

**Mental toughness in an academic context: conceptualisation, the Academic Mental Toughness Inventory (AMT) and predictability of academic achievement**

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# ACADEMIC MENTAL TOUGNESS CONCEPTUALISATION, MEASUREMENT AND APPLICATION

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### **Abstract**

Factors individuals can control that positively influence their life seem as important right now as they have ever been. This study explored the concept of mental toughness, which is characterised by openness to challenges and approach them as an opportunity to learn and grow. Gaps in research were identified around how mental toughness is conceptualised and whether it is best considered globally or setting specific. More specifically, if mental toughness in an academic setting is appropriately captured using an academic mental toughness (AMT) specific measurement tool and if AMT impacts academic achievement. Accordingly, this study aimed to address these gaps, to do so factor analysis, correlation analysis, reliability analysis and hierarchical regression analysis were conducted. A convenience sample of 124 participants were recruited from the University of Adelaide Psychology first year student pool. Results indicated a multicomponent model of mental toughness an appropriate approach with three underlying factors found, these were personal responsibility and drive, positive cognition and visualisation. The AMT measurement tool was valid and reliable, AMT factors were associated with mental well and illbeing and to some degree academic achievement and finally, AMT factors to some extent predicted academic achievement after controlling for known influential variables. Findings contribute to previous literature in the area, extend and refine the AMT specific measurement tool and highlight the appropriateness of considering mental toughness subcomponents in any intervention strategies.

### **Declaration**

This thesis contains no material which has been accepted for the award of any other degree of diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

1740631, August 2021



### **Contribution Statement**

With the completion of this thesis I would like to recognise the input and guidance provided by my supervisor throughout. It assisted in adjusting areas of focus, overcoming obstacles, staying on track, considering areas for improvement, refining aspects of the final write up and overall quality of the final product. I decided on specific research area, aims and questions, applied for ethical approval, developed the questionnaire to capture information, recruited participants, collected, cleaned and analysed data and wrote this thesis in its entirety myself.

### **Acknowledgements**

Firstly, I would like to thank my family, especially my fiancé, for the ever-present support, belief and encouragement during the completion of this thesis. The road was very long and difficult with many hurdles and setbacks and your support and love went so far in making this possible to endure and ultimately finish. A special thank you to my fiancé for your time spent reading and re reading this thesis to help refine and improve the end product.

Secondly, I would like to thank my supervisor for their patience, support, encouragement and at times ‘tough love’. There were many circumstances that interfered with progress and you were always kind, understanding and wanting to help where you could, for that I thank you. If I were to do this again under the same circumstances I would not want to work with any other supervisor.

Lastly, I would like to thank the University of Adelaide for their flexibility, support and decisiveness during the challenging circumstances provided from the COVID-19 pandemic. This time was difficult enough and the University’s actions and alterations to program delivery methods made it possible for students to continue studying and eventually complete this thesis. I believe the University did a great job supporting its students and at handling the COVID-19 pandemic challenges.

**Mental toughness in an academic context: conceptualisation, the Academic Mental Toughness Inventory (AMT) and predictive ability of academic achievement**

**Brief Introduction**

In 2021, personal factors that individuals can work on to improve their lives in some capacity appears as important as ever. In recent years people seem to be experiencing increasing levels of depression, anxiety, stress and pressure detrimentally impacting their overall wellbeing (Twenge et al., 2019; World Health Organization, 2021; Zheng & Echave, 2021). Although concerning, the extent to which factors like these negatively impact individuals is somewhat within their control. Different forms of intervention or self-adaptation like mindfulness, assertiveness training, physical activity and good sleep hygiene are examples of well-known things people can control to improve aspects of their lives. Accordingly, there is a breadth of information and evidence that these interventions improve aspects of people's lives, how these improvements can be made and the positive implications of doing so (e.g. Behan, 2020; Brown & Ryan, 2003; Klaperski et al., 2019; Parray & Kumar, 2017; Scott et al., 2017). Therefore, the current study looked to explore mental toughness, a concept less well known and with less comprehensive evidence that seems to be an increasing part of people's day to day language (Gerber, Brand, et al., 2013). Exploring mental toughness could provide additional information relating to ways individuals may improve their lives and better cope with the increasing challenges of modern life.

**Mental Toughness**

***Overview and Definition***

The concept of mental toughness originated from exploring athlete's performance in competitive sports settings. Sports people are regularly exposed to stress, pressure, setbacks and challenges and many still produce high levels of performance and achieve desired

outcomes. Unsurprisingly, research was conducted to explore and understand athlete's ability to perform under these circumstances (Amato-Henderson et al., 2014; Crust et al., 2014).

Mental toughness was discovered as a factor that significantly influences athlete's ability to produce high levels of performance and achieve outcomes despite the presence of pressure, stress, adversity and challenges of competitive sports (Clough et al., 2002; McGeown et al., 2016). From this finding, in 2002 Clough et al. gathered qualitative (descriptive) and quantitative (statistical) information from a wide range of professionals in sports settings and developed a measurement tool for mental toughness - the Mental Toughness Questionnaire (MTQ48) (McGeown et al., 2016). This provided researchers a tool to capture mental toughness and resulted in additional research in the area to better understand the concept.

Defining and conceptualising mental toughness has proven difficult as it shares some similarities and traits with some other well-known concepts like hardiness, resilience and grit (Gucciardi, 2017; St Clair-Thompson et al., 2015). The shared traits are: persistence or commitment in overcoming challenges or adversity, an emphasis on personal control of such situations and that determination is demonstrated over time (McGeown et al., 2016). Mental toughness is reported to offer some additional traits however. It is considered an enduring mindset where challenging circumstances are welcomed or even sought out and provide an opportunity to learn and grow rather than just a hurdle to be overcome (Amato-Henderson et al., 2014; Gucciardi et al., 2015; Lin et al., 2017). Further, that this is derived from within people themselves as a form of self-belief and drive rather than from any external source (Amato-Henderson et al., 2014; Gucciardi et al., 2015; Lin et al., 2017). Perhaps the most succinct definition is offered by Gucciardi et al. (2015), where mental toughness is defined as a personal capacity to produce high levels of performance or continue to strive towards an outcome despite challenges, stressors and adversities.

Along with difficulty defining mental toughness, there is also disagreement with how it is conceptualised as both singular and multicomponent models have been proposed (Amato-Henderson et al., 2014; Lin et al., 2017). The multicomponent model proposes that mental toughness is comprised of subcomponents or factors that when considered together make up mental toughness, the singular model proposes that no subcomponents exist (Gucciardi et al., 2015; Lin et al., 2017). Using personality as an example, personality is comprised of the underlying factors of openness, conscientiousness, extraversion, agreeableness and neuroticism that when considered together make up someone's overall personality (Schulze & Roberts, 2006).

### *Conceptualisation*

Lin et al. (2017) discuss in their meta-analysis of the mental toughness literature that whilst both singular and multicomponent models are acceptable, the singular approach offers a better fit. This opinion is shared by Gucciardi et al. (2015) who despite hypothesising that mental toughness would be comprised of underlying subcomponents, found that a singular model may be more appropriate. Results from this study indicated issues with reliability and validity of the multicomponent model of mental toughness (Gucciardi et al., 2015). Gucciardi et al. (2015) argued this was due to researchers' distinctions of underlying subcomponents not being reported by individuals when mental toughness was explored across different contexts/settings. Ultimately, this suggested that a singular model is more representative of mental toughness (Gucciardi et al., 2015). There are however limitations and critiques of these studies and findings of the singular model approach that must be considered.

Firstly, Lin et al. (2017) systematic review did not include formal assessment of the quality of studies reviewed (Gucciardi, 2018; Lin et al., 2017). Assessment of the quality of studies prior to review is crucial for accurate comparison and drawing strong conclusions as

bias and poor research design can be transferred to the synthesised findings (Gucciardi, 2018). Another limitation is that the majority of literature reviewed utilised measures of mental toughness theoretically constructed from sporting contexts, like the MTQ48, without adaptation of the measure or justification for its use outside of the sporting setting (Gucciardi, 2018; Lin et al., 2017). This is a major limitation of the studies reviewed by Lin et al. as many of the studies explored mental toughness outside of the sporting setting in domains like education, learning and mental health and it is possible measures are setting/domain specific (Gucciardi, 2018; Lin et al., 2017). Limitations for findings from Gucciardi et al. (2015) largely relate to the use of a self-developed mental toughness questionnaire. Questions were not setting/context specific and addressed mental toughness as a global rather than setting specific construct, despite evidence for mental toughness as setting specific construct (Gucciardi et al., 2012; Hardy III et al., 2014). Together, these limitations raise significant concern for findings of the appropriateness of a singular model approach for mental toughness. Moreover, the singular model approach is also critiqued for restricting possible practical implications of findings offered by a multicomponent model (Crust et al., 2014; McGeown et al., 2016). For example, distinct subcomponents of mental toughness could guide more specific targeted interventions to improve aspects of mental toughness (Crust et al., 2014; McGeown et al., 2016; St Clair-Thompson et al., 2015).

