

Academic Buoyancy: Investigating Measures and Developing a Model of
Undergraduates' Everyday Academic Resilience

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Statement of Authorship

I declare that this dissertation is the result of my own work. It has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

Signed:.....

Date:.....

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Abstract

Undergraduates face numerous challenges and pressures in pursuing a degree. This study explored variables and measures which can be used to assess and predict undergraduates' everyday academic resilience (i.e., academic buoyancy) and confirmed the nature of some key relationships between variables. This provides important insights for researchers, higher education providers and psychological practice with specific directions for policy and praxis. This study primarily aimed to test a model which maps undergraduates' academic buoyancy. The secondary objective was to assess the reliability and validity of the measures Martin, Marsh and colleagues (2007, 2008a) used to investigate high school students' academic buoyancy. Undergraduates ($n = 236$) aged 18 to 55 were recruited via snowball sampling to complete an online questionnaire comprising a battery of measures assessing psychosocial and educational variables. Acceptable ($> .70$) to excellent ($> .90$) internal consistency values were found for each measure investigated, while four of the six measures used by Martin, Marsh and colleagues demonstrated strong to very strong convergent validity with other psychometrically validated measures of the same construct. Support for the theoretical model was found using structural equation modelling, highlighting specific variables (parental attachment, self-efficacy, anxiety, control and engagement) which could constitute the basis for effective intervention. Suggestions for psychological and educational policy and praxis are offered for universities and individual students. Directions for future research could include stratified-random sampling, multiple sources of data and a longitudinal design to qualify results and increase generalisability. Research aimed at developing and testing effective applications of these findings is recommended.

Academic Buoyancy: Investigating Measures and Developing a Model of Undergraduates' Everyday Academic Resilience

All undergraduates face academic pressures, but vary greatly in how they manage them. Some students become discouraged and give up, while others rise to the challenges and realise their full potential. If, as Masten (2001) argued, resilience relies on basic human adaptational processes, why do some students, when encountering everyday academic pressure, falter and fall into maladaptive patterns of underachievement, while others adapt and ultimately succeed? Despite the daily difficulties of academic life, many students effectively manage and navigate through everyday challenges. What are the factors which enable this to occur and what can universities do to promote academic valour in their students? Over 40 years of research in the area of resilience has provided a solid basis for inquiry into undergraduate students' everyday academic resilience.

Resilience broadly refers to “the ability to bounce back in the face of adversity” (Prince-Embury, 2008, p. 4). Resilience thus implies both the experience and overcoming of considerable threats or major adversity (Luthar, Cicchetti, & Becker, 2000). Typically, resilience research has focused on major challenges or threats of substantial consequence, not addressing that deemed to be small and inconsequential (Martin & Marsh, 2009). Thus, research into resilience has predominantly explored the interplay between protective factors and risk in high-risk populations (e.g., clinical, minority, abused and substance abusers). Recent findings have suggested that resilience is highly complex and contextual, resulting from dynamic interactions between individuals and particular environments (Cassen, Feinstein, & Graham, 2009). While

many protective or mitigating factors are implicated, resilience research has focused particularly on intellect (e.g., Mayer & Faber, 2010), temperament (e.g., Smith & Prior, 1995), autonomy (e.g., Masten et al., 2004), sociability (e.g., Luthar & Zigler, 1991), self-reliance (e.g., Polk, 1997) family environment (e.g., Black & Lobo, 2008) and peer relationships (e.g., Criss, Pettit, Bates, Dodge, & Lapp, 2002). This study focused on the role of such factors in students' everyday academic resilience.

Academic resilience denotes "student's capacity to overcome acute or chronic adversities that are seen as major assaults on educational processes" (Martin & Marsh, 2009, p. 353). Similarly, students characterised as academically resilient maintain a high degree of achievement motivation and performance, overcoming the adversities and pressures that could make them susceptible to poor performance or even school drop-out (Alva, 1991). Research has demonstrated that students who are academically resilient have superior confidence and self-efficacy, healthier self-concepts, better self-esteem, and a greater capacity for engagement (Kanevsky, Corke, & Frangkiser, 2008).

The concept and study of resilience originated from earlier research into psychopathology, coping and stress (Condly, 2006). Thus, inquiry into resilience emerged from the quest to understand, prevent and treat mental illnesses (Tusaie & Dyer, 2004). Pioneers of resilience research claimed that examination of children who were able to successfully adapt in the face of significant adversity was critical to the formation of accurate and comprehensive aetiological theories in psychopathology, and empirically-based intervention and policy (Garmezy, 1971; Rutter, 1979). Their proactive approach has served as a catalyst for four decades of inquiry, producing a

large quantity of data, methods and models concerning the phenomenon of resilience (Masten, 2001)

Masten (2007) outlined that resilience research has undergone four waves. The first attempted to identify its correlates, the second sought to understand the processes which undergirded these correlates, and a third focused on prevention and intervention. She indicated that the fourth wave of research, assisted by developing technology, is now moving towards a systems approach which seeks to describe the mechanisms by which, and levels in which, resilience operates. This current wave attempts to map the dynamic interplay of adaptive and change processes within the systems in which individual development is embedded (e.g., families, educational institutions and social networks) via multiple levels of analysis (e.g., physiological, psychological, sociological and ecological). In this vein, resilience broadly refers to the ability of dynamic systems to resist or recuperate from considerable threat or major adversity. Consequently, an objective of this study was to add to the fourth wave of resilience research by investigating the relationships between constructs across multiple systems; namely, individual, family and educational systems.

Although there is a current emphasis on understanding resilience processes across multiple systems, research into resilience has generally focused on positive adaptation in response to major adversity. In querying the percentage of students for whom typical academic resilience research is relevant, multiple sources have confirmed the likelihood that most students face minimal levels of adversity. First, Walker, Cheney, Stage, Blum and Horner (2005) indicated that approximately 5% of students face substantial adversity, while approximately 10% to 15% of students undergo a

moderate level of adversity. They indicated that the majority of students (approximately 80%) encounter low, though still problematic, levels of adversity. Secondly, in a study involving over 14, 000 15-year-old Australian students, 60% of Indigenous students, 73% of students living in remote areas and 77% from low socioeconomic backgrounds achieved above the baseline proficiency level for scientific, reading and mathematical literacy (Thomson & Bortoli, 2008). Third, most Australians rated their health as excellent, very good or good, according to findings from the last three ABS National Health Surveys (Australian Bureau of Statistics, 2010). Fourth, research has indicated that four out of five Australians are free from significant mental health concerns (Australian Bureau of Statistics, 2007). Fifth, data collected in 2004 by the Australian Institute of Health and Welfare (2007), indicated that 62% of Australians aged 14 years and over had never used an illicit drug (85% in the last 12 months). Since typical resilience research has addressed major adversity which is relevant for only a small proportion of students, its applicability to the majority of students who face lower levels of adversity has been considerably restricted.

The limited applicability of typical academic resilience research for the general student population is further illustrated by the fact that the majority of research within the relatively small body of literature on academic resilience has focused on students at risk of substance abuse and drop-out (e.g., McMillan & Reed, 1994), gang violence (e.g., Catterall, 1998), students with learning disabilities (e.g., Miller, 2002) and ethnic minorities facing significant difficulties such as poverty (e.g., Gizir & Aydin, 2009) and abuse (e.g, Perkins & Jones, 2004). Martin and Marsh (2009) argued that, while such conventional constructions and operationalisations of resilience are important for those

select few facing substantial adversity, they hold little value for the greater proportion of students who contend with the common adversities of daily life. In order to overcome this discrepancy, Martin and Marsh (2008a) proposed the concept of academic buoyancy.

Resilience versus Buoyancy

Academic buoyancy has been defined as “students' ability to successfully deal with academic setbacks and challenges that are typical of the ordinary course of school life (e.g., poor grades, competing deadlines, exam pressure, difficult schoolwork)” (Martin & Marsh, 2008a, p. 54). Martin and Marsh (2009) differentiated between academic resilience and academic buoyancy in several important ways. Firstly, by definition, academic resilience deals with extreme adversity, whereas academic buoyancy encompasses everyday demands and hassles. Secondly, regarding sampling, academic resilience applies to the minority of students who face extreme circumstances, whereas academic buoyancy relates to the majority of students responding to the challenges experienced in daily life. Thirdly, in relation to intervention, academic buoyancy is considered a corollary of academic resilience, and therefore the two can be mapped hierarchically. Thus, fostering students' ability to manage and overcome daily pressures and hassles may have important implications for helping them withstand struggles of a more serious nature. Similarly, if those students experiencing extreme adversity are able to boost their capacity to deal with the more ordinary challenges of life, this may work to offset the severity of more significant threats.

A further distinction between academic resilience and academic buoyancy, posed by Martin and Marsh (2009), pertains to what they termed ‘differences of degree’ and

'differences of kind'. Differences of degree delineates between the chronic and debilitating nature usually associated with academic resilience; and the more common experience of daily stress, pressure and threats to confidence associated with academic buoyancy. Differences of kind delineates between major effects such as depression, emotional estrangement, social isolation and rebellion associated with academic resilience; and the more common challenges on students' confidence, motivation and engagement in everyday academic life associated with academic buoyancy.

In line with Martin and Marsh's (2008a, 2009) delineation between resilience and buoyancy, and given that the traditional resilience concept is not applicable to the majority of students confronted with everyday challenges, impediments and stress, this study sought to address these gaps. Additionally, and in consideration of the plausible significance of buoyancy, it was important to gain a deeper understanding of this phenomenon, which in turn can inform policy, educational praxis and intervention. Specifically, this study set out to identify prominent predictors of academic buoyancy in undergraduate students.

While a small number of studies have examined high school students' academic buoyancy, to date no enquiry has considered an undergraduate population. Despite noteworthy increases in undergraduate enrolments over the last 20 years, and the implementation of an array of programs designed to enhance students' capacity to realise their full potential, numerous studies have confirmed that low academic achievement and high rates of attrition prevail (e.g., Hsieh, Sullivan, & Guerra, 2007; Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008). Undergraduates encounter manifold challenges, pressures and stresses because of the requirements on them to complete

structured activities in their pursuit of passing assessments and obtaining a degree (Salanova, Schaufeli, Martinez, & Bresó, 2009). Stressors which undergraduates face have been categorised as self-imposed, time-related, health-related, financial and academic. They include such things as mastering a large amount of content in a small time frame, studying for and taking exams, completing assessments and grade competition (Misra & McKean, 2000). Therefore, in focusing on an undergraduate demographic, this study addressed a pertinent gap in the research literature and has contributed to practical discussions of how to improve policy, teaching and learning in higher education.

This study therefore primarily set out to develop and validate a theoretical model to explain the relationships between constructs that contribute to undergraduates' academic buoyancy. To this end, a review of existing research was undertaken to identify the most pertinent predictors of academic buoyancy and to determine the structure of the model. Having established the hypothesised model a definition and overview of each predictor was provided. Appropriate measures were then identified to test the theoretical model. As such, a further objective of this study was to assess each measures' reliability and validity.

Developing a Model of Undergraduates' Academic Buoyancy

Since the construct of academic buoyancy has been recently proposed, and given that no research has applied it to an undergraduate population, existing research pertaining to academic resilience and its related constructs was examined. Although a wide range of predictive factors have been investigated, the research literature commonly distinguishes between distal and proximal factors, with studies typically

focusing on one or the other (Bottrell, 2009). Martin and Martin (2002) outlined that proximal factors concern recent life experiences or currently available resources (e.g., psychological, educational, family and peer factors), whereas distal factors refers to significant experiences from the individual's personal history which impact on current events (e.g., low socioeconomic status, minority status, single-parent households). Research findings have shown that proximal factors can be treated more effectively in intervention, having greater potential to yield positive change (Cappella & Weinstein, 2001; Masten, Best, & Garnezy, 1990). Proximal factors were therefore the chosen foci for the present study.

In general, proximal factors can be divided into three categories: (1) psychological factors, (2) school-based factors, and (3) family and peer factors. Psychological factors include intellect, temperament, self-efficacy, locus of control, self-esteem and motivation (Condly, 2006; Rouse, 2001). School-based factors include opportunity for participation, academic achievement, enjoyment of school, positive teacher influences and co-curricular activity (McMillan & Reed, 1994; Prince-Embury, 2008). Family and peer factors include family warmth, emotional support, cohesion, positive attachment style, close bond with at least one caregiver, pro-social attitudes, responsiveness to others, and supportive peers (Cowan, Cowan, & Mehta, 2009; Gardner, Dishion, & Connell, 2008). A consideration of existing research was therefore undertaken to determine which of these factors would most directly predict undergraduates' academic buoyancy.

One of the most comprehensive studies regarding academic resilience was completed by Borman and Rachuba (2001). It investigated the suitability of five

models, each with a unique emphasis: (1) individual characteristics, (2) effective schools, (3) school resources, (4) peer groups, and (5) supportive school communities. To assess the models, 40,000 first, third, and seventh grade students completed questionnaires annually over a four-year period. While they reported that two of the five models accounted for most variance in students' academic resilience (the individual characteristics model and the supportive school community model), figures are not provided. Key individual factors included engagement, locus of control, and self-efficacy ($F(5, 915) = 147.87, 37.09, 19.39$, respectively; $p < .001$), while a significant supportive school community factor was found to be the strength of the student-parent attachment ($F(3, 917) = 12.94, p < .001$).

