.2013.66>

Background

The current study is a behavioural genetic investigation of the Dark Triad traits of personality, consisting of Machiavellianism, narcissism and psychopathy, and the variables of mental toughness, reflecting individual differences in the ability to cope when under pressure. The investigation explores explanations for success of individuals exhibiting the Dark Triad traits in the workplace and social settings.

Method

Participants were 210 same sex twin pairs, 152 MZ twins and 58 DZ twins, ranging in age from 17 to 92 (mean=41.42, SD=17.54). Each participant completed the Narcissistic Personality Inventory (NPI) which measures variation in subclinical narcissism, using a 40-item questionnaire that measures four factors of narcissism: exploitativeness/entitlement, leadership/authority, superiority/arrogance and self absorption/self admiration. They also completed the Self Report Psychopathy Scale (SRP-III), which assess the individual differences in subclinical psychopathy, measuring subscales: interpersonal manipulation, callous affect, erratic lifestyle and antisocial behaviour. The MACH-IV a 20-item measure of individual differences in subclinical Machiavellianism was also completed, measuring the four subscales; cynical view of human nature, positive view of human nature, negative interpersonal tactics primarily defined by manipulateness and positive interpersonal tactics identifiable through honesty. The MTQ-48 was also completed measuring total mental toughness and the subscales; challenge, commitment, interpersonal confidence, confidence in abilities, life control and emotional control.

Results

Table 1: Mean and standard deviation for the NPI, SRP-III, MACH-IV, and MT48

Variables	Mean	Standard deviation
Dark Triad		
Narcissism	0.38	0.18
Psychopathy	2.14	0.41
Machiavellianism	2.54	0.38
Mental Toughness		
Challenge	3.70	0.53
Commitment	3.84	0.49
Control	3.39	0.45
Confidence	3.75	0.53

A correlational analysis of participants' scores on the NPI, MACH-IV, SRP-II and the four major dimensions of MTQ-48 (challenge, commitment, control and confidence) was conducted to investigate the magnitude of any possible relationship between the Dark Triad and mental toughness variables.

It was found that all factors of mental toughness positively and significantly correlated with narcissism, while being negatively and significantly correlated with psychopathy, with the exception of the association between psychopathy and the challenge factors of mental toughness.

Correlations were diverse for Machiavellianism, as there was a significant positive correlation between commitment and control, but a significant negative correlation between challenge and confidence.

A behavioural genetic analysis was conducted and showed associations between narcissism and mental toughness factors are largely influenced by non-shared environmental factors.

Common non-shared environmental factors account for significant correlations between narcissism and three of the four factors of mental toughness (commitment, control and confidence), correlations between narcissism and challenge were best explained by correlated genetic factors only.

Three significant phenotypic associations were found between psychopathy and mental toughness, and shown to be entirely attributable to common genetic factors.

Four significant correlations between Machiavellianism and mental toughness were entirely accounted for by correlated genetic and correlated non-shared environmental factors.

Conclusion

In conclusion the results of this study show that there is a relationship between mental toughness and the Dark Triad of personality traits. It also demonstrates how the Dark Triad can be adaptive and be positive, as well as being maladaptive.

Adolescents with high mental toughness adapt better to perceived stress: A longitudinal study with Swiss vocational students.

Gerber, M., Brand, S., Feldmeth, A. K., Lang, C., Elliot, C., Holsboer-Trachsler, E., & Pühse, U. (2013). University of Basel

Personality and Individual Differences, 54(7), 808–814.

<http://doi.org/10.1016/j.paid.2012.12.003>

Background

The study set out to see if mentally tough students adapt better to perceived stress better than less mentally tough students. The study was conducted over 10 months, students being assessed at the start and then a follow up assessment took place at the end, 378 participants dropped out after the baseline period. The participants were 865 students (369 females, 496 males, mean age of 17.86 years, $SD=1.32$). These participants were recruited from 2 vocational schools, school A and school B. Each participant was asked to complete 2 psychological questionnaires.

Method

The students provided information such as their gender, age and their family financial situation on a 5 point scale ranging from 1 (the worst) to 5 (the best), so that they could be compared against each other. The students then completed MTQ-48 short version composing of 18 items which measured total mental toughness at the baseline period (T1) and at the follow up (T2). The students also completed a perceived stress scale, the German version of Adolescent Stress Questionnaire, a 30 item version of the questionnaire, which was composed of a 5 point Likert scale, ranging from 1 (not stressed at all) to 5 (very stressful). This was conducted at T1 and T2. Depressive symptoms were also measured at T1 and T2 using the German version of CES-D Short Version, which was used to assess the cognitive, emotional, motivational, behavioural and somatic aspects associated with depression. Life satisfaction was measured at T1 and T2 using 3 items off the Satisfaction With Life Scale, a 7 point Likert scale ranging from 1 (strongly agree) to 7 (strongly disagree).

Results

Students who had low to moderate stress also had low depressive symptoms and moderate life satisfaction and mental toughness. 12.9% and 18.8% had depressive symptoms which was positively correlated with stress, and negatively correlated to life satisfaction and mental toughness. A positive relationship was found between life satisfaction and mental toughness. Age was found to not be related to any of the variables and there was a weak correlation between mental toughness and family financial situations. Gender differences were found, as compared to females, males reported lower stress scores at the baseline period ($F(1,864)=29.3, p<.001$), and similarly at the follow up ($F(1,864)=23.48, p<.001$). Males were also found to have significantly lower depressive symptoms at the baseline period ($F(1,864)=11.53, p<.001$). Males were also found to have a more elevated life satisfaction at the baseline period ($F(1,864)=16.17, p<.001$).

Table 1: Descriptive statistics and correlations between variables

	Means	SD	Range	2	3	4	5	6	7	8	9	10
1. Stress T1	69.52	18.02	20-122	.55* **	.45* **	.31* **	- .34* **	- .26* **	- .42* **	- .30* **	-.01	- .15* **
2. Stress T2	69.06	20.01	30-139	-	.30* **	.48* **	- .23* **	- .39* **	- .32* **	- .44* **	.01	- .13* **
3. Depressive symptoms T1	9.48	7.30	0-42	-	-	-	-.40* **	-.28* **	-.36* **	-.35* **	.06	- .08* **
4. Depressive symptoms T2	10.63	7.92	0-43	-	-	-	-.23* **	-.45* **	-.30* **	-.52* **	.06	- .08* **
5. Life satisfaction T1	14.66	3.43	3-21	-	-	-	-	.51* **	-.32* **	.29* **	-.05	.17* **
6. Life satisfaction T2	14.55	3.41	3-21	-	-	-	-	-	.26* **	.47* **	-.01	.09* *
7. Mental toughness T1	58.23	6.66	39-85	-	-	-	-	-	-	.50* **	-.02	.14* **
8. Mental toughness T2	58.16	8.00	31-90	-	-	-	-	-	-	-	.00	.12* *
9. Age	17.86	1.32	16-25	-	-	-	-	-	-	-	-	-.05
10. Family financial situation	3.26	0.75	1-5	-	-	-	-	-	-	-	-	-

*p<.05.

**p<.01.

***p<.001.

Cluster analyses-TA hierarchical cluster analysis was conducted on student's data from school A, to identify the number of clusters. The baseline (T1) and follow up (T2) scores for stress, depressive symptoms and life satisfaction were used to identify each cluster. Four profiles were identified, the first profile was labelled 'well-adjusted' (N=95, 21%) which included student with low stress scores at T1 and T2, and had consistently low depressive symptoms and high life satisfaction. The second profile was labelled 'maladjusted' (N=78, 18.1%) which included students with elevated stress scores at T1 and T2, with consistently high depression and low life satisfaction. The third profile was labelled 'deteriorated' (N=76, 17.7%) which included people who had increasing stress levels, depressive symptoms and decreasing life satisfaction from T1 to T2. The fourth profile was labelled 'resilient' (N=181,

42.1%) which included students who were moderately stressed at T1, but reported decreased depression at T2, life satisfaction also increased from T1 to T2. This group was named resilient because the students were exposed to risk, but still were able to achieve positive outcomes.

Table 2: Means and standard deviations for the main study variables in each cluster for school A.

	Well adjusted (N=95)		Maladjusted (N=78)		Deteriorated (N=76)		Resilient (N=181)		F	η^2
<i>Differences in variables used to identify the clusters</i>										
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Stress T1	54.63a,b,c	11.46	83.71a,d	15.41	78.07b,e	16.42	69.36c,d,e	14.80	66.19***	.318
Stress T2	47.12a,b,c	9.02	82.41a,d	13.48	86.87b,e	15.97	67.26c,d,e	12.73	171.24***	.547
Depressive Symptoms T1	3.76a,b,c	2.79	17.00a,d,e	6.20	7.04b,d	4.06	8.79c,e	6.37	91.68***	.392
Depressive Symptoms T2	4.05a,b,c	3.51	18.54a,d,e	7.22	14.37b,d,f	6.24	6.66c,e,f	3.85	164.30***	.536
Life Satisfaction T1	17.32a,b,c	1.91	11.13a,d	3.60	15.29b,e	2.56	15.01c,d,e	2.37	83.61***	.371
Life Satisfaction T2	17.61a,b,c	1.63	11.29a,d,e	3.16	13.93b,d,f	2.39	15.60c,e,f	2.13	117.23***	.452
<i>Differences in mental toughness</i>										
Mental Toughness T1	62.77a,b,c	6.78	53.92a,d,e	5.48	57.65b,d	4.71	58.31c,e	6.29	25.61***	.154
Mental Toughness T2	64.24a,b,c	7.48	52.06a,d,e	6.75	55.60b,d,f	6.75	59.76c,e,f	6.33	42.98***	.234

Note. Df = 3,429 across all analyses. Bonferroni post hoc tests: Means with equal letters are different ($p < .05$).

1 Controlled for gender, and family financial situation.

*** $p < .001$.

School B was used as an independent sample to cross validate the findings from school A. A *k*-means cluster analysis was conducted and confirmed a four cluster solution, with 'well adjusted' (N=179, 41.1%), 'maladjusted' (N=59, 13.6%), 'deteriorated' (N=96, 22.3%) and 'resilient' (N=101, 23.2%).

Table 3: Means and standard deviations for the main study variables in each cluster for school B.