Multiple other researchers (e.g. Crust et al., 2014; Perry et al., 2013; St Clair-Thompson et al., 2015) argue there is greater support for a multicomponent model of mental toughness than for it as a singular construct. This is best highlighted by the fact the most widely accepted and used measurement tool of mental toughness is the MTQ48, that reflects four subcomponents of mental toughness (Clough et al., 2002; Crust et al., 2014; St Clair-Thompson et al., 2015). Additionally, there is more current evidence that reinforces this belief. Firstly, in 2013 Perry et al. reassessed the validity of the MTQ48, where findings

revealed the original four factor structure proposed by Clough et al. (2002) was a valid, reliable and robust measurement tool of mental toughness (Perry et al., 2013). Secondly, Crust et al. (2014) demonstrated acceptable reliability of the subcomponents of mental toughness and the usefulness of these in identifying possible areas for specific intervention across different domains like mental health and academics. Similarly, McGeown et al. (2016) highlighted the accuracy and practicality of mental toughness as a multidimensional construct by discussing how considering individual subcomponents allowed for more accurate and therefore effective intervention strategies. Despite the multicomponent approach seeming a widely accepted stance, findings and conclusions are not without limitations or critique and these must be considered.

One limitation for Perry et al. (2013) research is around the fit of the questions into respective subcomponents from the MTQ48. Question fit to subcomponents was restricted in that each could only fit to a single subcomponent rather than share fit across multiple, which is possible (Perry et al., 2013). For example, question 12 could only fit into subcomponent one rather than possibly fitting to some degree with subcomponents two and three. This restriction is not recommended when exploring psychological constructs like mental toughness as a) questions sharing fit with multiple subcomponents is expected in psychological research and b) this sharing of fit across subcomponents allows for better understanding and interpretation of any underlying factor structure (Field, 2013, pp. 1966-1977). Ultimately, this limits the robustness of Perry et al. (2013) findings as the potential for an alternative underlying factor structure exists.

Findings from Crust et al. (2014) and McGeown et al. (2016) share similar limitations through the use of the MTQ48. As previously indicated, this measurement tool was derived from sporting settings and while Crust et al.'s sample consisted entirely of sports students, their findings extrapolated to contexts outside of sports (e.g. mental health, academics). The

use of the MTQ48 seems appropriate for their sports student sample but findings may not be generalisable to broader student populations not involved in sports (Crust et al., 2014).

McGeown et al. (2016) utilised the MTQ48 to measure mental toughness across a range of settings like business, academics and mental health. This raises concern for the validity and credibility of their findings that the subcomponents of mental toughness are not only accurate but also provide practically relevant and effective intervention strategies (Gucciardi et al., 2012; Hardy III et al., 2014; McGeown et al., 2016).

The contradiction between authors beliefs on the conceptualisation of mental toughness provides justification for further exploration. Therefore, the present study aims to explore the factor structure of mental toughness to add knowledge and deepen understanding of this construct.

### ***Findings From Sporting, Business and Mental Health Settings***

As previously discussed, early research into mental toughness has its roots in sporting contexts where findings are consistent and conclusive. In the mid to late 2000's many researchers reported mental toughness as a key component to elite sports people's ability to deal with challenges, stressors and pressure and this directly relates to performance and success (McGeown et al., 2016). This summary from McGeown et al. appropriately represents the findings from the broader literature. The consistency of these findings usurpingly led to the exploration of mental toughness outside of the sporting domain and into areas like business, mental health and academics.

Business environments, like sports, are also characterised by ever present pressure, competition and challenge and provide another ideal setting to explore mental toughness. Results from Marchant et al. (2009) highlighted that individuals in "higher" more senior managerial roles, generally accepted as success/achievement in business, displayed higher



levels of mental toughness. Further, mental toughness has been found to vary across people working in challenging sectors such as the military, with levels of mental toughness related to volunteer turnover and recruits workplace attitude which directly relates to progression and performance (Godlewski & Kline, 2012). These findings provide just a couple of examples of research exploring mental toughness in a business context, however there is a breadth of additional research reporting similar findings. Overall, findings are best summarised by stating that mental toughness positively impacts business performance and success (McGeown et al., 2016). Justification for the exploration of mental toughness as it relates to mental health differs from the competitive and performance driven focus of sports and business. Exploration of this relationship relates more to coping with adversity and challenges and the impact on overall wellbeing and health. As in sporting and business contexts findings from the literature are extensive and clear, mental toughness positively impacts individual's ability to mitigate perceived stress, anxiety, depression and overall mental health (e.g. Gerber, Brand, et al., 2013; Gerber, Kalak, et al., 2013; Haghghi & Gerber, 2019). These comprehensive findings for the positive impact of mental toughness across sports, business and mental health settings has seen research extend to the academic setting. However, to date the literature on mental toughness in academics is less comprehensive.

### ***Findings From Academic Settings***

Much of the recent research around academics has focused on exploring non-cognitive (e.g. personality traits, mental health, physical health) individual differences (McGeown et al., 2016; St Clair-Thompson et al., 2017). From the above-mentioned findings, it is unsurprising that mental toughness is one concept that has gained attention and that recent research has targeted the exploration of its fit and possible usefulness in academics. In 2014, Crust et al. studied the relationship and predictive ability of mental toughness on students'

academic grade and progression (pass or fail). Total mental toughness and all subcomponents bar one significantly correlated with both academic grade and progression (Crust et al., 2014). Also, the subcomponents life control and interpersonal confidence significantly predicted academic grades (Crust et al., 2014). Finally, the level of mental toughness (low, medium or high) impacted both academic grade and progression (Crust et al., 2014). These results provided strong indication that mental toughness is relevant and important in academic contexts. St Clair-Thompson et al. (2015) examined the impact of mental toughness on academic attainment, attendance, classroom behaviour and peer relationships in adolescents. In all three studies, significant associations between these outcome measures and different aspects of mental toughness were found (St Clair-Thompson et al., 2015). Adding to implications from Crust et al.'s research, these results highlighted the potential usefulness and benefit of considering mental toughness in an academic setting (McGeown et al., 2016; St Clair-Thompson et al., 2015). Exploring other elements of academic performance and outcomes, St Clair-Thompson et al. (2017) and Stock et al. (2018) discuss that subcomponents of mental toughness also positively impact year level transition, education level adjustment (tertiary to higher) and student affect (emotion). Considered together these findings suggest that mental toughness is a relevant and potentially useful concept possibly deepening understanding of non-cognitive individual differences in an academic context.

The majority of research exploring mental toughness in academics has been conducted within the last decade, making many studies preliminary and with possible areas for improvement/refinement. This must be considered along with studies limitations and critiques before drawing definitive conclusions. The presented literature acknowledged limitations of their research and interestingly there are similarities across the studies. The major common limitation and critique is the use of the measurement tool of mental toughness, the MTQ48 (Crust et al., 2014; Lin et al., 2017; St Clair-Thompson et al., 2015).

As discussed previously, the MTQ48 was developed from examining mental toughness in sports and studies using this tool did not adapt it to be academic specific (Lin et al., 2017; St Clair-Thompson et al., 2015). This is either an oversight or a considered decision based on the belief that mental toughness is a global rather than context specific concept. Either way Gucciardi et al. (2012) and Hardy III et al. (2014) raise concern for the validity of findings that utilised the MTQ48 as there is evidence that mental toughness is context specific.

Research by Hardy III et al. (2014) compared the measurement and predictive ability of mental toughness as a global and setting specific construct, finding that only setting based mental toughness related to outcome measures. Additionally, in 2012 Guiccardi et al. critically examined the MTQ48 fit to specific athletic and workplace samples and found it to be an unsatisfactory, indicating that capturing mental toughness in specific contexts may require a setting specific measurement tool (Gucciardi et al., 2012). Despite this evidence of mental toughness as a domain specific construct the MTQ48 appears to have been uncritically adopted by many exploring mental toughness in the academic setting, possibly corrupting results and findings (Gucciardi et al., 2012).

Another limitation and critique of mental toughness findings in academics is that theoretical underpinnings of the MTQ48 overlap a great deal with the concept of hardiness, possibly limiting the ability to accurately measure mental toughness itself (Gucciardi, 2017; St Clair-Thompson et al., 2015). Highlighted by Gucciardi (2017), theory behind MTQ48 was initially derived from the concept of hardiness and shares three of its four subcomponents (control, commitment and challenge). Although this alteration/expansion on hardiness to measure mental toughness was deemed appropriate and necessary by Clough et al. (2002), little theoretical and statistical justification for doing so was provided nor has been since (Gucciardi, 2017). This blurs the conceptual boundaries of mental toughness with hardiness and raises questions over the MTQ48 ability to accurately capture mental toughness

(Gucciardi, 2017). Taken together these major limitations and critiques raise concern over promising results from mental toughness research in academics and warrant further exploration of mental toughness in the academic setting.