Martin and Marsh (2006, 2008a) provided a second set of research findings pertinent to the focus of this study. In 2006 they proposed a model of academic resilience which mapped its psychological and educational correlates. They examined predictive factors of academic resilience in 402 year 11 and 12 students. The analysis revealed that self-efficacy, planning and persistence positively predicted academic resilience, whilst anxiety and uncertain control were negative predictors. The latter have been termed 'cognitive mufflers' as they impede cognitive functioning and constrain motivation and engagement (Martin, 2010). Anxiety, a cognitive muffler, was found to be the strongest (negative) predictor of the five ($\beta = -.63, p < .05$).

Having proposed the construct of academic buoyancy, Martin and Marsh (2008a) investigated whether factors which predicted academic resilience would also predict academic buoyancy. Using similar materials and analysis to those of their 2006 research they sampled 598 year 8 and 10 students. Self-efficacy, engagement and

anxiety (a cognitive muffler) were similarly found to significantly predictor academic buoyancy ($\beta = .25, .12$ and $-.68$, respectively; $p < .05$). They reported that of the three, the bulk of the variance in academic buoyancy was accounted for by anxiety.

Although Martin and Marsh's research in 2006 and 2008a investigated several key factors shown to be linked with academic resilience, additional factors have been implicated by existing research. One such factor, in line with the aforementioned study by Borman and Rachuba (2001), found to have considerable bearing on undergraduates' academic resilience was parental attachment. A considerably large body of research has documented the substantial impact that parents have on their child's experiences of and outcomes from school, college and university (e.g., Cowan et al., 2009; Fass & Tubman, 2002; Mattanah, Hancock, & Brand, 2004). Indeed, attachment theory holds that the quality of parent-child attachment plays a critical and foundational role in the development and actualisation of an individual (Bowlby, 2005; Cassidy & Shaver, 1999). In contrast with early theorists of adolescent development (e.g., Erikson, 1956) who argued that strong parental attachment was not a prerequisite for the attainment of adult competence, more recent research has suggested that persons who maintain strong parental ties throughout adolescence into adulthood have greater self-confidence, lower anxiety and greater capacity for skill acquisition (Cutrona, Cole, Colangelo, Assouline, & Russell, 1994; Mattanah et al., 2004). In fact, in a sample of 3450 students from year 7 to 12, Martin and Marsh found that the quality of students' relationships with their parents had a significant ($\beta = .27$; $p < .001$) influence on their academic resilience (see Martin, Marsh, McInerney, Green, & Dowson, 2007). It was

therefore expected that parental attachment would influence undergraduates' academic buoyancy.

Indeed, numerous studies have confirmed the importance of quality parent-child attachment in undergraduates' academic coping and achievement, with findings from several of these studies reported below. First, a series of 3 studies was conducted by Cutrona et al. (1994) involving 796 undergraduates. Utilising structural equation modelling, the main finding was that, when academic aptitude, family achievement orientation, and family conflict were controlled for, parental attachment, but not peer or romantic attachments, significantly predicted academic performance ($\beta = .14, p < .05$). Second, in a sample of 408 undergraduates aged 17 to 27, it was found that good communication with parents and feelings of connectedness to parents not only enhanced psychological well-being, but also significantly predicted ($\beta = .14$ and $.15$, respectively; $p < .05$) students' capacity to cope with educational pressures and experience academic success (Wintre & Yaffe, 2000). Finally, in a sample of 357 undergraduates aged 18 to 24, Fass and Tubman (2002) stated that students who reported moderate to strong parent-child attachment were more likely to achieve higher academic outcomes and possessed greater college-related psychosocial competence. In contrast, undergraduates who reported weak attachment levels demonstrated diminished academic success and low psychosocial competence. It therefore seemed important to include parent attachment as a predictor of undergraduates' academic buoyancy.

Several inferences were made from the literature review, informing the factors to be included in the formation of a hypothesised model. First, a focus on proximal predictors is warranted due to their greater intervention efficacy (Cappella & Weinstein,

2001). Second, a recognition of the three broad categories of proximal factors and of key research findings necessitates their inclusion in a model that would adequately account for students' responses to everyday academic challenges and stress (Borman & Rachuba, 2001; Martin & Marsh, 2006, 2008a). Proximal factors found most likely to be related to the school-based factor (undergraduates' academic buoyancy), consisted of psychological factors (that include self-efficacy, engagement and cognitive mufflers: control and anxiety), and family factors (that include parental attachment). The inclusion of parental attachment as a meaningful predictor of undergraduates' academic buoyancy was affirmed by findings from Cutrona et al. (1994), Wintre and Yaffe (2000) and Fass and Tubman (2002). In summary, the reviewed literature has pointed to a model in which academic buoyancy was predicted by parental attachment, self-efficacy, anxiety, control and engagement.

Having identified potential predictors of academic buoyancy, the question then arose as to the layout of the hypothesised model. An important consideration in determining the model, other than its factors, was its arrangement. Although the aforementioned studies by Borman and Rachuba (2001), and Martin and Marsh (2006, 2008a) directly mapped each of the factors onto buoyancy, several studies have suggested that a number of the factors under investigation have intermediary roles.

Although there is a small body of research which has considered antecedents and mediators of resilience, it has not been an explicit focus for the majority of resilience research. In a critical evaluation of research regarding resilience, Luthar et al. (2000) claimed that there was a lack of consensus and varying findings regarding the antecedents of resilience and that future research should seek to clarify its antecedents.

Further, Olsson et al. (2003) contended that research into resilience which fails to include antecedents and mediators is unable to adequately account for the influence of protective mechanisms and therefore is likely to attain an over-simplified picture of resilience. While antecedent and mediatory conditions clearly exist, it was noticeable that they had not received much attention in the research literature. Therefore, on the basis of findings from Luthar et al. and Olsson et al., an important gap to be addressed in the research relates to the antecedents and mediators of resilience. Further, a limitation of Borman and Rachuba's (2001), and Martin and Marsh's (2006, 2008a) research was that antecedents or mediators of academic buoyancy were not considered. The current study sought to address these gaps and extend previous research by including antecedent and mediatory conditions.

Numerous studies and authors have pointed to a model of undergraduates' academic buoyancy which contains antecedent and mediatory conditions, several of which are now discussed. First, the aforementioned study by Cutrona et al. (1994) also found that high self-efficacy mediated the relationship between parental attachment and academic achievement. Second, Zimmerman (1997) argued that the development of an individual's self-efficacy, within the framework of parental attachment, significantly influences psychological factors (including anxiety, control and engagement), and ultimately determines academic accomplishment. Third, Chorpita and Barlow's (1998) review of findings in the area of anxiety, control, parenting, attachment theory, stress and resilience suggested that secure parental attachment promotes exploration of self and achievement mastery, which in turn promotes engagement and reduces the potential for anxiety and uncertain control. Fourth, research findings have indicated that low self-

efficacy is one of a number of pathways which leads to anxiety and uncertainty of control (e.g., Bandura, Pastorelli, Barbaranelli, & Caprara, 1999; Chemers, Hu, & Garcia, 2001). Finally, findings from Ransom, Ammerati, Nowicki and Osborn (2007) have suggested that coping strategies and sense of control develop in the context of parental attachment, are directly linked to a person's beliefs about their academic capabilities, and thereby influence academic success.

The Hypothesised Model

Existing research findings have therefore pointed to a model (displayed in Figure 1) in which (a) parental attachment is an antecedent of undergraduates' self-efficacy; (b) self-efficacy mediates the relationship between parental attachment and students' anxiety, control and engagement; and (c) anxiety, control and engagement mediate the relationship between self-efficacy and academic buoyancy. In line with Martin and Marsh's (2006, 2008a) research and theoretical conceptualisation, it was deemed efficacious to combine anxiety and control into one latent (negative) predictor entitled 'cognitive mufflers'.

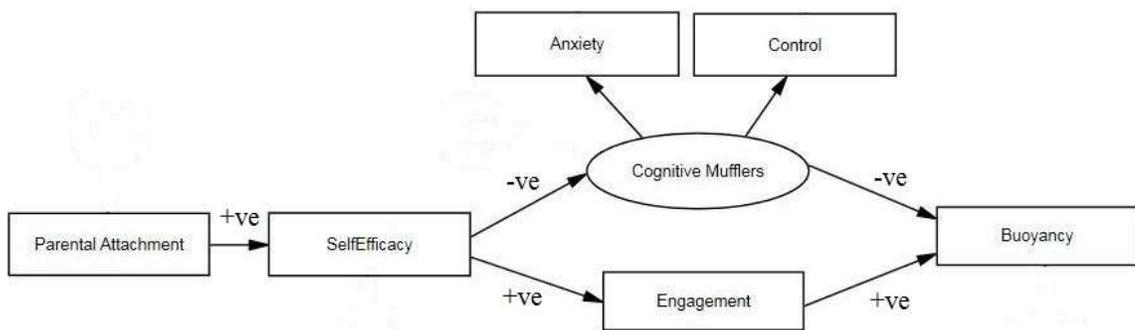


Figure 1. Hypothesised model of undergraduates' academic buoyancy.

An Overview of Each Predictor

Having established the hypothesised model this section provides an overview of each predictor. Each predictor within the model is defined and described in turn, and its role within the phenomenon of buoyancy is discussed.

Parental attachment has received considerable attention in the resilience literature as it has been found to be the most prominent predictor of adaptive functioning (Kumpfer & Summerhays, 2006; Luthar, Sawyer, & Brown, 2006). Parents uniquely influence their children (e.g., beliefs, values, pursuits), being either a source of resilience or risk (Condly, 2006). Hence, parents have a central role in the development of their children, with parent-child attachment accounting for a large portion of an individuals' developmental and resilience outcomes (Stanley, 2010). Parental attachment has been defined as "an enduring emotional bond that forms between the parent and the child across the life span" (Mattanah et al., 2004, p. 214). Soucy and Larose (2000) indicated that secure attachment is cultivated when a parent notices their child's distress and responds to it; conversely insecure attachment develops when a parent is unresponsive to their child's distress or responds inconsistently. Attachment theory holds that how parents respond to the early experiences of their child's insecurity advances either secure or insecure cognitive representations (i.e., schemas; Cummings-Robbeau, Lopez, & Rice, 2009). Research has suggested that a secure attachment with one or both parents facilitates the formation of a positive self-concept, the expectation of positive and supportive relationships with others, and promotes exploration and skill acquisition (Cutrona et al., 1994; Mattanah et al., 2004). Hence, parental attachment was considered

a potential determinant of undergraduates' capacity to successfully manage and overcome academic demands and hassles.

Self-efficacy, a contextualised mechanism of human agency, is thought to underpin all facets of an individuals' well-being, motivation and accomplishment, across age and diverse functional settings (Bandura, 1993; Pajares, 2006). Academic self-efficacy refers to "beliefs about one's capabilities to learn or perform behaviours at designated levels" (Schunk & Pajares, 2002, p. 2). Unless an individual believes they are capable of producing the desired results through their own actions, they retain little incentive to apply themselves or persevere when encountering difficulties or adversity (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001). Academic self-efficacy therefore shapes individuals' pursuits, the amount of effort expended in those pursuits, and the duration of persistence when facing obstacles and pressure (Bandura, 1997; Choi, 2005; Gore, 2006). Research has shown that self-efficacious students typically are more ready to participate, work harder, possess higher expectations, pursue more ambitious goals, persevere longer, achieve a higher standard and are less likely to respond with detrimental emotional reactions when facing difficulties or adversity (e.g., Schunk & Pajares, 2002; Zimmerman, 2000). Additionally, students with higher self-efficacy more frequently enter into problem solving (i.e., consider and assess alternate solutions) when they initially fail, whereas students low in self-efficacy generally focus on their shortcomings and perceive circumstances to be more difficult than they actually are (Martin & Dowson, 2009). Therefore, for undergraduates to achieve to a high standard in the face of academic difficulties and pressure, it is imperative that they not only

develop the ability and skills needed to complete specific tasks, but also a strong conviction of their ability to successfully complete tasks (Hsieh et al., 2007).

Cognitive mufflers constrain and impede students' motivation and engagement via maladaptive cognitions (Martin, 2009). Two pertinent cognitive mufflers are anxiety and uncertain control (Martin, 2007, 2008). Martin (2010) indicated that academic anxiety refers to students' feelings of nervousness (feeling uneasy when they think about coursework) and worrying (e.g., fear of doing poorly on assessments), while uncertain control refers to the degree to which students perceive they are capable of avoiding failure and attaining success. Regarding anxiety, if an individual believes circumstances to be threatening, and that they possess insufficient resources to manage the threat, stress (including anxiety) results and the individual attempts to escape the situation (Milgram & Toubiana, 1999). Eysenck, Derakshan, Santos and Calvo (2007) indicated that anxiety inhibits attentional control and increases the time an individual spends attending to threat-related stimuli. Hence, low grades can result from excessive anxiety, while conversely, low grades can themselves cause anxiety (Mazzone et al., 2007). Concerning uncertain control, Martin (2010) claimed that students who perceive that they possess little or no control over educational outcomes become increasingly uncertain of their ability to prevent failure and achieve success. Consequently, he contended that students may resort to counterproductive behaviour (e.g., self-sabotage) or ultimately give up (e.g., learned helplessness). In comparison, students who perceive that they have a great deal of control over their academic achievement are more likely to be optimistic, motivated, persistent, utilise more effective study strategies and take pride in their academic endeavours (Ruthig, Haynes, Stupnisky, & Perry, 2009; Shell &

Husman, 2008). A considerable body of research (Bandura et al., 1999; Chorpita & Barlow, 1998; Martin & Marsh, 2008a; Perry, Hall, & Ruthig, 2005) has demonstrated the detrimental impact of both anxiety and uncertain control on students' academic achievement (e.g., impaired memory and cognitive functioning), suggesting a strong link with undergraduate academic buoyancy.