	Well adjusted (N=95)		Maladjusted (N=78)		Deteriorated (N=76)		Resilient (N=181)		F	η^2
<i>Differences in variables used to identify the clusters</i>										
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Stress T1	55.82a,b,c	12.26	89.49a,d,e	14.17	68.85b,d,f	14.07	79.62c,e,f	15.26	120.00***	.455
Stress T2	55.30a,b,c	14.16	94.12a,d,e	15.24	80.90b,d,f	18.00	67.69c,e,f	16.51	113.30***	.441
Depressive Symptoms T1	5.01a,b,c	3.49	19.31a,d,e	7.16	8.20b,d,f	4.49	15.53c,e,f	7.43	148.08***	.508
Depressive Symptoms T2	6.29a,b,c	5.02	19.51a,d	6.37	19.24b,e	7.30	9.31c,d,e	5.74	140.48***	.494
Life Satisfaction T1	16.52a,b,c	2.35	10.49a,d,e	2.98	15.15b,d,f	2.80	12.50c,e,f	3.52	87.60**	.379
Life Satisfaction T2	16.53a,b,c	2.15	10.02a,d,e	2.96	11.47b,d,f	3.30	14.80c,e,f	2.57	130.84***	.477
<i>Differences in mental toughness</i>										
Mental Toughness T1	60.98a,b,c	6.77	53.54a,d,e	4.91	57.22b,d	6.25	56.39c,e	5.60	26.97**	.158
Mental Toughness T2	61.50a,b,c	7.17	50.08a,d,e	6.51	53.94b,d,f	5.92	59.01c,e,f	7.31	53.42**	.271

Note. Df = 3,434 across all analyses. Bonferroni post hoc tests: means with equal letters are different ($p < .05$).

1 Controlled for gender and family financial situation.

*** $p < .001$.

Regression analyses-baseline mental toughness was used to predict future depressive symptoms and life satisfaction.

Table 4: Hierarchical regression analysis with depressive symptoms and life satisfaction as outcomes.

All Students (N=865)				
	Depressive Symptoms		Life Satisfaction	
	ΔR^2	β	ΔR^2	β
Step 1	.02***		.01*	
Gender		.00		-.03
Family financial situation		-.02		-.01
Step 2	.16***		.25***	
Depressive Symptoms T1		.38***		-
Life satisfaction T1		-		.49***
Step 3	.02***		.01***	
Mental Toughness T1		-.18***		.12***
Step 4	.08***		.05***	
Stress ($\Delta T2-T1$)		-.28***		-.23***
Total R ²	.28***		.32***	

* $p < .05$. ** $p < .01$. *** $p < .001$

Baseline mental toughness negatively predicted depressive symptoms at the follow up ($\beta = -.18$, $p < .001$). Baseline mental toughness accounted for 2% of the variance in depressive symptoms. Similar results were found for life satisfaction, as baseline life satisfaction positively predicted life satisfaction at the follow up, ($\beta = .12$, $p < .001$).

High toughness scores were associated with increased life satisfaction at follow up ($\beta = .12$, $p < .001$). These results remained significant even after adding stress. Increased stress was also found to be associated with lower T2 life satisfaction ($\beta = -.23$, $p < .001$). Baseline mental toughness accounted for 1% variability in life satisfaction score follow up at T2.

Conclusion

In conclusion 'well adjusted' adolescents scored higher on mental toughness than maladjusted, deteriorated and resilient adolescents at T1, but at T2 well adjusted and resilient adolescents scored higher on mental toughness than maladjusted and deteriorated adolescents, which supports mental toughness working as a stress resilience resource.

Mental Toughness and stress resilience in adolescents

Markus Gerber, Nadeem Kalak, Sakari Lemola, Peter J. Clough, Uwe Pühse, Edith Holsboer-Trachsler, Serge Brand. University of Basel

Background and method

This study investigates whether factor structure of MTQ-48 can be replicated by means of a confirmatory factor analysis in a sample of high school student and tests whether mentally tough students are more resilient to stress. Participants were 284 high school students (99 males, 185 females). The mean age of male students (mean=19.05, SD=5.00) was found to be significantly higher than that of female students (mean=17.83, SD=3.58) ($F(1,283)=5.60$, $p<.05$). Each participant completed the MTQ-48 questionnaire measuring subcomponents; commitment, challenge, emotional control, life control, interpersonal confidence and confidence in abilities. They also completed the Perceived Stress Scale (PSS), which is a 10 item scale assessing the degree that participants feel that they find their lives are unpredictable, uncontrollable and overloading. Depressive symptoms were also measured using the Beck Depressive Inventory (BDI) which assesses the affect, behavioural, cognitive and somatic symptoms indicative of unipolar depression.

Results

The MTQ subscales were highly correlated with both overall indices. High correlations between MTQ subscales were also found. High mental toughness was found to be associated with lower stress and depressive symptoms. Except for interpersonal confidence, most coefficients indicated strong relationships. Strong relationships existed between high perceived stress and increased depressive symptoms.

It was found that mentally tough participants were more resilient against stress than less mentally tough participants. Significant main effects for perceived stress and mental toughness occurred across all toughness indicators. Significant interactions were also found between stress and all MTQ subscales with between 1% and 3% explained variance. Age and gender explained 7% of variance in depressive symptoms ($p<.01$). Challenge subscale and perceived stress resulted in a significant R^2 -increment and 37% additionally explained variance ($p<.001$). Both challenge ($\beta=-.18$, $p<.01$) and stress ($\beta=.52$, $p<.001$), were found to be independent predictors of depressive symptoms. The interaction between challenge \times stress explained 2% of variance beyond that of main effects ($p<.01$). Significant regression weight ($\beta=-.16$, $p<.01$) indicated that high challenge is associated with lower depressive symptoms if participants experienced high stress.

Conclusion

The results support the hypothesis that the more mentally tough you are, the more resilient to stress you are. This could have future implications for mental toughness interventions, to help people develop higher levels of mental toughness, to help them become more resilient to stress.

Are Adolescents With High Mental Toughness Levels More Resilient Against Stress?

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Perry, J. L., Pühse, U., ... Brand, S. (2012). *Stress and Health*, 29(2), 164–171. <http://doi.org/10.1002/smi.2447>

Background

The aim of the study was to see if participants with high mental toughness levels exhibit resilience to stress. The study used two samples. Sample 1 was made up of 284 high school students (99 males, 185 females, mean age= 18.3 years, SD=4.17). Sample 2 was made up of 140 undergraduate exercise and health students (53 males, 87 female, mean age= 20 years, SD=5.0). All participants completed a series of questionnaires assessing social and demographic background, stress, mental toughness and psychological functioning.

Method

All the participants completed the MTQ-48 questioning measuring mental toughness, and its subcomponents; challenge, commitment, emotional control, life control, interpersonal confidence and confidence in ability. The 5 point Likert scale scores from 1 strongly disagree to 5 strongly agree.

Participants also completed the 10 item Perceived Stress Scale (PSS) which assess the degree to which you find your life unpredictable, uncontrollable and overloading, on a 5 point Likert scale with 1 being never to 5 very often.

Depressive symptoms were also assessed using the Beck Depression Inventory (BDI), which is a 21 item scale assessing affective, behavioural, cognitive and somatic symptoms that are indicative of unipolar depression.

Results

The results were consistent across the two samples, as all MTQ-48 subscales were significantly and highly correlated with the overall index (correlations from $r=.20$ to $.39$ were regarded as low/small, $r=.40$ to $.59$ moderate and $r \geq .60$ high/strong. Significant moderate to high correlations were found to exist in various MTQ-48 subscales.

Increased overall mental toughness is significantly and strongly associated with lower stress level and depressive symptoms. There is also a strong significant relationship between high stress levels and depressive symptoms.

Looking at sample 1, age and gender explained 8% of the variance in depressive symptoms ($p<.01$). The inclusion of MTQ-48 overall index and levels of stress perceived resulted in a significant R^2 -increment and 40% additionally explained variance ($p<.001$).

Both mental toughness ($\beta=-.29$, $p<.001$) and perceived stress ($\beta=.37$, $p<.001$), are independent predictors of depressive symptoms. Interactions between mental toughness x stress explained 2% of the variance beyond that of main effects ($p<.01$).

The significant regression weight ($\beta=.14$, $p<.01$) indicated that high mental toughness is associated with low depressive symptoms when the participant is experiencing high stress. The total percentage of explained variance for the total model amounted to 50% ($p<.001$).

Sample 2 found an even stronger stress-protective effect occurred for mental toughness. The total model explained 57% of the variance ($p<.001$). The variance of stress x mental toughness interaction was 10% with a significant regression weight ($\beta=.33$, $p<.001$), which also indicated that high stress and low depressive symptoms were associated when the participant had high mental toughness.

Conclusion

In conclusion the study shows that elevated mental toughness is associated with lower levels of stress and depressive symptoms and increased levels of mental toughness mitigated the relationship between elevated stress and depressive symptoms.

Adolescent's classroom behaviour: The contributions of motivation and mental toughness.

**Clair-Thompson, H., Bugler, M., McGeown, S., & Clough, P. (nd).
(nd)**

Background

The aim of the study was to find out if there is a significant link between academic motivation, mental toughness and classroom behaviour. The participants taking part in the study were 181 UK year 11 students (93 girls, 88 boys) aged between 15-16 years (mean age=16.19, SD=1.9).

Method

The students completed the Student Motivation and Engagement Scale, which measures motivation in four dimensions; booster thoughts (self-belief, valuing school work and learning focus), booster behaviours (planning, task management and persistence), mufflers (anxiety, failure, avoidance and uncertain control) and guzzlers (self-sabotage and disengagement). This is a 44 item questionnaire, formatted as a seven point Likert scale ranging from strongly agrees to strongly disagree. The students also completed the MTQ-48.

The teachers were also asked to complete the Conners Teacher Rating Scale Revised Short Version, for each child. This is a 28 item, four point Likert scale, assessing four dimensions of behaviour in the classroom; cognitive problems/inattention, oppositional behaviour (rule breaking), hyperactivity and ADHD index.

Results

The results confirmed that there was a positive correlation between booster thoughts and behaviours and mental toughness. They also found that there was a negative correlation between mufflers and mental toughness and guzzlers were not significantly related to mental toughness.

Booster thoughts and booster behaviours were found to be negatively associated with negative classroom behaviours, and mufflers were weakly but generally positively associated with negative classroom behaviours. Guzzlers were significantly, positively associated with negative classroom behaviour.

Mental toughness was negatively related to negative classroom behaviours. Relationships were particularly noticeable for mental toughness attributes for commitment, control of life and interpersonal confidence.

As there were interrelationships between motivation, mental toughness and classroom behaviour, regression analyses were conducted to test whether motivation or mental toughness was the best predictor of classroom behaviour. For each behavioural construct an analysis was conducted.

In the first analysis motivation was tested first, then mental toughness, in the second analysis mental toughness was tested first, then motivation, for each of the four behaviour constructs stated in the Conner Teacher Rating Scale Revised Short Version.