### *Academic Mental Toughness Measurement Tool*

In 2014, Amato-Henderson et al. developed an academic specific mental toughness measurement tool by adapting the Psychological Performance Inventory (PPI) by Loehr (1986). The original PPI consists of 42 items that address situations related to sports performance (Amato-Henderson et al., 2014; Loehr, 1986). Amato-Henderson et al. (2014) modified these statements to address academic situations, for example “I don't have to be pushed to play or practice hard. I am my own best igniter” was modified to “I don't have to be pushed to study hard. I am my own best igniter.” (Amato-Henderson et al., 2014; Loehr, 1986). There is no indication that Amato-Henderson et al. (2014) study was in response to limitations and criticism of research into mental toughness in academics, nevertheless the design and findings do begin to address some of the major limitations and critiques discussed earlier. After pilot tests and preliminary analysis, the final Academic Mental Toughness scale (AMT) consisted of eighteen statements across four subscales: drive/determination, positive cognition, visualisation and impression management (Amato-Henderson et al., 2014). This component structure was robust and each of the subscales displayed acceptable to excellent reliability (Amato-Henderson et al., 2014). Further, positive cognition and drive/determination correlated with and predicted aspects of academic self-efficacy (one's belief in their ability to meet academic goals) (Amato-Henderson et al., 2014). These results provide a promising first step in addressing raised limitations and critiques and in creating a reliable and valid tool to measure mental toughness specifically in the academic setting. Amato-Henderson et al. recommended that future research should further examine the reliability and validity of the AMT using larger more diverse samples and investigate if

academic mental toughness predicts academic achievement rather than academic self-efficacy (Amato-Henderson et al., 2014).

Considering the present studies interest in exploring mental toughness and the findings, limitations and critiques of relevant literature across sports, business and academics, this research will aim to: further explore mental toughness in the academic setting by seeking to validate the Academic Mental Toughness scale (AMT) and examine the ability of academic mental toughness to predict academic achievement. These aims are designed to gain a deeper understanding of academic achievement as it relates to mental toughness. Accordingly, the literature around academic achievement was explored to inform any necessary considerations for analysis.

### **Academic Achievement**

Academic achievement is reflected in many ways throughout the literature, with grade being the most common measure. Like mental toughness in sporting and business contexts, there is also a breadth of literature that highlight some factors consistently found to influence academic achievement. Conscientiousness, a personality trait associated with behaviours like motivation, efficiency, organisation and self-discipline, is one of these factors (Dry et al., 2018). Conscientiousness is consistently related to and predictive of a range of academic performance, success and outcome indicators (e.g. grade, time to graduation) (e.g. Busato et al., 2000; Kappe & van der Flier, 2012; Nofle & Robins, 2007). Another factor found to reliably relate to, influence and predict academic achievement is individuals' level of intelligence (e.g. Busato et al., 2000; Dry et al., 2018; Kappe & van der Flier, 2012). From the consistency and strength of these findings it is clear conscientiousness and intelligence play an important role in academic achievement. Therefore, this study will capture and

consider their influence when examining the impact of academic mental toughness and academic achievement.

### **Research Justification and Implications**

As it shares similarities with more well-known concepts like resilience, hardiness and grit, mental toughness is a relatively new concept in psychological research. Despite increased attention in recent years it seems yet to be accurately captured and adequately understood. There is ambiguity and disagreement around the factor structure, a lack of clarity on it as a global or setting specific construct, uncertainty of appropriate measurement tool and major limitations and critiques of influence in an academic context. These are clear gaps in research that have been identified and warrant further exploration. Addressing these gaps will allow for improved knowledge and understanding of the concept of mental toughness and potentially aid the application of any intervention strategies that individuals, organisations or institutions wish to implement to improve people's level of mental toughness.

### **Present Studies Aims**

From the abovementioned gaps identified, the present study aims to:

1. Explore the factor structure of mental toughness in an academic context.
2. Investigate the association between academic mental toughness and students mental well and ill being.
3. Assess the validity and reliability of the academic mental toughness scale.
4. Investigate the predictive ability of academic mental toughness on academic achievement.

## Method

### Participants

Participants were recruited via convenience sampling through the University of Adelaide's Research Participation System (RPS). The only restriction to participation in the study was that participants were required to be enrolled in Psychology 1A at the University of Adelaide. The University of Adelaide's School of Psychology stipulated that a maximum of 133 students could complete the study. Upon completion of the survey all participants were granted course credit per the requirements of their enrolment in Psychology 1A. No other incentives for participation were offered.

Initially there were 132 participant responses. To maximise appropriateness of data for analysis, obviously incorrect responses, inappropriate responses and incomplete responses were removed. This resulted in a final data set of 124 responses. Of these 124, 27.4% ( $n = 34$ ) were male and 72.6% were female ( $n = 90$ ). Participant age ranged from 17 to 37, with an average age of 19.76 ( $SD = 2.70$ ).

### Materials

#### *Survey and measures*

Online survey program Qualtrics XM was used to construct the survey, develop a secure distributable link and collect raw data. The platform for distribution of this secure link was the University of Adelaide's Research Participation System. The survey contained relevant instructional, consent and participation information along with demographic questions, The Raven's Advanced Progressive Matrices Scale - short form (Raven's), the Openness Conscientiousness Extraversion Agreeableness Neuroticism Index Condensed (OCEANIC), the Depression Anxiety Stress Scale (DASS-21), the Engagement Perseverance Optimism Connectedness Happiness Scale (EPOCH), and the Academic Mental Toughness Inventory

(AMT). See Appendix A for AMT inventory, other scales were not included as appendices as they are more established recognised scales. For participant convenience and accuracy of reporting the survey was split into two 'blocks', Part A and Part B. A "save and continue" feature was utilised to automatically save progress after completing each section so it was possible to for participants to leave and return to continue at a later time.

**Ravens Advanced Progressive Matrices – short form.** Ravens was used to assess participants intellectual ability and is comprised of a two sample questions and 12 official questions. Participants selected only one of eight possible responses for each question with a higher total of correct responses reflecting higher intellectual ability. The two sample questions were not included in the summative score. Acceptable internal consistency has been reported for the Ravens with a Cronbach alpha ( $\alpha$ ) of .73 (Bors & Stokes, 1998).

**Openness Conscientiousness Extraversion Agreeableness Neuroticism Index Condensed.** The OCEANIC assess five components of personality: openness, conscientiousness, extraversion, agreeableness, and neuroticism. The present study only utilised the conscientiousness subcomponent, which contained a total of nine statements. For these nine statements, participants indicate on a 6-point Likert scale (1 = Never, 6 = Always) how frequently each statement applied to them. Higher scores reflected higher levels of conscientiousness. Schulze and Roberts (2006) report excellent internal consistency and reliability for the conscientiousness subcomponent with Cronbach alpha ( $\alpha$ ) of .91.

**Depression Anxiety Stress Scale.** The DASS-21 was used to measure levels of depression, anxiety and stress. Participants indicate how much each of the 21 statements applies to them on a 4-point Likert scale (0 = Never, 3 = Always). Depression, anxiety, and stress each have seven questions, the higher the sum of responses from these seven questions for each category, the higher participants levels of the respective aspect of mental ill-health.



This study used the collective score of depression, anxiety and stress as an indication of participants level of overall illbeing. Each component of the DASS-21 consistently displays high levels of internal consistency with Cronbach alphas of .85, .81 and .88 for Depression, Anxiety, and Stress respectively (Osman et al., 2012).

**Engagement Perseverance Optimism Connectedness Happiness Scale.** The EPOCH Scale explores five aspects of wellbeing: engagement, perseverance, optimism, connectedness, and happiness. The EPOCH contains a total of 20 statements, four for each subcomponent of wellbeing. Participant responses for all 20 statements range from 1 to 5 with how much each statement describes them. An important note is the first 11 response options are worded differently from the last nine, “Almost Never” to “Almost Always” for first nine and “Not at all like me” to “Very much like me” for the remaining nine. Higher summative scores reflect higher levels of that subcomponent scores for each subcomponent computed as the average of the four responses. This study considered the combination of all subcomponents a representation of participants level of overall mental wellbeing. The internal consistency of the subcomponents of the EPOCH range from acceptable to excellent with Cronbach alpha’s from .74-.77 for engagement, .79-.80 for perseverance, .76-.81 for optimism, .77-.81 for connectedness, and .83-.86 for happiness (Kern et al., 2016).