Research has suggested engagement to be directly linked with an individual's level of persistence and their resultant academic achievement (Cole & Denzine, 2002; Pike & Kuh, 2005). Carini, Kuh and Klein (2006) contended that the quantity of time students apply themselves to their course work is indicative of the breadth and depth to which knowledge and skills are learnt and the ensuing level of mastery. Other factors found to influence undergraduates' willingness to engage in coursework include valuing of university (e.g., Bong, 2001), enjoyment of university (e.g., Ruthig et al., 2008) and educational aspirations (e.g., Brint, Cantwell, & Hanneman, 2008). Salanova et al. (2009) defined engagement in the academic context as "a persistent, positive affective-motivational state of fulfilment that includes three aspects: vigour, dedication, and absorption" (p. 2). As engagement has been found to be positively related to persistence and achievement in educational settings, it was likely to be of salience to undergraduate buoyancy.

Measures of Buoyancy and its Predictors

In order to select the best measures for each construct in the hypothesised model this study sought to identify potential measures with good psychometrics and then assess their suitability to test the model. A prevailing issue with psychological tests relates to their capacity to precisely gauge what they are intending to measure (Nunnally

& Bernstein, 1994). Jacoby (1978) stated that “more stupefying than the sheer number of measures is the ease with which they are proposed and the uncritical manner in which they are accepted” (p. 91). Currently, only Martin and Marsh (2008a) have investigated academic buoyancy and the items which they used to assess academic buoyancy were originally designed to assess academic resilience. Also, Martin and Marsh’s inquiry sampled high school students, whereas the present study investigated an undergraduate demographic. As such, and given that the construct of academic buoyancy has been posed only recently, it was deemed valuable for the present study to conduct further assessment of the measures used by Martin, Marsh and colleagues (2006, 2007, 2008a).

Another reason for examining Martin, Marsh and colleagues’ (2006, 2007, 2008a) measures is that they predominantly used brief instruments, with each construct being measured by 4 items, except one construct (engagement) which was measured by 20 items. Although they reported acceptable ($> .70$) to excellent ($> .90$) Cronbach’s alpha values for each of their measures, Streiner and Norman (2003) have argued that it is unwise to accept high values of alpha without close scrutiny. Streiner and Norman outlined that alpha is reliant on the size of the correlations between items and the quantity of items in a scale. Further, they maintained that the combining of scales which measure different constructs into one big scale can serve to inflate alpha. Finally, they asserted that a high alpha can be the result of items within a particular measure asking similar questions in slightly varied forms. It was therefore deemed important to submit the test instruments used by Martin, Marsh and colleagues to further psychometric testing.

One way to evaluate the accuracy of measures is to compare measurements obtained from a new tool with other tools that measure the same construct and have been widely proven to have sound psychometric properties (Mitchell & Jolley, 2007). In order to locate measures with sound psychometrics a comprehensive review of the research literature was conducted using EBSCOhost, OvidSP and Google scholar. As the buoyancy construct and each of the predictor variables were directly related to the undergraduate academic arena it was important to find contextualised measures (e.g., academic self-efficacy, not general self-efficacy). Additionally, it was necessary to find measures which had been previously applied in university-age populations. Consequently, the measures were selected based on their proximity to the construct under investigation and rigour of psychometric evaluation. Although the measures were selected on their merit, some variability was to be expected and should be considered when interpreting results (Kaplan & Saccuzzo, 2009; Kline, 2005). A summary of the psychometric assessments which each of the measures have undergone are presented in the Method section and the items for each measure are included in Appendix A.

An additional reason for scrutinising Martin, Marsh and colleagues' (2006, 2007, 2008a) measures was the considerable influence their research has been having on policy and educational practice in Australia and beyond. A substantial level of funding has enabled them to continue their research, with results being used to shape policy and practice (The University of Sydney, 2010). This is illustrated by the recent awarding of the only education-based Future Fellowship in Australia to Andrew Martin by the Australian Research Council (The University of Sydney, 2009). As researchers who have received government support and have an avenue to affect educational and political

reform, it was considered vital that their findings be based on measures which demonstrate sound reliability and validity.

Based on the aforementioned arguments, one objective of this study was to evaluate the utility and accuracy of the measures Martin, Marsh and colleagues (2007, 2008a) used to research academic buoyancy. Specifically, it sought to compare the internal consistency of Martin, Marsh and colleagues' measures for academic buoyancy, parental attachment, self-efficacy, anxiety, control and engagement against other more comprehensive measures of the same constructs which have demonstrated sound psychometrics. Additionally, it sought to evaluate the convergent validity between Martin, Marsh and colleagues' measures and alternative scales which have previously been used (and psychometrically tested) to measure each of the same constructs. Internal consistency refers to the degree of inter-relatedness among the items of a measure, while convergent validity refers to the degree to which two or more measures of the same construct correlate (DeVon et al., 2007).

In summary, this study sought to explore and expand current understandings of variables and measures which can be used to assess and predict undergraduates' academic buoyancy. Based on existing research findings, prospective predictors of academic buoyancy were identified and a hypothesised model was established. Although a battery of measures were used by Martin, Marsh and colleagues (2007, 2008a) to test their model of academic buoyancy, they sampled high school students, adapted a measure to assess academic buoyancy, and predominantly used brief instruments. For these reasons, and given that the current study investigated an undergraduate sample, further assessment of their measures was warranted. A further

reason for investigating the psychometric qualities of Martin, Marsh and colleagues' measures was to select the best measures to be used in the testing of the model.

Therefore, additional measures for each construct were selected as a means of comparing the psychometrics for each measure and evaluating their utility.

Research Aims and Hypotheses

This study initially aimed to assess the internal consistency and convergent validity of the measures which Martin, Marsh and colleagues used in 2007 and 2008a to assess academic buoyancy and related constructs (parental attachment, self-efficacy, anxiety, control and engagement). The second and central aim of this study was to test a theoretical model which described the relationships between key constructs contributing to undergraduates' academic buoyancy. The suggested model, depicted in Figure 1, contained four predictors: parental attachment, self-efficacy, cognitive mufflers (anxiety and control) and engagement. The present study therefore hypothesised that:

1. Martin, Marsh and colleagues' measures for buoyancy, parental attachment, self-efficacy, anxiety, control, and engagement, when compared with alternative measures of the same construct, would have lower internal consistency scores.
2. Strong (.50 to .69) to very strong (.70+) bivariate correlations would be obtained between Martin, Marsh and colleagues' measures and the additional measures which were used, demonstrating convergent validity.
3. Support would be found for the proposed model in which (a) parental attachment positively predicts self-efficacy; (b) self-efficacy negatively predicts cognitive mufflers and positively predicts engagement; and (c) that cognitive mufflers directly

(negatively) predicts, while engagement directly (positively) predicts, undergraduates' academic buoyancy.

Method

Design

This quantitative study utilised a cross-sectional analysis of undergraduates' self-reported data. As there was no modification of behaviour or condition, findings were descriptive rather than experimental (Mitchell & Jolley, 2007). The battery of variables collected included participant demographic, psychosocial and educational variables.

Participants

The participants were 236 volunteers invited via internet-based snowball sampling to complete an anonymous online questionnaire. Participants were required to be aged 18 or over and currently studying an undergraduate level course. Although 332 people began the questionnaire, 96 responses were incomplete; therefore they were omitted from the analysis. The final sample of which 50% were single and 50% partnered, were aged between 18 and 55 ($M = 25.61$, $SD = 8.88$) and included 70 males (30%) and 166 females (70%). Sample demographics for year of study, mode of study and average grade for subjects completed thus far are shown in Table 1.

Materials

Participants were required to complete an online questionnaire (see Appendix A). The questionnaire contained 203 items, comprised 8 sections and was designed to measure undergraduates' academic buoyancy. A summary of each section within the questionnaire, including the psychometrics of each measure, is presented below.

Table 1

Sample Demographics for Year of Study, Mode of Study and Average Grade (N =236)

Year of Study			Mode of Study			Average Grade		
First	71	(30.1)	Internal	140	(59.3)	Fail	0	(0.0)
Second	42	(17.8)	Distance	60	(25.4)	Pass	43	(18.2)
Third	56	(23.7)	Mixed	36	(15.3)	Credit	101	(42.8)
Fourth	52	(22.0)				Distinction	80	(34.3)
Fifth	12	(5.1)				High Distinction	11	(4.7)
Sixth	3	(1.3)						

Note. Percentages are reported in parenthesis.

Section A – General information.

Participants were asked to report their gender, age, relationship status, year of study, mode of study and average grade for completed subjects.

Section B – Measures used by Martin, Marsh and colleagues to investigate academic resilience and academic buoyancy.

For each of Martin, Marsh and colleagues’ (2007, 2008a) measures used in this study, participants rated themselves on a seven-point Likert scale: 1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Disagree somewhat*, 4 = *Neither agree nor disagree*, 5 = *Agree somewhat*, 6 = *Agree*, 7 = *Agree strongly*. They reported acceptable (.77) to excellent (.93) internal consistency scores for each of their measures, with a mean alpha of .84 (*SD* = .04). In their sample of 598 year 8 and 10 students, Martin and Marsh (2008a) reported a .67 test-retest reliability score over a 3-month interval for academic buoyancy. In relation to validity, research by Martin (2007) and Martin and Marsh (2006, 2008a) using between-network analysis, within-network item-level analysis and

within-network factor-level analysis demonstrated the construct validity of buoyancy and each of the predictor variables: self-efficacy, anxiety, control and engagement.

Additionally, in a sample of 3450 year 7 to 12 students, academic buoyancy was shown to be significantly positively correlated ($p < .01$) with homework completion ($r = .18$), student participation in class ($r = .39$), persistence in the face of adversity ($r = .35$) and enjoyment of school ($r = .36$), and significantly negatively correlated ($p < .01$) with absenteeism ($r = -.08$) and disengagement ($r = -.31$; Martin & Marsh, 2008b). The following reviews each of the measures used by Martin, Marsh and colleagues.

Academic buoyancy was assessed through 4 items (e.g., “I don’t let study stress get on top of me”) which Martin and Marsh used in 2008. These items are four of the six items which Martin and Marsh (2006) developed for their research into academic resilience.

Engagement was assessed through the five factors of persistence, valuing of school, enjoyment of school, class participation and educational aspirations (Martin & Marsh, 2008a). Each factor contained four items. While persistence and valuing of school were intact subscales taken by Martin and Marsh from the Motivation and Engagement Scale – High School (MES-HS; Martin, 2001), the items for enjoyment of school, class participation, and educational aspirations were developed by Martin (2006) for his research into high school students’ goal setting in the academic arena. For the two MES-HS measures, the corresponding items from the Motivation and Engagement Scale – University/College (MES-UC) were used in this research. Sample items for each of the measures include: “If an assignment is difficult, I keep working at it trying to figure it out” (Persistence item), “Learning at university/college is important” (Valuing

of School item), “I like university/college” (Enjoyment of School item), “I get involved in things we do in class” (Class Participation item), and “I intend to complete university/college” (Educational Aspirations item).

Self-efficacy, anxiety and uncertain control were assessed through four-item measures. The items employed by Martin and Marsh (2008) to measure these three constructs were taken from the MES-HS. Similarly, the corresponding items from the MES-UC were used in this study. Sample items for each of the measures included: “If I try hard, I believe I can do my university/college work well” (Self-Efficacy item), “I worry about failing exams and assignments” (Anxiety item), and “I’m often unsure how I can avoid doing poorly at university/college” (Uncertain Control item).

Parent-child relationships were assessed by four items from the Parent Relationships subscale in the Self Description Questionnaire II, originally developed by Marsh (1990). Martin et al. (2007) utilised these items (e.g., “My parents treat me fairly”) in their research into the impact of parental attachment on students’ academic life.

Section C – Academic buoyancy.

The Resilience Scale (RS) was used in this research to measure individuals’ level of academic buoyancy (Wagnild & Young, 1993). Participants were asked to rate themselves for the 25 items (e.g., “I usually manage one way or another”) on a 7-point Likert scale (from 1, *strongly disagree*, to 7, *strongly agree*). Scores ranged from 25 to 175, with scores below 120 signifying low academic buoyancy, 125-145 suggestive of moderately low to moderate academic buoyancy and scores higher than 145 reflecting moderately high to high academic buoyancy.