The findings displayed a shared variance (8%, 10%, 7%) for oppositional behaviour, cognitive problems, hyperactivity and ADHD, and motivation was found to have a significant proportion of unique variance in cognitive problems, hyperactivity and ADHD (7%, 8%, 10%).

However overall mental toughness was found to be the best predictor of classroom behaviour, with a large proportion of unique variance (11% for oppositional behaviour, hyperactivity, ADHD and 16% for cognitive problems).

Conclusions

In conclusion the results of this study show that mental toughness does effect academic motivation and classroom behaviour. Therefore this could be used to help develop projects to help improve classroom behaviour by addressing motivation and mental toughness.

Mental toughness in education: exploring relationships with attainment, attendance, behaviour and peer relationships.

St Clair-Thompson, H., Bugler, M., Robinson, J., Clough, P., McGeown, S. P., & Perry, J. (2014).

Educational Psychology, 1–22. <http://doi.org/10.1080/01443410.2014.895>

Background

The study aimed to find a relationship between mental toughness and difference aspects of educational performance in adolescents aged 11-16, focusing on academic attainment, school attendance, classroom behaviour and peer relationships. Three different studies were used to assess this.

Study 1-Method

The first study tested the relationship between mental toughness and academic attainment and attendance. Participants were 159 students (89 males, 70 females) aged between 13 and 15 years (mean age= 14.5 years), from schools in the North East of England.

The study was designed to test the relationship between mental toughness and academic attainment and attendance. Students completed the MTQ-48 questionnaire, and the schools were asked to supply the latest national curriculum (mathematics, science and english) levels for each student who took part. These assessments were the teacher's assessment of progression rather than standardised test scores, with levels ranging from 2-8. The expected levels of this particular age group are 5 or 6.

The average score was calculated across all three curriculum areas. The schools were also asked to supply information of attendance percentages of the previous academic term which was a 15 week period.

Results

The Cronbachs Alpha was computed for each subscale of MTQ-48; challenge, commitment, control of emotions, control of life, overall control, confidence in abilities, interpersonal confidence and overall confidence, as well as total mental toughness. However previous research has found low reliability for subscale control of emotion, so for this reason question 26 and 34 were removed from the questionnaire. The Cronbach Alpha values were; .62, .69, .47, .50, .67, .64, .51, .66 and .87 respectively.

To examine the factor structure of MTQ-48, Exploratory Structural Equation Modelling (ESEM) was conducted on the overall sample across all three studies (548 participants) using Mplus7.1. The ESEM results supported the factor structure of MTQ-48 in the overall sample ($\chi^2(730) = 9.65.5$ (FI=.95, TLI=.93, SRMR=.03, RMSEA=.02 [90% confidence interval: .02, .03]).

The findings for study one show that challenge, commitment, control of life, overall control, and total mental toughness were significantly related to both attainment and attendance. Control of emotion and confidence in abilities were significantly related to attendance.

Linear regression analyses were conducted, using the scores of the subscales that were significantly related to attainment and attendance.

High correlations were found between total mental toughness and subcomponents of mental toughness, so therefore total mental toughness was not included in the regression analyses. High correlations were also found in overall control and its two subcomponents and overall confidence and its two subcomponents, so they were also not included in the regression analyses.

The results showed that attainment had 12% of variance ($F(3,152)= 6.36, p<.01$), with control of life ($p<.01$) which shows a significant variance. Attendance had 9% of variance ($F(5,153)= 3.03, p<.01$), which also showed a significant variance predicted by control of life ($p<.01$)

The results reveal significant relationships between several aspects of mental toughness and student's attainment and attendance. However the regression analyses show that the most important predictor of attainment and attendance was the component of mental toughness control of life.

Study 2-Method

The second study conducted tested the relationship between classroom behaviour and mental toughness. Participants were 295 students (142 males, 152 females) aged between 11-16 years (mean age=14.8 years), who had not taken part in the first study.

Students carried out the MTQ-48 questionnaire and the teachers were asked to complete the Conners Teacher Rating Scale Revised Short Version for each child. The scale is a 28 item questionnaire testing four dimensions of behaviour; cognitive problems/inattention, oppositional behaviour, hyperactivity and ADHD. The teachers were asked to rate each child on a 4 point Likert scale, the total for each child was computed.

Like study one, questions 26 and 34 were removed from MTQ-48. Cronbach Alpha values were calculated as .64, .67, .48, .54, .66, .69, .60, .70 and .89, for challenge, commitment, control of emotion, control of life, overall control, confidence in abilities, interpersonal confidence, overall confidence and total mental toughness.

The results showed that commitment, control of life, overall control, interpersonal confidence and total mental toughness significantly related to the four aspects of behaviour. Challenge was also related to oppositional behaviour and cognitive problems/inattention and ADHD.

Linear regression analyses were conducted testing the mental toughness subscales that were significantly linked to classroom behaviour. Oppositional behaviour had 10% of variance ($F(5,289)= 5.51, p<.01$), with commitment ($p<.01$) having a significant variance. Cognitive problems/inattention had 7% of variance ($F(4,290)= 5.80, p<.01$), with control of life ($p<.05$) having a significant variance. Hyperactivity had a variance of 6% ($F(2,292)= 8.81,$

$p < .01$) with control of life being a significant predictor ($p < .01$). ADHD had an 8% of variance ($F(3,291) = 8.84, p < .01$), with control of life having a significant variance ($p < .01$)

These results show that there is a significant relationship between mental toughness and classroom behaviours, but the regression analyses show that control of life is the best predictor of classroom behaviours.

Study 3-Method

Study three aimed to test the relationship between mental toughness and peer relationships, as mentally tough people are described as being social and outgoing. This would therefore suggest that students who are mentally tough will have more positive peer relationships than students who are less mentally tough.

Participants were 93 school students (50 males, 43 females) aged between 11-13 years (mean age=11.5 years, SD= 6 months), who had not taken part in the two earlier studies.

Students took part in three tests, the MTQ-48, the Social Inclusion Survey and the Social Acceptance Scale from the Self Perception Profile, which is a scale set up of 6 sets of 2 contrasting statements e.g. 'some children find it hard to make friends', 'others don't'.

The student has to pick one of the statements that sounds most like them and rate whether it is very true for them, or sort of true for them. These responses are then scored from 1-4, with 4 being really true for the more socially acceptable answer e.g. some children find it easy making friends, 3 being sort of true, 2 being sort of true for the less acceptable e.g. some children find it hard making friends, and 1 being really true for the less acceptable statements. The total scores are then calculated for each child.

Questions 26 and 34 were removed from MTQ-48, like the previous studies. The Cronbach Alpha values were .66, .71, .70, .41, .73, .63, .65, .72, .90 for challenge, commitment, control of emotion, control of life, overall control, confidence in abilities, interpersonal confidence, overall confidence and total mental toughness.

A significant relationship was found between the Social Inclusion Survey, between the ratings of 'play with' and 'work with' and both confidence in abilities and interpersonal confidence, as well as total mental toughness.

The Self Perception Profile was found to have a significant link to challenge, control of emotion, control of life, overall control, confidence in abilities, interpersonal confidence, overall confidence and total mental toughness.

Linear regression analyses were conducted to analyse the mental toughness subscales which were significant to the peer relationship measures.

The Social Inclusion Survey, particularly the 'play with' rating found that interpersonal confidence was a significant predictor ($p < .05$) with a 10% variance ($F(2,90) = 5.16, p < .05$), and the 'work with' rating having 9% of variance ($F(2,90) = 4.50, p < .05$), with confidence in abilities being a significant predictor.

The Self Perception Profile found that confidence abilities ($p < .05$) and interpersonal confidence ($p < .01$) were significant predictors accounting for 24% of the variance ($F(5,87) = 5.61, p < .01$).

Conclusion

In conclusion confidence in abilities, interpersonal confidence and overall confidence and total mental toughness are significantly related to social inclusion, and challenge, control of emotion, control of life and each aspect of confidence is significantly related to self perception of social acceptance.

Therefore this suggests that mental toughness is linked to peer relationships, being that high mentally tough students have more positive peer relationships than less mentally tough students.

Overall all three studies demonstrate a significant relationship between mental toughness and the different elements of education; attainment, attendance, behaviour and peer relationships.

Mental Toughness in Higher Education: Link to Drop-out, Achievement and Progression in a Degree Programme.

K. Earle, P. Clough Hull University

Background

The study aimed to examine the importance of mental toughness in higher education and predicted mentally tough students would be more likely to pass and achieve higher grades than less tough students.

Method

Participants were 161 first year University Students (105 men, 56 women) who were enrolled on three different sports related degree programs;

- Sport and exercise students (46)
- Sports coaching students (65)
- Sport rehabilitation students (50)

All students completed the MTQ-48 measuring total mental toughness and subscales; challenge, commitment, emotional control, life control, confidence in abilities and interpersonal confidence.

Academic progress (credits) and academic achievement (end of year grade) were also measured. Academic progression was measured using the university credit system, each module is given a credit value of 20 with a minimum of 40% to achieve this credit value, to pass the year 120 credits are needed. Students with credits between 60 and 100 are eligible for re-sits, however below 60 are not eligible for re-sits and have therefore failed the year.

However the credits system does not measure academic achievement as better students will achieve 70% or above and not the minimum of 40% needed to pass, therefore achievement was measured by calculating the mean grades for the year.

Table 1: Descriptive Data Showing Reported Mental Toughness with Respect to Progression and Gender.

	Pass ^a (n = 88)	Resit ^b (n = 40)	Fail ^c (n = 31)	Men ^d (n = 105)	Women ^e (n = 56)
MT Total	3.57 (.41) ^{***c}	3.52 (.39)	3.30 (.43) ^{**a}	3.59 (.42) ^{***e}	3.35 (.39) ^{***d}
Challenge	3.75 (.49)	3.56 (.49)	3.56 (.55)	3.79 (.48) ^{***e}	3.54 (.52) ^{***d}
Commitment	3.68 (.49)	3.58 (.44)	3.38 (.52)	3.63 (.51)	3.52 (.45)
Control (emotional)	3.14 (.64)	3.21 (.63)	3.10 (.57)	3.21 (.64)	3.04 (.58)
Control (life)	3.60 (.55) ^{**c}	3.60 (.48) ^{**c}	3.27 (.51) ^{**ab}	3.60 (.55)	3.40 (.50)
Confidence (abilities)	3.45 (.62)	3.40 (.47)	3.13 (.64)	3.47 (.57)	3.20 (.63)
Confidence (interpersonal)	3.81 (.66) ^{**c}	3.60 (.78)	3.36 (.76) ^{**a}	3.87 (.63) ^{***e}	3.30 (.75) ^{***d}

Note. * $p < .05$, ** $p < .01$. Means followed by standard deviation (shown in parentheses). Progression data was unavailable for two participants.