**Academic Mental Toughness Inventory.** The AMT measures four aspects of mental toughness in an academic context: positive cognition, drive/determination, visualisation and impression management. Participants respond to each of the 18 statements on a 5-point Likert scale (1 = Almost Always, 5 = Almost Never) indicating how much each statement applies to them. Each statement is applicable to one of the four subcomponents and are appropriately summed to provide overall scores for each subcomponent of AMT. Responses for statements one, three, seven, 10, and 18 must be reverse scored prior to scoring. Internal consistency for the AMT subcomponents is reported by Amato-Henderson et al. (2014) to range from

questionable to good with Cronbach alpha's of .85 for positive cognition, .77 for drive/determination, .67 for visualisation and .63 for impression management.

### ***Data cleaning and analyses***

Microsoft Excel was used for preliminary data cleaning and matching of participants academic scores. Version 27 of IBM's Statistical Pack for Social Sciences (SPSS) was used for data scoring and analyses.

### **Procedure**

Ethical approval was sought and granted by the University of Adelaide's Human Research Ethics Committee (approval number H-20-19). The survey was constructed on Qualtrics XM. Careful consideration and refinement was applied to the language, format, structure, and survey flow as they relate to both questions and responses for participants. Prior to acceptance of the final survey, a total of five pilot tests using five participants were conducted. These five participants provided feedback on possible areas for survey improvement. Responses from these pilot tests were not included in the official data collection of the study. Once the final version of the survey was complete, Qualtrics XM produced a secure link that was posted on the University of Adelaide's RPS, where eligible students could then complete the survey.

Participants were first provided detailed information regarding participation, consent, withdrawal, privacy, researcher contact details and ongoing support, see Appendix B information provided to participants. Next, participants were encouraged to complete Part A and Part B of the survey separately, however it was possible to complete both parts in one sitting. Specific instructions for each block and scale were also provided. After the maximum number of responses was reached, the survey was closed for participation. Using the RPS, course credit was granted on an ongoing weekly basis as participants completed the survey.

Data were exported to Microsoft Excel for initial cleaning, where incomplete responses were removed, and students' academic performance results (Psychology 1A overall grade) were paired. Data were then exported to SPSS for relevant recoding, final scoring and analyses.

## **Results**

### **Variables Descriptive Statistics**

Prior to further analysis, descriptive statistics and normality testing were conducted for all variables. The assumption of normality was explored through inspection of histograms and boxplots along with skewness and kurtosis calculations. Normality was upheld for conscientiousness, intelligence, mental wellbeing, mental illbeing and all four factors of academic mental toughness (positive cognition, drive/determination, visualisation and impression management). For academic achievement however, normality was initially violated. A total of eight cases with scores of no value, 16, 26 and 36 were revealed as outliers. The removal of these cases resulted in an approximately normal histogram and a much more acceptable skewness value, therefore the assumption of normality was upheld for academic achievement also. The final data set was 116 for any analysis involving academic achievement and 124 for any analysis not involving academic achievement. See Appendix C for variables descriptive statistics.

### **Exploratory Factor Analysis (EFA)**

To address the research aim of exploring the factor structure of academic mental toughness, EFA was performed. Appropriateness of analysis was assessed and confirmed through inspection of indicators of sampling adequacy, multicollinearity and factorability of items (questions/statements). Sample size was below Field (2013) recommended level of ten to fifteen participants per variable as the current study had 18 variables (AMT questions) and 124 participants. However, the Keiser-Meyer-Olkin measure of sampling adequacy was .85,

well above the acceptable level of .50, therefore sample size was deemed adequate (Field, 2013; Kaiser, 1974). Items three and 18 displayed numerous extremely weak and close to zero correlations with other items which indicated possible concern for multicollinearity. There is evidence suggesting the removal of items with multiple low correlations, therefore additional EFA was conducted with items three and 18 removed (Field, 2013). The resulting factor structure was illogical and uninterpretable. Other indicators for appropriateness of EFA, like no item correlations above .80 and Bartlett's test of sphericity being significant, resulted in the assumptions of multicollinearity and factorability of data being upheld (Field, 2013). Overall, all assumptions necessary to proceed with EFA were met. See Appendix D for all academic mental toughness item correlations.

After appropriateness of data for factor analysis was confirmed, EFA was conducted. There are two types of data rotation that assist researchers interpretation of any underlying factor structure, these are oblique and orthogonal (Dancey & Reidy, 2011). Oblique rotation allows for correlation between any underlying factors and orthogonal assumes independence of factors (Field, 2013). For the exploration of psychological constructs, like academic mental toughness, correlation between factors is expected (Field, 2013). Therefore, the current study utilised oblique rotation.

The original factor structure of academic mental toughness indicated a four-factor solution (Amato-Henderson et al., 2014). For the current study, decisions regarding the factors to be extracted were based on consideration of the point of inflexion on the scree plot, individual factor eigenvalues, the amount of variance explained by factors and individual item factor loading values (Field, 2013). Firstly, EFA was performed with eigenvalue cut-off set at 1.0 (Kaiser, 1960). Results suggested a three-factor solution which accounted for 56.31% of the total variance (Table 1). Inspection of the scree plot, seen in Figure 1 below, reinforced the extraction of three factors as the point of inflexion was most noticeable at component number

four. Further, all items loaded greater than .40 on their respective factors and no items loaded above .40 on any other factor, see Table 2 below. These results considered together provide strong evidence a three-factor solution. Factors were termed or labelled based on shared themes and similarities across the items comprising that factor. Accordingly, items in Factor 1 represented personal responsibility and drive, items in Factor 2 represented positive cognition and items in Factor 3 represented visualisation.

**Table 1**

*Variance explained and Eigenvalues for Academic Mental Toughness items from Principal Components Factor Analysis*

| Component/Factor | Individual Eigenvalues | Individual % of Variance | Cumulative % or Variance |
|------------------|------------------------|--------------------------|--------------------------|
| <b>1</b>         | <b>6.16</b>            | <b>34.20</b>             | <b>34.20</b>             |
| <b>2</b>         | <b>2.48</b>            | <b>13.75</b>             | <b>47.95</b>             |
| <b>3</b>         | <b>1.50</b>            | <b>8.36</b>              | <b>56.31</b>             |
| 4                | 0.93                   | 5.14                     | 61.44                    |
| 5                | 0.91                   | 5.08                     | 66.52                    |
| 6                | 0.80                   | 4.46                     | 70.98                    |
| 7                | 0.77                   | 4.26                     | 75.26                    |
| 8                | 0.69                   | 3.84                     | 79.10                    |
| 9                | 0.64                   | 3.55                     | 82.65                    |
| 10               | 0.51                   | 2.85                     | 85.50                    |
| 11               | 0.49                   | 2.71                     | 88.21                    |
| 12               | 0.42                   | 2.32                     | 90.53                    |
| 13               | 0.38                   | 2.12                     | 92.66                    |
| 14               | 0.32                   | 1.80                     | 94.45                    |
| 15               | 0.29                   | 1.64                     | 96.09                    |
| 16               | 0.29                   | 1.61                     | 97.70                    |
| 17               | 0.22                   | 1.21                     | 98.91                    |
| 18               | 0.20                   | 1.09                     | 100.00                   |

*Note.* Boldened figures are extracted factors and corresponding Eigenvalues and % of explained Variance.

**Figure 1***Scree Plot for Academic Mental Toughness factor extraction***Table 2**

Pattern Matrix of Academic Mental Toughness items from Principal Components Analysis

| Item no.                                     | Item   | Component/Factor |      |      |
|--|--|------------------|------|------|
| Factor 1 – Personal responsibility and drive |  |                  |      |      |
| 2  | I don't have to be pushed to study hard. I am my own best igniter.             | <b>.88</b>       | -.10 | -.18 |
| 4  | The goals I've set for myself as a student keep me working hard.               | <b>.84</b>       | -.11 | -.01 |
| 11   | I'm willing to give whatever it takes to reach my full potential as a student. | <b>.76</b>       | -.09 | .13  |
| 13   | I project the outward image of a confident student.                            | <b>.59</b>       | .04  | .03  |
| 6  | I mentally practice my academic skills.  | <b>.54</b>       | .17  | .23  |
| 9  | I can remain calm during class when confused by problems.                      | <b>.50</b>       | .22  | -.09 |

|                               |  |            |            |            |
|-------------------------------|--|------------|------------|------------|
| 15                            | I get challenged and inspired in tough academic situations.  | <b>.49</b> | .32        | .27        |
| Factor 2 – Positive cognition |  |            |            |            |
| 1                             | I lose my confidence very quickly. (R)   | .04        | <b>.85</b> | .02        |
| 3                             | Mistakes get me feeling and thinking negatively. (R)   | -.27       | <b>.78</b> | -.08       |
| 10                            | I tend to get emotionally flat when things turn against me during challenging academic situations. (R) | .00        | <b>.76</b> | .08        |
| 7                             | My self-talk during challenging academic situations is negative. (R)                                   | .19        | <b>.67</b> | .03        |
| 14                            | I can keep strong positive emotion flowing during challenging academic situations.                     | .37        | <b>.56</b> | .21        |
| 5                             | I am a positive thinker during challenging academic situations.  | .40        | <b>.55</b> | .06        |
| 17                            | I can change negative moods into positive ones by controlling my thinking.                             | .10        | <b>.55</b> | .18        |
| 18                            | Uncontrollable events like illness, cheating classmates, and bad teachers get me very upset. (R)       | -.09       | <b>.48</b> | -.42       |
| Factor 3 – Visualisation      |  |            |            |            |
| 8                             | I use images while taking an exam that help me perform better.   | -.14       | .05        | <b>.83</b> |
| 12                            | Thinking in pictures about my studies comes easy for me.   | -.05       | .02        | <b>.75</b> |
| 16                            | I visualize working through tough questions prior to an exam.  | .25        | .10        | <b>.62</b> |

*Note.* Boldened values are item loading values for respective factors. (R) represents recoded items.