Wagnild's (2009) review of 12 studies which utilised the Resilience Scale confirmed its validity and reliability, having been used with a broad range of ages (16 to 103) and population and demographic types. For 11 out of the 12 studies, Cronbach's alpha was consistently high, ranging from .85 to .94, demonstrating good internal consistency. She indicated that correlations in the anticipated direction between the Resilience Scale and the Beck Depression Inventory ($r = -.37$), the Life Satisfaction Index ($r = .30$), the Philadelphia Geriatric Center Morale Scale ($r = .28$), and her physical health measure ($r = .26$) have established its concurrent validity.

Section D – Academic self-efficacy.

The Self-Regulated Learning (SRL) subscale from the Multidimensional Scales of Perceived Self-Efficacy (MSPSE) was used to assess academic self-efficacy; a sample item is "How well can you finish homework assignments by deadlines?" (Bandura, 1990). The MSPSE, developed by Bandura (1990), contained 57 items and in its original version asked respondents to rate their perceived capability level on a 7-point Likert scale. In 2006, Bandura argued that a 0-100 response format is more effective in predicting performance because it is more sensitive and respondents tend to avoid extreme positions. This study therefore used the suggested 11-point Likert scale (0 = *cannot do at all*, 50 = *moderately can do*, 100 = *highly certain can do*). Higher scores reflected a stronger belief in one's ability to produce desired academic outcomes.

Although the MSPSE was originally designed for adolescents, several studies have validated its use in undergraduate populations. In accordance with research by Bryant and Fuqua (1997) and Choi, Fuqua and Griffin (2001), this study utilised the 11-item SRL subscale of the MSPSE to assess undergraduates' academic self-efficacy. A

Cronbach's alpha of .87 was reported by both of these studies, signifying good internal consistency. Additionally, the predictive validity of the SRL subscale has been supported. First, in research sampling 102 year 9 and 10 students, Zimmerman, Bandura and Martinez-Pons (1992) found that students' academic self-efficacy was predictive of academic achievement ($r = .56, p < .01$). Second, findings from Zimmerman and Bandura (1994), sampling 95 undergraduates aged from 17 to 20, indicated that academic self-efficacy was predictive of final grades ($r = .38, p < .05$).

Section E – Academic anxiety.

The Adult Manifest Anxiety Scale-College (AMAS-C) was used in this research to measure individuals' level of academic anxiety (Reynolds, Richmond, & Lowe, 2003). The AMAS-C consisted of 42 items and contained 4 anxiety subscales: Worry/Oversensitivity (12 items; e.g., "My feelings get hurt easily"), Physiological Anxiety (8 items; e.g., "I often feel restless"), Social Concerns/Stress (7 items; e.g., "Other people are happier than I") and Test Anxiety (15 items; e.g., "Tests make me nervous"). Additionally, the AMAS-C contained a 7-item Lie scale that was not included in this research due to the length of the total questionnaire. Participants responded to each item via a yes-or-no format. The scores for the four subscales were combined to form a global measure of manifest anxiety (Total Anxiety scale score), with larger scores indicative of a higher level of anxiety.

Reynolds et al. (2003) reported sound psychometrics for the AMAS-C. In the standardisation sample of 818 undergraduates, Cronbach's alpha for the Total Anxiety scale scores was .94 and the subscale scores ranged from .72 to .95, indicating adequate to excellent internal consistency. Test-retest reliability (1-week interval) was adequate to

good, $r = .87$ for the Total Anxiety Scale score and the subscale retest scores ranged from .76 to .83. Regarding construct validity, the aforementioned internal consistency coefficients and the moderate inter-correlations between the anxiety subscale scores (ranged from .36 to .48) implied different but related dimensions of anxiety being represented by the AMAS-C subscales.

Moderate correlations (r ranged from $-.52$ to $.65$) in the expected direction between the AMAS-C subscales and subscales from the Coping Scale for Adults, Multiscore Depression Inventory, Multidimensional Anxiety Questionnaire, the Endler Multidimensional Anxiety Scale, Tennessee Self-Concept Scale: Second Edition, Test Anxiety Inventory and State-Trait Anxiety Inventory confirmed its predictive validity (Lowe, Papanastasiou, DeRuyck, & Reynolds, 2005; Lowe, Peyton, & Reynolds, 2007; Lowe & Reynolds, 2005; Reynolds et al., 2003).

Section F – Academic control.

The Academic Control Scale (ACS) contained 8 items and was used to assess students' perceptions of their ability to influence academic outcomes (Perry, Hladkyj, Pekrun, & Pelletier, 2001). Respondents rated themselves for each item (e.g., "No matter what I do, I can't seem to do well in my courses.") on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Scores ranged from 8 to 40, with scores 12 to 34 signifying 'moderate' academic control and scores 35 and greater reflecting 'high' academic control. Cronbach's alpha was found to be .80 in a sample of 524 college students, representing good internal consistency. Test-retest reliability (5-month interval) signified acceptable stability ($r = .64$, $p < .001$) in a sample of 571 undergraduates aged from 17 to 24 (Hall, Chipperfield, Perry, Ruthig, & Goetz, 2006).

Section G – Academic engagement.

Following the approach by Kuh, Cruce, Shoup, Kinzie and Gonyea (2008), student engagement was assessed by 21 items from the College Student Experiences Questionnaire (CSEQ), the central part of the National Survey of Student Engagement (NSSE) instrument. The NSSE assesses students' participation and level of engagement in effective educational practices that are related to positive learning outcomes (Kuh, 2001). The reliability and validity of the CSEQ has been well documented (see Kuh, 2001; Kuh, 2009; Kuh, Kinzie, Cruce, Shoup, & Gonyea, 2006; Pike, 2006).

Two items asked respondents to indicate the number of hours spent in a typical 7-day week studying and participating in co-curricular activities (0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30 and more than 30). The other 19 items (e.g., "discussed grades or assignments with an instructor") were rated on a 4-point Likert scale ("Very Often", "Often", "Sometimes" and "Never") and equally contributed toward a global measure of student engagement. Higher scores indicated a greater level of engagement in students' academic endeavours.

These 21 items were selected by Kuh et al. (2008) as each has been linked with effective and productive learning qualities through existing student development research. Additionally, these items represented activities and behaviours which institutions are capable of influencing via such things as teaching praxis, resulting in the cultivation of particular forms of student engagement. Kuh et al. (2008) reported Cronbach's alpha as .83 in a sample of 11,420 students from 18 colleges. In an assessment of the NSSE scalelet scores, Pike (2006) found moderate to strong associations in the expected direction between scalelet scores and improvement in

academic achievement, indicating convergent validity (r ranged from $-.44$ to $.80$, $p < .05$). Evidence for discriminant validity was also found by Pike via the comparison of the relationships between scalelet scores and academic achievement, and academic achievement scores and the NSSE benchmarks.

Section H – Parental attachment.

The revised version of the Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987) was used to measure participants' attachment to their parents. Considering the cognitive, affective and behavioural facets of the attachment relationship, the IPPA evaluated three dimensions of attachment: degree of mutual trust (10 items; e.g., "I trust my father"), quality of communication (9 items; e.g., "I tell my mother about my problems and troubles"), and extent of anger and alienation (6 items; e.g., "I feel angry with my father"). The IPPA contained three 25-item subscales, with a subscale for mother, father and peer attachment. As this research was concerned with parental attachment, the Peer Attachment subscale was not used. Subscales were rated on a five-point Likert scale from one (*almost never or never true*) to five (*almost always or always true*). Mother and Father subscale scores were combined to form a final parental attachment score, with higher scores reflecting stronger attachment.

The reliability of the IPPA is supported by previous research. Armsden and Greenberg (1987) reported a .93 test-retest score (3-week interval) in a sample of 27 participants aged from 18 to 20 for parent attachment (combined). Cronbach's alpha was found to be .87 for mother attachment and .87 for father attachment. Although the original scale was developed and tested with adolescents, it has since been well-used with college-aged students. For example, in a 217-strong sample of 18 to 24 year-olds,

Cummings-Robeau, Lopez and Rice (2009) reported Cronbach alphas of .94 for mother attachment and .96 for father attachment (see also Lapsley, Rice, & FitzGerald, 1990; Lee & Hughey, 2001; Mattanah et al., 2004).

The general validity of the IPPA has been supported by findings of previous research. First, in a sample of 10 to 16 year olds, high attachment scores were found to be positively correlated with greater self-esteem and lower levels of depression and antisocial behaviour (Armsden & Greenberg, 1987; Armsden, McCauley, Greenberg, Burke, & Mitchell, 1990; Marcus & Betzer, 1996). Second, in a sample of 12 to 18 year olds, parental attachment scores were found to be moderately correlated with the Family subscale from the Tennessee Self Concept Scale and with subscales from the Family Environmental Scale (Armsden & Greenberg, 1987).

Procedure and Analysis

Following approval from Charles Sturt University's (CSU) ethics committee of this research project (see Appendix B), undergraduates were referred to the online questionnaire located at SurveyMonkey via an internet-based message and web link. Utilising snowballing (i.e., chain referral sampling), a convenience sampling technique, participants were recruited through four main sources: (1) first-year psychology students at CSU required to participate in research, (2) a message on online forums within CSU's student portals (see Appendix C), (3) immediate network of family, friends and colleagues via, and (4) a Facebook group which invited 'friends' to join and participate. In each case, it was requested that the message be forwarded to other known undergraduates, encouraging them to participate also.

On accessing the link, the initial screen provided an overview of the research project (i.e., an information statement) and by clicking on the 'next' button participants provided consent to participate (see appendix A). SurveyMonkey then guided participants through the eight sections of the questionnaire. The questionnaire took approximately one hour to complete and upon completion responses were automatically and anonymously submitted to SurveyMonkey for collection.

The preliminary analysis and screening of the 236 participants' data was conducted in SPSS (version 17) and AMOS (version 18). Of these participants, no cases were found to have missing data. Initially, participants' total scores were computed for each measure. According to scoring procedures, the assigned items were reverse-scored for Martin and Marsh's (2008) parental attachment measure (Martin et al., 2007), the academic control measure (Perry et al., 2001) and the alternative parental attachment measure (Armsden & Greenberg, 1987).

Internal consistency and convergent validity was estimated using version 17 of SPSS, while the hypothesised model of undergraduates' academic buoyancy was tested via structural equation modelling (SEM), using the 236 participants and version 18 of AMOS. SEM was the statistical tool of choice as it is able to simultaneously analyse an entire system of variables in order to establish the degree to which a hypothesised model is consistent with the data (Kline, 2005). An additional advantage of SEM over other analysis methodologies (e.g., path analysis) is that it takes measurement error into account (Byrne, 2010). The design of the hypothesised model was depicted through rectangles (measured variables) and circles (latent variables). Independence of error terms for each variable were specified and factors were correlated via uni-directional

arrows. The proposed model was initially evaluated and subsequently refined on the basis of theoretical constraint and the resultant modification indices before reaching its final form. A range of goodness of fit tests were employed to assess the model fit. Data and output for analyses are included in Appendix D (see attached CD).

Results

Results of this study are presented in four sections. First, to determine the appropriate correlation coefficient to assess the first hypothesis, and as SEM required normalised data, an assessment of the distribution of all measures, including skew, kurtosis and normality was conducted. The results of the tests used to assess the internal consistency of each of the measures under investigation (first hypothesis), the convergent validity between Martin, Marsh and colleagues' (2007, 2008a) measures and the alternative measures used to assess each of the same constructs (second hypothesis), and the goodness of fit between the data and hypothesised model (third hypothesis) are presented separately below.

Distributions of Each Measure

An initial assessment (see Table 2) revealed that the distribution of total scores for all variables, except Martin and Marsh's (2008) buoyancy and anxiety scales, and the IPPA (Armsden & Greenberg, 1987), demonstrated significant skew, kurtosis or both. Further indication of non-normally distributed data was evinced by the Shapiro-Wilk normality statistic. All measures, except the IPPA, demonstrated non-normality.

Although several strategies were employed to manage the non-normalised distribution (e.g., deletion of univariate and multivariate outliers, data transformation, bootstrapping), further analysis showed that these made little difference to results.

Table 2

Descriptive Statistics and Normality for Each Measure

Measures	Scale Mean	S.D.	Possible Range	Z- skew	Z- kurtosis	Normality
Martin and Marsh						
Buoyancy (2008a)	17.49	4.42	4-28	-2.27	-1.35	.98
Self-efficacy (2008a)	23.77	2.85	4-28	-7.68**	42.04**	.92
Anxiety (2008a)	18.93	5.08	4-28	-1.27	-2.31	.98
Control (2008a)	14.03	5.00	4-28	1.95	-2.78*	.96
Engagement (2008a)	112.59	12.64	20-140	-5.79**	8.66**	.96
Parental Attachment (2007)	23.09	4.74	4-28	-7.60**	3.12	.87
Alternative Measures						
RS (Wagnild & Young, 1993)	134.93	15.36	25-175	-3.07**	4.06**	.98
SRL (Bandura, 1990)	78.23	16.79	0-110	-5.38**	4.98**	.96
AMAS-C (Reynolds et al., 2003)	18.71	11.01	0-42	1.82	-3.31**	.96
ACS (Perry et al., 2001)	15.82	4.44	8-40	2.51*	-0.68	.97
CSEQ (Kuh et al., 2008)	45.03	8.93	19-90	2.89*	1.43	.98
IPPA (Armsden & Greenberg, 1987)	181.95	34.79	50-250	-1.63	-0.43	.99

Note. Normality was assessed via the Shapiro-Wilk statistic. All measures were significant ($p < .05$), except the IPPA ($p = .01$), signifying that the normality assumption is violated.