Internal reliability for the mental toughness subscales were acceptable (0.7 or above), with the exception of emotional control. Pearson's correlations found that all the mental

toughness subscales (except emotional control) were significantly and positively related to grades and credits.

Table 2: *Pearson correlations between academic achievement (grade), progression (credits), and mental toughness.*

	1	2	3	4	5	6	7	8	9
Grade (1)	—								
Credits (2)	.86**	—							
MT Total (3)	.31**	.25**	(.90)						
Challenge (4)	.22**	.18*	.75**	(.70)					
Commitment (5)	.25**	.22**	.73**	.46**	(.76)				
Control (Emotional) (6)	.03	.03	.63**	.42**	.39**	(.60)			
Control (Life) (7)	.32**	.24**	.80**	.50**	.55**	.30**	(.70)		
Confidence (Abilities) (8)	.24**	.20*	.81**	.49**	.41**	.47**	.63**	(.78)	
Confidence (Interpersonal) (9)	.31**	.25**	.70**	.50**	.32**	.21**	.59**	.54**	(.79)

Note. * $p < .05$, ** $p < .01$. Cronbach's alpha for scales / subscales shown in parentheses.

A linear regression analysis was computed using the mental toughness subscales (except emotional control) as predictor variables and end of year grades as the dependent variable. To account for potential gender and course effects these variables were included in the regression equation with the mental toughness subscales.

A significant gender effect was evident ($\beta = -.19$, $p < .05$). Life control ($\beta = .28$, $p < .01$) and interpersonal confidence ($\beta = .18$, $p < .05$) were found to be significant predictors, as 15.4% of the variance was accounted for overall.

Table 3: *Linear regression results for mental toughness subscales and academic grades*

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>
Gender	-7.25	2.91	-.19	-2.49	.01
Course	-2.92	1.69	-.13	-1.73	.09
Life control	9.43	2.53	.28	3.73	.00
Interpersonal confidence	3.66	2.41	.18	1.52	.05
Challenge	.31	3.21	.01	.01	.92
Commitment	3.79	3.35	.10	1.13	.26
Confidence in abilities	-.36	3.06	-.01	-.12	.91

Note. Emotional control subscale excluded due to low reliability.

Because of large and significant correlations between mental toughness subscales, collinearity statistics were conducted since with collinearity can make it difficult to draw inferences about relative contributions of predictor variables. All predictor variables were found to have collinearity tolerance of greater than .10 (.55 to .75) and VIF of less than 5 (1.3 to 1.8) indicating no collinearity problems.

Using STEN scores for MTQ-48, participants were classed as high (24), medium (102) or low (33) in mental toughness. When concerning end of year grades, a two-way ANOVA indicated significant main effects for levels of mental toughness ($F_{2, 158} = 4.28$, $p = .015$) but not for gender or interactions ($p > .05$).

Post hoc analysis was conducted and found mean grades for students with high ($M=49.54$, $d=0.71$) and medium ($M=45.97$, $d=0.51$) mental toughness were significantly higher ($p<.01$) than students with low mental toughness ($M=37.01$).

Students who failed ($n=31$; 0-40 credits), who required re-sits ($n=40$; 60-100 credits) and students who passed ($n=88$; 120 credits) in their first year of study were compared in total mental toughness. A two-way ANOVA found significant main effects for credits ($F_{2, 158}=3.11$, $p<.05$) and for gender ($F_{1, 158}=6.19$, $p<.05$) but no significant interactions ($p>.05$).

A Post hoc analysis found those achieving pass grades had higher total mental toughness than those who failed ($p<.01$, $d=0.50$), and men reported significantly higher levels of total mental toughness than women ($p<.05$, $d=0.59$).

Conclusion

Findings suggest mental toughness is related to academic retention and achievement. The MTQ-48 could be an important screening device that would allow the identification of at-risk groups. These groups could then benefit from additional support in terms of adjusting to the demands of higher education.

Adolescents' exercise and physical activity are associated with mental toughness.

Gerber, M., Kalak, N., Lemola, S., Clough, P. J., Pühse, U., Elliot, C., & Brand, S. (2012). *Mental Health and Physical Activity*,5(1), 35–42.
<http://doi.org/10.1016/j.mhpa.2012.02.004>

Background

The study compared the mental toughness of adolescents and young adults with self-reported exercise, physical activity and recommended levels of physical activity. 248 high school students took part all together (99 males and 185 females), with the mean age being significantly higher among males (mean=19.05, SD=5.00), than females (mean=17.83, SD=3.58) ($F(1,285) = 6.60, p < .05, \eta^2 = .02$).

Method

The participants completed the MTQ-48 measuring overall mental toughness and subscales; challenge, commitment, control of emotions, life control, interpersonal confidence and confidence in abilities. Questions were taken from the International Physical Activity Questionnaire to assess how many days per week participants exercised or participated in high intensity activities and sports, how many days per week they engaged in moderate physical activity, they were also asked to indicate the average duration per day they engaged in these activities. To meet the recommended level of physical activity, according to the Behavioural Risk Factor Surveillance System (BRFSS), participants needed to engage ≥ 5 days per week of moderate activity for ≥ 30 minutes each time, or engage in ≥ 3 days per week of vigorous activity for ≥ 20 minutes per day.

Results

Table 1: Participants' levels of vigorous exercise and moderate physical activity and recommended levels of activity

	Total sample		Males		Females	
	N	%	N	%	N	%
Vigorous activity						
0 days per week	37	13.0	12	12.1	25	13.5
1-2 days per week	96	33.8	17	17.2	79	42.7
3-4 days per week	105	37.0	43	43.4	62	33.5
5-7 days per week	46	16.2	27	27.3	19	10.3
Moderate physical activity						
0 days per week	21	7.4	10	10.1	11	5.9
1-2 days per week	63	22.2	14	14.1	49	26.5
3-4 days per week	79	27.8	18	18.2	61	33.0
5-7 days per week	121	42.6	57	57.6	64	34.6
Recommended physical activity						
Accomplished	161	57.0	72	72.7	90	48.6
Not accomplished	122	43.0	27	27.3	95	51.4

Table 2: Psychometric properties of the mental toughness and physical activity indicators.

	<i>n</i>	<i>M</i>	<i>SD</i>	<i>a</i> (items)	Skew	Kurt	Sample items
Challenge	284	28.34	4.69	.80 (8)	-.94	1.62	Challenges usually bring out the best in me
Commitment	284	37.24	6.31	.82 (11)	-.27	.93	I don't usually give up under pressure
Control (emotion)	284	15.33	3.28	.61 (5)	.06	.09	Even when under considerable pressure I usually remain calm
Control (life)	284	23.29	3.95	.71 (7)	-.41	.48	I generally in control
Confidence (interpersonal)	284	21.64	3.96	.72 (7)	-.31	-.36	I usually take charge of a situation when I feel it is appropriate
Confidence (abilities)	284	30.94	5.71	.82 (9)	-.36	.30	I am generally confident in my own abilities
Overall mental toughness	284	162.14	22.05	.93 (46)	.36	-.05	–
Moderate activity	284	4.20	4.25	–	1.77	3.56	During the last 7 days, on how many days did you do moderate physical activities like brisk walking, hiking, gardening, low intensity sport? How much time on one of those days?
Vigorous activity		4.02	3.27	–	1.05	1.18	During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? How much time on one of those days?

Note. *a* = Cronbach's alpha

Two separate ANOVAs showed gender was significantly associated with self reported days of vigorous exercise ($F(1,283)=19.14, p<.001, \eta^2=.014$), with men engaging in frequent vigorous exercise more than women, and women engaging in moderate activity more than men. A Chi-squared test showed lower proportions of women met the BRFSS physical activity recommendations.

The MANOVA revealed gender was significantly associated with overall mental toughness, with males reporting higher mental toughness scores than females (Wilks $\Lambda =.86, F(7,277) =7.73, p<.001, \eta^2=.14$). No significant relationship was found between age and the number of days per week of vigorous or moderate activity or the recommended the physical activity. A weak positive correlation was found between and age and MTQ-48 scores ($r=.13-.18, p<.05$) apart from the subscale interpersonal confidence ($r=.05, p=ns$)

Table 3: Mental toughness as a function of gender.

	Women (n=185)		Men (n=99)		F	p	η^2
	M	SD	M	SD			
Challenge	27.61	4.69	29.71	4.39	15.52	<.001	.05
Commitment	36.63	6.09	38.38	6.59	5.03	<.05	.02
Control (emotion)	14.61	3.01	16.69	3.36	28.30	<.001	.09
Control (life)	22.51	3.75	24.75	3.91	22.34	<.001	.07
Confidence (interpersonal)	20.94	4.03	22.94	3.48	17.41	<.001	.06
Confidence (abilities)	29.90	5.52	32.88	5.56	18.72	<.001	.06
Overall toughness	157.78	20.47	170.30	22.05	22.37	<.001	.07

Note. Degrees of freedom $\frac{1}{4}$ 1283 across all analyses

The MANCOVA showed the tendency for a general significant relationship between the number of days per week of vigorous activity and the various mental toughness subscales (Wilks $\Lambda = .91$, $F(18,772) = 1.53$, $p < .10$, $\eta^2 = .03$). Significant univariate main effects were found between vigorous activity and most of the MTQ-48 subscales after controlling age and gender with 3-6% of explained variance. Except for interpersonal confidence, participants with high vigorous activity levels consistently reported elevated mental toughness scores. Participants with 0 days per week of activity scored significantly lower than those with ≥ 3 days per week of activity. Participants with 1-2 days per week of activity had slightly (not significant) increased mental toughness scores, and no difference was found between 3-4 days and ≥ 5 days per week of activity.

The second step of the analyses was controlled by age, gender and moderate physical activity. The relationship remained significant between activity, challenge and overall mental toughness, while a trend was found for emotional control and confidence in abilities. Significant effect was found of moderate activity in various mental toughness subscales (Wilks $\Lambda = .84$, $F(18,772) = 2.75$, $p < .001$, $\eta^2 = .06$), significant main effects existed across all MTQ-48 subscales. A posthoc test found evidence that the differences were mainly due to lower scores of the participants with 0 days per week activity. Between other groups no substantial differences appeared. The level of explained variance was between 5-11%. Differences on various mental toughness subscales existed between participants below the recommended levels of physical activity (Wilks $\Lambda = .94$, $F(6,275) = 2.81$, $p < .01$, $\eta^2 = .06$). Participants who engaged in sufficient levels of physical activity reported higher mental toughness scores on three of the six MTQ-48 subscales, with levels of explained variance ranging between 2% for commitment and 5% for challenge.