As there is argument for an eigenvalue cut-off level of 0.7 rather than 1.0 (Jolliffe, 1972) and results of initial EFA produced multiple factors with eigenvalues greater than 0.7, consideration was given to possible alternative factor structures using this adjusted cut-off value. Seven factors had eigenvalues above 0.7 and explained 75.26% of the total variance, which was an additional 18.95% on the initial three-factor solution. However, the scree plot

still indicated three factors for extraction and item factor loadings were higher than .40 on multiple factors, which is cause for concern for any factor structure (Field, 2013). These considered together along with the fact there are only 18 items in total, this seven-factor solution appeared uninterpretable and inappropriate. Further combinations of eigenvalue cut-off levels were examined with results for all uninterpretable and inappropriate. Consequently, the initial three-factor structure of academic mental toughness (personal responsibility and drive, positive cognition and visualisation) was deemed the most robust and interpretable and was accepted for further analysis.

### **Reliability Analysis**

Reliability analysis was conducted to address the research aim of further exploring the reliability the Academic Mental Toughness inventory (AMT). Reliability was reflected by Cronbach's alpha on a 0-1 scale (0 being no reliability and 1 being perfect reliability). Regarding classification, Field (2013) discusses that for psychological constructs there is evidence for Cronbach alpha values of close to 0.7 being more than acceptable, especially when research is exploratory in nature where values as low as 0.5 have been deemed acceptable. Accordingly, values of 0.5 or above were deemed acceptable, 0.7 or above good and 0.8 or above excellent. Overall, results found the AMT to be a reliable measurement tool. Factor 1, personal responsibility and drive displayed excellent reliability with Cronbach alpha of .83. Factor 2, positive cognition produced excellent reliability with Cronbach alpha of .84. Factor 3, visualisation produced acceptable reliability of .67.

### **Correlation Analysis**

To begin to address the research aims of exploring the relationship between academic mental toughness and academic achievement, mental wellbeing and mental illbeing, correlation analysis was performed. Intelligence, conscientiousness and age were also



included for analysis. Firstly, assumption testing was conducted to assess suitability of data for analysis. Assumptions of linearity, homoscedasticity, related pairs and normality were upheld, therefore Pearson's product moment correlation coefficient (Pearson's  $r$ ) was utilised for correlation analysis (Dancey & Reidy, 2011). Correlations of  $\pm .1$  were considered small/weak,  $\pm .3$  as medium/moderate and  $\pm .5$  as large/strong (Dancey & Reidy, 2011; Field, 2013).

All academic mental toughness factors shared statistically significant relationships with one another, see Table 5 below for correlations between all variables. Considering the main research aim of exploring the relationship between academic mental toughness and academic achievement, some interesting results were yielded. The only AMT factor to share a statistically significant relationship with academic achievement was personal responsibility and drive, ( $r = .32$ ,  $N = 116$ ,  $p = .001$ ), this was a moderate positive relationship. No statistically significant relationship was identified between positive cognition and academic achievement and visualisation and academic achievement.

Considering the next research aim of exploring the relationships between academic mental toughness and mental well and illbeing, personal responsibility and drive displayed a strong positive statistically significant relationship with mental wellbeing, ( $r = .54$ ,  $N = 124$ ,  $p = .001$ ), and a moderate negative statistically significant relationship with mental illbeing ( $r = -.33$ ,  $N = 124$ ,  $p = .003$ ). Positive cognition also had a strong positive statistically significant relationship with mental wellbeing, ( $r = .52$ ,  $N = 124$ ,  $p < .001$ ), and a strong negative statistically significant relationship with mental illbeing ( $r = -.62$ ,  $N = 124$ ,  $p < .001$ ). Visualisation shared a weak positive statistically significant relationship with mental wellbeing ( $r = .27$ ,  $N = 124$ ,  $p < .001$ ), but no statistically significant relationship with mental illbeing.

Lastly, considering factors known to influence academic achievement, as expected intelligence and conscientiousness both shared statistically significant relationships with academic achievement, ( $r = .37, N = 116, p < .001$ ) and ( $r = .28, N = 116, p = .002$ ) respectively. There was a moderate relationship with intelligence and a weak relationship with conscientiousness. Two of the three AMT factors (personal responsibility, drive and positive cognition) displayed statistically significant relationships with conscientiousness and no AMT factor shared a statistically significant relationship with intelligence. The later result is interesting as personal responsibility and drive and intelligence both displayed statistically significant relationships with academic achievement but were not statistically significantly related to one another. Additional interesting results of note were the relationships between age and academic achievement and age and personal responsibility and drive. Age shared a weak negative statistically significant relationship with both, ( $r = -.29, N = 116, p = .001$ ) and ( $r = -.23, N = 124, p = .009$ ) respectively. The results considered with evidence from literature warrant further exploration of the predictive ability of some of the variables discussed above. Hence, hierarchical regression was the next analysis performed.

**Table 3**

*Correlation Matrix for Academic Mental Toughness, Academic Achievement, Mental Wellbeing, Mental Illbeing, Intelligence, Conscientiousness and Age*

| Variables                            | Variables |        |        |       |        |       |      |      |    |  |
|--------------------------------------|-----------|--------|--------|-------|--------|-------|------|------|----|--|
|                                      | 1         | 2      | 3      | 4     | 5      | 6     | 7    | 8    | 9  |  |
| 1. Academic achievement              | --        |        |        |       |        |       |      |      |    |  |
| 2. Personal responsibility and drive | .32**     | --     |        |       |        |       |      |      |    |  |
| 3. Positive cognition                | -.02      | .45**  | --     |       |        |       |      |      |    |  |
| 4. Visualisation                     | .07       | .42**  | .22*   | --    |        |       |      |      |    |  |
| 5. Mental wellbeing                  | .09       | .54**  | .52**  | .27** | --     |       |      |      |    |  |
| 6. Mental illbeing                   | -.12      | -.33** | -.62** | -.06  | -.57** | --    |      |      |    |  |
| 7. Intelligence                      | .37**     | .05    | -.00   | -.07  | -.14   | .11   | --   |      |    |  |
| 8. Conscientiousness                 | .28**     | .47**  | .22*   | .17   | .48**  | -.22* | .13  | --   |    |  |
| 9. Age                               | -.29**    | -.24** | .00    | -.12  | -.12   | -.01  | -.11 | -.16 | -- |  |

*Note.* \*\* represents significance at the .01 level and \* at the .05 level.  $N = 116$  for any correlation involving Academic Achievement, for all other correlations  $N = 124$ .

### **Hierarchical Regression**

Hierarchical regression analysis was performed to address the research aim of exploring the predictive ability of academic mental toughness. Prior to analysis assumptions of appropriate sample size, outliers, influential cases, multicollinearity, normality, linearity, homoscedasticity and independent errors were considered. All were upheld except for independent errors as the Durbin-Watson statistic was .45, which is below the recommended minimum value of 1 (Field, 2013). Hierarchical regression is however robust to such violations and was therefore deemed appropriate to further analyse the data.

Hierarchical regression analysis was performed to address the research question: does academic mental toughness predict academic achievement after controlling for intelligence and conscientiousness. Firstly, intelligence and conscientiousness entered the model at step 1 and academic mental toughness factors personal responsibility and drive, positive cognition and visualisation entered at step 2. Model 1 explained a significant 18.2% of variance in academic achievement,  $F(2, 113) = 12.58, p < .001$ . Model 2 explained a significant 22.2% of variance in academic achievement,  $F(5, 110) = 7.12, p < .001$ . The inclusion of academic mental toughness factors to the model explained an additional 6.80% of variance, which was a significant change,  $F \text{ Change}(3, 110) = 3.03, p = .033$ ). In the final model, intelligence and personal drive and responsibility were the only variables that significantly predicted academic achievement. Intelligence was a stronger predictor ( $B = .99, \beta = .31, SE = .28, t = 3.58, p = .001$ ) than personal drive and responsibility ( $B = .57, \beta = .31, SE = .21, t = 2.78, p = .006$ ). All other predictors did not significantly predict academic achievement, see Table 6 below for full results of hierarchical regression analysis.