* $P < .01$

** $P < .001$

Therefore subsequent analysis was based on the raw data. A comprehensive summation of methods which were attempted to address the data's non-normal distribution is included in Appendix E.

Internal Consistency

Evaluation of the first hypothesis entailed comparing the internal consistency of Martin, Marsh and colleagues' (2007, 2008a) measures against alternative measures of the same constructs. Cronbach's alpha for each measure is reported in Table 3.

Although this table indicates acceptable ($> .70$) to excellent ($> .90$) internal consistency for each of the scales under investigation (George & Mallery, 2009), the finding that greater internal consistency was obtained for buoyancy, self-efficacy, anxiety and parental attachment via the alternative measures supported the second hypothesis. However, the finding that greater internal consistency was obtained for control and engagement via Martin, Marsh and colleagues' (2007, 2008a) measures did not support the second hypothesis. This suggests that the alternative measures for buoyancy, self-efficacy, anxiety and parental attachment exhibited greater capacity to measure the same characteristic than Martin and Marsh's measures for these constructs. Conversely, Martin and Marsh's measures for control and engagement demonstrated greater consistency in their measurement than the other measures for the same constructs.

In order to determine which of the two measures for each construct should be used to test the hypothesised model it was necessary to consider internal consistency (Bollen & Lennox, 1991; Kline, 2005). Reliability is a prerequisite to validity, and attenuates the greatest possible size of relationships between variables (Henson, 2001).

Table 3

Cronbach's Alpha for Each Measure

Measure	Buoyancy	Self-Efficacy	Anxiety	Control	Engagement	Parent Attachment
Martin, Marsh (2007, 2008a)	.76(.80)	.78(.77)	.83(.78)	.84 (.80)	.89 (.85)	.90(.87)
RS (Wagnild & Young, 1993)	.88 (.85)					
SRL (Bandura, 1990)		.88 (.87)				
AMAS-C (Reynolds et al., 2003)			.94 (.94)			
ACS (Perry et al., 2001)				.82(.80)		
CSEQ (Kuh et al., 2008)					.79(.83)	
IPPA (Armsden & Greenberg, 1987)						.97 (.87)

Note. Boldface indicates measure with the highest reliability for each construct from the present study.

^aFigures in brackets are the reported Cronbach's alpha for each measure from previous research, as detailed in the Method.

Thus, lower internal consistency directly correlates with reduced power (Streiner, 2003a). As Martin and Marsh's (2008a) measures for control and engagement, along with the additional measures for buoyancy (RS; Wagnild & Young, 1993), self-efficacy (SRL; Bandura, 1990), anxiety (AMAS-C; Reynolds et al., 2003) and parental attachment (IPPA; Armsden & Greenberg, 1987) demonstrated greater capacity to

measure the same characteristic, it was considered advantageous that these be used in the analysis.

Convergent Validity

Evaluation of the second hypothesis involved assessing the convergent validity between Martin, Marsh and colleagues' (2007, 2008a) measures and the alternative measures selected to assess each of the same constructs (reported in Table 4).

Spearman's rho (r_s) was used rather than Pearson's r due to the data's non-normalised distribution (Cohen, Cohen, West, & Aiken, 2003).

Table 4

Correlations between Martin, Marsh and Colleagues Scales and the Alternative Scales

Martin, Marsh and Colleagues Scales	Additional Scales	Correlation Coefficient
Buoyancy (2008a)	RS (Wagnild & Young, 1993)	$r_s = .57$
Self-Efficacy (2008a)	SRL (Bandura, 1990)	$r_s = .43$
Anxiety (2008a)	AMAS-C (Reynolds et al., 2003)	$r_s = .74$
Control (2008a)	ACS (Perry et al., 2001)	$r_s = .52$
Engagement (2008a)	CSEQ (Kuh et al., 2008)	$r_s = .39$
Parental Attachment (2007)	IPPA (Armsden & Greenberg, 1987)	$r_s = .71$

Note. * Correlation is significant at the .01 level (2-tailed).

This table indicates that the correlation for each construct between Martin, Marsh and colleagues' (2007, 2008a) measures and the alternative measures were all significant, although relationship strength ranged from moderate (.30 to .49) to very

strong (.70+; Cohen et al., 2003). The strong (.50 to .69) correlation coefficient values for buoyancy and control, and the very strong values for anxiety and parental attachment were in support of the second hypothesis. However, the moderate coefficient value obtained for self-efficacy and engagement did not support the first hypothesis. This implies that the measures for buoyancy, control, anxiety and parental attachment assessed somewhat similar constructs, while the measures for self-efficacy and engagement assessed somewhat different constructs.

Structural Equation Modelling

To test the proposed model depicted in standardised form in Figure 2, SEM was performed. The resultant model is referred to as Model 1. The hypothesised model tested predictors of undergraduates' academic buoyancy. It was posed that (a) parental attachment positively predicted self-efficacy; (b) self-efficacy negatively predicted cognitive mufflers and positively predicted engagement; and (c) that cognitive mufflers directly (negatively) predicted, while engagement directly (positively) predicted, students' academic buoyancy. The model was theoretically modified (modification indices were considered in relation to theoretical constraints) before reaching its final form.

In order to assess the goodness of fit between the data and Model 1, maximum likelihood model estimation was used. In evaluating goodness of fit, multiple fit indices were considered (Hu & Bentler, 1995). The most fundamental measure of overall fit is the likelihood-ratio Chi-square test (χ^2) which assesses the magnitude of the difference between the observed and the expected (reproduced) covariance matrices (Kaplan, 2008). A good fit of the data to the model should therefore have a close match

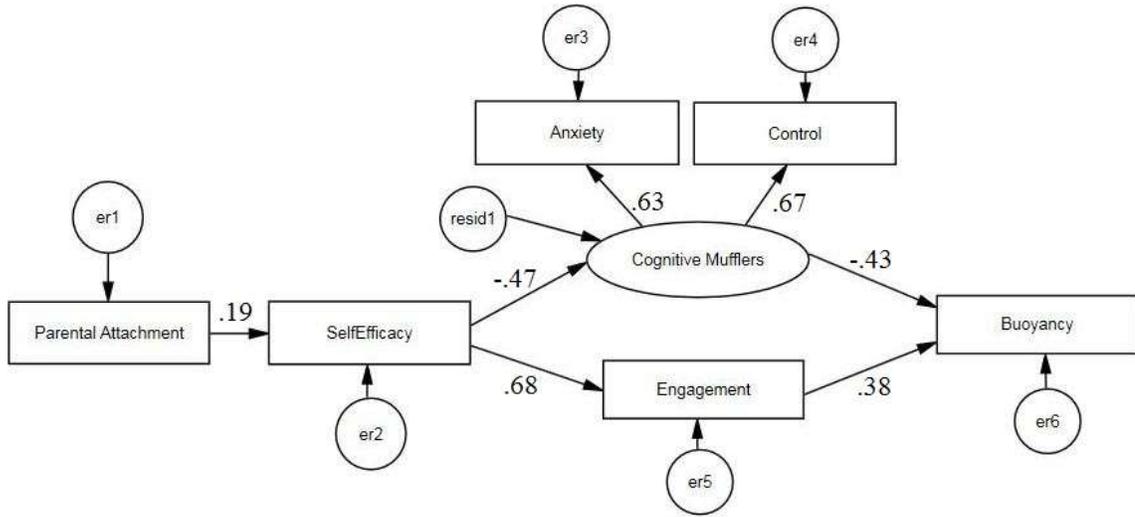


Figure 2. Model 1: Hypothesised model showing standardised regression weights.

between the two matrices and consequently a low, non-significant χ^2 value in accordance with degrees of freedom (Bentler, 2007). The independence model that tests the hypothesis that all variables were uncorrelated was easily rejected, $\chi^2 (15, n = 236) = 381.78, p < .001$. In regards to Model 1, the χ^2 statistic was both high and significant signifying dissimilarity between the data and the model $\chi^2 (8, n = 236) = 39.00, p < .001$. However, the χ^2 statistic is sensitive to departures from normality and increases with sample size (Tabachnick & Fidell, 2007), therefore additional fit indices were also examined.

Other fit indices include (1) the minimum sample discrepancy divided by degrees of freedom (know as Relative or Normal Chi-square [CMIN/DF]), (2) the Goodness-of-Fit Index (GFI), (3) the Adjusted Goodness-of-Fit Index (AGFI), (4) the Comparative Fit Index (CFI), and (5) the Root Mean Square Error of Approximation (RMSEA). Firstly, the CMIN/DF is an index less dependent on sample size than χ^2 , with

values larger than two signifying an inadequate fit to the data (Tabachnick & Fidell, 2007). Secondly, the GFI assesses the extent to which a model fits compared with no model at all, while the AGFI additionally adjusts for degrees of freedom and accounts for parsimony (Hu & Bentler, 1995). Values range from zero to one, with values greater than .90 indicative of a better fit (Fan, Thompson, & Wang, 1999). Secondly, the CFI evaluates the fit of the hypothesised model with the independent (null) model, indicating the degree of complete covariation (Bentler, 1990). Values range from 0 to 1, with values greater than .95 considered a good fit (Hu & Bentler, 1999). Finally, the RMSEA is a measure based on degrees of freedom which compares the discrepancies of the hypothesised model with a perfect (saturated) model (Browne & Cudeck, 1993). Values less than .05 are considered to have good fit and values as high as .08 suggest reasonable fit, although with small sample sizes RMSEA has been found to over-reject true population models (Bentler & Yuan, 1999). RMSEA values greater than .01 strongly suggests an unsatisfactory model fit. Further analysis of Model 1, presented in Table 5, confirmed that there was not an acceptable fit between the data and the hypothesised model. Joreskog (1993) maintained that the fit of most initial models is typically deemed unacceptable and that model modification is an inevitable process. However, it is crucial that model modification have a theoretical justification (Kaplan, 2008).

Post hoc modifications were therefore performed (on the basis of theoretical constraint and the resultant modification indices) in an attempt to obtain an acceptable fit of the data to the model. An evaluation of the modification indices of Model 1 revealed that allowing the error term (er1) for parent attachment to covary with the residual term (resid1) associated with cognitive mufflers reduced the value of χ^2 by at

Table 5

Goodness of Fit Test Indices for the Hypothesised Model

	CMIN/DF	GFI	AGFI	CFI	RMSEA
Fit to data if	< 2	> .90	> .90	> .95	≤ .08
Hypothesised model	4.88	.95	.86	.91	.13

Note. Fit to data indicates thresholds for adequate model fit for each test. Normal chi-square (CMIN/DF), Goodness-of-Fit Index (GFI), the Adjusted Goodness-of-Fit Index (AGFI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA).

least 18.50. Ho (2006) argued that if there is theoretical justification and a significantly better fit to the data than the original model, then it is feasible to allow the errors to correlate. He indicated that where this type of modification is employed it is important to consider the results when making inferences as this method has the potential to capitalise on the uniqueness of the data set and thus limit its generalisability. There are multiple theoretical explanations which may elucidate the association between error terms. Both variables with which the terms were associated are directly linked with a number of other salient constructs (e.g., sense of security, coping strategies and sociability). Thus, it seems likely that they share commonalities with other pertinent constructs, above and beyond the buoyancy construct. Indeed existing research (e.g., Bowlby, 2005; Chorpita & Barlow, 1998; Gross, 2007) has indicated that control, anxiety and parent attachment are directly related to such things as individuals' sense of security, use of coping strategies and sociability. Further, given the high correlation between these two variables, this was considered theoretically acceptable.

The hypothesised model was consequently modified to allow the specified error and residual terms to covary. Following this modification, the model was re-estimated as Model 2 (see Figure 3). The resultant model demonstrated a sound fit with the data, $\chi^2(7, n = 236) = 17.99, p = .01$. Support for this modified model was found from each of the Goodness of Fit test indices displayed in Table 6.