Conclusion

The findings showed a relationship between self-reported levels of vigorous and moderate physical activity and mental toughness. The study is in line with past studies that found significant relationships between physical activity and mental toughness. One possible explanation of physical activity being related to mental toughness might be that exercise and sport provide a suitable setting for the acquisition of mental toughness attributes. From a mental health perspective, mental toughness may be seen as a resilience resource.

Cognitive Appraisals in Sport: The Direct and Moderating Role of Mental Toughness.

Levy, A., Nicholls, A., & Polman, R. (2012).

International Journal of Applied Psychology, 2(4), 71–76.

<http://doi.org/10.5923/j.ijap.20120204.05>

Background

The aim of the study was to investigate the relationship between mental toughness and cognitive appraisals. 296 athletic participants took part, 200 male and 96 females aged between 16 and 51 (mean=21.92, SD=4.61). They were rated beginners (n=20), club/University level (141), country level (74) and national level (51), the overall mean of experience of competitive sport was 9.65 years (SD=5.11).

Method

Participants completed the MTQ-48 measuring total mental toughness and subscales; challenge, commitment, emotional control, life control, interpersonal confidence and confidence in abilities. The Stress Appraisal Measure (SAM)[2] was used to assess cognitive appraisals, this consists of a 28 item questionnaire examining six dimensions of appraisal, three primary (threat, challenge and centrality) and three secondary appraisals relating to stress controllability (controllable-by-self, controllable-by-others and uncontrollable-by-anyone).

Results

Table 1: Means and standard deviations for cognitive appraisals and mental toughness

	Means	Standard deviations
Threat	7.35	2.53
Challenge	13.73	2.90
Centrality	9.52	3.29
Controllable-by-self	15.58	3.03
Controllable-by-others	12.79	3.66
Uncontrollable-by-anyone	6.50	2.52
Stressfulness	9.56	2.50
Mental toughness	3.62	0.39

Table 2: Pearson product moment correlations for cognitive appraisals and mental toughness

	Challenge	Centrality	Controllable-by-self	Controllable-by-others	Uncontrollable-by-anyone	Stressfulness	Mental toughness
Threat	.05	.40**	-.25**	-.21**	.36**	.58**	-.33**
Challenge		.49**	.43**	.32**	-.19**	.24**	.28**
Centrality			.18**	.11	.06	.44**	.04
Controllable-by-self				.44**	-.31**	-.08	.48**
Controllable-by-others					-.28**	.05	.22**
Uncontrollable-by-anyone						.14*	-.27**
Stressfulness							-.18**

*p<.05; **p<.01

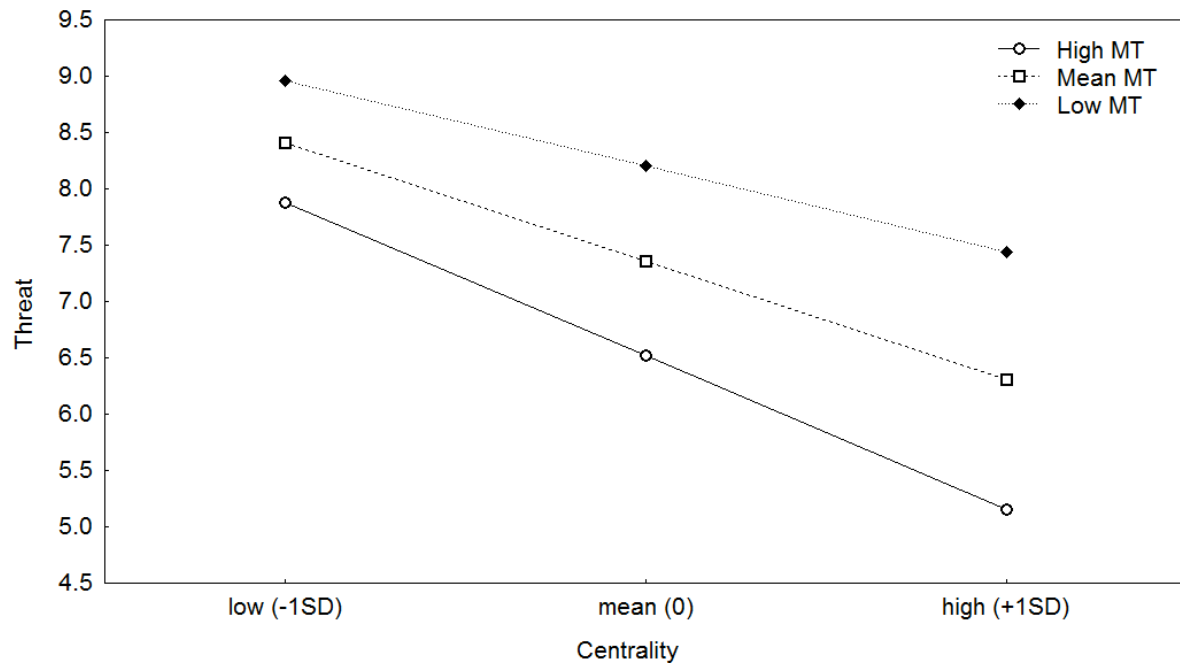


Figure 1. Regression of threat on centred centrality at various levels of mental toughness (MT)

Mental toughness was found to have an inverse relationship with threat appraisal and a linear relationship was found with challenge appraisal. The multiple regression analysis found threat had a small but significant change in variance and was explained by the interaction term, this explained additional 2% of variance over and above the 50% explained by the first order effect of mental toughness and the appraisal variables. Only mental toughness by centrality interaction was statistically significant which indicates that at higher levels of centrality (mean and +1SD) individuals with lower levels of mental toughness experience more threat than individuals with mean or higher mental toughness. There also appears to be an increasing threat appraisal at mean and +1SD between the mean and higher mentally tough individuals. First order effects found higher levels of mental toughness were less likely to be associated with seeing the situation as a threat. Independently of higher levels of centrality, uncontrollability and stressfulness increased the likelihood that a stressful even was seen as a threat whereas control by others was associated with decreased likelihood that a stressful event was seen as a threat. High mental toughness was associated with increased chance of evaluating an event as a challenge, high levels of centrality, controllable-by-self, controllable-by-others and stressfulness predicted that the stressful event would be perceived to be a challenge.

Conclusion

The current findings suggest mentally tough athletes are more likely to perceive a situation as a challenge, whereas low mentally tough athletes are more likely to appraise the situation as a threat. This suggests mental toughness has the potential to moderate stress. Appraisals, and interventions that manipulate threat appraisals among low mentally tough athletes may have potential to facilitate better emotional and coping responses, which ultimately may enhance sport performance.

Mental toughness and athletes' use of psychological strategies.

Crust, L., & Azadi, K. (2010).

European Journal of Sport Science, 10(1), 43–51.

<http://doi.org/10.1080/17461390903049972>

Background

The aim of the study was to test the relationship between mental toughness and athletes' use of psychological performance strategies. Participants included 67 male (mean age=22.5 years, SD=4.96) and 40 female (mean age=21.08, SD=2.81) athletes ranging from club/University to national level in a variety of sport.

Method

Each participant completed the MTQ-48 measuring total mental toughness and subscales; challenge, commitment, life control, emotional control, interpersonal confidence and confidence in abilities. They also completed the Test of Performance Strategies (TOPS) questionnaire used to assess psychological skills and strategies used in competition and practice settings, subscales; activation, automaticity, attentional control, goal-setting, imagery, relaxation, emotional control, negative thinking and self-talk were measured.

Results

Table1: Means and standard deviations of MTQ-48

Dependent variables	(N=107)	
	Means	Standard deviations
Total mental toughness	176.32	15.98
Challenge	31.82	4.13
Commitment	40.97	4.76
Emotional control	22.82	3.44
Life control	25.64	3.60
Confidence in abilities	31.85	4.77
Interpersonal confidence	23.22	2.46

Table 2: Means and standard deviations of TOPS data

	Club/University (n=36)				County standard+ (n=71)				Total sample (n=107)			
	Competition		Practice		Competition		Practice		Competition		Practice	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Activation	3.67	0.59	3.02	0.57	3.87	0.57	3.28	0.63	3.80	0.56	3.19	0.64
Automaticity	3.13	0.77	3.31	0.65	3.34	0.85	3.51	0.60	3.27	0.83	3.44	0.62
Emotional control	3.40	0.79	3.04	0.71	3.52	0.83	3.19	0.74	3.48	0.82	3.14	0.73
Goal setting	3.20	0.74	3.22	0.71	3.73	0.76	3.34	0.74	3.55	0.79	3.30	.73
Imagery	3.06	0.74	3.09	0.59	3.37	0.86	3.38	0.81	3.27	0.83	3.28	0.75
Relaxation	3.31	0.54	2.56	0.82	3.33	0.70	2.61	0.72	3.32	0.66	2.59	0.75
Self-talk	3.15	0.73	3.36	0.74	3.29	0.66	3.41	0.93	3.24	0.86	3.39	0.74
Attentional control	-	-	3.06	0.38	-	-	3.08	0.53	-	-	3.08	0.28
Negative thinking	2.62	0.65	-	-	2.29	0.74	-	-	2.41	0.72	-	-

Measures of skewness and kurtosis found the data to be normally distributed and as such use of parametric statistics were deemed appropriate. Three of the performance strategies (self-talk, emotional control and relaxation) were found to be significantly and positively correlated with mental toughness in both practice and competition settings. Automaticity was found to be significantly correlated with mental toughness in practice, and in competition, activation and goal setting positively correlated with mental toughness.

The largest correlation was a significant negative correlation with negative thinking in a competition setting ($r=0.47$, $p<.0.01$). Linear regression analyses and Pearson correlation analysis found an association between commitment and the use of performance strategies in both practice and competition settings, a significant correlation was also found between commitment and 13 of the 16 subscales of TOPS inventory ranging from 0.19 (imagery and attentional control in practice) to .40 (imagery in competition).

Linear regression analyses found a number of MTQ-48 subscales significantly predict the use of psychological strategies in both practice and competition setting, with mental toughness subscales accounting between 4 and 20% of the variance in use of psychological strategies. Variance for emotional control, imagery and negative thinking in competition settings and self-talk in practice settings was moderate, and all of the other values were considered small with less than 10% of the variance. Therefore the meaningfulness of these relationships should be viewed with caution.