**Table 4***Univariate Analysis of individual predictor variables of Academic Achievement*

| Model | Variables                         | Unstandardised |            | Standardised |          |      |
|-------|-----------------------------------|----------------|------------|--------------|----------|------|
|       |                                   | Coefficients   |            | Coefficients |          |      |
|       |                                   | B              | Std. Error | Beta         | <i>t</i> | Sig. |
| 1     | (Constant)                        | 62.69          | 4.58       |              | 13.68    | .000 |
|       | Intelligence                      | 1.06           | 0.28       | 0.33         | 3.79     | .000 |
|       | Conscientiousness                 | 0.30           | 0.12       | 0.22         | 2.56     | .012 |
| 2     | (Constant)                        | 61.87          | 5.29       |              | 11.69    | .000 |
|       | Intelligence                      | 0.99           | 0.28       | 0.31         | 3.58     | .001 |
|       | Conscientiousness                 | 0.16           | 0.13       | 0.12         | 1.21     | .229 |
|       | Personal responsibility and drive | 0.57           | 0.21       | 0.31         | 2.78     | .006 |
|       | Positive cognition                | -0.27          | 0.15       | -0.17        | -1.83    | .070 |
|       | Visualisation                     | -0.09          | 0.30       | -0.03        | -0.28    | .780 |

## Discussion

### Overview

The aims of the current study were, to investigate how mental toughness is conceptualised in an academic setting, to assess the reliability of the Academic Mental Toughness inventory (AMT), to examine the association between academic mental toughness and students mental well and ill being, and to explore if academic mental toughness predicted academic achievement (indicated by student grade) after controlling the impact of other factors known to influence academic achievement. Amongst researchers there is divided opinion on how mental toughness is best conceptualised (e.g. Crust et al., 2014; Gucciardi et al., 2015; Lin et al., 2017; Perry et al., 2013) and to date research exploring mental toughness in an academic context can be considered very preliminary. Accordingly, the present study was exploratory research and did not state any specific hypotheses. Mental toughness was found to be best conceptualised as a multicomponent construct rather than a singular construct as three distinct

factors were identified. The AMT was found to be a reliable measurement tool of academic mental toughness as each of the three factors had good to excellent reliability. Personal responsibility and drive was the only mental toughness factor found to predict academic achievement after the impact of other influential variables was accounted for. As the present study is preliminary in nature, findings contribute to knowledge of mental toughness and its application in an academic setting, identify considerations for any intervention strategies and provide indications and directions for future research.

### **Conceptualisation of Mental Toughness**

The first aim of this study was to investigate how mental toughness is best conceptualised in an academic setting. Findings supported a three-factor structure of academic mental toughness. These factors were termed personal responsibility and drive, positive cognition and visualisation. Results are in line with several previous studies that report a multi factor structure underlying the construct of mental toughness (e.g. Amato-Henderson et al., 2014; Crust et al., 2014; Perry et al., 2013; St Clair-Thompson et al., 2015). Although consistent with some previous findings, considerations must be given to the differences between aspects of this and previous studies.

Rather than the current studies reported three factor structure, the above mentioned studies found an alternative four factor structure of mental toughness with challenge, commitment, control and confidence the four underlying factors (excluding Amato-Henderson et al. (2014)). This difference is possibly explained by the use of different measurement tools of mental toughness between the present and previous studies. The present study utilised the Academic Mental Toughness inventory (AMT) whilst Crust et al. (2014), Perry et al. (2013) and St Clair-Thompson et al. (2017) used the Mental Toughness Questionnaire (MTQ48). As previously discussed, there is criticism for the use of the MTQ48 when measuring mental

toughness due its theoretical underpinnings overlapping with hardiness and its development from sporting specific settings (Gucciardi, 2017; Lin et al., 2017; St Clair-Thompson et al., 2015). The present study attempted to address this criticism by utilising an appropriate, reliable domain specific measurement tool for mental toughness, the AMT. Consequently, it is possible the present study's findings indicate that it may be more appropriate to consider mental toughness as context/setting specific (e.g. sports, academics) rather than as a broad or global construct which is in line with reports from Gucciardi et al. (2012) and Hardy III et al. (2014). In saying this, the present study's findings from the use of the AMT are preliminary and further research exploring its application and reliability is necessary before drawing conclusions.

Further, Amato-Henderson et al. (2014) initially developed the AMT and reported a four factor structure of mental toughness with drive/determination, positive cognition, visualisation and impression management the underlying factors. The present study's findings differ from this as impression management as an underlying factor was not found and drive/determination was adjusted to personal responsibility and drive. These differences possibly relate to the items/questions previously part of impression management being part of alternate factors in the present study. Item 17 "I can change negative moods into positive ones by controlling my thinking" was found to fit under positive cognition, which seems theoretically appropriate. Items nine "I project the outward image of a confident student" and 13 "I can remain calm during class when confused by problems" fell under personal responsibility and drive. The inclusion of items 9 and seventeen in what was initially drive/determination saw the collection of items under this factor now share more of a personal element. Accordingly, this factor was changed to personal responsibility and drive as it seemed more specific and appropriate. In line with Amato-Henderson et al. (2014)

findings for visualisation, the present study was comprised of the same items/questions as initially proposed.

Another potential explanation for these differences with Amato-Henderson et al. (2014) research is that the present study attempted to address outlined limitations from their preliminary research with a larger and more diverse sample. Amato-Henderson et al.'s study consisted of only 82 participants, all female, while the present study recruited 124 participants, of which 32 were male and 92 were female. From this sample difference, it is possible the present study more accurately captured academic mental toughness. This possibility is further reinforced as the item factor loadings from the present study are more robust than loadings reported by Amato-Henderson et al. and the alternative factor structures considered by our research were inappropriate and uninterpretable. Ultimately, the three-factor structure of personal responsibility and drive, positive cognition and visualisation may more accurately represent mental toughness in an academic setting than the initial four-factor solution proposed by Amato-Henderson et al. (2014). To reiterate, consideration must be given to the fact the present study's findings are very preliminary in nature and further research is necessary before drawing definitive conclusions.

### **Reliability of the AMT**

The next aim of this study was to assess the reliability of the Academic Mental Toughness index (AMT) developed by Amato-Henderson et al. (2014). Excellent reliability was found for personal responsibility and drive and positive cognition and an upper level of acceptable reliability (close to good) was found for visualisation. These levels of reliability are slightly higher than those reported by Amato-Henderson et al. (2014). They reported an upper level of acceptable reliability for drive/determination, an upper level of good reliability for positive



cognition and an upper level of acceptable reliability for visualisation (Amato-Henderson et al., 2014).

There are two main differences between reliability findings from Amato-Henderson et al. (2014) and the current study. Firstly, Amato-Henderson et al. (2014) reported reliability results from a fourth factor, impression management, which the current study did not as this factor was not identified during analysis. Secondly, the present study found excellent reliability for personal responsibility and drive while Amato-Henderson et al. (2014) found a slightly lower level of reliability for the comparable factor drive/determination. As two of the three items from impression management fell under personal responsibility and drive in the present study, it is possible the difference in slightly higher reliability for this factor provides indication that item structure (which items factors fall under) and factor solution reported by the present study more accurately represent academic mental toughness.

Further, as stated earlier the present study attempted to address limitations of Amato-Henderson et al. (2014) preliminary research with a larger more diverse sample. This contributes to confidence for the accuracy and appropriateness of a three-factor structure underlying academic mental toughness. Although there are some possible takeaways from the discussed differences and explanations offered, consideration must be given to the fact that this study is very preliminary and further research is warranted.

### **Academic Mental Toughness and Student Mental Well and Illbeing**

The third research aim was to assess if academic mental toughness was associated with mental wellbeing and mental illbeing. Although there is extensive previous research indicating these factors do share an association (e.g. Gerber, Kalak, et al., 2013; Haghghi & Gerber, 2019), our study was exploring academic mental toughness specifically and no research exploring its impact on mental well and illbeing was found. Therefore, it was

deemed necessary to assess the association between academic mental toughness and mental well and illbeing in this study. Findings revealed all three academic mental toughness factors shared an association with mental ill and wellbeing, the only exception was visualisation not being significantly associated with mental illbeing. Unsurprisingly, these findings are in line with previous findings that levels of mental well and illbeing are related to mental toughness (Gerber, Brand, et al., 2013; Gerber, Kalak, et al., 2013; Haghghi & Gerber, 2019). The current study's findings are however to some extent unique in that academic mental toughness specifically rather than global mental toughness was explored. These findings contribute to knowledge of the association between mental toughness and mental well and illbeing. They also add that academic mental toughness specifically can influence students' feelings of mental well and ill being and offer more details on possible areas of intervention.