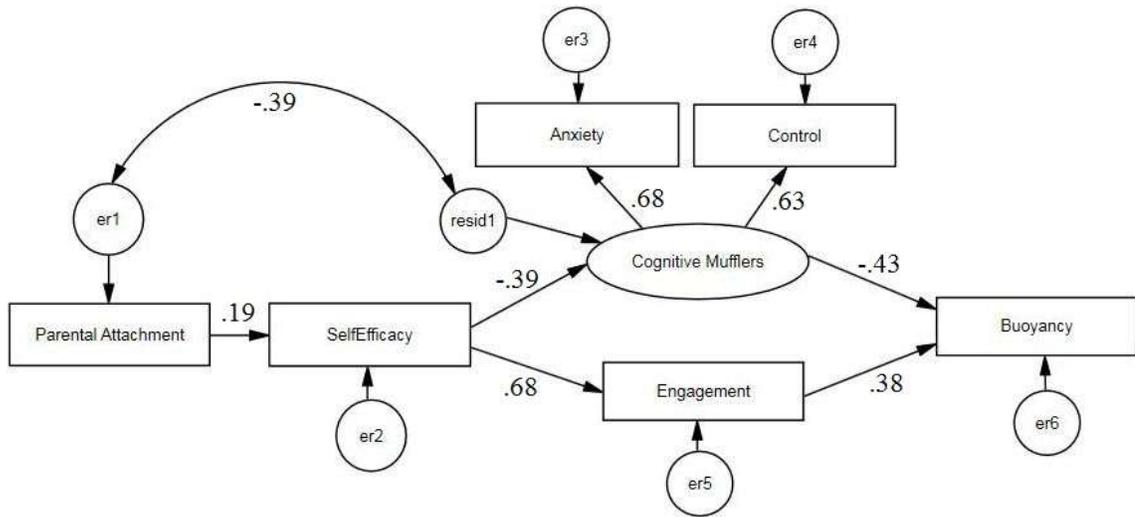


Figure 3. Model 2: Modified model showing standardised regression weights.

A comparison of χ^2 between Model 1 and Model 2 revealed a difference of 21.01. As the difference in degrees of freedom between models was 1, the chi-square value of 21.01 was significant at the .05 level, indicating that Model 2 represented a significantly better fit to the data than Model 1. Additional examination of the results, as expected, revealed little difference between the regression weights from Model 1 and Model 2.

According to the final model and in line with the hypothesised model, parent attachment positively predicted self-efficacy (.19), and self-efficacy negatively

Table 6

Goodness of Fit Test Indices for the Modified Model

	GFI	AGFI	CFI	RMSEA
Fit to data if	> .90	> .90	> .95	≤ .08
Hypothesised model	.98	.93	.97	.08

Note. Fit to data indicates thresholds for adequate model fit for each test. Goodness-of-Fit Index (GFI), the Adjusted Goodness-of-Fit Index (AGFI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA).

predicted cognitive mufflers (-.39) and positively predicted engagement (.68). In turn, both cognitive mufflers and engagement predicted buoyancy (-.43 and .38 respectively) in the anticipated directions. Cognitive mufflers were found to be the strongest predictor of undergraduates' academic buoyancy. As a latent variable, cognitive mufflers were manifest through anxiety and control, with anxiety being the most strongly expressed (.68). Almost half (43%) of the variance in buoyancy was accounted for by cognitive mufflers and engagement, while only 4% of the variance in self-efficacy was accounted for by parental attachment. See Appendix F for a summary of variance findings.

Discussion

This study primarily sought to test a theoretical model that explains the relationship of key contributors to academic buoyancy in undergraduate students. A secondary aim was to explore the psychometric qualities of relevant measures of these constructs including those developed by Martin, Marsh and colleagues (2007, 2008a). In terms of the first hypothesis, four of the six alternative measures demonstrated higher internal consistency than Martin, Marsh and colleagues' measures. Regarding the

second hypothesis, four of the six measures used by Martin, Marsh and colleagues demonstrated strong to very strong convergent validity with other psychometrically validated measures of the same construct. The theoretical model of undergraduates' academic buoyancy proposed in the third hypothesis was supported using structural equation modelling.

In order to discuss each hypothesis, this section initially evaluates the measures of buoyancy and its predictors, giving recommendations about their utility and accuracy. It then explicates this study's findings regarding the proposed theoretical model and explores implications for policy and praxis. Finally, it discusses the limitations of the present study and provides a conclusion.

An Evaluation of the Measures of Buoyancy and its Predictors

In support of the first hypothesis, the alternative measures used to assess buoyancy, self-efficacy, anxiety and parental attachment demonstrated higher internal consistency. However, Martin, Marsh and colleagues' (2007, 2008a) measures for control and engagement obtained higher internal consistency scores, which was contrary to prediction. The internal consistency scores ranged from acceptable ($> .70$) to excellent ($> .90$) for each measure in the present study and were comparable with findings from previous research (see Table 3). Although there has been some argument over where the threshold should be set for internal consistency scores (Cicchetti, 1994), reliability estimates in the range of .70 to .80 have generally been accepted as adequate for most research purposes (Kaplan & Saccuzzo, 2009). Consequently, based on findings from the present study and prior research, all measures demonstrated an adequate degree of inter-relatedness among the items.

Possible reasons why Martin and Marsh's (2008a) measure for engagement demonstrated higher internal consistency than the alternative measure for engagement (CSEQ; Kuh et al., 2008) are now discussed. Each of Martin and Marsh's measures contains 4 items, except for the engagement measure which contains 20 items. As alpha is reliant on the size of correlations between items, a greater number of items in a scale (provided they are correlated) increases the value of alpha (Henson, 2001). Additionally, the combining of scales which measure different constructs into one larger scale can serve to inflate alpha (Streiner, 2003b). As previously mentioned, Martin and Marsh's measure for engagement is assessed through five factors which each contain four items, whereas the CSEQ solely assesses the amount of time spent completing certain activities (21 items). Taken together, it is not surprising that Martin and Marsh's measure for engagement obtained a higher alpha value than the CSEQ.

Reasons why the alternative measure for control (ACS; Perry et al., 2001) demonstrated lower internal consistency than Martin and Marsh's (2008a) measure are now suggested. It was somewhat difficult to locate an alternative measure for uncertain control which had undergone extensive psychometric evaluation. From the limited range of alternatives, the measure which research indicated had the best psychometrics was the ACS. However, the findings in this study may suggest the need for further development of the ACS to improve the inter-relatedness among the items. In doing so it would be important to consider the possibility of decreased validity as increased internal consistency can reduce validity (DeVon et al., 2007). Therefore, the few alternatives to measure uncertain control, along with the limited testing undergone by even the best of

these may account for the ACS obtaining a lower internal consistency score than Martin and Marsh's measure.

Whatever the case, the internal consistency scores need to be interpreted with caution. This study used Cronbach's alpha to assess internal consistency. Although alpha is commonly used in current research practice, several authors have questioned its use (e.g., Bentler, 2009; Boyle, 1991; Hattie, 1985; Novick & Lewis, 1967; Sijtsma, 2009). General critiques include that it is sample specific and influenced by the number and similarity of items in a measure. In terms of the present study, this likely explains the particularly high alpha value (.97) for parental attachment as measured by the IPPA (Armsden & Greenberg, 1987). Of more serious concern, Sijtsma (2009) and Bentler (2009) argued that (a) there is no association between alpha and a measure's internal structure, (b) alpha does not provide evidence of whether items in a measure assess the same thing, and (c) the only information revealed by alpha is the *average* inter-relatedness of items (unless negative covariances exist). Although there has been some debate over alternative approaches to assess internal consistency, Sijtsma and Bentler suggested that dimension-free internal consistency coefficients (e.g., ρ_{glb} and ρ_{blb}) and model-based internal consistency coefficients (e.g., ρ_{xx}) may overcome the limitations associated with Cronbach's alpha. Further research could use such alternative methods as a way of validating the findings of this study.

In support of the second hypothesis, significant strong correlations (.50 to .69) were found between the buoyancy and control measures, and very strong correlations (.70+) between the anxiety and parental attachment measures. However, contrary to expectation, significant moderate correlations (.30 to .49) between the self-efficacy and

engagement measures were found. Thus, evidence of convergent validity between the measures of buoyancy, control, anxiety and parental attachment was found, but not so for the measures of self-efficacy and engagement.

Overall, these results indicate a reasonable and significant amount of shared variance between the scales used to measure buoyancy, control, anxiety and parental attachment. Thus, each of these scales assess somewhat similar constructs. However, findings suggest that the two measures of self-efficacy and engagement appear to represent somewhat similar, but not identical constructs. That the two measures for each of these constructs were only moderately correlated with each other seems to support this. For different measures to be found to assess the same construct, higher correlations would be expected even considering attenuation attributable to measurement error (Kline, 2005).

Several factors might explain these correlations. As previously mentioned each of the constructs under investigation relate directly to the undergraduate academic arena. Hence, contextualised measures which had been psychometrically validated in university-age populations were required, but were difficult to locate for some constructs. In this light, although each of the additional measures were selected on their merit, some variability was expected.

Evidence of variability and incompatibility between measures of the same construct are identifiable in a number of key areas. First, although the SRL (Bandura, 1990) has been used and psychometrically validated in adult populations, it was originally designed for use with adolescents. This may explain to some extent the low convergent validity finding for the self-efficacy measures ($r_s = .43$), as Martin and

Marsh's (2008a) measure was specifically designed for use with an undergraduate population. Second, a comparison of the items in each of the measures (included in Appendix A) indicated variation in domain-specificity (i.e., different cognitive functions implicated) and the generality versus specificity of items (i.e., differing levels of focus). Two noteworthy examples may account for the low convergent validity findings for the measures which assess self-efficacy and engagement. While Martin and Marsh's measure of self-efficacy concerned general academic self-efficacy, the SRL focuses on a more specific dimension of academic self-efficacy, namely perceived capacity for self-regulated learning. Similarly, while Martin and Marsh's measure for engagement assessed a range of factors (e.g., persistence, valuing of university, educational aspirations, enjoyment of university and class participation), the CSEQ (Kuh et al., 2008) items were limited in that they only assessed the amount of time spent completing certain activities. Pajares (1996) states that a pervasive and problematic issue in educational research is the use of global measures which tap broad constructs (e.g., general academic behaviours), rather than appropriately specified measures, resulting in confounded associations and ambiguous findings. It seems plausible then, that differences in domain-specificity and focus of items account to some extent for the low convergent validity finding for both self-efficacy and engagement.

Interestingly, similar variations in domain specificity are evident in the measures for other constructs that were found to have stronger convergent validity and may undermine this line of reasoning. For example, the convergent validity of the measures of anxiety was found to be very strong ($r_s = .74$). Martin and Marsh's measure (2008) assesses general academic anxiety, whereas the AMAS-C (Reynolds et al., 2003)

assesses psychological, worry/oversensitivity, relational and assignment-related anxiety. Similarly, that the measures for academic buoyancy demonstrated 'strong', but not 'very strong' convergent validity ($r_s = .57$) is not surprising. While Martin and Marsh's (2006) measure was initially developed to measure academic resilience, the RS scale (Wagnild & Young, 1993) was designed as a general, non-contextualised measure of individuals' resilience.

One additional variation in the measurement methods that were used to assess each of the constructs has likely impacted on the convergent validity findings. The number of response options which a respondent is given determines in part the presence of random error, and invariably influences the validity, accuracy and reliability of a measure (Gliem & Gliem, 2003; Streiner, 2003b). Each of Martin, Marsh and colleagues' (2007, 2008a) measures were rated on a 7-point Likert scale, whereas the alternative measures used to assess the same construct utilised varying rating scales (from 2-point [anxiety] to 11-point [self-efficacy] Likert scales). Given that both the SRL (Bandura, 1990) and CSEQ (Kuh et al., 2008) utilised different rating scales from Martin, Marsh and colleagues (SRL: 11-point Likert scale; CSEQ: 19 items used a 4-point likert scale, while 2 items used an 8-point Likert scale), it is possible that variations in random error accounts to some extent for the low convergent validity findings. However, similar noteworthy variations in response options exist between the measures for anxiety and parental attachment, yet both sets of measures were found to have very strong convergent validity. Thus, such differences in rating scales may have only had minimal impact on convergent findings.

A further complicating factor possibly impacting on the convergent validity findings relates to the inclusion of both internal and distance students in this study. Internal students comprised 59.3% of the present sample, 25.4% were distance students and 15.3% studied via mixed mode. A disproportionate number of the items within the two measures for engagement were either explicitly directed at internal students and therefore irrelevant for distance students, or were more or less relevant for either internal or distance students. Taken together, both measures did not account for differences between internal and distance students allowing for response bias. Thus, a difference in the response bias of the two engagement measures may account to some extent for the low convergent finding.

In summary, there are a number of important factors which a test user must consider, amongst them being the test's reliability and validity (DeVon et al., 2007). Further considerations include mode of administration, test length, delivery time, response format, cost, ethical and legal (Kaplan & Saccuzzo, 2009). In light of these considerations, and based on the findings of the present study, a number of recommendations are made regarding measures used to assess academic buoyancy. First, as cost, test length and delivery time are legitimate concerns when conducting research, it would seem practical to use measures with a minimal number of items. Given that each of Martin, Marsh and colleagues' (2007, 2008a) measures demonstrated acceptable to excellent internal consistency, and for the most part were found to have strong convergent validity with other measures of the same construct, it would seem feasible that they continue to be used in future research. However the findings in this study may suggest the need for further development of their buoyancy and self-efficacy

measures which demonstrated acceptable ($> .70$), but not good ($> .80$) or excellent ($> .90$) internal consistency. Second, the mixed convergent validity findings highlight the importance of contextualised and specified measures, and a rigorous psychometric test design process. It is clear that further research is required to establish 'gold standard' measures of academic buoyancy and its related predictors. To do so it would be necessary to define exactly what is to be measured and the desired level of specificity in the context of associated theory (DeVellis, 2003). The use of both classical test theory (e.g., examining item-total correlations and inter-item correlations) and modern test theory (e.g., item response theory analyses) would also likely improve the utility and accuracy of measures (Kothari, 2008).