Independent t-tests found a significant difference in total mental toughness between club/University level athletes and county standard and above athletes ($t_{105}=-2.25$, $p=0.03$, $d=0.45$). County standard and above were found to have significantly higher mental toughness score (mean=178.75, SD=15.08) than club/University level athletes (mean=171.53, SD=16.83). This difference was found to be primarily due to difference in commitment scores. No significant differences between gender and mental toughness were reported ($p>0.05$).

Conclusion

The findings suggest that mental toughness is significantly related to the use of a number of performance strategies both at practice and competition level. Overall the strongest correlation was a negative relationship between mental toughness and negative thinking ($r=0.47$, $p<0.01$), and is therefore consistent with previous theoretical and empirical research that emphasise mental toughness as a positive psychological construct associated with optimism and self-belief.

Because of the relationship between the use of performance strategies and commitment, it remains plausible that the results of this study reflect highly committed, mentally tough athletes being attracted to using psychological strategies that are likely to aid their performance.

Examining the Relationship Between Mental Toughness and Imagery Use.

Mattie, P., & Munroe-Chandler, K. (2012).

Journal of Applied Sport Psychology, 24(2), 144–156.

<http://doi.org/10.1080/10413200.2011.605422>

The study investigated the relationship between mental toughness with imagery in a sample of varsity athletes. Participants were 151 (male= 101, female=50) varsity athletes, aged between 18 and 27 years (mean= 20.70, SD= 1.84). Demographic data was recorded from each of the participants including; age, gender, varsity sport and number of year's active in that sport.

The Sports Imagery Questionnaire (SIQ) was also used to assess athletes' frequency of imagery use, assessing cognitive and motivational imagery and subscales; CS "When learning a new skill, I imagine performing it perfectly", CG "I imagine myself successfully following my game/event plan", MS "I imagine myself winning a medal", MG-A "I imagine the emotions I feel while doing my sport", MG-M "I imagine myself being in control in difficult situations". The MTQ-48 was also used to assess total mental toughness and the four subscales; challenge, commitment, control and confidence.

Table 1: Means and standard deviations of demographic information and SIQ and MTQ-48

Variable	Male (n=101)		Female (n=50)		Combined Sample (n=151)	
	Mean	SD	Mean	SD	Mean	SD
Age	20.88	1.83	20.34	1.84	20.70	1.84
Years played	9.65	4.94	10.59	4.43	9.97	4.78
SIQ						
CS	5.23	.93	4.77	.96	5.08	.96
CG	5.10	.87	4.72	1.00	4.97	.93
MS	4.92	1.25	4.57	1.29	4.80	1.27
MG-A	4.92	1.25	4.61	1.04	4.82	1.04
MG-M	5.58	1.00	5.29	1.00	5.49	1.00
MTQ-48						
Control	3.36	.42	3.35	.47	3.36	.43
Commitment	3.76	.63	3.72	.44	3.75	.57
Challenge	3.72	.50	3.62	.52	3.68	.51
Confidence	3.66	.46	3.49	.47	3.60	.47

Note. SIQ = Sport Imagery Questionnaire, CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, MG-M = motivational general-mastery, MT48 = Mental Toughness

48 Inventory, M = mean, SD = standard deviation. The SIQ is rated on a 7-point Likert scale anchored at 1 (rarely

use that type of imagery) to 7 (often use that type of imagery). The MT48 is rated 5-point Likert ranging from 1 (disagree) to 5 (agree).

Table 2: Bivariate correlations between subscales of the SIQ and MTQ-48

	CS	CG	MS	MG-A	MG-M	Control	Commitment	Challenge	Confidence
CS	-								
CG	.67**	-							
MS	.62**	.56**	-						
MG-A	.63**	.63**	.68**	-					
MG-M	.71**	.65**	.56**	.59**	-				
Control	.17*	.25**	.01	-.06	.25**	-			
Commitment	.24**	.30**	.12	.12	.35**	.53**	-		
Challenge	.27**	.28**	.12	.06	.38**	.55**	.52**	-	
Confidence	.36**	.34**	.16*	.08	.40**	.59**	.52**	.56**	-

Note. CS = cognitive specific, CG = cognitive general, MS = motivational specific, MG-A = motivational general-arousal, MG-M = motivational general-mastery.

* $p < .05$ level. ** $p < .01$.

Each of the imagery subscales showed positive small to moderate correlation with each of the other imagery subscales. Mental toughness subscales also had positive and significant correlations with one another, which were also small to moderate.

Imagery subscales MS only correlated with confidence, while MG-A was not significantly with any of the mental toughness subscales. Positive moderate correlations were found between MG-M and each of the mental toughness subscales. CS and CG were found to have small to moderate positive correlations with each of the mental toughness subscales.

Hierarchical multiple regression analyses were conducted to assess the contribution of imagery use to the prediction of mental toughness. When control was the dependent variable, motivational imagery was found to be significant ($F(3, 144) = 1.08, p < .001$) in step 1 and accounted for 12.9% of the variance. MG-A ($\beta = -.28, p < .05$) and MG-M ($\beta = .45, p < .001$) were significant independent predictors, with MG-M emerging as the strongest predictor.

Cognitive imagery was found to significantly improve predictions ($F(2, 142) = 5.85, p < .01$) accounting for an additional 6.6% of the variance in mental toughness scores. The only significant predictor at step 2 was CG imagery ($\beta = .35, p < .01$).

When commitment was the dependent variable, motivational imagery was significant ($F(3, 144) = 8.17, p < .001$) accounting for 14.5% of the variance. In the first step MG-M was the only significant independent predictor ($\beta = .45, p < .001$). In step 2 cognitive imagery did not significantly improve predictions ($F(2, 142) = 2.71, p > .05$) with an ΔR^2 of .03. Independent contributions of CG were found to be significant ($\beta = .25, p < .05$).

When challenge was the dependent variable, motivation imagery at step 1 was found to be significant ($F(3, 144) = 10.94, p < .001$) accounting for 18.6% of the variance. Individual contribution of MG-A imagery ($\beta = -.25, p < .05$) and MG-M ($\beta = .33, p < .001$) were found to be significant predictors, with MG-M being the strongest predictor. Step 2 found cognitive imagery did not significantly improve predictions ($F(2, 142) = 1.80, p > .05$) with ΔR^2 of .02.

When confidence was the dependent variable, motivation imagery was found to be significant ($F(3, 143) = 1.49, p < .001$) accounting for 19.4% of the variance. In step 2 cognitive

imagery was also found to be significant ($F(2, 141)=5.92, p<.01$), accounting for an additional 6.2% of the variance. MG-A ($\beta= -.23, p<.05$), MG-M ($\beta=.52, p<.001$) were found to be significant at step 1, while CG ($\beta=.24, p<.05$) and CS ($\beta=.24, p<.05$) were significant at step 2.

The strongest individual predictor was MG-M.

Conclusion

Imagery use, particularly MG-M imagery are strong and significant predictors of mental toughness.

The Relationship Between Body Awareness and Mental Toughness in Collegiate Athletes.

Diaz, A. (2013, March). Chicago School of Professional Psychology. USA

Background

The study aimed to test the relationship between body awareness and mental toughness in collegiate athletes. Participants were 55 male and 60 female athletes, who were all participating in the National Collegiate Athletics Association (NCAA) Division II competition.

Method

The athletes completed the MTQ-48 measuring total mental toughness and subscales; challenge, commitment, control and confidence. They also completed the Body Intelligence Scale (BIS), measuring overall well-being on a 32-point likert scale measuring three subscales; energy body awareness, comfort body awareness and inner body awareness.

A Pearson's correlation coefficient indicated a moderate, positive significant relationship between overall body awareness and overall mental toughness ($r(113)=+0.3749$, $p<.05$). A moderate, positive, significant relationship was also found between the two variables when looking at gender differences (male= $r(113)=+.3753$, $p<.05$, female= $r(113)=+.3776$, $p<.05$). They then assessed the relationship between body awareness and the different subscales of mental toughness. They found that the relationship between body awareness and commitment subscale was not statistically significant ($r(113)=+.1689$, $p>.05$), and no differences were found when looking at gender either (male= $r(113)=+.2288$, $p>.05$, female= $r(113)=+.1197$, $p>.05$).

A significant, positive and moderate relationship was found between body awareness and subscale control ($r(113)=+.3119$, $p<.05$). They also found a significant relationship between genders when assessing the two variables (male= $r(113)=+.3651$, $p<.05$, female= $r(113)=+.2889$, $p<.05$).

A positive, moderate and significant relationship was also discovered between body awareness and subscale challenge ($r(113)=+.2575$, $p<.05$). Gender differences were also discovered as the relationship was significant for males ($r(113)=+.4040$, $p<.05$), but not for females ($r(113)=.1080$, $p>.05$).

Moderate, positive and significant relationships were also found between body awareness and subscale confidence ($r(113)=.2320$, $p<.05$). Gender differences were also discovered as the relationship was significant for females ($r(113)=.3936$, $p<.05$), but not significant for males ($r(113)=.0286$, $p>.05$).

Conclusion

In conclusion, the study revealed body awareness is positively and significantly related to mental toughness for collegiate athletes. The subscales of mental toughness are also significantly associated with body awareness. Body awareness for males show to be significantly related to control and challenge, and for females control and confidence.

The Role of Mental Toughness in Acquisition and Retention of a Sports Skill.

Moradi, J., Mousavi, M. V., & Amirtash, A. M. (2013)

European Journal of Experimental Biology. 3(6), 438-442.

Background

The study investigated the role of mental toughness in acquisition and retention of a sports skill.

Method

40 undergraduate students were randomly selected in the first round; MTQ-48 was administered to determine the participants with high and low mental toughness. 26 undergraduate students were then selected to participate in the study. They were then assigned into two homogenous groups based on their scores on the Stubbs Ball Handling Test. Participants had no history of basketball training.

The Stubbs Ball Handling test comprises of 3 circles with a diameter of 30cm drawn on the wall each with 1.6m distance from the other circles. The first, second and third circles are 1.51m, 1.21m and 1.36m above the ground level, respectively. Participants stood behind a line at 450cm distance from the wall and were asked to pass the ball to the first circle, and then when the ball bounced back they passed it to the second circle and so on.

People who scored above 3.5 and under 2.5 on the MTQ-48 were assigned into high and low mental toughness groups, respectively. Before the intervention started, a qualified coach described and displayed appropriate basketball passing performance to the participants. Based on pre-test scores, participants were divided into two homogenous groups each with 13 members. Participants trained on basketball passing skills in 15 sessions, 3 sessions per week for 5 successive weeks. They stretched and warmed up and then practiced the criterion skill for 15 minutes. In the acquisition phase participants received verbal feedback and in the retention phase they received no feedback.