#### **Academic Mental Toughness Predicting Academic Achievement**

The fourth and final research aim of this study was to investigate if academic mental toughness predicted academic achievement after controlling for conscientiousness and intelligence. As previous research exploring mental toughness in academic settings have utilised other academic outcome measures like attendance, progression and attainment (Crust et al., 2014; St Clair-Thompson et al., 2015), students' subject grade was used to reflect academic achievement in the present study. Moreover, the use of grade as an academic achievement measure was also recommended by Amato-Henderson et al. (2014) as their study's measure of academic achievement was academic self-efficacy (self-belief). Therefore it seemed appropriate for grade to represent academic achievement in our study as in many aspects it builds upon Amato-Henderson et al. (2014) preliminary research. There is extensive research highlighting that individual's levels of intelligence and conscientiousness are consistent and robust predictors of academic achievement (e.g. Kappe & van der Flier, 2012; Nofle & Robins, 2007). Therefore, it was deemed necessary to statistically control for

the influence of these factors during analysis to isolate and appropriately investigate the impact of academic mental toughness on academic achievement.

Findings revealed that of the three factors of academic mental toughness, personal responsibility and drive significantly predicted academic achievement while positive cognition and visualisation did not. These findings are in line with some previous research exploring mental toughness but also contradictory to others. Firstly, they are consistent with research reporting that the underlying factors of mental toughness relate differently to outcome measures (Crust et al., 2014; St Clair-Thompson et al., 2015). Regarding factors predictive ability specifically, Amato-Henderson et al. (2014) found that drive/determination, a factor very similar to personal responsibility and drive, predicted academic self-efficacy and that visualisation did not. Possible explanation for the similarity of these findings is that individual subcomponents of mental toughness (academic or broad) relate differently to outcome measures. Ultimately, this finding reinforces previous research reporting the appropriateness of mental toughness as a multicomponent construct and the usefulness of this approach.

In contrast to these similarities shared with Amato-Henderson et al. (2014), there are also some differences that warrant discussion. Amato-Henderson et al. (2014) reported that positive cognition as well as drive/determination predicted academic self-efficacy, our results did not support this finding. One possible explanation for this is the difference in outcome measure used by the studies. Amato-Henderson et al. captured academic self-efficacy, our study captured academic achievement indicated by student grade. Although academic self-efficacy has been found to predict academic achievement (Noftle & Robins, 2007), and would therefore seem logical for achievement findings to be in line with self-efficacy findings, other factors like stress, depression and burnout may play a role in this not eventuating. Given the present study was conducted in 2020/2021 during the COVID-19

pandemic this explanation seems plausible. From this, the importance of protective factors like mental toughness is highlighted. Academic mental toughness could possibly also influence academic achievement through its positive impact on mental well and ill being and perhaps self-efficacy. In proposing these takeaways, consideration must again be given to the fact the current study was largely exploratory in nature.

### **Additional findings of interest**

From exploring the specific research aims of this study some interesting findings were discovered relating to the relationship between conscientiousness and the AMT factors. Correlation analysis revealed all AMT factors shared an association with conscientiousness. Hierarchical regression analysis revealed that conscientiousness predicted academic achievement when the AMT factors were not considered, however when included conscientiousness no longer predicted academic achievement and the AMT factor personal responsibility and drive did. These findings are interesting and indicate a possible ‘overlap’ between conscientiousness and AMT, specifically personal responsibility and drive. Inspection of the statements used to capture these two factors revealed some similarities. From these findings, it is possible that conscientiousness and AMT, specifically personal responsibility and drive, are representing and capturing similar themes or the same construct.

### **Implications, limitations and directions for future research**

Findings from this study offer several useful contributions to existing literature. Firstly, our findings reinforce the widely accepted notion for mental toughness as a multicomponent model. Secondly, they also provide further backing to literature reporting mental toughness as a setting/context specific construct as the AMT was found to be a reliable measurement tool. Moreover, our findings built upon initial foundational research by offering additional understanding and refinement for the AMT. Findings also provide contributions to the

understanding of individual differences in academics and further highlight that mental toughness subcomponents relate differently to outcome measures. Whilst this study did not explore intervention strategies to improve mental toughness, the findings do provide insight to some useful considerations for interventions. These implications by in large reinforce, extend or build upon previous literature to deepen the understanding of mental toughness broadly and academic mental toughness more specifically and offer considerations for possible interventions.

There are several limitations of the current study that warrant attention. Consideration must be given to the fact there is evidence for factor analysis requiring a substantially larger sample size than the present study was able to obtain (Field, 2013). In saying this, the present study's sample was larger than foundational research by Amato-Henderson et al. exploring the AMT. Nonetheless, future research should aim for a much higher sample size. The use of one subject grade to reflect academic achievement is another limitation and future research should capture academic achievement across multiple subjects and or over time. There are also many different forms of academic achievement/success the present study did not explore. Future research should also consider factors like year progression, graduation and employment when exploring academic achievement. All questionnaires utilised in the current study were self-report measures, this provides possibility for responder bias that potentially corrupts results (Crust et al., 2014; Gucciardi, 2017; Perry et al., 2013). Future research could explore mental toughness with objective means of data collection as well as self-reported measures. Derived from the interesting findings previously outlined, research could consider exploring the use of the NEO-PI, an alternative measure of conscientiousness that captures distinct "facets" (Costa Jr & McCrae, 2008). This could aid in understanding the possible overlap between conscientiousness and mental toughness. Other suggestions for considerations for future research are to explore gender differences, age differences, levels of mental toughness (i.e.

low, medium, high), to further explore the AMT and to compare the AMT to other measures of mental toughness like MTQ48. This would provide direct rather than inferred indication of appropriate use of measurement tool (i.e. global or setting specific).

## **Conclusion**

This study sought to deepen understanding of mental toughness as a concept, validate an academic specific mental toughness measurement tool and contribute to existing literature around the impact and importance of mental toughness in academics. Findings build on literature reporting the appropriateness and usefulness for mental toughness as a multicomponent construct. The validity and reliability of the academic mental toughness measurement tool was further established, refined and even improved. Lastly, the subcomponents of academic mental toughness were found to be important factors in individual differences in academics. Identified limitations provide several suggestions and directions for future research. Perhaps the most important of which is the consideration of exploration of relationships between subcomponents of conscientiousness and subcomponents of academic mental toughness. Overall, the findings contribute to the understanding of mental toughness and its impact in aspects of individuals lives and provide important considerations for intervention strategies effectiveness.

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**Appendices**

**Appendix A**

**Academic Mental Toughness Index**

There is a total of 18 statements, please indicate how each statement apply to you where 1 = Almost Never, 2 = Not Often, 3 = Sometimes, 4 = Often, 5 = Almost Always.

|  | <b>Score</b> |
|--|--------------|
| 1. I lose my confidence very quickly. (R)  |              |
| 2. I don't have to be pushed to study hard. I am my own best igniter.                                      |              |
| 3. Mistakes get me feeling and thinking negatively. (R)  |              |
| 4. The goals I've set for myself as a student keep me working hard.  |              |
| 5. I am a positive thinker during challenging academic situations.   |              |
| 6. I mentally practice my academic skills.   |              |
| 7. My self-talk during challenging academic situations is negative. (R)                                    |              |
| 8. I use images while taking an exam that help me perform better.  |              |
| 9. I can remain calm during class when confused by problems.   |              |
| 10. I tend to get emotionally flat when things turn against me during challenging academic situations. (R) |              |
| 11. I'm willing to give whatever it takes to reach my full potential as a student.                         |              |
| 12. Thinking in pictures about my studies comes easy for me.   |              |
| 13. I project the outward image of a confident student.  |              |
| 14. I can keep strong positive emotion flowing during challenging academic situations.                     |              |
| 15. I get challenged and inspired in tough academic situations.  |              |
| 16. I visualize working through tough questions prior to an exam.  |              |
| 17. I can change negative moods into positive ones by controlling my thinking.                             |              |
| 18. Uncontrollable events like illness, cheating classmates, and bad teachers get me very upset. (R)       |              |

Positive cognition = 1, 3, 5, 7, 10, 14, 18. Drive/determination = 2, 4, 6, 11, 15. Visualisation = 8, 12, 16. Impression management = 9, 13, 17.  
 (R) = reverse scoring required.

## Appendix B

### Participant information

Dear Participant,

You are invited to participate in the research project described below.

#### **What is the project about?**

This research project will be exploring a range of factors which influence University students' academic outcomes. Specifically, we will be looking at perceptions of threatening world events (i.e. terrorism, climate change related disasters, pandemics), mental toughness, stress, psychological well-being and ill-being, and hope. The main aim of this research project is to explore the relationships between these variables and academic outcomes. We also aim to gain an understanding of which factors mediate these relationships.

#### **Why am I being invited to participate?**

You are being invited to participate in this study because you are enrolled in Psychology 1A of Semester 1 at the University of Adelaide and are eligible to receive course credit for research participation. You are also being invited to participate if you are between the ages of 18 and 21 years old.