A Model of Undergraduates' Academic Buoyancy

The hypothesised model provides a means of understanding factors which influence undergraduates' capacity to deal with poor performance, typical daily pressures and undulating motivation and engagement in the academic setting. In support of the third hypothesis, an adequate fit was found between the data and final model in which (a) parental attachment positively predicted self-efficacy; (b) self-efficacy negatively predicted cognitive mufflers and positively predicted engagement; and (c) cognitive mufflers directly (negatively) predicted, while engagement directly (positively) predicted, students' academic buoyancy.

Thus, the model containing antecedent and mediatory conditions followed a causal sequence in which parental attachment, self-efficacy, cognitive mufflers (anxiety and control) and engagement were all found to influence undergraduates' academic buoyancy. A specific buoyancy process could thus follow this sequence: strong parental

attachment strengthens the development of high self-efficacy which in turn forms the basis for high engagement and low cognitive mufflers, thus resulting in high academic buoyancy. Conversely, weak parental attachment undergirds the development of low self-efficacy which in turn forms the basis for high cognitive mufflers and low engagement, thus resulting in low academic buoyancy. However, given that only a small percentage of the variance in self-efficacy was accounted for by parental attachment, it could be possible for an undergraduate to report weak parental attachment, but exhibit high self-efficacy and thus high academic buoyancy.

It must be noted that the model was theoretically modified (modification indices were considered in relation to theoretical constraints) before reaching its final form. As such, the error term for parental attachment was allowed to covary with the residual term associated with cognitive mufflers. In considering reasons for error terms being correlated, past research (e.g., Chamorro-Premuzic & Furnham, 2008; Dollinger, Matyja, & Huber, 2008) has demonstrated that numerous complexities are involved in undergraduates' academic success (e.g., intellect, personality, learning style, sense of security, social support, sociability, coping strategies, substance use). Thus, there are several variables which may have influenced the need for the error terms to covary. Sense of security, coping strategies and sociability are specific variables demonstrated by research to be linked with parental attachment and cognitive mufflers, and are likely to share common qualities independent from the buoyancy construct (Chorpita & Barlow, 1998; Shaver & Mikulincer, 2002). Indeed, those who have a history of secure parental attachment are more likely to possess a strong sense of security, effective coping strategies and enhanced sociability, whereas those with a history of poor parental

attachment are more likely to be insecure, utilise maladaptive coping strategies and be socially inhibited (Gross, 2007). Bowlby (2005) maintains that this is because secure attachments promote positive and optimistic expectations regarding the availability of support and its inherent benefits to regulating affective symptomology.

On the other hand, it is possible that individuals' personality could account for the need for the error terms to covary. Numerous studies (e.g., John & Gross, 2004; Nettle & Shaver, 2006) have indicated that individual differences are of considerable consequence in how people appraise the availability of parental figures and manage their attachment behaviour in response to threats. However, there is some debate over the extent to which this is a reflection of temperament (John, Robins, & Pervin, 2008). Nonetheless, there is reason to believe that parental attachment and cognitive mufflers share qualities above and beyond the buoyancy construct. Future research would need to determine the specific construct or constructs which are involved.

As predicted and in agreement with previous research (e.g., Cutrona et al., 1994; Mattanah et al., 2004), the strength of undergraduates' parental attachment was directly related to their level of self-efficacy. Accordingly, undergraduates who reported stronger attachment with their parents also had a strong belief in their capacity to produce the results that they desire through their own actions. Conversely, those who reported weaker attachment perceived that they had minimal ability to achieve desired outcomes by their actions. However, although research has demonstrated parental attachment to be of consequence to individuals' self-efficacy, further factors have been implicated (Bandura, 2001). Additional determinants found to impact self-efficacy include differences in intellect and skill capacity, personality, affective control, motivation, and

the task itself (Gist & Mitchell, 1992; Lee & Bobko, 1994; Zimmerman et al., 1992). Although parental attachment proved to be a significant predictor in the present study, only a small percentage of the variance in self-efficacy was accounted for by it. Hence, it is likely that other determinants are of greater consequence to undergraduates' self-efficacy. For example, in a meta-analytic path analysis by Brown et al. (2008) which examined predictors of undergraduates' academic achievement, both cognitive ability and past performance mediated students' self-efficacy beliefs. Nonetheless, the results of the present study provide further evidence that even into adulthood, quality of parent-child attachment still has a significant influence on individuals' capability perceptions.

Undergraduates' perception of their capabilities to orchestrate desired outcomes significantly influenced both students' experience of cognitive mufflers (negatively), and level of engagement (positively). As expected, students who obtained higher self-efficacy scores reported lower academic anxiety and uncertain control, and higher academic engagement. Conversely, those who obtained lower self-efficacy scores reported higher anxiety and uncertain control, and lower engagement. That lower self-efficacy was synonymous with higher levels of anxiety and uncertain control supports previous research (e.g., Bandura et al., 1999; Chemers et al., 2001) and affirms that low self-efficacy leads to anxiety and uncertainty of control. Similarly, that higher self-efficacy was synonymous with higher levels of engagement, and that self-efficacy mediated the relationship between parental attachment and academic engagement is also in agreement with previous research (e.g., Chorpita & Barlow, 1998; Cutrona et al., 1994; Hsieh et al., 2007). Although self-efficacy was found to be predictive of students' cognitive mufflers, in two studies by Neff, Hsieh and DeJitterat, (2005) self-compassion

(entailing mindfulness, and desire for and action toward personal well-being) was found to be the strongest predictor of undergraduates' anxiety and use of adaptive coping strategies. These findings therefore suggest that other variables (e.g., self-compassion), in addition to self-efficacy, are instrumental to undergraduates' capacity to cope with academic pressures.

Replicating findings from Martin and Marsh's (2008) initial exploration of academic buoyancy with high school students, this study found cognitive mufflers to be the strongest (negative) predictor of undergraduates' academic buoyancy. As a latent variable, 'cognitive mufflers' was manifest through anxiety and control, with anxiety being the most strongly expressed. It is not surprising that cognitive mufflers significantly constrained and impeded undergraduates' academic buoyancy given that previous research (e.g., Salanova et al., 2009; Shell & Husman, 2008) has consistently found significant associations between academic difficulties and coping, anxiety and control. One explanation may be that students' anxiety and uncertain control reflects their posture toward failure and thus their level of academic buoyancy. Kannan and Miller (2009) conducted a series of case studies which examined the role of negative emotions in 10 undergraduates' completion of university coursework. In contrast to those who demonstrated low anxiety and uncertain control, students high on these dimensions anticipated poor performance and more negative appraisal, and frequently worried about making errors. Concerning buoyancy, it is possible that these outcomes are demonstrative of processes associated with students' low academic buoyancy. Research by Martin (2010) corroborates this supposition, with anxiety and uncertain control found to be indicative of the employment of counter-productive strategies (e.g.,

defensive pessimism and self-handicapping) to address fear of failure. The employment of such strategies could also reflect processes implicated in students' (low) academic buoyancy.

Engagement was also found to directly (positively) predict students' academic buoyancy. This study supports previous studies (e.g., Cole & Denzine, 2002; Pike & Kuh, 2005) showing that undergraduates who engage themselves in their coursework are more likely to overcome difficulties and pressures within academia. As anticipated from the literature review, numerous reasons likely undergird the association between engagement and academic buoyancy. First, time and effort spent studying or practising for a subject enhances the potential for continual learning and self-development (Carini et al., 2006). Second, students who place a high value on university are more likely to invest time and energy in pursuit of academic achievement (Bong, 2001). Third, level of university enjoyment corresponds with students' willingness to apply themselves to their coursework (Ruthig et al., 2008). Finally, students' intention to pursue graduate degrees (i.e., educational aspirations) has been shown to be a determining factor in their level of engagement (2008). Thus, it is to be expected that those who have a strong sense of purpose in what they are doing, and who diligently apply themselves to their coursework are more successful at managing everyday academic difficulties and pressures.

In considering the findings of this study it is important to bear in mind that buoyancy is conceptually distinct from resilience. Thus, findings represent those dealing with everyday difficulties and pressures of academic life, and may not transcribe to those facing difficulties of greater consequence (e.g., clinical disorders, significant

health challenges, problematic family relations, and substance abuse). Given the demarcation of the two constructs, it may be that students' ability to successfully deal with daily pressures and difficulties undergirds their capacity to respond to more significant threats. Similarly, the act of successfully dealing with extreme adversity may enhance students' capacity to deal with the more ordinary challenges of academic life, and in turn may work to offset the severity of more significant threats. Subsequent research is needed to clarify the nature of the relationship between resilience and buoyancy.

Implications for Policy and Praxis

The results from this study hold implications for psychological and educational policy and praxis, highlighting specific variables (parental attachment, self-efficacy, cognitive mufflers and engagement) which could constitute the basis for effective individual and group strategies, programs and interventions. Having identified specific factors which underpin academic buoyancy, the present study provides salient information which could allow more targeted support and intervention to increase undergraduates' capacity to manage and overcome academic difficulties and pressures that are characteristic of everyday higher education. Suggestions related to each factor in turn are presented below.

Parental attachment was found to be foundational to undergraduates' academic buoyancy. Therefore, providing services and resources which promote secure attachments would be beneficial in helping students cope with and overcome typical academic difficulties and pressures. Such services and resources would need to incorporate both students and parents and target such components as continual

involvement and support, effective communication skills, reciprocity, warmth, care, acceptance, authenticity and autonomy (Fass & Tubman, 2002; Frey, Beesley, & Miller, 2006; Mattanah et al., 2004).

This study indicates that self-efficacy underpins cognitive functioning and engagement capabilities and therefore mediates undergraduates' academic buoyancy. Therefore it is critical that students not only develop a broad range of abilities and skills, but also a strong conviction that they have the ability to successfully achieve in diverse academic competencies. Practices and pedagogies found to enhance students' self-efficacy include targeting (negative) self-beliefs, tailoring tasks to students' abilities, maximising opportunities for success, providing frequent and immediate enactive feedback, setting specific and proximal goals and modelling (Bandura, 1997; Pajares, 2006; Schunk & Pajares, 2002; Zimmerman, 2000).

Cognitive mufflers were found to be the strongest predictor of undergraduates' academic buoyancy. Therefore, both anxiety and control are of considerable consequence. By constraining motivation and impeding engagement via maladaptive cognitions, anxiety and uncertain control can hinder students from successfully dealing with poor performance and typical academic pressures. It is therefore necessary to address students' fear of failure, avoidance orientation, self-sabotaging and helplessness (Martin, 2010). This could involve such things as (a) ensuring students experience success, (b) helping students distinguish between personal worth and academic achievement, (c) promoting a positive perspective toward failure (i.e., learning from mistakes), (d) de-emphasising competition and cultivating a climate of cooperation, (e) equipping students with core skills needed to complete assessments and strategies to

deal with academic-related stress and anxiety, (f) fostering sense of control through providing students with appropriate choices (e.g., lesson goals and assignments), and (g) directing attention to the controllable factors in students' academic lives (e.g., effort, strategy and attitude), outlining how they are linked with achievement (Martin, 2010; Martin & Marsh, 2006; Ruthig et al., 2009).

Engagement also was found to be a key determinant of undergraduates' academic buoyancy. Research has clearly demonstrated that the quantity of time students apply themselves to their course work is indicative of the breadth and depth to which knowledge and skills are learnt and the ensuing level of mastery (Carini et al., 2006). Thus, in order to foster academic engagement it would be important to consider style and pace of learning, the level of academic challenge, self-regulatory skills, the links from effort and strategy to improvement and achievement, ideal conditions and effective strategies for completing assessments, and the link from what is taught to world events and students' lives (Brint et al., 2008; Martin, 2010; Salanova et al., 2009). These practices are suggestive (i.e., not prescriptive) and apply not only to undergraduates facing adversity, but are of direct relevance to all students' academic success, including those who are achieving to a high standard.

Existing research (e.g., Condly, 2006; Hsieh et al., 2007; Martin, 2010; Ruthig et al., 2009; Walker et al., 2005) has indicated a number of additional strategies which educational bodies could employ to enhance undergraduates' academic buoyancy. First, rather than passively relying on student initiation, it is imperative that universities take a proactive posture in providing effective preventative and supportive measures. This would include such things as the implementation of systematic university-wide

screening processes and support programs, and the provision of dedicated services and resources (e.g., targeting underachievers, cheaters and students struggling with affective problems). Second, provide a wide range of meaningful and practical opportunities for students to safely explore and develop fundamental proficiencies (e.g., time management, problem solving, social and study skill development, extracurricular activities and mentoring). Third, monitor and evaluate faculty members' teaching performance.

Given these implications for policy and praxis, a number of suggestions can be made for future research. First, further development and testing of the model in a diversity of educational settings is warranted. It would be important to clarify causality, directionality and relationship strength between difficulties, risks and resources. Also it would be beneficial to differentiate between predictors of high school students' and undergraduates' academic buoyancy and their related interventions. Second, future research could explore other pertinent antecedent, mediator and predictor variables (e.g., parent-teacher and peer attachment) which may underpin undergraduates' academic buoyancy. Third, findings of the present study suggested that effective university programs and interventions could target undergraduates' parental attachment, self-efficacy, cognitive mufflers and engagement. Research aimed at developing and testing effective applications of these findings is therefore recommended. Fourth, it would be valuable to examine the relationship between students' academic achievement (e.g., grade point average [GPA]) and buoyancy. It may be possible to predict undergraduates' GPA from their academic buoyancy.