The results showed significant differences in mental toughness between the two groups ($t(24)=15.94$, $P=0.001$). Comparison of the two groups in the pre-test stage showed no significant differences between the two groups at the beginning of the study ($t(24)=-0.15$, $P=0.88$). In the acquisition stage results revealed training sessions proved to be effective ($F(4.89, 1174)=24.57$, $p<0.001$). Besides the group effect ($F(1,24)=12.98$, $p<0.001$) and the interaction effect of groups by training sessions was found to be significant ($F(14, 336)=2.97$, $p<0.001$). Therefore there were significant differences between the two groups in the acquisition stage. Individual t-tests showed significant differences in retention test performance between the two groups ($t(24)=3.23$, $P=0.004$).

Conclusion

The findings suggest that mental toughness is a key factor in the acquisition and learning of basketball passing skills. Implying that mentally tough people perform better than less mentally tough individuals not only in competitive, pressing situations, but also in acquisition and retention of motor skills.

Among adolescents, favourable sleep patterns are related to increased mental toughness and optimism, but not to physical activity.

Serge Brand, Nadeem Kalak, Peter Clough, Markus Gerber, Sakari Lemola, Edith Holsboer-Trachsler (2011)

Background

For adolescents, there is evidence that favourable sleep patterns are related to favourable psychological functioning such as curiosity, lack of depressive symptoms, and to increased physical activity. Though, the relation between sleep and mental toughness has not been investigated so far. Mental toughness is understood as a multidimensional construct including coping effectively with pressure and adversity, recovering from set-backs and failures, persisting or refusing to quit, being insensitive or resilient, having increased self-belief in controlling ones own behaviour, and thriving on pressure and possession of higher mental skills.

Method

A total of 98 adolescents (mean age 18.36 years; 66 females) took part in the study. They completed a series of questionnaires related to mental toughness, optimism, depressive symptoms, and perception of pain, physical activity, and sleep.

Results

Increased sleep complaints were related to (1) decreased scores of domains of mental toughness such as low control, low confidence in one's abilities, and low challenge (r 's > $-.48^{***}$), (2) increased perception of pain ($r = .52^{***}$), (3) increased depressive symptoms ($r = .63^{***}$), and (4) decreased optimism ($r = -.52^{***}$). No gender-related differences were observed. Moreover, the amount of physical activity per week was not related to mental toughness, sleep, or other domains of psychological functioning.

Conclusions

In adolescents, favourable sleep and favourable mental toughness seems to be related. Whereas the underlying mechanisms remain unclear, it seems conceivable that improving both sleep and mental toughness should confer to increased well-being.

Mental toughness and attitudes to risk-taking.

Crust, L., & Keegan, R. (2010).

Personality and Individual Differences, 49(3), 164–168.

<http://doi.org/10.1016/j.paid.2010.03.026>

Background

The aim of the study was to investigate the relationship between mental toughness and attitudes towards risk-taking. Participants were a mixed sample of 105 student athletes (69 males, mean age=22.6, SD=5.3, 36 females, mean age=24.6, SD=7.7) attending undergraduate sport programs. They all provided information regarding their participation during sport classes.

Method

Each participant completed the MTQ-48 questionnaire measuring commitment, challenge, emotional control, life control, confidence in abilities and interpersonal confidence. They also completed the Attitudes Towards Risks questionnaire, which has 10 items, with two factors being analysed; psychological risks and physical risks. The participants were asked to read 10 statements and indicate how representative each statement was on a 5 point Likert scale from like me to not like me.

Results

Overall mental toughness was found to be significantly and positively related to attitudes towards physical risks ($r=0.3$, $p<.01$), but not psychological risks ($r=0.15$, $p>.05$).

Subcomponents challenge ($r=0.42$, $p<.01$), confidence in abilities ($r=0.21$, $P<.05$) and commitment ($r=0.20$, $p<.05$) correlated significantly with attitudes towards physical risk taking.

Table 1: Descriptive data and gender differences for mental toughness and risk-taking

	Men		Women		t	p
	Means	SD	Means	SD		
Mental toughness	168.72	14.99	162.53	14.09	2.05	.04
Challenge	26.67	2.67	28.53	3.76	1.79	.08
Commitment	39.43	3.87	39.25	3.08	.25	.80
Emotional control	19.17	4.04	18.97	4.36	.24	.81
Life control	24.75	2.63	24.58	3.61	.28	.78
Confidence in abilities	30.85	4.46	28.92	4.60	2.09	.04
Interpersonal confidence	22.29	3.07	20.78	4.27	1.89	.07
Psychological risks	5.43	3.86	3.00	3.01	3.36	.00
Physical risks	10.70	3.54	8.28	3.50	3.36	.00

Standard linear regression analyses were conducted to examine the relationship with physical risk entered as the dependant variable and the mental toughness subcomponents found to be significantly related were entered as predictor variables. Only challenge ($\Delta R^2=.17$; $p<.01$, $\beta=.43$) was found to be a significant predictor of physical risk.

Interpersonal confidence was found to be related to attitudes towards psychological risks ($r=0.24$, $p<.05$). One interpersonal confidence was found to be related to attitudes towards psychological risks ($r=0.24$, $p<.05$). There was a significant and negative correlation between age and attitudes towards psychological risk ($r=-0.21$, $p<.05$), age was not related to physical risks. Age was found not be related to overall mental toughness, but mental toughness subcomponents emotional control ($r=0.2$, $p<.01$) and interpersonal confidence ($r=-.28$, $p<.01$) were found to be related to age.

Independent t-tests found that men had significantly high mental toughness ratings ($t_{103}=2.05$, $p<.05$, $d=0.43$) and reported greater confidence in abilities ($t_{103}=2.05$, $p<.05$, $d=0.43$). Men also recorded more positive attitudes towards physical risks ($t_{103}=3.36$, $p<.01$, $d=0.69$) and psychological risks ($t_{103}=3.29$, $p<.01$, $d=0.70$).

Conclusion

The results show a relationship between mental toughness and attitudes towards risk-taking, as more mentally tough people are more likely to take risks than less mentally tough people. The results also suggests that men tend to be more mentally tough than women, and therefore take more risks.

Mental toughness: managerial and age differences.

Marchant, D. C., Polman, R. C. J., Clough, P. J., Jackson, J. G., Levy, A. R., & Nicholls, A. R. (2009).

Journal of Managerial Psychology, 24(5), 428–437.

<http://doi.org/10.1108/02683940910959753>

Background

The study investigates whether employees in a variety of managerial positions could be distinguished on aspects of mental toughness. Participants included 504 (248 males, 366 females) aged between 20-65, from different organisations around the UK. Job positioning was measured, 157 participants were senior managers, 189 middle managers, 122 junior managers and 47 in clerical roles.

Method

All participants completed the MTQ-48 questionnaire assessing subcomponents; challenge, commitment, confidence (ability and interpersonal) and control (emotional and life). All participants indicated their age, gender and career position. It was found that not all age categories were represented in the managerial position, so two separate one way multivariate analysis of variance (MANOVA) were conducted to see whether there was a significant difference between managerial position, age and aspects of mental toughness. A follow-up univariate analysis of variance was executed in the instance of a significant effect.

Results

The MANOVAs for management (Wilks $\lambda = .83$; $p < 0.001$) and age (Wilks $\lambda = 0.86$; $p = 0.01$) were significant. A posthoc comparison of managerial groups show that senior managers scored significantly higher than middle managers and junior managers on the scales. Middle managers scored significantly higher than junior managers and clerical workers on total mental toughness, life control, ability confidence and interpersonal confidence, and higher than clerical staff on challenge and commitment. Junior managers scored higher than clerical staff in commitment, life control and interpersonal confidence.

Posthoc comparison on age shown that >56 age category had significantly higher total mental toughness, commitment and emotional and life control scores than the <25, 26-30, 31-35, 36-40 groups. The >56 age group also had significantly higher commitment and life control scores than the 41-45 age group.

The 51-55 age group had significantly higher total mental toughness, commitment, emotional control and life control when compared to the <25 and 26-30 age groups, they also had significantly more life control than the under 25s.

The under 25s were found to have lower life control than all age groups apart from the 31-35s, they were also found to have lower total mental toughness than both the 41-45 and 46-50s.

Age group 31-35 were found to have low total mental toughness and life control compared to the 41-45 and 46-51 groups, with also having significantly low commitment and emotional control compared to the 46-50s.

Finally the 26-30s scored significantly low on commitment and life control compared to the 46-50 age group.

Conclusion

These findings therefore suggest that mental toughness increases with age, and is also related to higher managerial positions, and therefore is one of the reasons why older age groups tend to be in higher managerial positions than younger age groups.

The relationship between mental toughness and affect intensity.

Crust, L. (2009).

Personality and Individual Differences, 47(8), 959–963.

<http://doi.org/10.1016/j.paid.2009.07.023>

Background

The aim was to test the relationship between mental toughness and affect intensity to determine whether mentally tough athletes generally experienced more or less intense emotions. Participants were 112 sport participants (55 men and 57 women) who regularly attend various sport and fitness clubs/activities at a University in the North of England. The mean age was 30.1 years (SD=11.6) for men and 28.6 years (SD=8.9) for women.

Method

Participants completed the MTQ-48 measuring overall mental toughness and its subscales. They then completed the Affect Intensity Measure (AIM) questionnaire which assesses the characteristic intensity with which an individual typically experiences emotions.

Results

Table 1: Descriptive data for mental toughness and affect intensity (n=112).

	Mean	SD
Overall mental toughness	173.4	17.02
Challenge	3.93	0.51
Commitment	3.66	0.43
Emotional control	3.28	0.48
Life control	3.59	0.52
Confidence in abilities	3.48	0.53
Interpersonal confidence	3.73	0.52
Affect intensity	3.72	0.40

Table 2: Pearson product moment correlations between mental toughness and affect intensity.

	Overall mental toughness	Challenge	Commitment	Emotional control	Life control	Ability confidence	Interpersonal confidence	Affect Intensity
Overall mental toughness		.76**	.72**	.67**	.74**	.79**	.58**	.06
Challenge			.45*	.54**	.44**	.48**	.33**	.10
Commitment				.36*	.45**	.42*	.29**	.06
Emotional control					.45**	.43**	.15	-.03
Life control						.50**	.37**	.10
Ability confidence							.47**	-.03
Interpersonal confidence								.07
Affect intensity								

*p<.05.

**p<.01.

A series of Pearson correlations between affect intensity, overall mental toughness and the six subscales of mental toughness found no significant relationships ($p > .05$).