#### **What am I being invited to do?**

You are being invited to undertake a two-part online survey which involves a range of measures relating to our variables of interest. Part 1 of the survey includes a demographics questionnaire, a non-verbal intelligence task, and a measure assessing the Big Five personality traits. Part 2 of the survey includes a questionnaire looking at perceptions of threatening world events, and scales assessing mental toughness, stress, psychological well-being, psychological ill-being and hope. Both Part 1 and Part 2 of the survey need to be completed in order to receive course credit.

#### **How much time will my involvement in the project take?**

Part 1 and part 2 of the survey will take a total of 45 minutes – 1 hour to complete. Once you have completed the two-part online survey, you will receive 1 course credit for your research participation. There is an automatic save and continue feature for this questionnaire. Every time you select the next arrow in the bottom right hand corner of your screen your progress is saved. If you wish to take a break and come back to the survey you can simply exit and return to the point you exited when you are ready.

#### **Are there any risks associated with participating in this project?**

This research project involves some inconvenience relating to giving up time to fill out the online survey. The survey has purposefully been separated into two parts to minimise the inconvenience of undertaking one time-consuming survey for an extended period. There is also the potential for some discomfort to arise when undertaking the scale relating to psychological ill-being in part 2 of the survey. This may be especially relevant to participants who have had personal experiences with mental health issues. If any discomfort is evoked,

we encourage you to contact the University of Adelaide counselling service. If you would feel more comfortable reaching out to an external service, we equally encourage this alternative. Contact information for these support services is listed below:

University of Adelaide Counselling Services

Web Address: <https://www.adelaide.edu.au/counselling/access-counselling-support>

Phone: 08 8313 5663

Lifeline Australia

Web Address: <https://www.lifeline.org.au/>

Phone: 131 114

Beyond Blue

Web Address: <https://www.beyondblue.org.au/>

Phone: 1300 22 4636

### **Can I withdraw from the project?**

Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time up until submission of the two-part online survey. Once you have submitted the two-part survey, withdrawal from the study is no longer viable. Note that if you complete part 1 of the survey and withdraw before completing part 2, you will not receive course credit. However, this will not affect your ongoing treatment at the University of Adelaide or your freedom to participate in other research projects.

### **What will happen to my information?**

**Confidentiality and privacy:** All data will be de-identified to ensure participant confidentiality and anonymity. Participants will be asked to report their unique research participation number and student identification number. However, this will be for the purpose of receiving course credit, not for data analysis or publishing.

**Storage:** All data will be stored on a password protected device on a secure data collection website. The people who will have access to this data are the student researchers, XXXX and XXXX, and the research supervisor, XXXX. Data will be retained by the University of Adelaide for a minimum of 5 years.

**Publishing:** The information collected for this research project will be used to develop a research thesis for the Honours Degree of Bachelor of Psychological Science at the University of Adelaide. The research thesis will be presented to the University of Adelaide Honours cohort. There is also the potential for journal publication. However, raw data will not be reported, thus, participant identification will not be available to the public.

**Sharing:** If you would like to receive a summary of the findings once the research project is complete, you are welcome to request this by emailing XXXX, XXXX, or XXXX. Email addresses are listed at the end of this information and consent section.

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

**Who do I contact if I have questions about the project?**

If you have any questions about the research project you are welcome to contact any of the researchers listed in this information sheet. Keep in mind that the research supervisor, XXXX, is the primary contact. Alternatively, you may contact the Chair of the Ethics Committee at the University of Adelaide, XXXX or student researchers XXXX and XXXX. Contact information is listed below.

**Researcher contact details**

Research Supervisor, XXXX

Email: XXXX

Honours Student Researcher, XXXX

Email: XXXX

Honours Student Researcher, XXXX

Email: XXXX

**What if I have a complaint or any concerns?**

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-20-19). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact the Human Research Ethics Committee's Secretariat on:

Phone: +61 8 8313 6028

Email: [hrec@adelaide.edu.au](mailto:hrec@adelaide.edu.au)

Post: Level 4, Rundle Mall Plaza, 50 Rundle Mall, ADELAIDE SA 5000

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

**If I want to participate, what do I do?**

Thankyou for taking the time to consider participating in this research project. If you agree to the above and wish to complete this survey please select YES below and enter your Student Identification Number and Research Participation Number (RPS), without these you will be unable to receive course credit for your participant. You will then be directed to begin the survey.



## Appendix C

## Variables descriptive statistics

| Variables                     | Statistic            |  |                           |                           |                           |                           |
|-------------------------------|----------------------|--|---------------------------|---------------------------|---------------------------|---------------------------|
|                               | Mean<br>( <i>M</i> ) | Standard<br>Deviation<br>( <i>SD</i> ) | Min.<br>possible<br>score | Max.<br>possible<br>score | Min.<br>score<br>recorded | Max.<br>score<br>recorded |
| Conscientiousness             | 38.25                | 6.71                                   | 9                         | 54                        | 22                        | 51                        |
| Intelligence (Raven's<br>APM) | 7.08                 | 2.78                                   | 0                         | 12                        | 0                         | 12                        |
| Mental Wellbeing<br>(EPOCH)   | 68.03                | 12.39                                  | 5                         | 25                        | 9                         | 24                        |
| Mental Illbeing (DASS-<br>21) | 20.12                | 12.36                                  | 0                         | 63                        | 0                         | 50                        |
| Positive Cognition            | 20.84                | 5.13                                   | 7                         | 35                        | 9                         | 34                        |
| Drive/Determination           | 17.54                | 3.98                                   | 5                         | 25                        | 7                         | 25                        |
| Visualisation                 | 8.94                 | 2.74                                   | 3                         | 15                        | 3                         | 15                        |
| Impression<br>Management      | 10.28                | 1.92                                   | 3                         | 15                        | 6                         | 15                        |
| Academic Achievement          | 82.39                | 9.00                                   | 0                         | 100                       | 56                        | 96                        |

*Note.* N = 124 for all variables excluding Academic Achievement for which N = 116.

## Appendix D

## Academic Mental Toughness item correlations

| Items | Items |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |    |  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|----|--|
|       | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14    | 15    | 16    | 17  | 18 |  |
| 1     | 1     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |    |  |
| 2     | .18*  | 1     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |    |  |
| 3     | .57** | -.03  | 1     |       |       |       |       |       |       |       |       |       |       |       |       |       |     |    |  |
| 4     | .20*  | .60** | -.03  | 1     |       |       |       |       |       |       |       |       |       |       |       |       |     |    |  |
| 5     | .55** | .41** | .28** | .37** | 1     |       |       |       |       |       |       |       |       |       |       |       |     |    |  |
| 6     | .25** | .43** | .02   | .43** | .53** | 1     |       |       |       |       |       |       |       |       |       |       |     |    |  |
| 7     | .56** | .27** | .43** | .21*  | .52** | .37** | 1     |       |       |       |       |       |       |       |       |       |     |    |  |
| 8     | .07   | .05   | -.02  | .07   | .20*  | .41** | .08   | 1     |       |       |       |       |       |       |       |       |     |    |  |
| 9     | .32** | .31** | .11   | .35** | .43** | .33** | .32** | .12   | 1     |       |       |       |       |       |       |       |     |    |  |
| 10    | .67** | .06   | .39** | .16   | .44** | .31** | .53** | .14   | .30** | 1     |       |       |       |       |       |       |     |    |  |
| 11    | .14   | .55** | -.04  | .61** | .31** | .48** | .22*  | .19*  | .36** | .18*  | 1     |       |       |       |       |       |     |    |  |
| 12    | .15   | .08   | .03   | .22*  | .16   | .12   | .15   | .46** | .12   | .08   | .29** | 1     |       |       |       |       |     |    |  |
| 13    | .23*  | .40** | .01   | .41** | .27** | .31** | .23** | .11   | .29** | .15   | .36** | .22*  | 1     |       |       |       |     |    |  |
| 14    | .53** | .34** | .29** | .38** | .65** | .48** | .59** | .24** | .40** | .53** | .36** | .24** | .46** | 1     |       |       |     |    |  |
| 15    | .41** | .39** | .08   | .44** | .46** | .55** | .45** | .24** | .24** | .41** | .51** | .25** | .45** | .61** | 1     |       |     |    |  |
| 16    | .24** | .27** | .02   | .37** | .29** | .40** | .25** | .38** | .18*  | .22*  | .44** | .37** | .22*  | .41** | .51** | 1     |     |    |  |
| 17    | .49** | .16   | .33** | .19*  | .48** | .25** | .33** | .14   | .16   | .33** | .26** | .11   | .22*  | .48** | .42** | .35** | 1   |    |  |
| 18    | .24** | -.05  | .31** | -.15  | .14   | .03   | .13   | -.15  | .03   | .22*  | -.04  | -.17  | -.04  | .05   | .05   | .19*  | .13 | 1  |  |

Note. \*\* represents significance at the .01 level and \* represents significance at the .05 level.