Another valuable direction for future buoyancy research would be to create a stronger link with research into thriving. O'Leary and Ickovics (1995) explain the concept of thriving as one of four potential responses to setbacks and challenges: (1) a downward spiral whereby the initial negative effect is compounded, exerting a detrimental longer term effect; (2) survival, but resultant impairment; (3) return to pre-setback and challenge state (either gradually or rapidly); and (4) enhanced functioning in one or more domains, above and beyond prior levels of functioning. A focus on this fourth response in research would continue the movement beyond vulnerability/deficit models of students and into health enhancement models which cultivate successful activation of assets and movement beyond homeostasis (Epel, McEwen, & Ickovics, 1998).

Limitations

Important limitations of this study must be considered when viewing results. Its limitations pertain to the nature of self-reported data, the design of the study, the distribution of total scores, the sample size and the generalisability of findings. Each of these are discussed below.

This study exclusively utilised self-reported data. Although its use is commonplace in evaluating the quality of undergraduate education, Gonyea (2005) indicated that both social desirability (i.e. editing a response to make it look good) and Halo error (i.e., providing parallel responses on items of a similar nature based on preconceptions of the topic) are prevalent in institutional research and must be considered when interpreting results. Thus, further research using multiple sources of

data (e.g., parent ratings, university archival and administrative data) would qualify the results from this paper.

This study utilised a cross-sectional design and therefore was descriptive, not experimental (i.e., no variables were manipulated). Consequently, no definitive conclusions can be drawn regarding the mediatory effects of the predictors under investigation on undergraduates' academic buoyancy. For example, it is possible that students who cope better in the face of academic difficulties and pressures also tend to report a stronger association with parents and less anxiety symptomology (Mattanah et al., 2004). The use of longitudinally designed studies would likely provide more complete understanding of developmental factors related to academic buoyancy (Cohen, Manion, & Morrison, 2007). Such a design would also assist in addressing aforementioned limitations and help to control for previous levels of academic buoyancy. A third approach could use randomised trials to assess the efficacy of interventions aimed at enhancing each predictive factor (Greenberg, 2006).

With regard to the distribution of total scores, all measures except the IPPA (Armsden & Greenberg, 1987) demonstrated significant skew, kurtosis or non-normality. Despite employing several strategies to manage the non-normalised distribution (detailed in Appendix D), these made little difference to results. Hence, these measures did not reflect the entire range of possible scores. However, it is possible that the results from the present study are more reflective of the population under investigation.

The sample size and generalisability of this study were also limited. There was an unequal distribution of males (30%) and females (70%), and 66% of the sample was

between the ages of 18 and 24. Additionally, the present sample contained undergraduates who voluntarily completed the questionnaire. It is possible that undergraduates willing to participate in such research are not representative of the general student population (Mattanah et al., 2004). Thus, replication of this research utilising an approach such as stratified-random sampling would be needed to increase the generalisability of the findings. Also, a larger sample size would enable researchers to explore possible effects within the model (e.g., gender, age). One final point is that the cultural diversity of the sample was unknown. Undergraduates attending Australian universities are of diverse ethnic backgrounds (Krause, Hartley, James, & McInnis, 2005). Therefore, it would be worthwhile for subsequent research to consider the impact of cultural background on academic buoyancy.

Conclusion

This study was the first attempt to understand the relationship between key determinants of undergraduates' academic buoyancy. Undergraduates encounter manifold challenges, pressures and stresses in their pursuit of obtaining a degree. Some students falter and fall into maladaptive patterns of underachievement, while others adapt and realise their full potential. It would seem that academic buoyancy has an important role in explaining this. Despite limitations, the results confirm measures and a theoretical model which can be used to assess and predict undergraduates' academic buoyancy. The current study extends Martin and Marsh's (2008a) initial exploration of academic buoyancy in several important ways: (1) applying the buoyancy construct in an undergraduate population (to date no research has done this), (2) considering an additional factor (parental attachment) which existing research has suggested is related

to undergraduates' academic buoyancy, (3) considering antecedent and mediatory conditions, and (4) providing further psychometric evaluation of their measures' reliability and validity.

In summary, results provide important insights for researchers, higher education providers and psychological practice. First, given the acceptable to excellent internal consistency scores obtained by Martin, Marsh and colleagues' (2007, 2008a) measures, and other important factors which a test user must consider (e.g., cost, test length and delivery time), it would seem feasible that they continue to be used in future research. Second, the mixed convergent validity findings highlight the importance of contextualised measures and the need for future research to establish 'gold standard' measures of academic buoyancy and its related predictors. Third, in light of the acceptable fit of the data to the theoretical model through SEM, parental attachment, self-efficacy, cognitive mufflers (anxiety and control), and engagement were found to be indicative of undergraduates' academic buoyancy. Thus, strategies, programs and interventions which target each of the implicated variables provide means for educators and practitioners to address students' capabilities of effectively managing academic difficulties and pressures, and thereby maximise students' academic success. Directions for future research could include stratified-random sampling, multiple sources of data and a longitudinal design to qualify results and increase generalisability. Research aimed at developing and testing effective applications of these findings is recommended.

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Appendix A

Online Questionnaire Used to Assess Predictors of Academic Buoyancy

Due to copyright restrictions, the questionnaire is not included.

Appendix B

CSU's Ethics Committee's Approval Letter


CHARLES STURT
UNIVERSITY

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17 May 2010

Mr Daniel Bowen
 72 Mc Brien Drive
 KELSO NSW 2795

Dear Mr Bowen,

Thank you for the additional information forwarded in response to a request from the Human Research Ethics Committee.

The Committee has now approved your proposal entitled *"Academic buoyancy: An initial exploration of undergraduate students' everyday academic resilience"* for a twelve month period from 17/5/2010. The protocol number issued with respect to this project is **2010/052**. Please be sure to quote this number when responding to any request made by the Committee.

You must notify the Committee immediately should your research differ in any way from that proposed.

You are also required to complete a Progress Report form, which can be downloaded from www.csu.edu.au/research/forms/ehrc_annrep.doc, and return it on completion of your research project or by 17/5/2011 if your research has not been completed by that date.

Please don't hesitate to contact the Executive Officer on telephone (02) 6338 4628 or email ethics@csu.edu.au if you have any enquiries.

Yours sincerely



Julie Hicks
Executive Officer
Human Research Ethics Committee
 Cc: Dr Matthew Thomas

www.csu.edu.au

The Commonwealth Register of Institutions and Courses for Overseas Students (CRICOS) Provider Number for Charles Sturt University is 00026F (NSW) and 21947Q (VIC)

Appendix C

Ethics Committee Approved Message to Place on CSU Forums

Subject Title: Research Participation Opportunity – Academic Resilience

Message:

Hi, my name is Daniel and I am currently studying Psychology at Charles Sturt University. For my Honours dissertation I am conducting research into undergraduate students' everyday academic resilience.

Your participation in this research project will provide valuable insight into the factors which promote everyday academic resilience and the pedagogical and psychological practices which can be used to support and enhance students' ability to deal with setback, challenge, and pressure in the academic setting.

The questionnaire may take up to an hour to complete and is located at:
<http://www.surveymonkey.com/s/academicresilience>

In order to participate you must be currently studying an undergraduate course and be over the age of 18. All responses are completely anonymous.

I would be extremely grateful for your participation in this research project. And if you would circulate this message to other undergraduate students that you know, and encourage them to participate also, that would be a great help.

Kind Regards,

Daniel Bowen

Appendix D

Raw Data and Output of All Analyses (See Attached CD)

The raw data and output of all analyses are included in the attached CD.

Appendix E

Addressing the Data's Non-Normal Distribution

In an effort to address the non-normal distribution of total scores, several strategies were employed during the data screening, and testing of the hypothesised model. The results (i.e., output) for each strategy can be found in Appendix D (see attached CD).

Data screening.

Prior to analysis, the data was examined for the assumptions of multivariate analysis. Thirteen cases involving eight participants with extreme z scores were found to be univariate outliers ($p < .001$). Extreme low z scores ranged from -5.53 to -3.37 ($M = -4.09$), while high z scores ranged from 3.31 to 3.36 ($M = 3.34$). A further two cases were identified through Mahalanobis distance as multivariate outliers (Mahalanobis $D^2 = [1] 43.78$, and $[2] 43.32$; $p < .001$).

Additional analysis of the assumptions of multivariate analysis confirmed that the data was significantly non-normally distributed. Mardia's normalised estimate of multivariate kurtosis (MK) was found to be 5.38. Bentler (2005) outlines that MK values > 5.00 are indicative of data that are non-normally distributed. Byrne (2010) asserts that as SEM is founded on the analysis of covariance structures, evidence of significant multivariate kurtosis is of concern and detrimental to SEM analysis. Several strategies are available to minimise deviations from normality.

An initial attempt to address the data's non-normality utilised data transformation. Although data transformation is not universally recommended due to such things as interpretation difficulties and the simplicity of reporting results (e.g.,

Games, 1983; Grissom, 2000), Tabachnick and Fidell (2007) contend that unless there are convincing arguments to the contrary, it is most efficacious to do so. As set out by Tabachnick and Fidell, square root, logarithmic and inverse transformations were used, dependent on the level of skew, for all variables except the parental attachment variable. Further analysis of the multivariate assumptions for the transformed data revealed that the assumptions were still violated, therefore the data transformations were disregarded. Output of the completed transformations is included in Appendix D (see attached CD).

In the situation where extreme deviations from normality are unable to be corrected through data transformation, then dichotomisation is recommended (Tabachnick & Fidell, 2007). Although there are several costs associated with dichotomisation (e.g., loss of effect size and power, loss of information regarding individual differences, overestimation of statistical significance), and a considerable body of research which argues against its use (e.g., Altman & Royston, 2006; Cohen, 1983; DeCoster, Iselin, & Gallucci, 2009), MacCallum, Zhnag, Preacher and Rucker (2002), and Streiner (2002) confirm that one of the rare occasions that it can be justified is when distributions are highly skewed. A core assumption of SEM is that data is interval in nature, which precludes the use of dichotomised data in standard SEM (Byrne, 2010). Although effective and empirically validated techniques have been developed to utilise ordinal data in SEM (Bollen & Maydeu-Olivares, 2007; Finney & DiStefano, 2006; Kline, 2005), it was decided against its use in this research, due to the aforementioned limitations and its current unavailability in AMOS.

One additional option was considered to manage problems associated with the non-normal data. Tabachnick and Fidell (2007) state that when outliers are detected,

several options can be considered to reduce their influence. Methods include score modification of the identified cases, case deletion and allowing the identified cases to remain in the analysis. Following the recommendation of Tabachnick and Fidell, all 10 participants responsible for outliers were deleted, leaving 226 cases for analysis. Subsequent analysis revealed little difference between results where the outliers were deleted and when they were not deleted. Given this, and that inspection of each outlier case suggested that they were a legitimate part of the sampled population, it was decided to proceed with SEM without outliers deleted.

Testing the hypothesised model.

In order to account for the non-normal data, a bootstrapping method developed by Bollen and Stine (1992) and available in AMOS was employed. Bootstrapping is a re-sampling procedure whereby the original sample is considered to represent the population and multiple sub-samples of the same size are randomly generated, replace the original data, and then used in the SEM computation (Davison & Hinkley, 1997). One application for the use of bootstrapping is when data is multivariate non-normal (Chernick, 2003). Of importance is that inferential SEM computation is linked to assumptions of normality, whereas bootstrapping is free from such assumptions (Nevitt & Hancock, 2001). Although there are numerous bootstrapping methods, the Bollen-Stine bootstrap is recommended for small ($N > 100$) to medium ($200 < N < 500$) sample sizes and was therefore chosen for this study (Bollen & Stine, 1992). Using the empirically validated procedure, as set out by Nevitt and Hancock (2000), little difference between results with bootstrapping and without bootstrapping were found (see Appendix D [attached CD]). Given that little difference was found when the

bootstrapping method was applied, it was decided to proceed with inferential SEM without applying the bootstrapping method.

Appendix F

A Summary of Variance Findings

The proportion of variance in a particular variable, accounted for by its predictors, is determined by the associated squared multiple correlations estimate (Tabachnick & Fidell, 2007). AMOS reports the squared multiple correlations estimates of a particular model in its output.

In accordance with Model 2's squared multiple correlations AMOS output:

- (a) 4% of the variance in self-efficacy was accounted for by parental attachment,
- (b) 21% of the variance in cognitive mufflers was accounted for by self-efficacy,
- (c) 46% of the variance in engagement was accounted for by self-efficacy,
- (d) 46% of the variance in anxiety was accounted for by cognitive mufflers,
- (e) 40% of the variance in control was accounted for by cognitive mufflers, and
- (f) 43% of the variance in buoyancy was accounted for by cognitive mufflers and engagement.

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