Age was found to be unrelated to mental toughness ($r = -.15$, $p > .05$) and affect intensity ($r = -.11$, $p > .05$).

Independent t-tests found no significant differences ($p > .05$) in overall mental toughness, the mental toughness subscales or affect intensity between men and women.

A series of independent t-tests were used to test the differences in mental toughness and affect intensity between recreational athletes ($n = 49$) and athletes at club level or high ($n = 63$). Bonferroni corrections were used to adjust p-values because of using multiple comparisons and no significant differences were found between recreational or club level athletes.

Conclusion

The results suggest that mental toughness and affect intensity are not linearly related. The present findings and previous evidence of a relationship between mental toughness and coping and mental toughness and use of psychological strategy appears to give some credence to those who contend that emotional control is a vital component of mental toughness.

Is the Body Image Perception among University Students affected by whether they study Health Related or Non-Health Related courses?

Amanda Nyeke (2012) University of Chester

Background

The study compared body image dissatisfaction (BID) in university students studying health-related (HR) and non-health related (NHR) courses, and analysed its associations with BID and mental toughness. The participants were 70 (45 female, 25 male) students studying HR and NHR courses at the University of Chester. They were aged between 18-35 years (HR male n= 8, HR female n=23, NHR male n=17 and NHR female n= 22).

Method

The MTQ-48 was administered to measure total mental toughness and subscales, commitment, challenge, life control, emotional control, interpersonal confidence and confidence in abilities. They also completed the FRS questionnaire which gathers data such as age, gender, university course, year of study, eating and exercise behaviours, and attitudes to gauge their effective body image, diet and exercise frequency. They also used gender specific body figures, 9 female 9 male, ranging from very underweight to very overweight.

Participants were asked to identify which body shape represents their current body shape, their ideal body shape, the ideal body shape of most women, and the ideal body shape of most men (cultural ideas), identify the body shape that's overweight and the body shape that is underweight. They also provided their height and weight by self-report, but did have the option to have anthropometric measures taken for confirmation, but they had the option to opt out of this. From this data, the BMI was calculated for each participant.

The results found that that there were no significant differences in diet frequencies between HR and NHR students. However HR students did feel more pressure about their weight/size than NHR students.

When looking at the difference in gender and body image satisfaction, the study found that male HR students were more satisfied with their bodies than female HR students, and NHR students had similar levels. However there was found to be no differences in body satisfaction levels between the HR and NHR group, suggesting this isn't effected by studying a health related course. When looking at exercise frequencies, it was surprising to see that the majority of HR students exercised only 0-1 times a week, whereas the majority of NHR students exercised 2-3 times per week.

When looking at ideal body shapes both HR and NHR students wanted bodies smaller than the average 'normal' body shape. Looking at the ideal body for most women (cultural ideal), students identified a body shape smaller than the average 'normal' shape.

When looking at the ideal body for most men HR students identified a body shape smaller than the average 'normal' shape, whereas NHR students identified the average 'normal' shape. When asked to identify an overweight body shape the majority of HR students chose

a figure depicting a body shape at the higher end of the ‘normal’ weight, whereas the NHR students chose a figure depicting a body smaller than the average overweight body. When asked to identify an underweight figure HR the majority of both HR and NHR students picked the smallest body size, depicting someone who is severely underweight and smaller than the average underweight individual, however this is still a representation of an underweight individual.

When looking at BID, there were no significant differences found between HR and NHR students, however a significant relationship was found between BMI and BID, with increasing BMI relating to increasing feeling of BID.

Table 1: Independent Samples t-test

Mental Toughness (MT) mean scores comparisons between HR and NHR cohorts. Equal variances assumed as $p=0.277$: $n=31$, $Mean=3.487$, $SD=0.351$, $SE=0.063$, NHR: $n=39$, $Mean=3.326$, $SD=0.403$, $SE=0.065$.

	Levene's test for equality of variances				t-test for equality of means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean diff.	Std. error difference	95% confidence interval of difference	
								Lower	Upper
MT									
Equal variances assumed	1.202	0.277	1.761	68	0.083	0.161	0.092	-0.021	0.344
Equal variances not assumed			1.790	67.397	0.078	0.161	0.090	-0.019	0.342

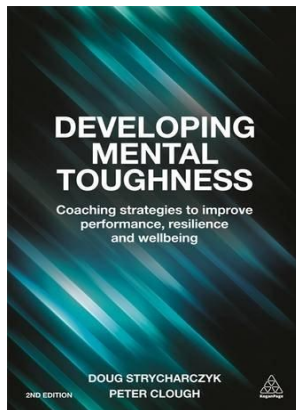
Only 4% of the variance in mental toughness was explained by academic disciplines studied, therefore there were no significant differences in mental toughness between HR and NHR students. Significant weak, negative correlations were found between BMI and mental toughness, meaning that increased mental toughness was related to decreasing BMI. Weak negative correlations were found between BMI and the mental toughness subscales except for confidence which showed no correlation and interpersonal confidence showed a weak positive correlation. Mental toughness helped to explain 1.8% of the variance in BMI scores. Medium, negative correlations were found between BID and mental toughness, as increased mental toughness was associated with decreased levels of BID. Mental toughness helped to explain 11.7% of the variance in BID scores. Medium negative and significant correlations were found between BID and subscale life control, as increased life control was associated with decreased levels of BID, explaining 17.5% of the variance in BID scores.

Conclusion

The results showed that there were no differences in mental toughness between HR and NHR students, however there were relationships found between BMI and BID and mental toughness. This suggests that mental toughness does have an effect of body image perceptions.

Further Reading

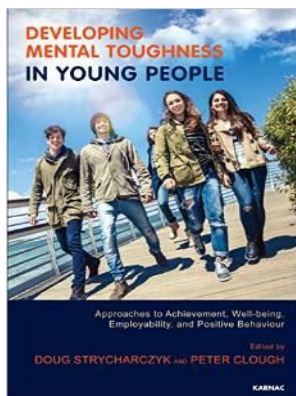
Peter Clough and Doug Strycharczyk (Kogan Page 2015) *Developing Mental Toughness*



Developing Mental Toughness examines how individuals respond to stress, pressure and challenge. A book for those whose role it is to improve individual and organizational performance; it details the core skills required to address these issues.

This book focuses on understanding and developing mental toughness from the individual perspective

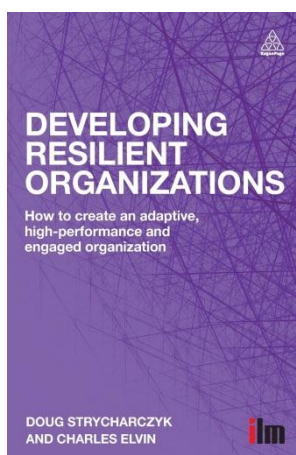
Strycharczyk and Clough (Karnac 2014) *Developing Mental Toughness in Young People*



This book describes 'Mental Toughness' so that the reader understands how it relates to the development of young people of all ages, whether they are in education or engage in extra-curricular activity. This is particularly important in the context of change and the challenge of preparing to live and work in a fast moving and fast changing world. One of the greatest challenges facing society today is that of developing young people who are the future generators of wealth so that they can play a full and productive part in the economic and social development of the world they will inhabit.

Education and youth work must prepare young people with the attributes and qualities to do this.

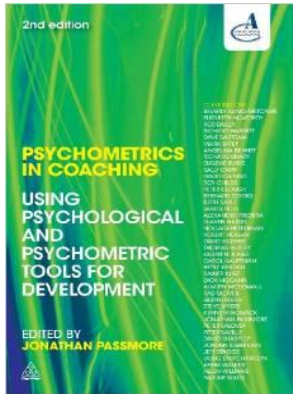
Doug Strycharczyk & Charles Elvin (Kogan Page 2014) *Developing Resilient Organisations*



Much of the fear and uncertainty surrounding the global recession is concerned with the adverse impact it will have on organisations and society. However, recessions are nothing new. We know from past experience that when a recession is over, there always emerge organisations and individuals who have not only survived but have thrived. They often emerge stronger, fitter and better performing. *Developing Resilient Organizations* argues that one of the fundamental keys to survival in these circumstances is resilience or mental toughness. The book addresses a wide variety of organizational issues including motivation, performance, staff retention, behaviour, trust, attention span and teamwork.

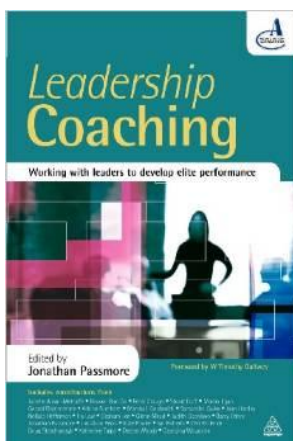
Prof Jonathan Passmore (Kogan Page & AoC 2014)* **Psychometrics in Coaching**

With a growing demand for psychometric testing in the coaching profession, coaches and practitioners alike need to understand the psychology underpinning the tests as well as how



to select and apply them effectively., **Psychometrics in Coaching** provides an overview of using psychometrics and providing feedback and offers clear explanations of the key models and tools used in coaching today including MTQ48. **Psychometrics in Coaching** is an essential resource for those seeking expert guidance from the leading writers in the field, as well as students on psychology, psychometrics, business and human resources programmes.

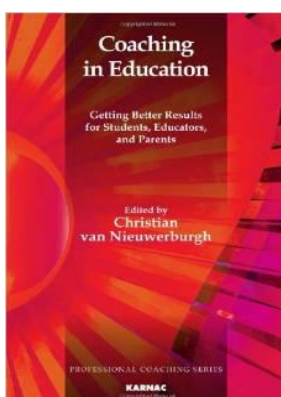
Prof Jonathan Passmore (Kogan Page & AoC 2015) **Leadership Coaching**



Leadership Coaching examines the models and techniques used to develop leadership in others through a coaching relationship. Looking at specific models, each contributor reviews the research which supports the model and then explores how the model can be of help in a coaching relationship.

The book includes a chapter on AQR’s Integrated Leadership Measure – ILM72 and – the mental tough measure – MTQ48

Dr. Christian van Nieuwerburgh (Karnac 2013) **Coaching in Education: Getting Better Results for Students, Educators and Parents**



'**Coaching in Education: Getting better Results for Students, Educators and Parents**' will support educational organisations to learn more about the current interest in coaching approaches within schools, colleges and universities. The notion of 'mental toughness' and its relationship to coaching is also explored.

The Authors

This manual has been compiled with contributions from the following: Professor Peter Clough, Dr John Perry, Dr Lee Crust, Doug Strycharczyk and Claudine Rowlands

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